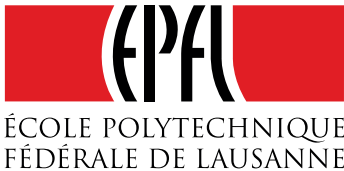
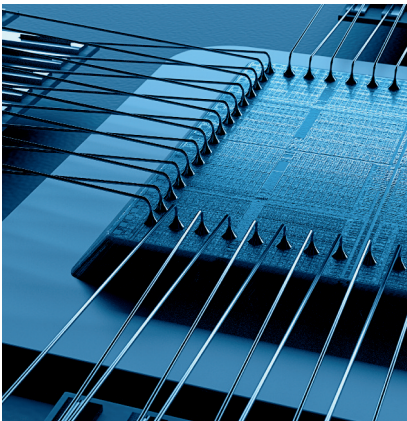


A new model for high-performance computing

Scientific institution centralizes its computing clusters using energy-efficient Intel® Xeon® processors E5 family

The Ecole Polytechnique Fédérale de Lausanne (EPFL) has been a national school since 1969, during which time its engineering institution has grown in many areas, becoming one of the most famous European centers for science and technology. Wanting to replace its fragmented high-performance computing (HPC) resources with one central cluster, EPFL ran a series of evaluations and benchmarks to find the right technology for the new resource. It chose to deploy servers powered by the Intel® Xeon® processor E5-2660 and has seen significant power savings and efficiency improvements.



“The system’s efficiency is much improved, so it’s definitely paid off for us to implement this new central cluster. By keeping the different units and departments informed about the changes and evidence of the performance and power-saving benefits they’re enabling, we’ve managed to build trust in the central IT organization even among those that were dubious initially.”

Vittoria Rezzonico
project manager
EPFL

CHALLENGES

- **Enable change.** Make a strategic move to a centralized HPC cluster
- **Uphold standards.** Ensure the performance of key research applications does not suffer
- **Drive efficiency.** Reduce power consumption without compromising performance

SOLUTIONS

- **The right platform.** First round of evaluation found the Intel Xeon processor E5 family to be the best foundation for the cluster
- **Comparative testing.** EPFL assessed three different versions of the processor family against real-life applications
- **The final choice.** The organization implemented the Intel Xeon processor E5-2660 to power its new centralized cluster

IMPACT

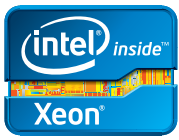
- **A trusted move.** Department stakeholders are now convinced of the value of the new cluster
- **Simple management.** The central IT team can now manage the whole cluster, freeing up space and time for scientists
- **Great potential.** EPFL can now build a long-term strategy for ongoing HPC improvement

A changing model

The research carried out at EPFL is varied and complex. Its most computationally demanding research fields are material science and molecular dynamics, but other disciplines are as wide-ranging as cardiovascular research and cryptography. While all sharing a need for high-performance, reliable computing platforms to support their simulations and calculations, the way in which each department carries out its research is unique, with specific applications and processes.

The organization has therefore traditionally run a build-your-own-cluster model, where professors in charge of each department have taken responsibility for purchasing and implementing their own HPC resources. This approach had its drawbacks, as Vittoria Rezzonico, project manager at EPFL, explains. “Most of the clusters would be managed by only one person, sometimes a PhD student, who of course had other things to focus on as well. Often, a department would struggle to find space for its cluster, so it couldn’t scale up as their needs increased. The de-centralized approach also meant that lots of funds were being spent on HPC across the organization.”

EPFL wanted to pool all its investment and resources into one centrally managed cluster to improve overall cost efficiency, make it easier to manage, and provide ongoing, scalable computing power to all research units. Creating a centralized cluster meant a significant cultural shift for the professors and teams that were used to creating their own bespoke platforms, so Rezzonico and her team also needed to ensure the new cluster did not cause performance to drop.



Leading scientific research facility confirms the energy-efficient performance of Intel® technology-based cluster through in-depth benchmarking

Building the evidence

With so much at stake in this cluster centralization project, EPFL wanted to make sure it made the right choice, so it carried out a detailed evaluation of the available technologies, broken into two stages. In the first stage, it compared a variety of platforms, including those based on the Intel Xeon processor E5 family and 5600 series, to identify the one that delivered the best performance.

"We found the Intel Xeon processor E5 family performed best¹ at this stage," says Rezzonico. "The next stage was to determine which flavor of the processor was the best match for our environment and software. To assess this, we ran a series of benchmarks with four representative applications, testing them against the Intel Xeon processor E5-2650L, E5-2660 and E5-2670."

The applications involved in the benchmark tests were:

- MiniFE* - A proxy application for unstructured implicit finite element codes
- GEAR* - For following the evolution and formation of galactic systems
- CPMD* - An open source application for computational chemistry
- QuantumEspresso* - An open source application for electronic and atomic-scale computations

Running the applications on the three processor types, EPFL looked at the comparative energy-to-solution and time-to-solution ratios, as well as at throughput, performance and power consumption.

"Our overall impression when testing the technologies was 'Wow, Intel has really kept its promises,'" comments Rezzonico. "All three processors performed very well in our benchmarks." As a result, EPFL decided to base its new cluster on the Intel Xeon processor E5-2660. Following implementation, the applications were optimized for the cluster using Intel® Advanced Vector Extensions (Intel® AVX). "The new cluster has a power usage effectiveness (PUE) of 1.08, so it certainly meets our energy efficiency goals," she adds.

Foundations for innovation

"The system's efficiency is much improved, so it's definitely paid off for us to implement this new central cluster," says Rezzonico. "By keeping the different units and departments informed about the changes and evidence of the performance and power-saving benefits they're enabling, we've managed to build trust in the central IT organization even among those that were dubious initially."

With the organization's HPC capabilities now centralized, EPFL can ensure that dedicated

Lessons learned

Scientists are always looking for evidence, so this is what the team at EPFL needed to deliver to convince them of the value of changing to a centralized HPC cluster. Instead of relying on industry-standard benchmarks, EPFL conducted its own, using the applications its scientists depend on for their research. By demonstrating the enhanced efficiency and performance the Intel® technology-powered cluster could deliver in this real-life environment, the project manager was able to allay the concerns of the departmental stakeholders.

personnel are on hand at all times to keep it running at peak performance and efficiency. Having a dedicated space for it also means that scientists no longer have cumbersome server equipment taking up room in their departments.

The centralized cluster also means EPFL can develop a more innovative roadmap for its future IT investments. "We're eager to be able to better monitor and measure the performance of the cluster in real time, so that we can shut down cores that aren't in use and lower the frequency of a processor when we don't need as much performance," says Rezzonico. This sort of strategic planning will enable EPFL to continue optimizing its energy efficiency over time, even as scientists' computing needs continue to grow in complexity.

Find the solution that's right for your organization. Contact your Intel representative, visit Intel's Business Success Stories for IT Managers (www.intel.co.uk/Itcasesudies) or explore the Intel.co.uk IT Center (www.intel.co.uk/itcenter).



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