CASE STUDY

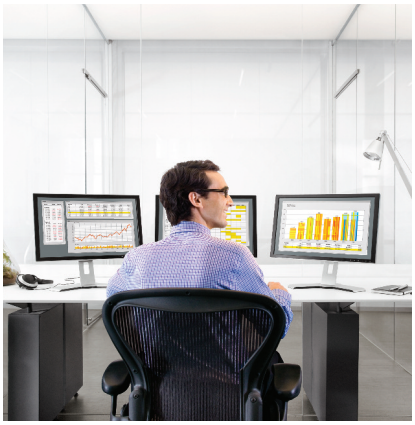
Intel® Xeon Processor E5-2670

Manufacturing
High-Performance Computing

Breaking ground with high-performance computing

Danielson Engineering beats the competition with Intel® technology-based supercomputing platform

Danielson Engineering is one of Europe's leading specialists in the design, manufacture and development of engine prototypes used to validate new engine concepts for car and automotive equipment manufacturers. It implemented a high-performance computing (HPC) platform, powered by Intel® Xeon® processors E5-2670, to support more complex calculations that, in turn, are helping enhance the products and services it offers its customers.



"We can guarantee our customers that our designs are now better optimized, which allows us to be more competitive. Although we're a small business, we now have the HPC capabilities to meet the future requirements of new customers and challenges."

Bernard Delaporte,
CEO of Danielson Groupe

CHALLENGES

- **Drive discoveries.** Build a powerful computing platform to underpin mission-critical calculation and simulation applications
- **Be ready.** Ensure Danielson Engineering can meet customer demands now and as they evolve and increase in complexity
- **Big ambitions.** Introduce HPC capabilities to smaller business environments

SOLUTIONS

- **Optimized technology.** The new HPC platform is based on Intel Xeon processors E5-2670, chosen for the best performance with key applications and optimized balance between licensing costs and computing power
- **Expert consultancy.** The French HPC-SME institutional initiative, driven by Inria, Genci and Oseo, provided expert consultancy and helped identify adequate financing to support the pilot and the solution implementation

IMPACT

- **Boosted calculations.** The volume of calculations possible in a given session has increased twenty-fold
- **New workflows.** Models can be built that were not possible before
- **Customer impact.** Clients receive optimized products and have noticed the improvement

A small company with big plans

Danielson Engineering deals with all stages of the development, validation, optimization, manufacture and testing of internal combustion engine prototypes for automotive and aerospace applications. To develop compelling products for the marketplace, the right simulation tools, such as process integration and design optimization (PIDO), are essential.

The organization carries out the calculations necessary to develop and test its prototypes using commercial software such as StarCCM+*, Abaqus*, Altair* and ConvergeCFD*. Open source tools like OpenFoam*, Code_Aster* and OpenWoam* are also evaluated on the cluster to develop future technological numerical simulations.

This sort of intensive scientific computing demands a strong platform to get the best results even as the volume of work increases. Eager to achieve high standards now, and to be ready for even more complex workloads in the future, Danielson wanted an HPC environment to support its current commercial and future open source applications. It also wanted to optimize the performance of its computing platform to ensure its commercial applications could run as efficiently as possible and, ideally, reduce the licensing costs associated with them.

Bernard Delaporte, CEO at Danielson Groupe, explains: "I defined our computing needs based on the sort of studies we undertake, our working methods, our number of users, and the structure of our organization as a small-to-medium-sized business (SMB). The real challenge was integrating HPC as a smaller company, as it had not previously been a priority in our production cycle."

Man-machine interface leader creates competitive advantage with an Intel Xeon processor E5 family-powered HPC platform

Lessons Learned

HPC is no longer the preserve of big-budget enterprises and academic institutions. Advances in processor technology mean that smaller organizations can now benefit from cost-effective, highly efficient HPC technologies as well. Danielson Engineering has taken the initiative by implementing its own HPC environment that gives it a competitive edge in the marketplace while enhancing the work it does for its customers.

Working with the experts

Danielson Engineering investigated its options carefully, assessing the performance of a number of solution providers in various HPC benchmarks and reports, which allowed it to determine the best solution in terms of both software and hardware.

It compared the best processors available in the marketplace and evaluated the raw power available in each solution versus the number of cores. It also considered the acquisition costs – including software licenses – of the two solutions that made it to the final short list and found that the platform based on the Intel Xeon processor E5 family was by far the most efficient, delivering a much higher level of performance[1].

Danielson Engineering therefore decided to implement a Bullx* HPC platform powered by the Intel Xeon processor E5-2670 with 192 cores. The platform was set up to run the Linux* operating system, supporting Danielson's application suite. A number of workstations, powered by Intel® Core™ i7 processors, are connected to the HPC platform to run calculations.

The HPC platform was tailored to support Danielson's Advanced Design for Vehicle and Internal Combustion Engine* (ADVICE*) project, which focused on enhancing the simulation of the combustion process. The design and implementation of the project were supported by Oseo, Inria and Genci, through the French HPC-SME institutional initiative. "These companies were an invaluable support to us," says Rui Da Silva, numerical analysis department manager. "Their expertise in the field of supercomputing has guided us throughout the project."

He continues: "Intel has been our expert in dealing with calculation issues in simulation mechanics, aerodynamics, and 3D simulation and combustion engines. The main thing for us about the Intel® technology-powered platform is that it is perfectly optimized for our software. We can easily consider linkages between different computer codes such as computational fluid dynamics (CFD) and combustion simulation, and we can keep internal control of mastering chain simulation across all our hardware and software."

A big difference

Since implementing the new HPC solution, Danielson Engineering has seen a clear improvement in its core capabilities. Being able to handle more ambitious projects means that it can offer a more compelling service, which its customers have already noticed. It has also been able to undertake projects that would not have been possible previously, and has set up two completely new workflows for the optimization of geometric and mechanical design support.

"The HPC platform is now perfectly integrated into our computationally-intensive workflows," Da Silva explains. "All our users – not just calculation engineers but project managers as well – quickly understood the importance of supercomputing for our business, particularly in terms of computation speed and its impact on the timeliness of our response to customer needs."

Danielson Engineering has changed the way it works to integrate this new tool and dramatically accelerate its services as a result. It has recruited four new mechanical engineers and an IT expert since the creation of the ADVICE project, creating a significantly larger team.

The combined improvement in computing capabilities and expertise that Danielson Engineering can now offer means that it is gradually becoming an industry-standard technical solution. "We now have a tool that allows us to expand our simulations to test new prototypes, creating new designs that were not possible before," says Da Silva.

This is evident in the case of geometric shape optimization for a particular mechanical component. One hundred geometric elements can now be evaluated numerically in a single night, whereas before, the organization could only have processed five in that time.

"We can guarantee our customers that our designs are now better optimized, which allows us to be more competitive," Delaporte comments. "Although we're a small business, we now have the HPC capabilities to meet the future requirements of new customers and challenges."

Another benefit of the solution has to do with the data protection around Danielson's work. All its simulation projects are carried out in-house to protect its intellectual property. Using the HPC, it is able to take this advantage further, pushing the limits of calculation volumes, while ensuring that it can respond in a timely manner to the needs of its customers.

"The next step is to integrate a graphics processing acceleration unit into our HPC environment, as our industrial codes now support it," concludes Da Silva. "We also plan to increase our raw computing power by adding a further 32 cores of the Intel Xeon processor E5-2670."

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/Itcasestudies**) or explore the Intel.co.uk IT Center (**www.intel.co.uk/itcenter**).

[1] Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations, and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to http://www.intel.com/performance

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