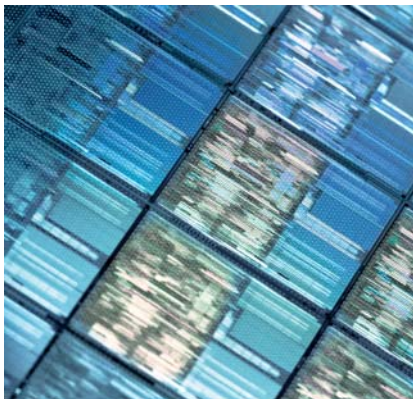
CASE STUDY
Intel® Xeon® processor 5500 and 5400 series
High-Performance Computing

In the footsteps of giants

Zürich University relies on Intel® technology to stay at the head of its game

Founded in 1833, the University of Zürich is Switzerland's largest, with a 24,000-strong student body and 1,900 graduates every year. Its illustrious list of alumni includes 23 Nobel Prize winners, among them Albert Einstein, Erwin Schrödinger (one of the founders of quantum mechanics), and Wilhelm Conrad Röntgen (the first person to win the Nobel Prize in physics). In keeping with this impressive record of achievement, the University is committed to making use of new technologies to continue driving innovation and discovery across scientific fields ranging from nanotechnology, over life sciences, to cosmology.



"The Sun/Intel solution means we can really boost researchers' productivity and time-to-results without burdening the University with a correspondingly enormous energy bill."

Dr. Alexander Godknecht,
Head IT-Infrastructure,
Bioinformatics & HPCN,
IT Services,
University of Zürich

CHALLENGES

- **Stay competitive.** Retain leading position in the scientific community by boosting ability to carry out more in-depth calculations faster
- **Save energy.** Boost performance of high-performance computing (HPC) cluster without exceeding energy quota allocated to it

TESTED SOLUTION

- **Combine strong technologies.** Intel® Xeon® processor 5500 series-powered Sun Blade X6275* server modules complement each other for the best performance and energy efficiency in HPC environments
- **Support throughout.** Ongoing consultancy and technical expertise provided by Sun engineers through testing and deployment of solution

IMPACT

- **Proven improvements.** Testing showed that the new platform delivers 12 times the application performance of the old cluster, with just 2.5 times the energy used
- **Easy to grow.** Scalability of rack-mounted blade servers means the University can accommodate future increases in demand for computing power

Great expectations

The University has been at the forefront of scientific research for many years and relies heavily on its HPC cluster to underpin complex calculations and simulations. Its environment was beginning to age, resulting in slow response times and even the inability to carry out certain simulations.

Dr. Alexander Godknecht, head of IT-infrastructure, bioinformatics and HPCN, IT Services at the University of Zürich, explains: "Many of our compute-heavy departments were having trouble getting what they needed out of the old platform. The astrophysics team, for example, needs large amounts of memory to carry out its calculations while the physical chemists require fast networks with low latency and multiple cores in order to get the compute performance to support their computations. Meanwhile, the biochemistry researchers were hardly able to compute their thousands of simulations as the time taken to do them was just too long."

To retain its competitive position in the scientific community, the University recognised that an enhanced HPC platform was essential. Key requirements were a high performance-to-cost ratio and low latency. The ability to run highly parallel applications was also important to enable each department to get the maximum results from its allocated time and capacity on the system.

"We wanted a Ferrari, with everything tuned for optimum overall and parallel performance," comments Dr. Godknecht. "We needed to achieve this, though, within the tight energy quota of 300 kW allocated to us by the University, so we had to ensure that the solution we deployed was as green as possible too."

Combining leading technologies from Intel and Sun gives Zürich University the competitive edge

Laying the right foundations

The University invited a number of vendors to submit proposals to meet its requirements. Intel, in collaboration with hardware partner Sun Microsystems, put forward a solution based on Intel® Xeon® processor 5500 series-powered Sun Blade X6275 server modules and interconnected by SUN's new M9 QDR Infiniband* Switch. The university chose this combination of technologies, designed specifically for compute-intensive, parallel applications in HPC environments, as the platform best able to deliver the high performance and low latency its researchers needed.

"We weighted real application benchmarks higher than the Linpack benchmark to evaluate the system," says Dr. Godknecht. "So the vendors had to provide benchmarks for the widely-used supercomputing applications cp2k* and pkdgrav2*. The core development teams for both applications are located at the University of Zurich. The detailed analysis of the results by the developers showed us that the Intel Xeon processor 5500 series had not only the better performance but also the greater potential than competing processors. In the end the faster floating point processing and the higher memory bandwidth were the key features that made our decision in favour of the Intel Xeon processor 5500 series."

At the time of the request for proposals, only a few of the new Intel Xeon processor 5500 series were available so some of the benchmarks were done on Intel® Xeon® processors 5400 series, with the intention of deploying with the soon-to-be-launched Intel Xeon processor 5500 series. "We knew that any results generated by the Intel Xeon processor 5400 series would be at least matched or bettered using the next-generation 5500 processor, and this way we could be ready to install as soon as the technology was available, giving us a competitive edge with our research," comments Dr. Godknecht.

The perfect partnership

The team ran its applications on the Sun/Intel platform and found that it delivered significant improvements over its previous HPC cluster. They noted an approximately 12-fold increase in application performance and, at a total of 220 kW, for just two and a half times the energy. "This is great for us, as it means we can really boost researchers' productivity and time-to-results without burdening the University with a correspondingly enormous energy bill," Dr. Godknecht points out. The fact that the solution was based on Sun rack-mounted blade servers also meant that it was easily scalable in order to keep up with future growth in demand for computing power.

In light of all these benefits, the University was convinced that the solution presented by Sun and Intel offered the best value for money, showing a particularly strong price/performance ratio when compared with its older platform.

Deployment of the solution was managed by Sun technicians, who worked on-site to optimise the new technologies for the University's requirements. Dr. Godknecht notes that he and his team were impressed by the in-depth knowledge and expertise delivered by the Sun engineers: "They were committed to fitting us out with the best solution possible, taking an innovative and creative approach throughout the project. They helped us to ensure that we were getting the most out of the new platform and able to provide the best service to our research departments."

The environment deployed was underpinned by six 48-blade racks of Sun Blade X6275 server modules, powered by a total of 4,608 Intel Xeon processor 5500 series cores. Running a SUSE Linux Enterprise* operating system, it supports all the applications used by the various departments.

Goals for the future

With deployment complete, the University will now make the new HPC cluster – named Schrödinger after the institution's famous son – available to researchers from the different departments that require particularly high-end computing power for their calculations and simulations. Where possible, serial computing jobs will be offloaded to its grid computing environment to ensure the cluster is kept free to run the parallel applications for which the Intel Xeon processor 5500 series is optimised.

"We're confident that the new cluster provided by Sun and Intel will last us for a good few years and enable us to push ahead with new scientific breakthroughs that Schrödinger himself would be proud of," concludes Dr. Godknecht. The industry has already recognised the University's new cluster by ranking it 96th in the Top 500 Supercomputers worldwide.[1]

While the cluster is currently used exclusively by scientists based at the University of Zürich, it forms a part of the general HPC strategy in Switzerland led by the Swiss National Supercomputing Centre (CSCS). Like other countries, Switzerland has a strategy for a national HPC infrastructure. A grid or a series of smaller clusters form the base of the pyramid, followed by big clusters like Schrödinger and at the top of the national pyramid will be the planned Petabyte-level Supercomputer at CSCS. By providing a platform where scientists can write and test codes for thousands of processing cores, the University of Zürich will be part of the Swiss national plan for High Performance Computing and Networking.

Spotlight on University of Zürich

The University of Zürich was founded in 1833, though its origins stretch back as far as 1525, to the days of protestant reformer Ulrich Zwingli. Two thousand lecturers in 140 specialist institutes provide the broadest range of subjects and courses available from any Swiss seat of higher education. With 24,000 students and 1,900 graduates every year, Zürich is also Switzerland's largest university. The University provides academic services, works with the private sector, and considers itself part of a national and global network for the acquisition and dissemination of knowledge.

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[1] http://www.top500.org/list/2009/11/100

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