



CSCS

Centro Svizzero di Calcolo Scientifico
Swiss National Supercomputing Centre

ETH zürich

FACT SHEET

CSCS – an engine for innovation and a User Lab for cutting-edge research

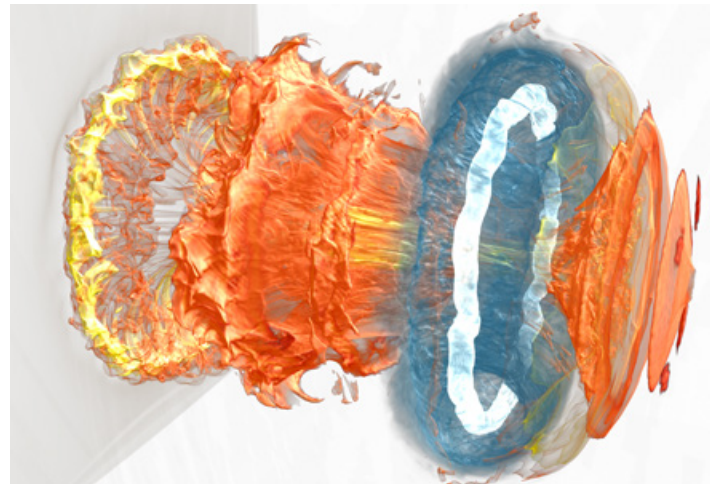
Supercomputers are an essential tool for the “explorers” of today’s world. The Swiss National Supercomputing Centre (CSCS) operates as a User Lab, providing a universal computing platform for cutting-edge research in the realm of high-performance computing (HPC), and has a team of staff to support researchers.

Supercomputers and HPC are now part of everyday life in the production of daily weather forecasts and in the traditional scientific disciplines. The simulations that supercomputers enable are especially useful because they can take researchers further when theory and experimentation have been stretched to their limits. Simulations can be used to check theoretical models or, more specifically, to discover new materials with as-yet-unknown properties and functions, or to understand the origins and history of the universe. They help economists to understand the markets and assess the scale of economic crises. Computer simulations enable the risks from natural hazards to be assessed and, in medicine, they support diagnosis and help improve treatment methods. At the same time, the methods and algorithms developed by researchers in all kinds of different disciplines, for example to simulate complex molecules or chemical reactions, could help the pharmaceutical industry to develop new drugs or equally the energy sector to produce more efficient solar cells.

A universal all-rounder

In addition to the conventional calculations that a supercomputer performs, specialist computers are also capable of analysing and structuring vast quantities of data. This enables them, for example, to filter out important information from a massive volume of data. This is a vital function in our age of “big data”. Supercomputers are also able to show the results of computations in visual form even while simulations are still under way. Images stimulate inspiration and intuition, and make it easier for researchers to understand complex processes. To meet all these different requirements, computer centres normally operate several computer systems, each specialised accordingly.

As a User Lab, however, CSCS operates a single universal computing platform equipped with the latest technologies, and able to satisfy all these requirements. At the heart of this system is the flagship supercomputer “Piz Daint”, which was switched on in December 2012.



What might look like an especially flamboyant jellyfish is actually a scientific simulation of flow phenomena. This extraordinarily detailed computer simulation conducted on supercomputers of CSCS, demonstrates what happens when a air shock wave hits a helium bubble. Similar phenomena are involved in rapid combustion processes or shattering kidney stones with shockwave lithotripsy, for instance. (Image: Diego Rossinelli, Computational Science and Engineering Laboratory, ETH Zurich)

CSCS – pooling resources

Over the last 20 years, high-performance computers have become essential technology. CSCS is affiliated to ETH Zurich. It consolidates computer resources at one location and makes scientific computing equally accessible to all universities. To enable this, it has an annual budget of about 40 million Swiss francs, similar to that of smaller research organisations in Switzerland.

Its innovative new building in Lugano ensures that supercomputers can continue to be operated flexibly over the next 40 years, preserving the high-quality service that CSCS provides to its users. In this way, the Swiss National Supercomputing Centre is supporting Switzerland as a centre for research and business.

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In September 2013 it was upgraded to a hybrid Cray XC30 system with a theoretical maximum processing speed of 7.8 petaflops. Capable of carrying out 3.2 billion arithmetic operations per watt, it is one of the world's most energy-efficient supercomputers in its class. The hybrid supercomputer is fitted with conventional processing units (CPUs) and graphics processing units (GPUs) and, thanks to its GPUs and specialised software, provides the capability for real-time visualization. In the second half of 2014, the system was expanded with the addition of "Piz Dora", a Cray XC40 comprising 1,256 compute nodes based entirely on CPUs. The new universal platform, "Piz Daint-Piz Dora", can analyze and structure data besides carrying out conventional calculations and visualizations and it is available both to researchers and to business and industry.

Comprehensive service

To ensure that the computer system is used to its maximum capability, the expert staff at CSCS – some 70 in number – help users with all aspects of scientific computing. Software and application services are also available, based on projects such as the "Platform for High-Performance and High-Productivity Computing" (HP2C) and the follow-up project "Platform for Advanced Scientific Computing" (PASC), which were initiated as part of the national High-Performance Computing and Networking (HPCN) strategy launched in 2009. These projects enable technical experts and scientists in the field of HPC to work together with CSCS and computer manufacturers, designing new application software for scientific simulations and developing more efficient simulation systems.

CSCS currently hosts over 500 users working on some 90 projects. Alongside regular projects, CSCS hosts a class of much larger projects, known as CHRONOS (Computationally-Intensive, High-Impact Research On Novel Outstanding Science) projects. These projects are expected to have a major impact on scientific research.

Services for Swiss institutions

Within "Piz Dora", CSCS hosts the cluster resources of the University of Zurich, the Paul Scherrer Institute (PSI) and the National Centre of Competence in Research (NCCR) "MARVEL" (Materials' Revolution: Computational Design and Discovery of Novel Materials). In addition, CSCS runs the MeteoSwiss computers that produce daily weather forecasts, the cluster for analysing data obtained by the Swiss Institute of Particle Physics (CHIPP) from the Large Hadron Collider (LHC) and the supercomputer for the Blue Brain Project at EPF Lausanne. To ensure a rapid flow of data between the users and CSCS, in autumn 2014 CSCS became the second service provider for the scientific community after CERN to provide a 100 gigabit per second network connection.