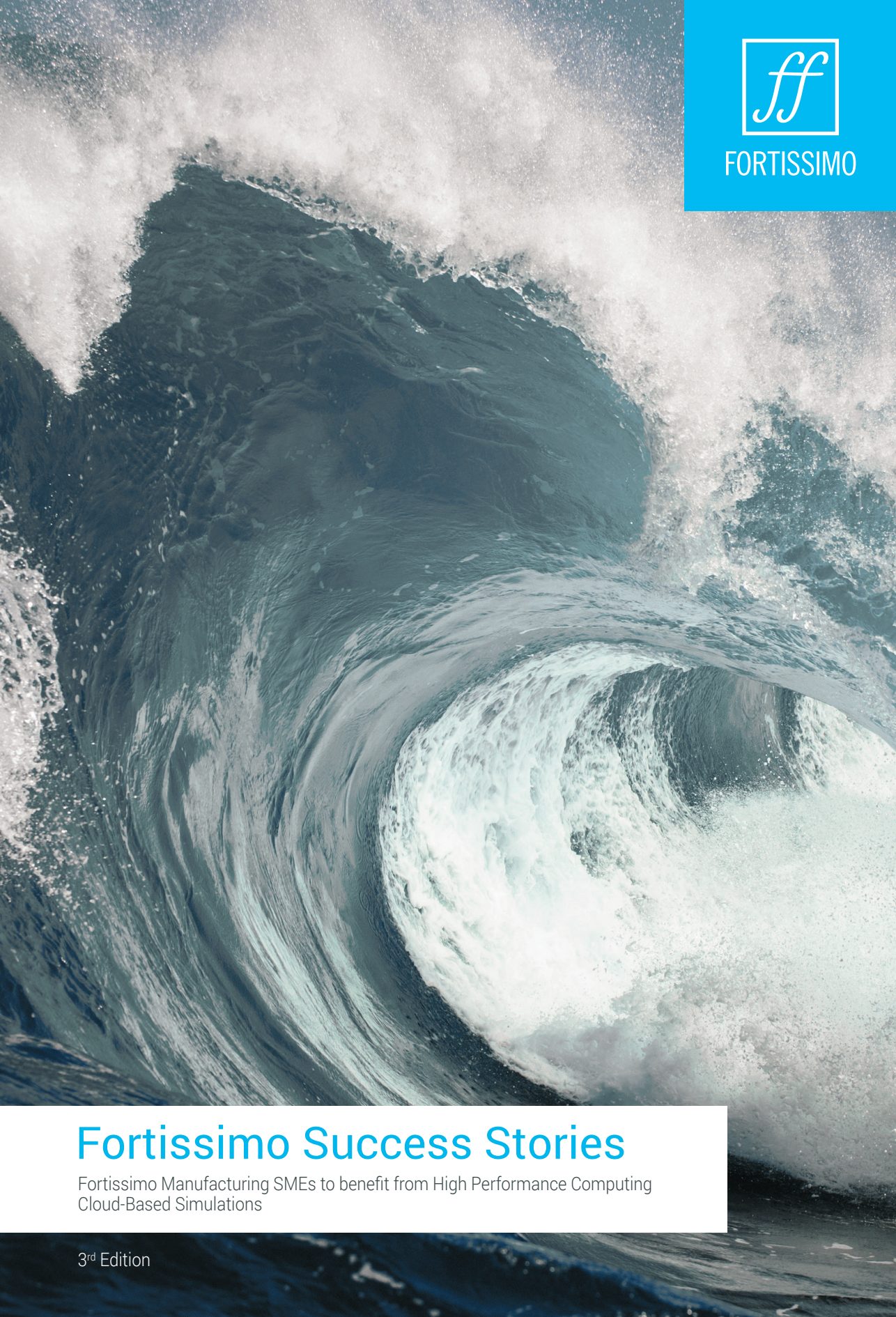


FORTISSIMO

Fortissimo Success Stories

Fortissimo Manufacturing SMEs to benefit from High Performance Computing Cloud-Based Simulations

3rd Edition

Fortissimo Success Stories - 3rd Edition, November 2016

Index

FORTISSIMO

The Fortissimo Marketplace

Fortissimo is a project funded by the European Commission within the I4MS initiative (ICT Innovation for Manufacturing SMEs) framework. It consists of two phases; the first phase started in July 2013 and will end in December 2016. Fortissimo 2 began in November 2015 and will end in October 2018.

THE AIM OF FORTISSIMO

The aim of Fortissimo projects is to strengthen the competitiveness of European businesses in a global market. To do this, Fortissimo provides companies with easy cloud-based access to computationally intensive digital simulations.

THE CHALLENGE

In the past, gaining access to the resources required for digital simulation has often posed serious technical and financial challenges to SMEs. Through the usage of High Performance Computing (HPC) simulations via a cloud-infrastructure, opportunities for optimisation can be identified and used along the entire value chain, saving companies time and money.

THE MARKETPLACE

The Fortissimo Marketplace – launched in October 2016 – provides all European businesses, in particular Small & Medium Enterprises (SMEs), with permanent, simple and cost-effective

access to the hardware, software, and know-how required for computationally-intensive digital simulations, via an on-demand, pay-per-use model.

Possible improvements resulting from the Fortissimo Marketplace approach are many-fold, including: better and more precise design of complex workpieces; acceleration of time-to-market; and cost savings in development, production and operation.

SMES PARTICIPATION

Fortissimo collaborates with SMEs, assembling a team of experts to conduct experiments alongside them, to prove the business value of digital simulations. Participating SMEs have to apply to run experiments through "open calls". For 18 months (the duration of one experiment), the Fortissimo partners then provide the participating SMEs with free access to HPC-resources via a cloud-infrastructure and support them in the planning, implementation and realisation of their respective project.

CLOUD-BASED HPC

The new cloud-based Fortissimo Marketplace offers fast and convenient access to supercomputing services:

- A new platform simplifies access to high-performance computer simulations for small and medium sized enterprises
- Sign-up is free for users
- We match service providers to users' requirements - handling set up, project management and billing

For further information, please visit: http://www.fortissimo-project.eu/

Joint review of I4MS project in Edinburgh, September 2014.

Core Partners

THE UNIVERSITY OF EDINBURGH

EPCC is a leading European centre of excellence in advanced research, technology transfer, and the provision of high-performance computing services to academia and industry.
http://www.epcc.ed.ac.uk/

ARCTUR

Arctur prides itself in being 'not just another HPC infrastructure provider'. Rather, they always provide personal support to users, ensuring that every HPC project achieves or even surpasses expectations.
http://hpc.arctur.net

ATOS

Atos is a leader in digital services, with 93,000 employees in 72 countries. Their deep technology expertise and industry knowledge has allowed them to build global client base across many different business sectors.
http://atos.net/en-us/home.html

Bull SAS

The only truly European IT company capable of designing, integrating and implementing supercomputers, Bull has made Extreme Computing one of its key strategic priorities.
http://www.bull.com/extreme-computing/

FUNDACION CENTRO TECNOLOGICO DE SUPERCOMPUTACION DE GALICIA

CESGA is a public foundation committed to the advancement of Science and Technical Knowledge, by means of research and application of HPC, communications and other IT resources for the benefit of society.
https://www.cesga.es/en/cesga

CONSORZIO INTERUNIVERSITARIO

CINECA, the Italian supercomputing centre, is equipped with the most advanced hardware resources. Its mission is to provide computational resources for present and future academic and industrial research.
http://www.cineca.it

GRAND EQUIPEMENT NATIONAL DE CALCUL INTENSIF

GENCI was created with the aim of placing France on the international stage in terms of HPC. Its role is to help implement the national strategy for HPC in support of scientific research within France.
http://www.genci.fr

GOMPUTE

Gompute is a leading HPC and HPC Cloud company, which offers HPC services to a large number of users worldwide. It delivers comprehensive solutions for HPC, both in-house and as a service.
http://www.gompute.com

HLRS – UNIVERSITY OF STUTTGART

The High Performance Computing Centre (HLRS) is one of three national computing centres affiliated to the University of Stuttgart. It operates and provides compute resources to research groups and industry.
http://www.hlrs.de

INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

Over the last 40 years, Inria's researchers have been working at the crossroads of computer sciences and mathematics. Inria is France's only public research body fully dedicated to computational sciences.
http://www.inria.fr/en

INTEL DEUTSCHLAND GMBH

Intel (NASDAQ: INTC) is a world leader in computing innovation. The company designs and builds the essential technologies that serve as the foundation for the world's computing devices.
http://www.intel.com

SCAPOS AG

Scapos was founded in 2009 for the sales, marketing and support of technical computing software and of advanced software solutions. Its customers range from large research institutes and industrial corporations to SMEs.
http://www.scapos.com

SICOS BW GmbH

SICOS BW has been founded to support SMEs in the usage of HPC. Its tasks are to support industrial users who want to use HPC systems, and to support computing centres to provide suitable services.
http://www.sicos-bw.de

SURFSARA BV

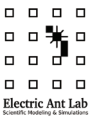
SURFsara supports research, education and industry in the Netherlands in the areas of HPC and big data, through the development and provisioning of advanced ICT infrastructure, services and expertise.
http://www.surfsara.nl

XLAB D.O.O.

XLAB Research is recognized in Slovenia as one of the strongest computer science research teams outside the academic world. Their expertise is in security and distributed systems.
http://xlab.si

FORTISSIMO

Experiment Partners





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Electromagnetism is our thing
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noesis
Nolangroup
dss lab
NUMTECH
Open Ocean
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VORTECH BV
VPLP design
WavEC
Offshore Renewables
ZECO
HYDROPOWER

FORTISSIMO

Fortissimo Success Stories

www.fortissimo-project.eu

FORTISSIMO

HPC Cloud-based simulation of light-aircraft aerodynamics

ORGANIZATIONS INVOLVED

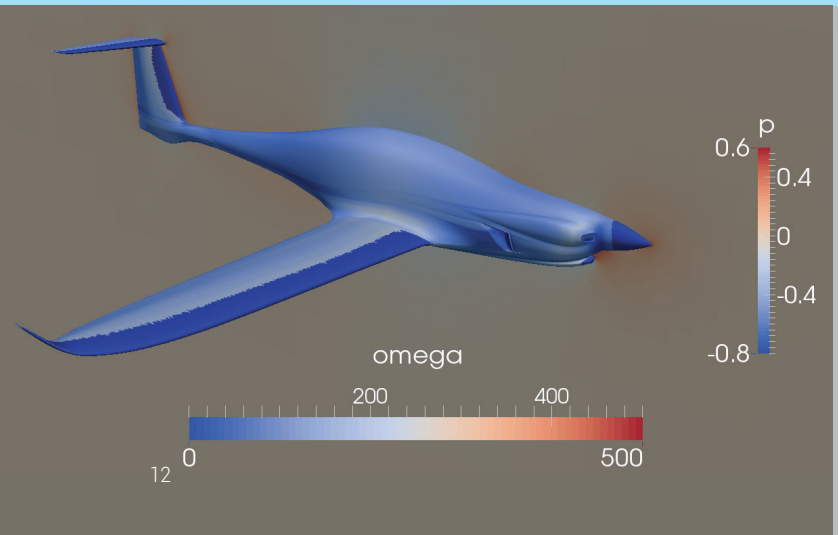
Pipistrel is a Slovenian SME. It was established in 1989 and is a leading designer and manufacturer of light aircraft. In order to develop its product line, Pipistrel needs to understand how air flows over its aircraft.

For an SME, it is virtually impossible to use wind tunnel tests during the design phase, because such tests are simply too expensive. The only option an SME has is to simulate the flow of air as accurately as possible using a high-performance computer. To replace wind-tunnel tests satisfactorily, aerodynamic models, which accurately simulate real airflows, need to be deployed. Such models require significant compute cycles and memory.

End User	HPC Expert	HPC Provider
PIPISTREL	XLAB NOT IDLE	ARCTUR
www.pipistrel.si	www.xlab.si	www.arctur.si

THE CHALLENGE

The challenge facing Pipistrel was to perform simulations of the flow over its aircraft in sufficient detail to model real physical effects accurately. Such simulations require expensive computer resources which are normally beyond the means of an SME. However, the use of Cloud-based HPC offers the possibility of running such simulations on a pay-per-use basis which is financially viable for an SME.



The challenge facing Pipistrel is to perform simulations of the flow over its aircraft which are sufficiently detailed to model real physical effects accurately.

This experiment allowed Pipistrel to use HPC for the first time and to learn about its capabilities. Pipistrel ran more demanding, higher fidelity simulations. It gained considerable experience in the use of HPCbased simulation.

THE SOLUTION

The use of Cloud-based HPC allowed Pipistrel to run simulations which accurately predicted how an aircraft would behave in flight. To simulate the air flow around the aircraft with the required degree of accuracy, a large computer model was used. Such a model ran in approximately 2 to 3 days on a Cloud-based HPC system. This enabled Pipistrel to perform complex simulations in a reasonable time and at an affordable cost.

EXPERIMENT #401 HIGHLIGHTS

Industry Sector:
Aerospace

Country: Slovenia

Software used:
OpenFOAM

End Date:
December 2014

BUSINESS IMPACT

Pipistrel needs to simulate the flow of air over the body of an aircraft only occasionally during the design process. It estimates that it is 10 times cheaper to use Cloud-based HPC simulations than have a suitably powerful in-house system which is only used for part of the time. The indicative annual costs of using Cloud-based HPC simulations are approximately €30k compared with an in-house costs of €300,000, which shows that this saving is considerable.

This case study allowed Pipistrel to use HPC for the first time and to learn about its capabilities. Pipistrel ran more demanding, higher fidelity simulations. It gained considerable experience in the use of HPC-based simulation. This experience will help Pipistrel to estimate the time and the cost of such simulations better. This will help them to decide if the use of HPC is justified or not in future projects.

Pipistrel learned that the use of HPC will be very valuable during a design phase of future aircraft. HPC can be used to run much more demanding simulations that improve the fidelity of results. The time needed for such simulations running on an HPC system is roughly the same as the coarser simulations currently run on Pipistrel's in-house cluster. The higher-resolution simulations give more and better data that can be incorporated into each design phase. This both accelerates the design phase and reduces the number of the design cycles.

Pipistrel
Slovenia

FORTISSIMO

HPC Cloud-based simulation of steel casting

ORGANIZATIONS INVOLVED

Ergolines is an Italian SME. They are world leaders in manufacturing products used in the production of speciality steels, including special instruments used in continuous casting. Ergolines' goal is to develop equipment which supports production of flawless steel alloys with properties that satisfy an increasingly quality-oriented market. Ergolines routinely uses in-house computational resources during development to simulate the flow of liquid steel as it solidifies. This case study addresses the problem of slag carry-over from the ladle to the tundish, which can lead impurities in steel or poor ladle yield. This is a complex phenomenon which cannot be observed directly, and simulating it requires the use of HPC, which Ergolines has not previously used.

End User

ergolines INNOVATION PARTNER

www.ergolines.it

HPC Expert and Centre

ARCTUR

www.arctur.si

THE CHALLENGE

In continuous steel casting it is crucial to prevent slag – a by-product – from transferring to the tundish. This causes breakouts, resulting in hot liquid steel spraying out – with serious safety and economic implications. An automated system for ladle-slag monitoring is thus in high demand, one which matches the vibration of the slag with the fluid dynamics of the system. This requires detailed simulation, which can only be done using HPC.

Dedicated HPC-based simulations followed by case experimental validation have provided Ergolines with key insights into the physics of the system and into different ladle-emptying mechanisms. As a result, it has been possible to establish a correlation between the shroud vibrational signal and the fluid dynamics of the system.

THE SOLUTION

HPC simulations gave new insights into the physics of the problem and different ladle-emptying mechanisms. The discovered link between the shroud vibrational signal and the fluid dynamics of the system forms the basis of an innovative monitoring technology, which will significantly improve occupational safety and productivity in steel plants. Ergolines had previously used simulation in its design process, but this was their first experience of using full-scale HPC and seeing its potential benefits.

EXPERIMENT #402 HIGHLIGHTS

Industry Sector:
Casting

Country: Italy

Software used:
OpenFOAM

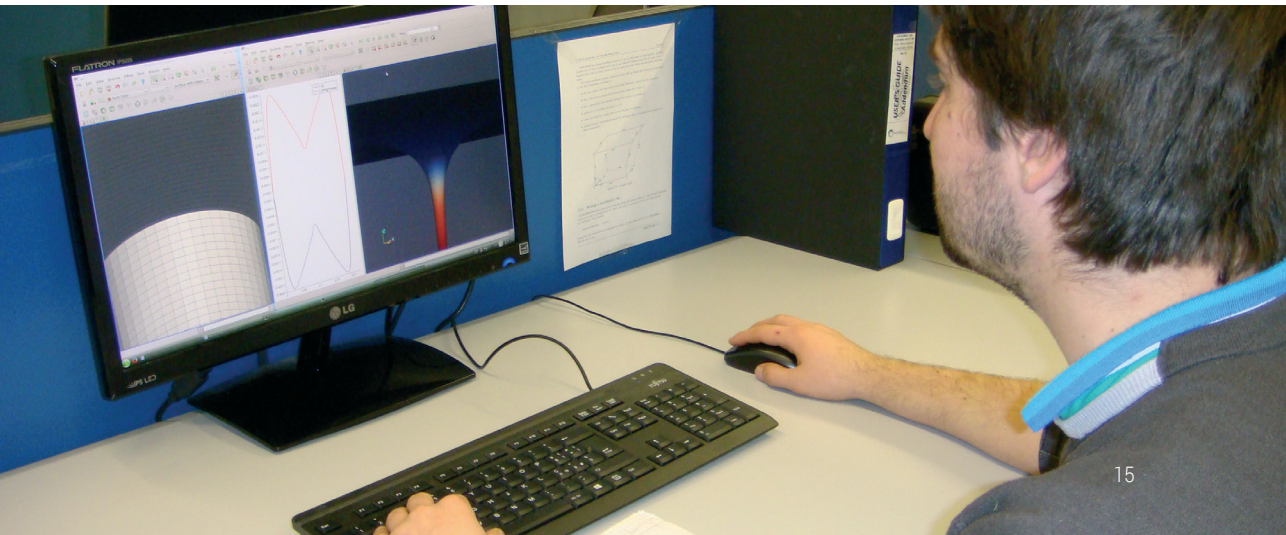
End Date:
December 2014

BUSINESS IMPACT

To get accurate results in complex slag carry-over simulations, it was necessary to use very fine-grained simulations for both geometry and time. This required powerful computing resources that Ergolines did not have. Access to a cloud-based HPC system thus allowed Ergolines to reduce computational times without incurring the high costs HPC ownership. The results from the fluid-dynamic analysis enabled development of a new automatic slag detection technology for steel continuous casting, which could bring significant improvements to occupational safety and productivity of steelworks.

Ergolines
Italy

The ability to detect slag while it is passing through the shroud enables a steel plant to control the closing of the ladle more finely. For an average ladle size of 100 tons, 0.5 - 1% of steel usually remains in the ladle. With the new monitoring technology, 60% of the lost steel can be saved. On an average production of 1 million tonnes of per year, a medium-size factory could avoid re-melting 6,000 tonnes of steel. Re-melting 6,000 tonnes of steel at approximately €70 to €100 per tonne represents a saving of €420,000 to €600,000. The loss of a further 300 tonnes of steel could be also avoided, saving 70,000€, for total savings of up to €670,000 per year, per medium-sized plant. Casting is a high-energy process, so on top of the monetary savings, energy savings for steel plants equipped with the monitoring technology would be significant.



FORTISSIMO

HPC Cloud-based design of high-pressure vessels

ORGANIZATIONS INVOLVED

Founded in 1991, Mikrosam is an SME, which manufactures winding machines for the construction of composite pressure vessels such as natural gas containers in automobiles. It is involved in the design of pressure vessels and the development and adjustment of its machines to produce such designs. The biggest advantage of modern composite materials is that they are many times lighter than and yet as strong or stronger than widely used metals. Composite materials have the potential to replace widely used steel and aluminium, often with better performance. Composite components can lead to weight savings of between 60% to 80% by replacing steel components and between 20% to 50% by replacing aluminium components.

End User

MIKROSAM CONTROL • AUTOMATION • ROBOTICS

www.mikrosam.com

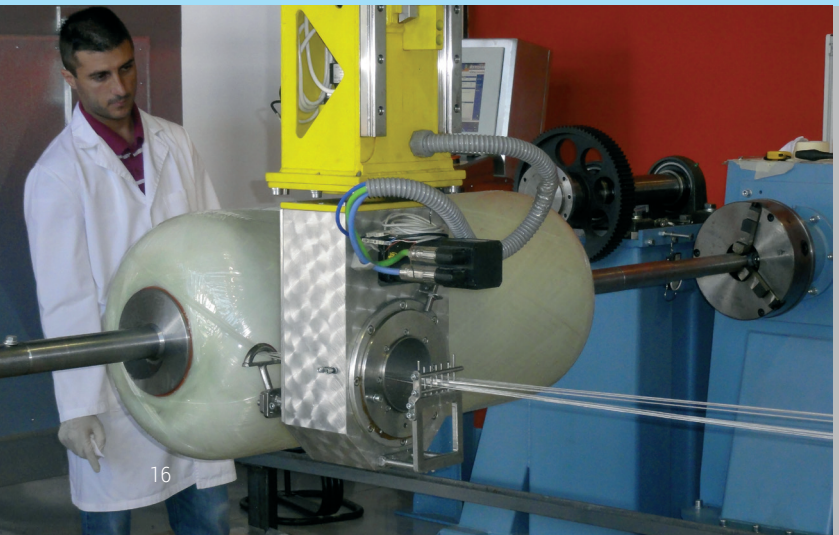
HPC Provider

ARCTUR

www.arctur.si

THE CHALLENGE

Previously for Mikrosam, design involved physical tests. To replace physical tests with numerical simulation requires significant computing resources. An HPC-based system is necessary to get results in a reasonable time frame. The challenge was to develop a model for the simulation of composite materials and to implement it on an HPC system which would enable accurate results to be obtained within an acceptable development time.



The challenge was to develop a modelfor the simulation of composite materials and to implement it on an HPC system which would enable accurate results to be obtained in a time frame allowing an acceptable development time.

THE SOLUTION

A HPC-based computer model was developed to simulate the behaviour of composite materials using an open-source software package. This model needed significant computing resources and ran on an HPC system. Such simulations reduce the amount of physical testing needed in the design of composite materials. Previously Mikrosam was using simulation in its design process. However this case study was their first experience of HPC and the benefits it could bring.

EXPERIMENT #403 HIGHLIGHTS

Industry Sector:
Composites

Country:
FYR Macedonia

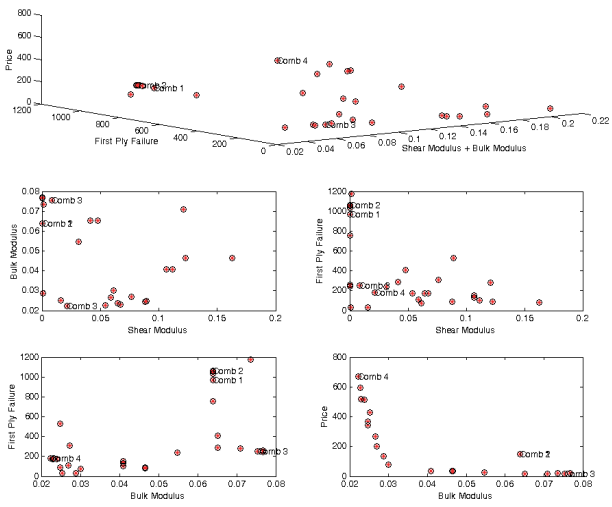
Software used:
OpenFOAM

End Date:
December 2014

BUSINESS IMPACT

For each filament winding machine used in the production of high-pressure vessels, different combinations of materials and winding angles for the composite, need to be considered. With the simulation code developed in this case study it is possible to shorten the design time and to reduce the number of physical tests and prototyping costs. The case study has shown that using simulation on an HPC system can reduce time for composite design by about 30% and reduce the cost of design and testing by 10%. As a result of the Fortissimo experiment, Mikrosam will be able reduce its production costs by about €30,000 per year for the next 5 years. More importantly its product offer (production machines for high-pressure vessels) will give each of its customers an advantage in production costs of around €300,000 per year per machine for machines that are currently on the market. The considerable advantage of Mikrosam's products over those of its competitors will, as a conservative estimate, lead to an increased revenue for the company of around €400,000 per year for the next 5 years. This is a significant amount for this SME. The experience gained in this experiment together with reduced production costs for both Mikrosam and its customers constitutes a base for further growth of the company and the resultant creation of new jobs.

Mikrosam
FYR Macedonia



FORTISSIMO

HPC Cloud-based simulation of flange tightening

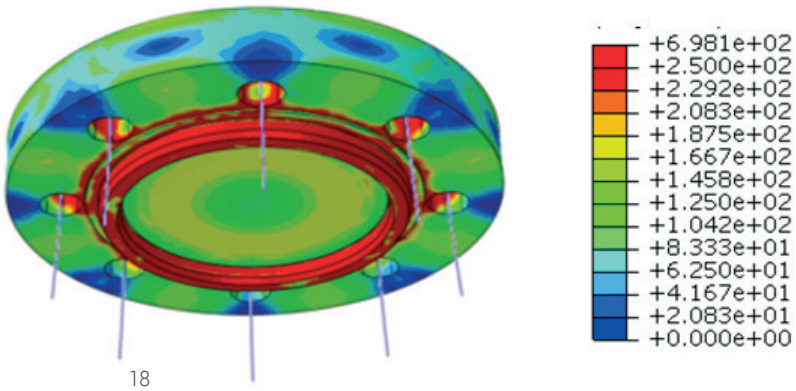
ORGANIZATIONS INVOLVED

Texas Controls is a Spanish SME offering tightening and sealing solutions to large industrial facilities in a number of sectors. These are especially important to customers in the oil and gas industry, where it is imperative to avoid leaks in pipes, pressure vessels, or reactors that are under extreme pressures and temperatures. In these situations, preventing leaks is much less costly than dealing with consequences of one. It is crucial to be able to predict the behaviour of flanged joints, and to understand elastic interactions between them. Texas Controls has used computer simulations previously, however, the computational demands of modelling the behaviour of flanges were high, and so an HPC-based solution was necessary. This was the first time they had used such technology.

End User	Domain Expert	HPC Centre and HPC Expert
TexasControls	aimen TECHNOLOGY CENTRE	CESGA
www.texascontrols.com	www.aimen.es	www.cesga.es

THE CHALLENGE

To seal a joint properly, a gasket is placed inside a groove located on both flanges. The challenge here was to simulate and optimise tightening of the flanges - during the closing and tightening process, the gasket and the flanges may be damaged through deformations and high levels of stress. If the joint is damaged, it could fail, which could seriously harm workers, the surrounding community, and the environment.



The challenge of this case study was to simulate and optimise the tightening of flanges. This required the development of a computer model for simulating the tightening process and a front-end application to control the simulations in order to improve the design of the tightening process. The mechanical division of Texas Controls is the only engineering company in Spain specialising in tightening and sealing.

THE SOLUTION

A computer model was developed which represented all the functional parts of a flange, including the gasket and the tightening bolts. This model was driven by a user interface, which enabled different tightening scenarios to be evaluated. Using the model, Texas Controls could accurately simulate and improve the design of the tightening process. The model was implemented using both open-source and proprietary simulation codes. Several sizes of case studies were run.

EXPERIMENT #404 HIGHLIGHTS

Industry Sector:
Mechanical Engineering

Country: Spain

Software used:
code_aster

End Date:
December 2014

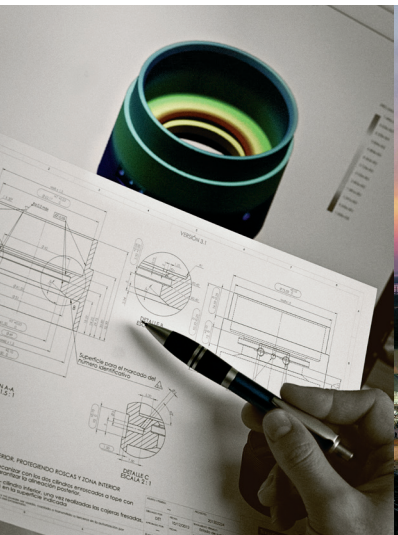
BUSINESS IMPACT

Based on previous experience in the field (when no simulations were carried out), a non-optimised tightening of a 24 stud bolt flange took 108 man-hours; using simulation, Texas Controls reduced the process to 72 man-hours - a 33% time saving per flange. Whilst this represents considerable savings in labour costs, the most important outcome is the reduction in downtime of industrial installations such as refineries.

The cost of "down time" for a medium-sized hydrocracker is about €21k per hour (€500k per day). Using advanced simulation, flange tightening can be reduced from 27 hours to 18 hours. This means a saving to the end-user of ~€180k, because the shutdown path is shortened by the same amount that the tightening process is optimized. HPC-based simulation also allows technicians to avoid damage to flanges during the tightening, which is not possible using the usual experience-based method. This can also have significant cost implications.

Texas Controls
Spain

These benefits give Texas Controls a significant competitive advantage in a highly technical industrial sector, which should result in winning major, international commissioning contracts. This is expected to result in an increase in revenue of €2 million over the next 3 years, and a related 15% increase in staff employed. Texas Controls has a range of other services where the use of cloud-based HPC tools have the potential to similarly enhance Texas Controls' competitive advantage.



FORTISSIMO

HPC Cloud-based design of high-voltage cables

ORGANIZATIONS INVOLVED

Prysmian Group is a world leader in the development and supply of energy and telecom cables and associated systems. Prysmian Group develops underground and submarine power cables in the energy sector, and medium- and low-voltage cables for the construction and infrastructure industry, and so need to model the physical behaviour of high-voltage power-transmission cables. Prysmian has a clear business requirement to scale-up its current simulations of energy cables and systems to a larger refinement and size, which exceeds the computing power available in-house. Prysmian would also like to undertake more ambitious simulations, requiring new competencies and tools. The demonstration of a successful, cost-effective cloud-based HPC simulation would be a breakthrough for Prysmian.

End User

Prysmian Group

www.prysmiangroup.com

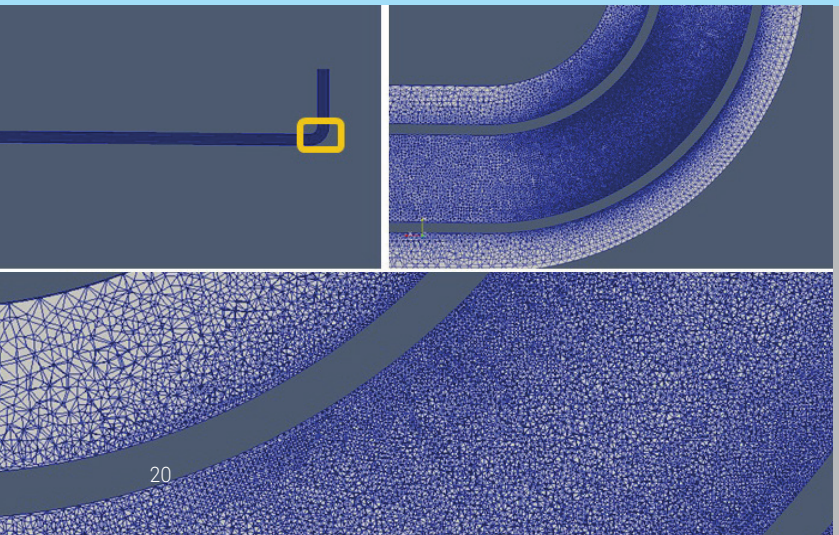
HPC Expert and HPC Service Provider

CINECA

www.cineca.it

THE CHALLENGE

Prysmian has used a standard modelling package for several years as its main tool for electromagnetic simulations, using 2D models on a few high-end workstations. However, finer simulations were needed, which were achieved using Cloud-based HPC to create a 3D model, and addressing how improved simulations could be exploited in a future business model. Another goal was to use open-source software in these simulations, to avoid expensive licences.



Both the third-party and open-source simulation packages have been ported to a Cloud-based HPC system. The resultant simulations have enabled Prysmian to improve the calculation of losses inside an energy cable, especially those induced by the magnetic field from the load current. They are also able to model better the heat transfer from the cable to the surrounding environment.

THE SOLUTION

Both the third-party and open-source simulation packages were ported to a Cloud-based HPC system. The resultant simulations enabled Prysmian to improve calculation of losses inside energy cables, especially those induced by the magnetic field due to the load current. Prysmian is also able to better model the heat transfer from the cable to the environment. This has improved their design capability significantly – 2D simulations have been replaced by much more realistic 3D simulations on the HPC system.

EXPERIMENT #405 HIGHLIGHTS

Industry Sector:
Electrical Engineering

Country: Italy

Software used:
COMSOL

End Date:
December 2014

BUSINESS IMPACT

The business benefits from the use of a Cloud-based HPC system arise from several sources. The move from the previous 2-D model to an advanced 3-D model enables much better cables to be designed. This allows Prysmian to retain the competitive edge needed to remain market leader with a time to market independent of the increase in complexity of the design process. The need for Cloud-based HPC simulation is of the utmost importance in this case study. Cloud-based HPC modelling has enabled better, more detailed simulations to be made in a shorter time. Running such simulations would not be feasible on a network of workstations, so previously Prysmian did not have this capability.

Prysmian Group
Italy

Prysmian estimates that the use of a Cloud-based HPC system instead of investing in an in-house system can provide savings of around 30% per annum in costs for cycles alone. This is based on the costs of the cycles needed to run the simulations in the HPC-Cloud compared with the costs of a suitable HPC computer system which would cost €150K, amortised over 3 years with additional annual operational costs of €40K. Further savings were also identified through the use of expertise on-demand at the computer centre rather than through the employment of a member of staff with the necessary expertise in simulation.

FORTISSIMO

HPC Cloud-based urban planning

ORGANIZATIONS INVOLVED

Founded in 1994, IES is an SME based in Scotland. IES develops the world's leading integrated building-performance modelling software system, designed to enhance building performance and create more sustainable buildings. The IES Virtual Environment (VE) is a suite of tools based around a single integrated data model. IES provides leading-edge support for the design, construction and operation of some of the largest, most challenging buildings in the world. Based on its VE, IES has developed a planning tool for cities, which will enable stakeholders to assess the energy efficiency of a city, quality of living, etc. The tool can be used in cities just beginning the journey towards a 'smart' city, or those that are well on their way towards integration with 'smart' technologies.

End User, Application Expert and ISV

INTEGRATED ENVIRONMENTAL SOLUTIONS

www.iesve.com

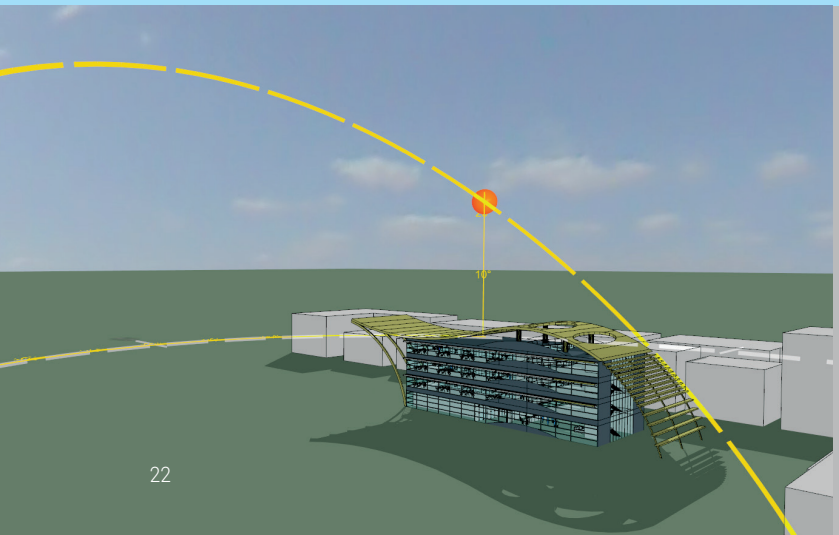
HPC Provicer and HPC Expert

epcc

www.epcc.ed.ac.uk

THE CHALLENGE

The purpose of IES' VE is to provide the information required to design, build and operate better performing, more sustainable communities. The planning tool based on the VE relies heavily on HPC cloud-based simulation, because of the amount of data generated by multiple buildings. A major objective here was to enable VE desktop installs and web-based interfaces to access calculation resources hosted on an HPC-cloud infrastructure.



Based on its VE, IES has developed a planning tool for cities, which will enable relevant stakeholders to assess, for example, the energy efficiency of a city, quality of living etc.

This tool relies heavily on the availability of HPC cloud-based simulation because of the very large amounts of data associated with multiple buildings and their interaction within the urban context.

THE SOLUTION

IES' planning tool addresses large simulations quickly and effectively through Cloud-based HPC, but uses a familiar workstation for data display. This case study has proved to be very significant for IES. Simulations run from personal workstations or company servers were often long and tedious, with the consultant having to wait for results to be available. A cloud-based HPC approach significantly decreased the run-time of simulations whilst substantially increasing the number of buildings per simulation.

EXPERIMENT #406 HIGHLIGHTS

Industry Sector:
Urban Planning

Country:
United Kingdom

Software used:
In-house code

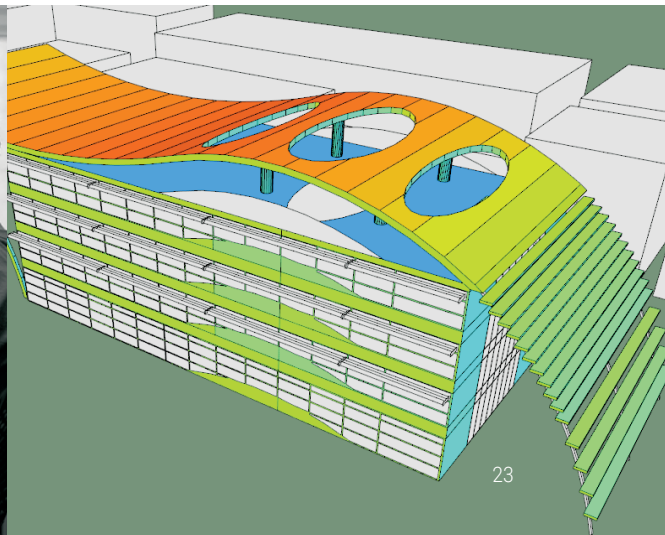
End Date:
December 2014

BUSINESS IMPACT

In this case study, model simulations ranging from the small to the very large were tested. Typical speedups (comparing the workstation to the HPC system) were between 5 and 10 times faster for the HPC system. The major benefit of this is that simulations, which previously had unrealistically long compute times of days or weeks on the workstation, could be run in a few hours or days using the Cloud-based HPC system. As IES' VE is used today by many of the world's leading architectural and engineering practices, this has clear commercial benefits. Indeed, based on the successful experiment, IES is now offering an HPC-based service to its customers. This service embodies a pay-as-you-go approach which is underpinned by HPC-systems available from EPCC, the HPC centre of the University of Edinburgh.

IES
United Kingdom

A 64-core in-house system costing £33k would have an annual running cost of around £22k (support, maintenance, electricity, housing, etc.). Amortised over three years, this gives a total cost per core hour of £0.10, compared with a cost of £0.05 for Cloud-based HPC cycles – already a 50% saving. Cloud-based HPC looks even more cost effective when it is considered that an in-house system would never be used continuously, and so would be even less competitively priced than this calculation indicates.



FORTISSIMO

HPC Cloud-based optimisation of aircraft wiring

ORGANIZATIONS INVOLVED

KEW, an SME founded in 2008, specialises in the optimisation of engineering-intensive projects in the manufacturing industry. In particular, KEW is active in the aerospace sector and has developed an application to optimise the routing of wiring within an aeroplane. This is an important issue in the design of aircraft, which traditionally has been addressed by trial and error. Although this problem can be tackled using computer models, applications to do this are very computationally intensive. SMEs generally do not have the available resources to buy and maintain the large computer systems needed to perform the necessary optimisations, nor do they have the required expertise to use such systems.

End User	Domain Expert	HPC Expert	HPC Centre
KE-works	noesis	CINECA	GOMPUTE
www.ke-works.com	www.noesissolutions.com	www.cineca.it	www.gompute.com

THE CHALLENGE

The challenge addressed by this case study was to adapt a wiring optimisation application from KEW to run on a Cloud-based HPC system, so that wiring layouts could be optimised in a feasible length of time, at an acceptable cost. This solution would involve computationally intensive simulations that could be run on a pay-per use basis, with significant savings over owning a system, and would offer sufficient resources to satisfy demand.

In particular KEW is active in the aerospace sector and has developed an application to optimise the routing of wiring within an aeroplane. This is an important issue in the design of aircraft which traditionally has been addressed by trial and error. This case study showed that an advanced wiring optimisation application would run 20 times faster on an HPC system compared to the current suboptimal simulation running on a workstation.

THE SOLUTION

The solution has involved porting the KEW optimization software to run on an HPC system and developing the necessary "glue" software to bring all the necessary software components together taking account of any software licensing issues. The successful implementation of this solution has enabled typical optimisations to be run on an HPC system much more quickly and effectively. It should be noted that this case study was the first time that KEW had used HPC in its wiring optimization.

EXPERIMENT #408 HIGHLIGHTS

Industry Sector:
Electrical Wiring

Country: Netherlands

Software used: MORE

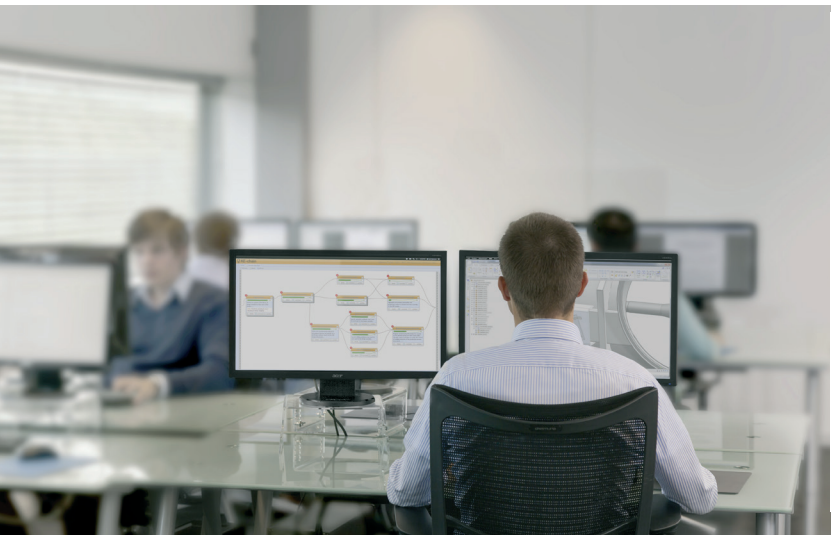
End Date:
December 2014

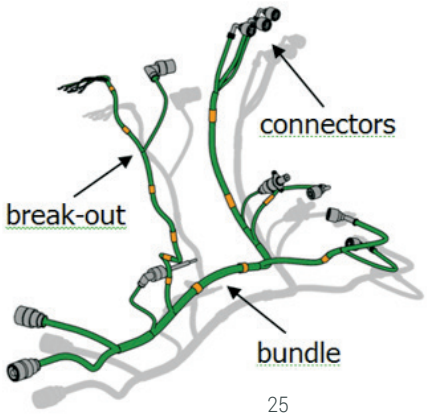
BUSINESS IMPACT

By using advanced simulations, KEW improved the quality of its designs, and reduced costs by 2.5% per design. Using Cloud-based HPC instead of in-house resources contributed to a reduction of 90% in the lead-time for the design of a single Electrical Wiring and Interconnection System, and an eight- to ten-fold reduction in computational costs. The impact of a single simulation may be very significant, as a single optimised wiring design may be used in hundreds of aircraft. The automated, optimised process running on a Cloud-based HPC system gave a 2.5% reduction in cost and weight of the wiring system. This is a recurring benefit, as all aircraft of the same type will utilise the same wiring design. As the aerospace industry has very fine margins, a 2.5% saving may increase profit margins by 50%. Saving one kilogram in the wiring may enable a 20kg reduction in overall aircraft weight, which will reduce fuel consumption over the aircraft's life.

KE-Works
Netherlands

The cost of computation on a Cloud-based HPC system is about €660 for a single design run, compared to an annual cost of an in-house HPC system of about €61K. Furthermore, a Cloud-based HPC system is much more flexible if more computational power is required. This demonstrates the feasibility and cost-effectiveness of using Cloud-based HPC for engineering simulations. SMEs are much more able to afford to use Cloud-based HPC, allowing them to compete better with larger organisations.





FORTISSIMO

HPC Cloud-based prediction of air quality

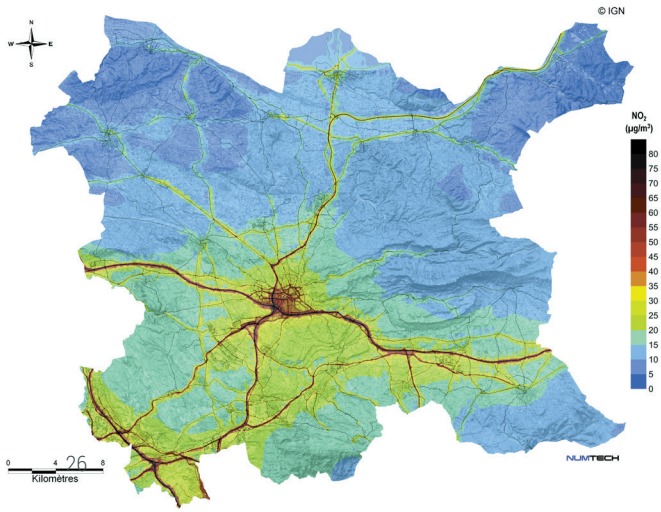
ORGANIZATIONS INVOLVED

Numtech is a French SME specialised in the development and use of innovative digital tools for air-quality and meteorological simulations. They are the market leader in France for modelling the weather and atmospheric dispersion. Its customers are mainly large companies, local and regional authorities, and research institutes. Numtech makes substantial use of the ADMS code from CERC in its business. European regulations on air-quality now require more and more testing and evaluation of pollution adaptation and reduction scenarios. Rather than evaluating 2 to 3 scenarios, consulting companies and regional air-quality agencies now need to evaluate tens of scenarios. This requires an increase in their capacity for computing, beyond what they can manage with in-house resources.

End User	Software and Domain Expertise Provider	HPC Providers and HPC Experts
NUMTECH	CERC	Bull atos technologies
www.numtech.fr	www.cerc.co.uk	www.bull.com

THE CHALLENGE

The challenge here was to demonstrate the use of Cloud-based-HPC services to investigate air-quality at city-scale. Running simulations using Cloud-based HPC would help to increase the numbers of scenarios which could be feasibly simulated in a given time, and reduce the computational time needed for simulations. The outcomes of using this system include shorter times for simulations and cost reductions, with resultant competitive advantages.



The challenge of this case study was to demonstrate the use of Cloud-based-HPC services to investigate air-quality at the scale of cities. This case study used the ADMS-Urban software from CERC running on the Extreme Factory HPC offering from BULL.

THE SOLUTION

This case study used the ADMS-Urban software from CERC running on the Extreme Factory HPC offering from BULL. ADMS-Urban was adapted to run on a Cloud-based HPC system. The results of the simulations were then made available via a familiar workstation environment. In doing this, an evaluation of the viability of this service on commercial HPC clouds has been carried out and possible business models for such a service have been proposed.

EXPERIMENT #410 HIGHLIGHTS

Industry Sector:
Urban Planning

Country: France

Software used:
ADMS Urban

End Date:
December 2014

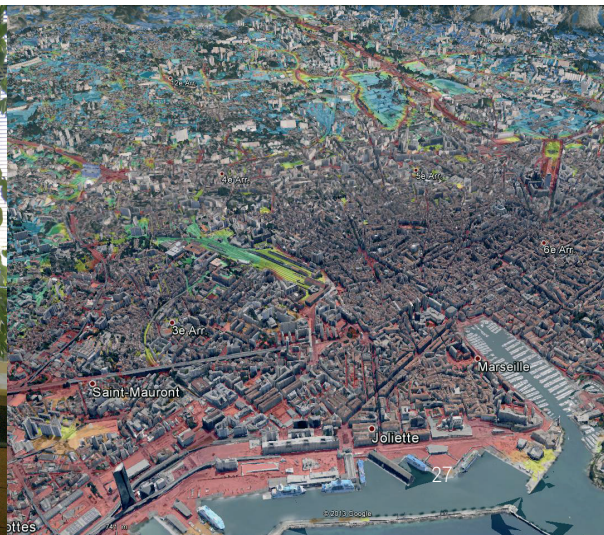
BUSINESS IMPACT

To offer a simulation service, CERC needs to source computer cycles, which means it either needs to own and maintain a sufficiently powerful HPC system, or it needs to buy cycles from an HPC centre. In the former case, a powerful enough in-house server would need to be purchased. Investigation shows that if the average time a server is in use falls below 40%, a pay-on-demand cloud service becomes a more economically viable option, compared with the costs to acquire and maintain that server. This depends on the mode of use, but buying cycles on demand offers considerable flexibility to SMEs looking to set up a service.

Numtech
France

As a result of this study, CERC can now offer the ADMS-Urban software as a cloud service on a pay-for-use basis, rather than requiring a customer to purchase an annual licence and run the software locally on workstations. This allows for an attractive pricing option for customers needing an infrequent use of the model.

Using Cloud-based HPC services, Numtech can save production costs of €125k over 5 years, which allows them to offer more competitive services. By recruiting new customers, Numtech's turnover is expected to increase by a total of €750k over the same time. Finally, the new capacity to launch multiple scenarios at reasonable cost using SaaS constitutes a new business model that will further increase NUMTECH's turnover by €150k up to 2020.



FORTISSIMO

HPC Cloud-based reduction of vehicle emissions

ORGANIZATIONS INVOLVED

AVL is the world's largest independent company in the development of powertrain systems for internal combustion engines and associated instrumentation and test systems, and has been working in partnership with companies all over the world for more than 60 years. The need for CO2 reduction, the increasing complexity of new powertrain systems, and a requirement to achieve the highest possible level of process efficiency are some of the key challenges facing the automotive industry now and for the foreseeable future. AVL provides its customers, many of which are SMEs, with a set of comprehensive simulation tools in a flexible and open environment enabling multi-disciplinary solutions as an integral part of the powertrain development process.

End User and Code Owner

AVL

www.avl.com

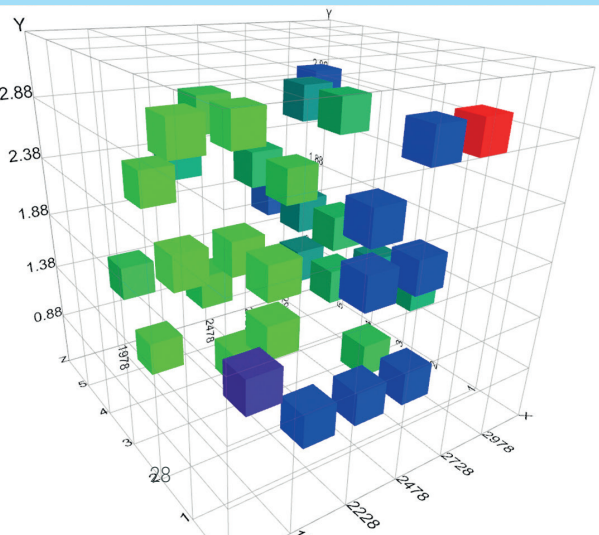
HPC Centre and HPC Expert

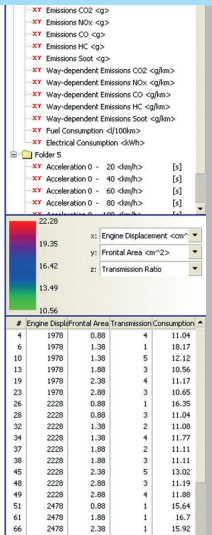
HLRS

www.hlrs.de/home/

THE CHALLENGE

This case study addresses the use of on-demand, Cloud-based HPC resources to tackle the important requirement for the reduction of CO2 emissions in the design of vehicles. The majority of projects in the area of vehicle optimization involve studies with large-scale variations in parameter and components on a limited palette of base vehicle models. These studies require high levels of CPU cycles on-demand.





The outcome of this case study has been to demonstrate the viability of on-demand computing resources in the design of powerchains with specific emphasis on the reduction of CO2 emissions.

THE SOLUTION

Providing sufficient computational resources to accomplish optimization tasks in an acceptable time-frame is a struggle faced not only by SMEs, but even by larger companies. The outcome of this case study has been to demonstrate the viability of on-demand computing resources in the design of powertrains with specific emphasis on the reduction of CO2 emissions. This solution involves the running of AVLs simulation codes on a Cloud-based HPC system where computer resources are made available on-demand.

EXPERIMENT #412 HIGHLIGHTS

Industry Sector:
Automotive

Country: Austria

Software used:
AVL CRUISE

End Date:
December 2014

BUSINESS IMPACT

The most clear cost benefit of using HPC-cloud resources is the possibility to lease a powerful computing cluster for single projects, instead of acquiring and maintaining in-house computational resources. These would likely be underutilized for most of the time, and may even not be sufficiently utilised to justify their cost when in use. Using a Cloud-based solution, taking into account all additional cloud overheads, short-term projects running millions of simulations on 400 cloud CPU cores for a period of a couple of weeks, several times a year, would run with costs reduced by up to 90% when compared to the total cost of ownership of a dedicated in-house system. This is the cost range where it becomes attractive for SMEs to participate in projects which require high CPU power for only a short time.

AVL
Austria

The results of using a cloud-based approach mean AVL are better able to offer their powerful simulation platforms to its clients. Given the breadth of the product space AVL and its clients occupy – among them diesel engines, electric drives, alternative fuels, control software, transmissions, and batteries - this should have significant economic and competitive advantages for AVL. AVL is now better able to go about its business, tackling the development of highly creative, mature and application-specific solutions for its customers in order to meet their market challenges.

FORTISSIMO

HPC Cloud-based simulation of hazardous chemicals

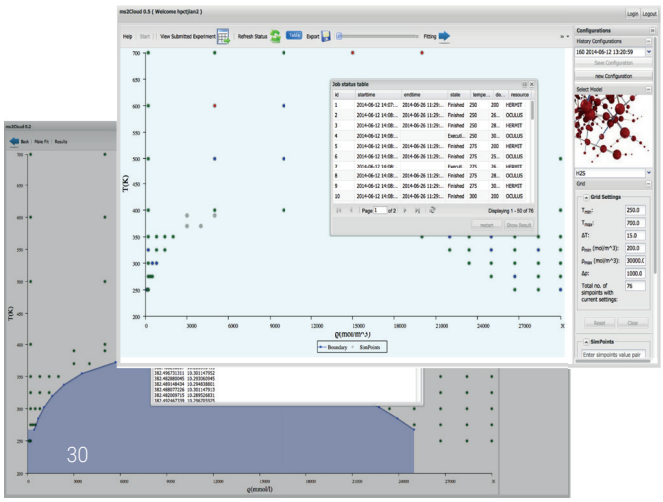
ORGANIZATIONS INVOLVED

Founded in 1897 in Switzerland, Lonza is one of the world's leading and most trusted suppliers to the Pharma & Biotech and Specialty Ingredients markets. A key part of Lonza's business is in distillation columns, whose operation requires a detailed knowledge of the thermodynamic properties of the target compounds. The chemical industry usually measures the required data experimentally, and this was previously how Lonza operated as well. However, when determining the properties of hazardous substances (explosive, toxic or mutagenic), computer-based simulations are a very attractive alternative to dangerous and expensive physical tests. Powerful predictive methods now exist that calculate the properties of compounds using simulation, but these require significant computing power.

End User	Domain Expert	HPC Centre and HPC Expert
Lonza	ThEt Universität Paderborn Die Universität der Informationsgesellschaft	HLRS
www.lonza.com	www.uni-paderborn.de	www.hlrs.de/home

THE CHALLENGE

In this case, the goal was to demonstrate the benefits of porting an existing third-party code to an HPC system. To determine a full set of physical properties for one compound, around 200 state points need to be calculated. Currently, a single state point calculation takes 20 hours on a 16-core workstation, so the total calculation would take up to 4000 hours - almost six months. Access to an HPC system would decrease this to a reasonable level.



Access to an HPC system decreased state point calculation time to a reasonable level.

Shortening the time needed to determine a compound's properties brings clear benefits to the design process.

THE SOLUTION

A detailed molecular-simulation code has been implemented on an HPC system driven by a simple, web-based user interface. Multiple simulations of state points can be initiated through this interface enabling the complete thermodynamic properties of a compound to be determined in a reasonable length of time. For example, whilst the calculation of a complete set of physical properties would take ~6 months on a 16-core cluster, the calculation time can be reduced to below 20 hours on an HPC system.

EXPERIMENT #414 HIGHLIGHTS

Industry Sector:
Chemical Engineering

Country: Switzerland

Software used: ms2

End Date:
December 2014

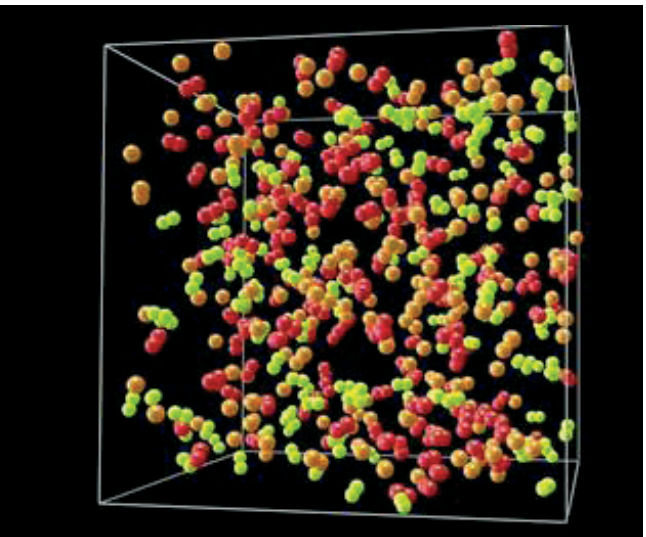
BUSINESS IMPACT

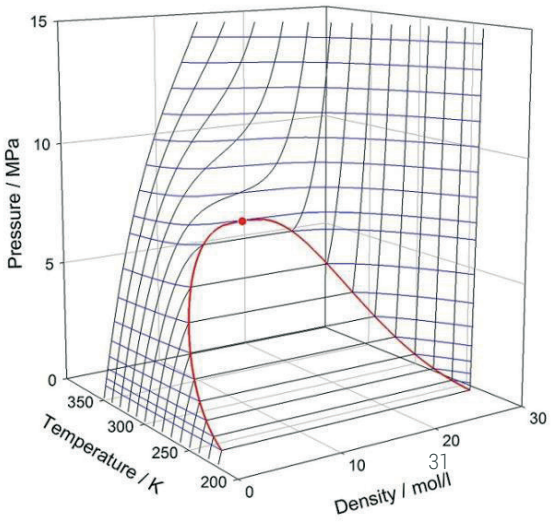
The use of simulation can bring massive savings to Lonza's production process. Shortening the time needed to determine a compound's properties brings clear benefits to the design process. It is also clear that the cost of cycles is much less than that of owning and maintaining a large HPC system in-house.

The cost to determine a single property of a single compound experimentally is approximately €2700. For a mixture of compounds, this cost increases significantly - 60 gas solubility data points of a binary mixture can cost up to €50,000. Compared to that, 60 molecular simulations covering the entire fluid region up to arbitrary high pressures will cost around €1,600, while for the mixture the cost usually doubles compared to a pure component, so €3,200. Not only does this represent a huge reduction in costs for Lonza, this also covers conditions that are difficult or impossible to test experimentally.

Lonza
Switzerland

A typical distillation column designed by Lonza costs around €1.5 million. This includes the design of a system to obtain all required physical properties through experimental measurements, costing €100,000 (100 staff days at €1,000). Using a modelling simulation, this cost would be only €13,600, saving €86,400 for a single distillation process, of which Lonza designs in excess of five per year. Given these figures, it is clear that HPC cloud-based simulation has considerable benefits for Lonza.





FORTISSIMO

HPC Cloud-based design of copper-alloy moulds

ORGANIZATIONS INVOLVED

Founded in 1959, IMR is an SME which designs and manufactures foundry equipment for brass alloys and bronze; the company also dedicated consulting services for designing moulds and other manufacturing processes. It is essential to ensure a laminar flow of liquid metal through the mould and a uniform cooling gradient, in order to avoid cracks and defects in the final piece. The success of this depends on the design of the mould; the quality of which usually depends on the experience of mould makers. Currently, the mould is often modified several times before committing to production. There are several commercial packages for the simulation of casting processes, but they have not been widely used in this sector.

End User

IMR E&T S.p.a. ENGINEERING & TECHNOLOGIES

www.imr.it

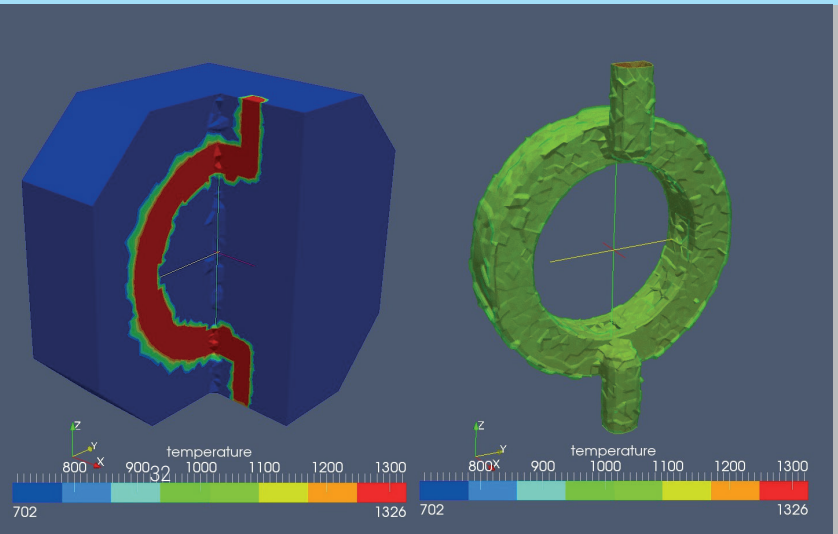
HPC Provider and HPC Expert

ARCTUR

www.arctur.si

THE CHALLENGE

In the past, IMR has tried to conduct simulations with commercial software, but never with HPC. The costs associated with purchasing dedicated casting software, the necessary hardware, and the training required are not viable for SMEs like IMR, whose normal activities do not require such an investment. They therefore wanted investigate how cloud-based simulations could improve the time to market and productivity.



The challenge of this case study was to demonstrate the benefits of simulation, in order to support the business decisions of the SME. A computer model to simulate the flow of copper alloys was developed based on an open-source software package. This model produces a reliable simulation, in a simple geometry, of the filling of a mould by the molten copper alloy at low pressure that keeps track of both the filling velocity and the thermal exchange between the mould and liquid metal.

THE SOLUTION

A computer model was developed, based on an open-source software package, which would simulate the flow of copper alloys. This model produces a simulation of the filling of a mould by the molten copper alloy at low pressure, and the reliability of the results were validated by comparison with physical tests. Using a Cloud-based HPC system, the time for simulations could be reduced from one day to 3 hours, which is a more acceptable time frame.

EXPERIMENT #415 HIGHLIGHTS

Industry Sector:
Casting

Country: Italy

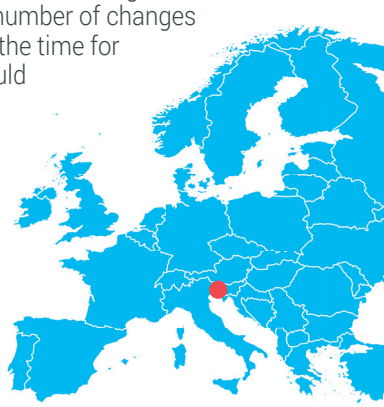
Software used:
Elmer FEM

End Date:
December 2014

BUSINESS IMPACT

Although IMR had used simulation in the past, this was their first experience of using an HPC cloud-based system for simulations. The use of HPC reduced the number of changes required to the mould prototype during its design. This reduced by 20% the time for development of the mould and saved 20% of the cost of testing the mould before mass production can begin.

The average cost for the design and testing of a set of moulds for a new product based on the traditional, experience-based, trial-and-error method is currently about €41,000. The use of a Cloud-based HPC simulation method saves about € 8,000 per set and 3 weeks of testing and modifications. This includes all costs, such as set-up times and computing costs, not just design and testing. IMR has about 8 sets of moulds per year to develop, so this represents a total annual saving of €64,000. It aslo reduces the time to market of the moulds, so IMR may be able to produce more moulds per year, increasing their profitability. The ability to quickly and accurately design a mould, without the wastage of materials inherent in the trial-and-error method, will further increase their competitiveness in their business sector. Furthermore these simulations create the opportunity for IMR to offer its customers a new, HPC-based design service.



IMR
Italy

FORTISSIMO

HPC Cloud-based simulation of sports-car aerodynamics

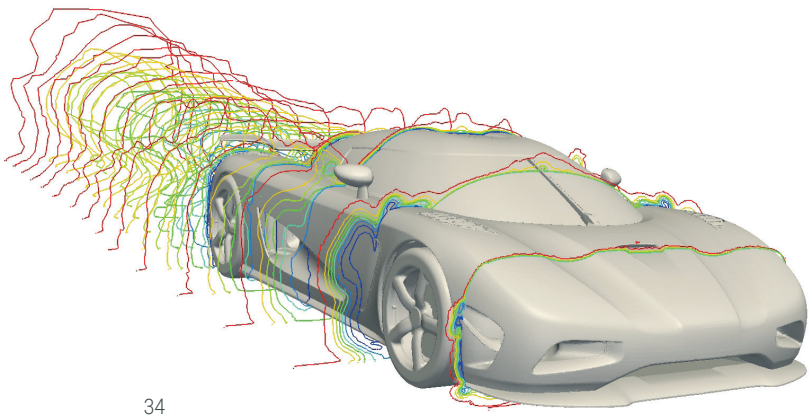
ORGANIZATIONS INVOLVED

Koenigsegg is a Swedish SME. Established in 1994, they are a leading designer and manufacturer of high-performance sports cars. In the development of these cars, intensive CFD simulations are carried out to reduce the cost of wind tunnel testing. Models are created which accurately replicate real-life cars, including all geometric details - such as rotating wheels and integrated components (including heat exchangers, fans and condensers). These models can be very large and complex, so the use of HPC can make a significant difference in how accurately a simulation can be conducted and how long it takes to complete. This case study was the first time that Koenigsegg had used HPC in the design of a hypercar, the One:1.

End User	ISV	HPC Expert	HPC Provider
Koenigsegg	icon		CINECA
www.koenigsegg.com	www.iconcfd.com	www.dit.hua.gr	www.cineca.it

THE CHALLENGE

There are two ways to determine how air flows over a car: wind tunnel testing and simulating air flow using Computational Fluid Dynamics (CFD). Wind tunnel tests are expensive and time-consuming, so are only used infrequently, but simulations can be used throughout the design phase. The challenge here was to show how cloud-based HPC resources can reduce the amount of required wind tunnel testing and show the cost-effectiveness of this approach.



The challenge facing Koenigsegg was to perform simulations of the flow over its hypercars which were sufficiently detailed to model real physical effects accurately.

Such simulations require suitable simulation codes and expensive computer resources, which are normally beyond the means of an SME.

THE SOLUTION

Before the start of this case study, Koenigsegg had only limited in-house computing resources and no experience in HPC-based CFD. Access to Cloud-based HPC allows simulations to run on a pay-per-use basis, which makes access to powerful computing resources financially viable for an SME, as well as reducing hardware and maintenance costs. The use of ICON simulation software on a Cloud-based-HPC system has enabled Koenigsegg to reduce or even, in some circumstances, avoid wind tunnel testing.

EXPERIMENT #417 HIGHLIGHTS

Industry Sector:
Automotive

Country: Sweden

Software used:
iconCFD

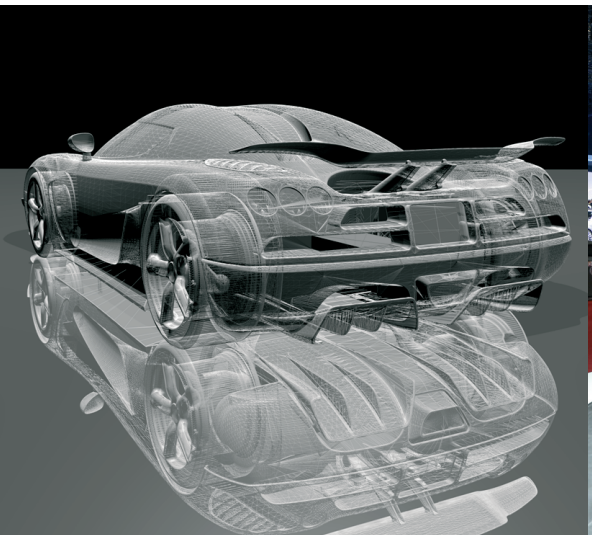
End Date:
December 2014

BUSINESS IMPACT

In this case study, 100% of the aerodynamic development of the Koenigsegg One:1 has been conducted using HPC-based CFD simulations. Koenigsegg were able to completely eliminate expensive wind tunnel tests thanks to the high fidelity of HPC simulations, allowing them to have confidence that the simulation results would transfer into real-world gains. In less than eight months, hundreds of simulations to test various configurations have been carried out. The results were an impressive 250% increase in down-force with only a 15% increase in drag at 250km/h and with a 50% higher down-force at 440km/h, the vehicle's maximum speed. Tests have shown that HPC-based simulation, supported by external software and expertise, led to a return on investment in less than three months for the production of a new car configuration. Significant costs can be saved and transferred to other critical parts of the development and production process.

Koenigsegg
Sweden

The benefits obtainable by the use of the Fortissimo HPC-Cloud can be quantified as a 5% saving in operational costs, a 30% saving in design costs, a reduction of 50% in wind tunnel and physical testing, a 60% saving in prototyping costs, and a 30% shortening of the time to market. Furthermore, savings in development were about €90K per year on the design process, a 1.5% reduction in overall development costs. These calculations take account of a computing cost on the Cloud-based HPC system of around €100K.



FORTISSIMO

HPC Cloud-based design of centrifugal pumps

ORGANIZATIONS INVOLVED

Founded in 1984, EnginSoft is a consulting SME operating in the field of computer-aided engineering, virtual prototyping and advanced simulation, including computational mechanics and fluid dynamics, numerical crash testing, and environmental engineering. EnginSoft has around 160 employees, 6 sites in Italy and 5 branch offices in Europe. In this case study, Enginsoft addressed the design of centrifugal pumps using advanced HPC-based simulation. Centrifugal pumps are widely used in many industrial applications, from oil & gas to water treatment, automotive and home appliances. Such devices may be required to operate over a wide flow range and the prediction of operating characteristic curves is essential for a designer.

End User

ENGINSOFT

www.enginsoft.com

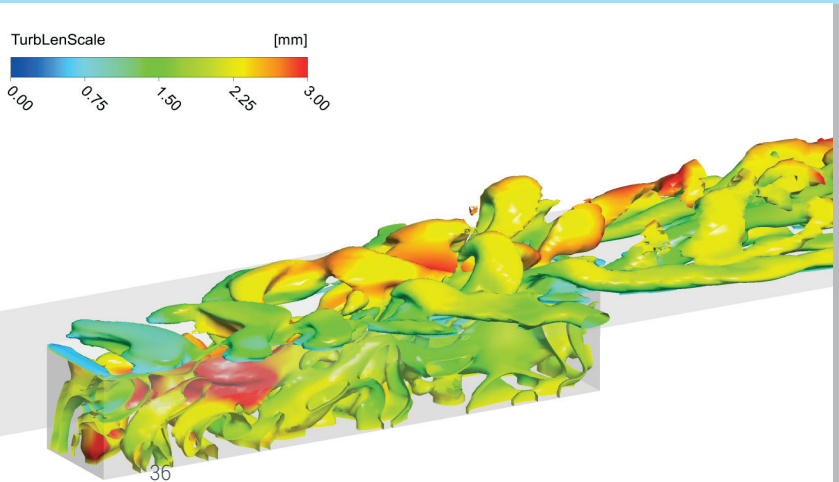
Computer Centre and HPC Expert

CINECA

www.cineca.it

THE CHALLENGE

Numerical simulation has become an important and common tool for pump designers. Many tasks can be solved faster and cheaper numerically than by means of experiments and, most important, the complex internal flows in water pump impellers can be predicted well. Performing the numerical simulations required would not be possible for a typical SME, which has neither the technical expertise nor the computing resources to carry out such a simulation.



The numerical simulation of centrifugal pumps is not easy due to a number of challenges: complex geometries, unsteady flows, turbulence, secondary flows, flow separation, boundary layers and so on. These aspects require a high-fidelity CFD model, very fine computational grids and the analysis of transient flows.

THE SOLUTION

A simulation model has been implemented on a Cloud-based HPC system for a centrifugal pump using a commercially available software package. This represents an attractive solution in terms of cost, effectiveness and relevance for those SMEs which do not have the resources to perform the necessary simulations on their own. The benefits of simulation using Cloud-based HPC system has been demonstrated through a series of experimental runs.

EXPERIMENT #418 HIGHLIGHTS

Industry Sector:
Turbomachinery

Country: Italy

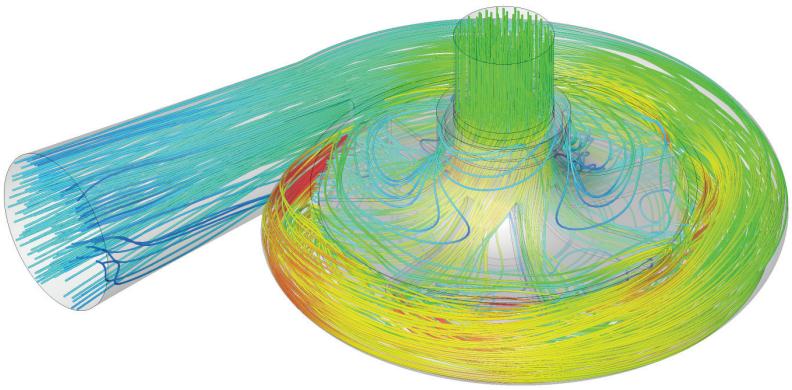
Software used:
ANSYS CFD

End Date:
December 2014

BUSINESS IMPACT

The test runs have shown that the use of HPC-based simulation using a combination of Cloud infrastructure and external expertise results in a return on investment in less than six months. The simulation of centrifugal pumps is not easy due to a number of challenges: complex geometries, unsteady flows, turbulence, secondary flows, flow separation, boundary layers and so on. Simulating these requires a high-fidelity CFD model, very fine computational grids and the analysis of transient flows. The design and optimisation of a single pump can thus take 2 to 3 years to complete. With the advantage of access to cloud-based HPC, this can be reduced to 6 months. The improved design process using simulations can give Enginsoft a significant commercial advantage, allowing them to design and test up to six different pump designs in the time it would take a competitor to perfect a single design. It can also offer these pumps at an extremely competitive cost thanks to the money saved: not only do EnginSoft not need to purchase and maintain costly dedicated computational resources, the increased efficiency of HPC-based simulations saves time, and therefore money, throughout the design process.. Due to this improvement in the design process, Enginsoft expects to increase its market share by at least 1% with a resultant profit of €100,000 per year.

Enginsoft
Italy



FORTISSIMO

HPC Cloud-based simulation of drifting snow

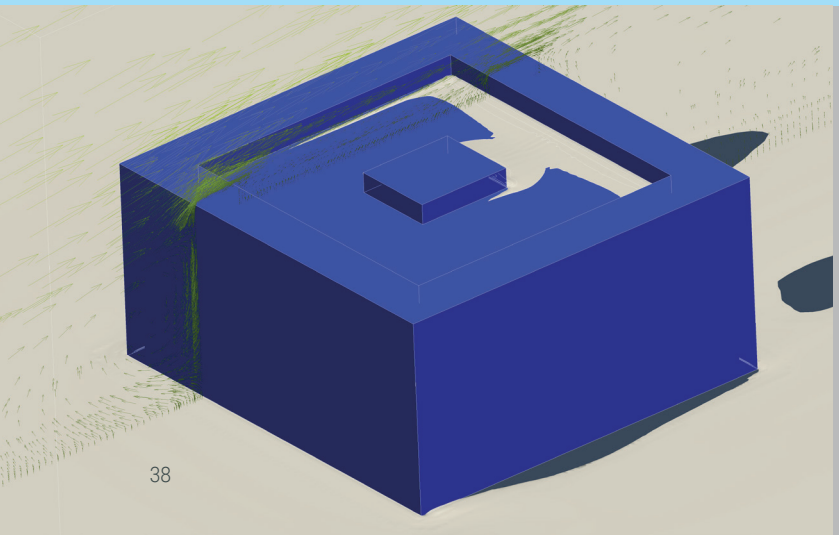
ORGANIZATIONS INVOLVED

Founded in 2005, Binkz is an SME whose business is consultancy, specialising in single and multiphase flows. Binkz provides state-of-the-art consultancy services using computational fluid dynamics (CFD) for applications such as wind engineering, process technology and aircraft icing. Binkz has developed the CFD program snowFoam. This program allows an accurate assessment of snow loads on buildings. The maximum snow load that may be accumulated on a building rooftop is an essential parameter in assessing the safety and stability of a building. When compared to existing alternatives, snowFoam is more accurate, more reliable and more versatile, but it requires the computational resources that only an HPC system can provide.

End User and Code Developer	HPC Expert	HPC Provider
BinkZ Inc.	VORTECH BV	SURF SARA
www.binkz.ca	www.vortech.nl	www.surfsara.nl

THE CHALLENGE

The overall challenge was to study the commercial feasibility of a CFD consultation service for assessing snow loads on buildings, employing snowFoam, to civil engineering firms on the Fortissimo HPC-cloud infrastructure. For the viability of such a consultancy service, it is essential that both the simulation time and the cost of the computation are acceptable within the framework of a typical CFD consultation project.



Every year, roof collapses due to accumulated and drifting snow are responsible for losses in the order of hundreds of millions of Euros as well as bodily injuries and loss of life. Binkz has developed the CFD program snowFoam. This program allows an accurate assessment of snow loads on buildings. When compared to existing alternatives, snowFoam is more accurate, more reliable and more versatile, but it requires the computational resources that only an HPC system can provide.

THE SOLUTION

This case study has shown that the simulation of drifting snow using snowFoam is feasible using a Cloud-based HPC system. Analysis can be completed within a few weeks, which fits well with the timescales for the design of buildings. In the solution developed here, the user has access to computing resources, storage, and visualization facilities from a desktop environment. The required computational resources needed and their costs are appropriate considering those for the overall design of a building.

EXPERIMENT #419 HIGHLIGHTS

Industry Sector:
Civil Engineering

Country: Canada

Software used:
OpenFOAM

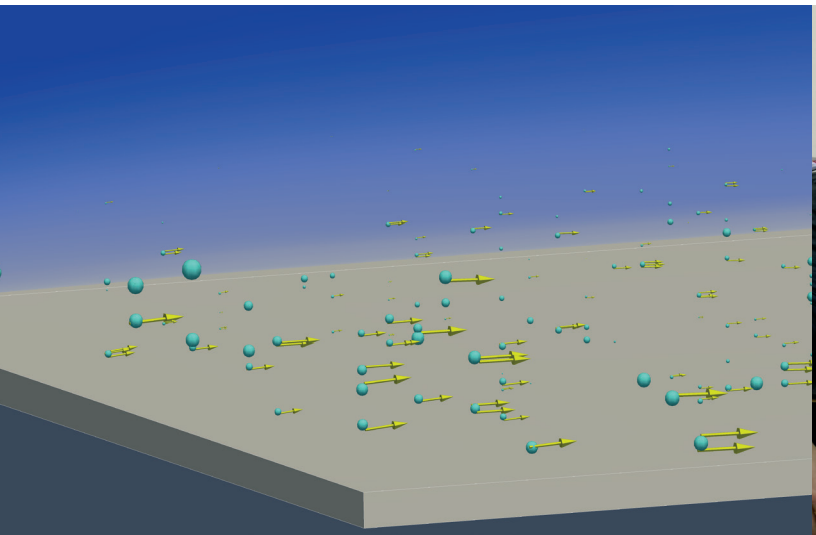
End Date:
December 2014

BUSINESS IMPACT

Every year, roof collapses due to accumulated and drifting snow are responsible for losses of hundreds of millions of Euros as well as bodily injuries and loss of life. This is a problem for all countries in Northern Europe and more generally in the Northern hemisphere. The maximum snow load that may be accumulated on a building rooftop is an essential parameter in assessing the safety and stability of a building. It is, however, hard to predict the maximum snow load when designing a new building. This leads to a costly over-design of the structure, which could be avoided if the snow load could be predicted with sufficient accuracy.

Binkz
Canada

The simulation of drifting snow requires significant compute resources, which can only be provided by a large HPC system. A typical simulation of drifting snow takes 50,000 CPU hours. This equates to 150 CPUs for 14 days. Furthermore, at a cost of €0.2 per CPU hour, this represents a cost of €10,000. A small consultancy at Binkz would not be able to afford the capital cost of a system containing 150 CPUs, neither could it use a smaller system in-house because the computation time would be much longer than the target two weeks. Even if Binkz were to buy a suitable system, then it would only be used for a fraction of the time and its overall costs would be much greater than the use of a Cloud-based system. Consequently, there is a clear benefit for Binkz in the use of a Cloud-based HPC system.



FORTISSIMO

HPC Cloud-based molecular modelling

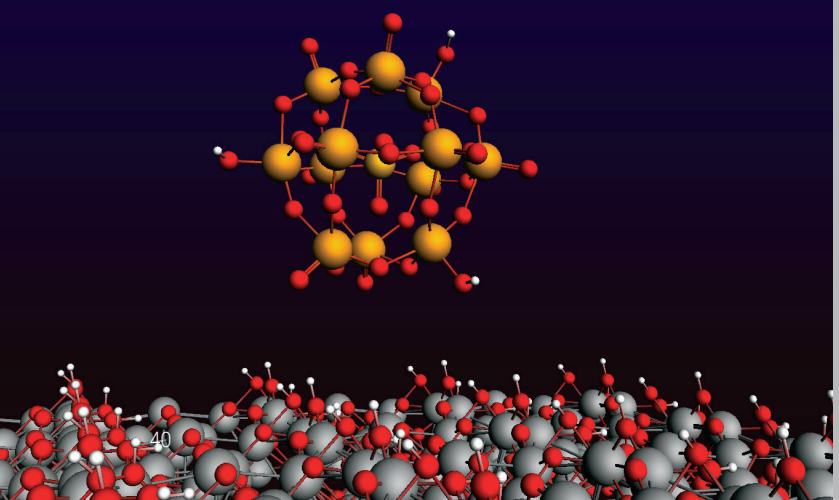
ORGANIZATIONS INVOLVED

The Albemarle Corporation is a global leader in the development, manufacture, and distribution of highly engineered speciality chemicals. It serves customers in approximately 100 countries in a wide range of sectors, including petroleum refining, automotive, transportation, pharmaceuticals, and food safety. Albemarle already uses HPC in the development of its products, however, it wants to improve its capability in this area through the use of CPU-GPU hybrid HPC platforms which offer significant benefits in terms of price-performance and power-performance. In order to take advantage of this, the simulation codes in use by Albemarle need some reprogramming.

End User	ISV	HPC Expert and Service Provider
ALBEMARLE®	SCM Scientific Computing & Modelling	SURF SARA
www.albemarle.com	www.scm.com	www.surfsara.nl

THE CHALLENGE

The challenge in this case was to port an existing simulation code for molecular modelling so that it would run on a hybrid HPC platform. To demonstrate the successful porting of this code and the benefits of using a hybrid HPC system, a test case was chosen from the petroleum refining sector which involved the use of catalysts in the removal of sulphur from vehicle fuels.



Molecular modelling is a proven powerful tool, providing key information for the design of new chemicals and materials.

THE SOLUTION

Molecular modelling is a proven powerful tool, providing key information for the design of new chemicals and materials. However, accurate molecular modelling requires significant computing power that even an SME with experience in HPC, such as Albemarle, would not have access to. The solution involved not only the porting of the simulation code for the target computer system, but also the development of a simple user interface to prepare the models and their submission to the HPC system.

EXPERIMENT #420 HIGHLIGHTS

Industry Sector:
Chemical Engineering

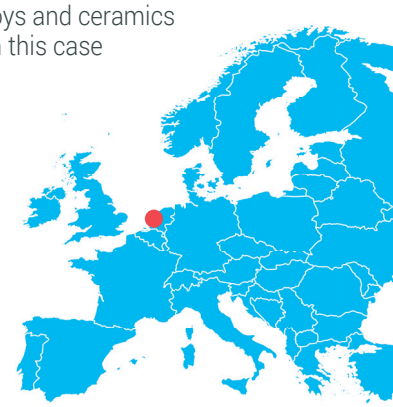
Country: Netherlands

Software used: ReaxFF

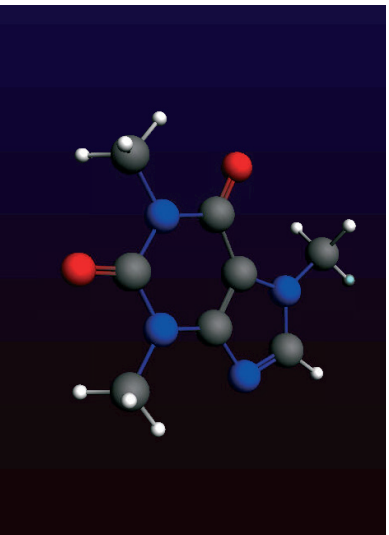
End Date:
December 2014

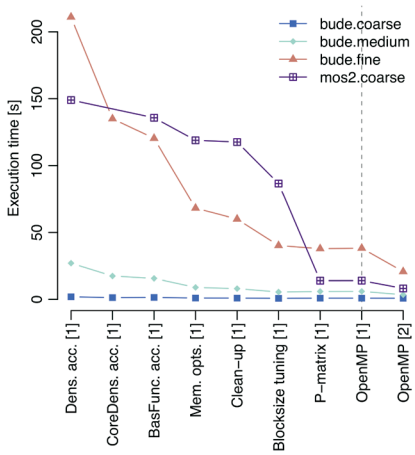
BUSINESS IMPACT

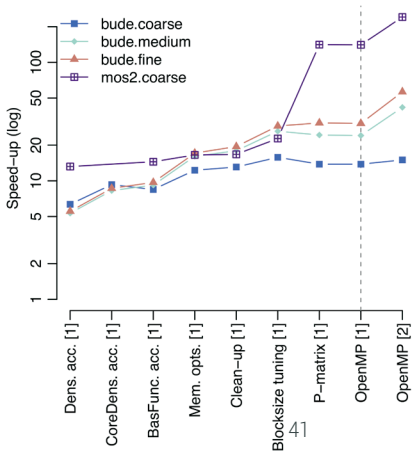
The software for modelling large-scale molecular systems has applications in sectors such as electronics, organic chemistry, food, paints, dyes, adhesives and alloys and ceramics for the aerospace industry. Modelling these systems is complex, and in this case required the use of a CPU-GPU hybrid system to provide the necessary computational power. This case study demonstrated a successful port of a molecular modelling software package to a hybrid HPC system, with resultant cost benefits. It was determined that, in this case, the annual costs for the use of a Cloud-based HPC system on a pay-per-use basis were approximately half that of owning and maintaining a sufficiently powerful in-house system, representing a yearly saving of €38,000. The ability to access powerful computing resources on a pay-per-use basis offers significant flexibility to SMEs who would not be able to access HPC in other ways. This allows them to develop and refine their product lines more efficiently, giving them a competitive advantage in their sectors. The results of this case study will benefit many SMEs, not just Albemarle, as the code developed in this case study can be offered to other companies wishing to perform detailed molecular simulations. As a result of this case study, Albemarle has allocated a significant budget for Cloud-based HPC computing for its next business year.



Albemarle Corporation
Netherlands







FORTISSIMO

Cloud-based map interpolation for civil engineering

ORGANIZATIONS INVOLVED

Sisener Ingenieros, a Spanish SME, is an engineering company whose main market is in energy projects, especially in the field of renewables. Projects undertaken by Sisener need accurate topographical information not only to determine the earthworks to be performed (which depends on intrinsic information, such as levels, slopes and volumes) but also for the overall design of the installation.. Ingeniería y Control Electrónico (Ingecon), a Spanish SME, develops and sells software for managing cartographic data. The objective of this experiment is to demonstrate how Cloud-based HPC can be used to convert and manage cartographic data across a range of formats and resolutions in order to improve the design process of wind farms and to reduce overall costs.

End User	HPC Expert	HPC Provider
SISENER INGENIEROS S.L.	Ingeniería y Control Electrónico, S.A.	CESGA
www.sisener.com	www.ingenieriaycontrol.es	www.cesga.es

THE CHALLENGE

Civil engineering projects need accurate cartographic data, requiring a map resolution of 1 metre or finer. Maps at this resolution are often unavailable, but can be created by applying a Kriging interpolation to existing maps. However, this is numerically intensive and typically requires HPC resources which are unavailable to SMEs. The challenge here was to create a solution using Ingecon's existing software that would be viable for Sisener.

Civil engineering projects need accurate cartographic data, requiring a map resolution of 1 metre or finer.

The use of HPC has reduced the processing times for wind farms to a few minutes and for other projects requiring greater resolution to a few hours.

THE SOLUTION

Ingecon has ported its software to run on an HPC system via a PC-based GUI. The use of HPC has reduced the processing times for wind farms to a few minutes and for other projects requiring greater resolution to a few hours. For the software vendor this is a scalable way to offer a new service to customers. Civil engineering companies save time and money because data acquisition times are reduced and expensive data gathering can be replaced by cheaper, quicker numerical interpolation.

EXPERIMENT #501 HIGHLIGHTS

Industry Sector: Renewable Energies

Country: Spain

Software used: In-house code

End Date: March 2016

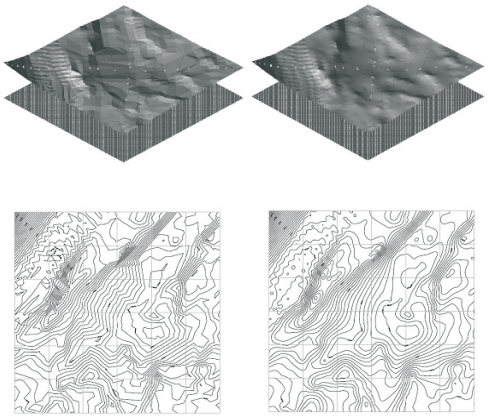
BUSINESS IMPACT

Ingecon sees this as a major opportunity to provide a new service not only in the design of wind farms, but also in other application areas where cartographic data is used. For a company like Sisener, the costs of a yearly software licence and a powerful enough computer to perform the necessary computations are prohibitive. However, a pay-per-use service where computing costs and software licensing are available, would be a very attractive proposition for all parties.

Sisener Ingenieros
Spain

The major benefit for Sisener is a reduction in the cost of map data. Through the use of interpolation, as opposed to buying raw data, the cost of a typical design can be reduced from €4k to €2k taking staff effort and computing costs into account. A company like Sisener will be involved in around 25 such projects per year, so annual savings amount to €50k.

Ingecon already has two further companies testing this solution and expects to engage 10 companies by the end of 2016. Based on data from Eurostat, there are over 350,000 potential customers across the EU for the proposed service from Ingecon of which 40,000 are based in Spain. Ingecon estimates a yearly income from this service at €200 per customer with 200 customers by 2018 and a 1% share of the European market (3,500 customers and a revenue of €700,000) by 2020.



FORTISSIMO

Advanced Simulation of Electromagnetic Effects

ORGANIZATIONS INVOLVED

SEEMI is a French SME which develops solutions for product packaging and transport. The devices it builds are often found in environments with significant electromagnetic fields, which can lead to serious malfunctions in equipment. Electrical devices play a major role in all types of automated and embedded systems. Cables, both shielded and non-shielded, have become a major issue in terms of safety, weight, performance, power consumption, cost and reliability. It is essential to verify during the design stage that cables are not susceptible to external electromagnetic effects, and to shield from any potential interference. Simulation has become mandatory in making such decisions. The customers for products designed by SEEMI are major national and international groups.

End User	HPC Expert	ISV	HPC Provider
www.seemi.com	www.inria.fr	www.algotech-informatique.com	www.bull.com

THE CHALLENGE

Algo'Tech has developed an electromagnetic simulator running on a PC to simulate small and medium-sized problems for customers. This approach allows SMEs, such as SEEMI, to reduce the design time and costs of electrical networks used in the packaging and other sectors. For larger installations, computing on a PC becomes too time-consuming to meet user requirements, as thousands of calculations are needed to cover a range of common frequencies.

An HPC Cloud-based electromagnetic simulator running on a PC reduced the design time and costs of simulations of small and medium-sized problems for customers.

Algo'Tech now offers a pay-per-use electromagnetic-design service to its customers which enables them to carry out large-scale simulations as needed.

THE SOLUTION

The solution developed here provides seamless access to their code, running on an HPC machine, from a PC. Cloud-based High Performance Computing (HPC) has dramatically reduced the computation time for complex electromagnetic simulations from hours to seconds, and is now an essential tool for simulating the complex electromagnetic behaviour of equipment. Algo'Tech now offers a pay-per-use electromagnetic-design service to its customers which enables them to carry out large-scale simulations as needed.

EXPERIMENT #502 HIGHLIGHTS

Industry Sector: Electrical Engineering

Country: France

Software used: Gramat

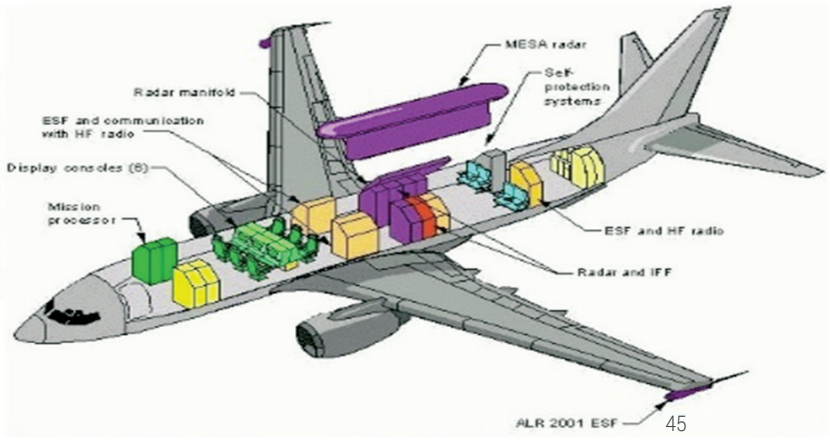
End Date: March 2016

BUSINESS IMPACT

The cost-benefits of simulating the electromagnetic behaviour of devices depends on where they are deployed. For example, an electromagnetic issue in manufacturing equipment has cost implications, but may present no danger to life. In contrast, unwanted electromagnetic effects in a vehicle may constitute a significant danger. In the former case, the value of a simulation can be estimated at 1% of the cost of the risk. In the latter case, the value of a simulation can be much greater because the cost of the risk is much higher. The market price for a small-scale simulation of the electromagnetic behaviour of a device is around €240. This cost can be broken down as follows: €200 for Algo'Tech to cover licence fees; and €40 to the computer centre for the cost of cycles. For a larger simulation the market price is €1,750: €1,500 in licence fees; and €250 for the cost of cycles.

Seemi
France

For the end users, the cost of electromagnetic issues, detected during the installation phase on customer premises, would be between tens to hundreds of K€. This compares favourably with the corresponding costs and benefits of simulation. As a result of the new service it can offer, Algo'Tech expects to see an increase of 10% in licence revenue and for HPC-based simulations to constitute 20% of its overall business. Overall, it expects an annual growth in its revenue of around 8% as a result of its new HPC-based, electromagnetic-simulation.



FORTISSIMO

Advanced Simulation of Metal Casting

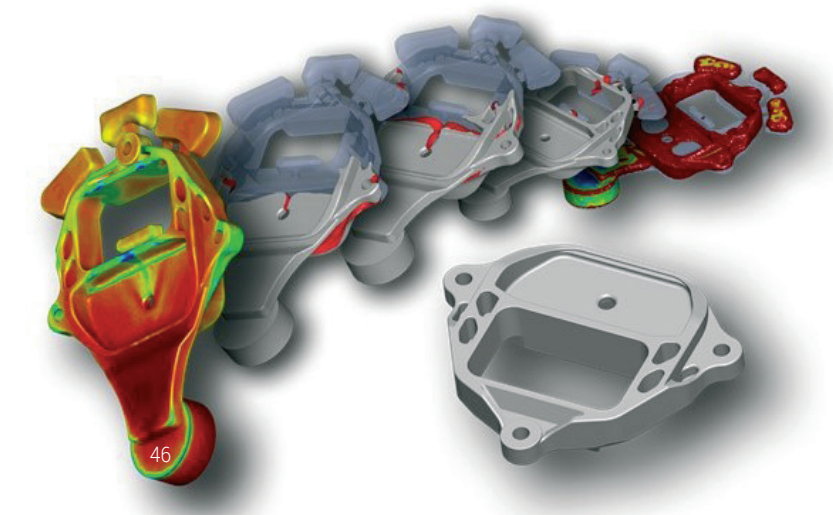
ORGANIZATIONS INVOLVED

Fundiciones de Roda is a Spanish SME specialising in the casting of grey and ductile cast iron. To save time and money, foundries need advanced simulation to detect metal casting defects as soon as possible, but, like many other SMEs in this sector, Fundiciones de Roda finds the advanced simulation of its casting process prohibitively expensive because of the costs of software licences and of computer hardware. Quantech is an ISV which develops and markets the software package Click2Cast, which simulates the casting of a range of metals including aluminium, steel, brass and copper. The software is able to simulate a range of components such as automobile and aerospace components, hydraulic valves, turbine disks, impellers and flanges.

End User	HPC Expert	ISV	HPC Provider
Fundiciones de Roda	CIMNE	QUANTECH ATZ	CESGA
www.fundicionesderoda.es	www.cimne.com	www.quantech.es	www.cesga.es

THE CHALLENGE

Many SMEs in the casting industry are reluctant to use advanced simulation software because of the high costs of software licences and of access high-performance hardware. Here, a service was developed based on Quantech's Click2Cast package which offers SMEs such as Fundiciones de Roda an affordable, pay-per-use option for simulating casting processes accurately and quickly and without the need for detailed specialist knowledge.



To save time and money, foundries need advanced simulation to detect metal casting defects as soon as possible.

A service was developed which offers SMEs such as Fundiciones de Roda an affordable, pay-per-use option for simulating casting processes accurately and quickly and without the need for detailed specialist knowledge.

THE SOLUTION

Click2Cast has been ported to a High Performance Computer system available via a Cloud infrastructure. Access to this application has been made available as a pay-per-use service which enables even inexperienced users access to advanced simulation via a simple click-based interface. Click2Cast tackles 90% of all casting techniques including High Pressure Die Casting, Gravity Casting, Low pressure Die Casting and Tilt Pouring.

EXPERIMENT #503 HIGHLIGHTS

Industry Sector: Casting

Country: Spain

Software used: Click2Cast

End Date: March 2016

BUSINESS IMPACT

The use of Click2Cast simulation service supported by an HPC-Cloud enables a foundry to determine the most efficient casting technique quickly and optimise its configuration. In this way, the weight of casting systems can be reduced as much as possible. In particular, the use of a service that simulates the completed metal casting processes can significantly save time and money in the development of new types of moulds, because defects in the casting process can be detected at design time and before expensive prototyping.

A pay-per-use service such as that now offered is a very attractive option for SMEs in this sector. Through the use of an HPC Cloud-based service, design times can be significantly reduced by up to 60% - from a week to a couple of days. Through the use of the Click2Cast service Fundiciones de Roda can reduce its annual design costs by €3,200. Furthermore, because of an increase in productivity, it expects to increase its annual revenue by €20,000.

Fundiciones de Roda
Spain

Quantech now offers the only casting design and simulation pay-per-use service in the market. Over the next 5 years, the growth in its business is estimated to be 40%, with a total of approximately 500 new customers by the third year. The additional profit for Quantech per customer is estimated to be €1,000 per annum.

FORTISSIMO

Cloud-based simulation of target drug compounds

ORGANIZATIONS INVOLVED

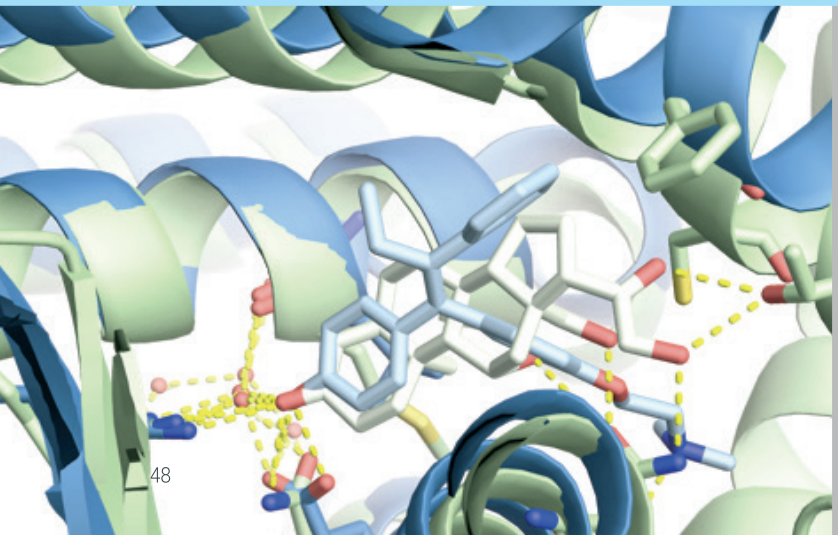
Transinsight is a German SME which develops software products in the area of bioinformatics where it analyses high-throughput data. This case study addresses the identification of existing drugs to treat illnesses other than those for which they are currently prescribed. This has the potential to make a significant impact in drug discovery where the costs of developing new treatments are becoming prohibitive.

The assessment of target compounds requires the use of Cloud-based HPC because the search space is so large and complex. A new Cloud-based-HPC service will be offered by Transinsight to support drug discovery both by SMEs and by larger organisations.

End User	Domain Expert	HPC Expert	HPC Provider
TRANSINSIGHT	biotec		epcc
www.transinsight.com	www.biotec.tu-dresden.de	www.dit.hua.gr	www.epcc.ed.ac.uk

THE CHALLENGE

In the field of drug discovery, there is great interest in investigating unknown drug-target relationships of existing compounds. Investigating these requires significant computational resources. The use of Cloud-based computing can speed up drug development and reduce its costs by uncovering off-target effects, and thus causes of adverse drug reactions, early in the development pipeline.



Investigating unknown drug-target relationships of existing compounds requires significant computational resources.

The use of Cloud-based computing speed up drug development and reduced the costs of the evaluation of a single compound.

THE SOLUTION

The use of an HPC-Cloud infrastructure combined with algorithmic improvements enabled substantially better computational performance. This was achieved through the parallelisation of the algorithms used combined with the more efficient use of memory. This resulted in a significant reduction in the time and cost of the evaluation of a single compound. The Cloud-based approach enabled significant computational resources to be deployed without the need to purchase and maintain expensive hardware.

EXPERIMENT #508 HIGHLIGHTS

Industry Sector: Pharma Industry

Country: Germany

Software used: In-house code

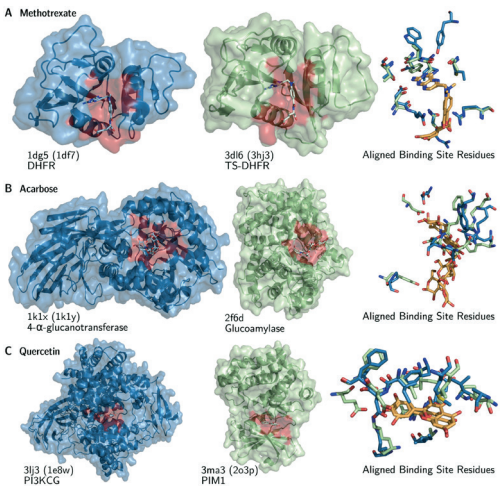
End Date: August 2016

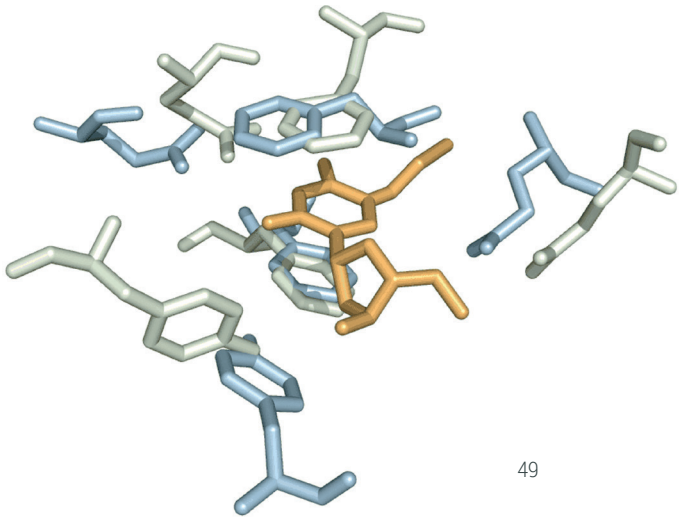
BUSINESS IMPACT

The journey for a drug from invention to market is a long one. There are many challenges to overcome, and many reasons that development of a promising compound may fail. The time required to develop a new drug de novo ranges between 10 and 17 years; that is, if it ever makes it. The chance for a new drug to actually make it to market is only 1:5,000. These slim chances are accompanied by the high cost for developing a new drug, which may reach an average of US$ 403 million. These rising costs threaten to make the development of new drugs increasingly unaffordable for both companies and patients. Repositioning existing drugs for new diseases could deliver the productivity increases that the industry needs. A prerequisite for drug repurposing is drug promiscuity, a drug's ability to bind to several targets. Here, a HPC-Cloud infrastructure demonstrates the viability of a system for investigating previously unknown binding capabilities of existing compounds. Because existing drugs have already undergone extensive safety and bioavailability studies, the cost and time to market of one of these compounds may be significantly reduced.

Transisight
Germany

Transinsight estimates that there are hundreds of potential users of its proposed service. Each user represents a potential profit of €2,000 per annum comprising around 4,000 queries regarding protein matching. For Transinsight this represents a potential increase in profits of around 3% per annum.





FORTISSIMO

HPC Cloud-based analysis for optical control in manufacturing processes

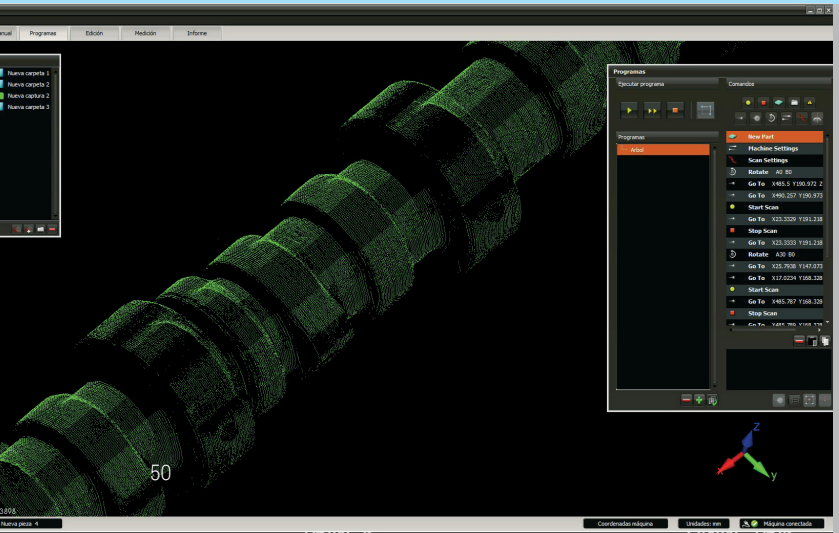
ORGANIZATIONS INVOLVED

EPC is a Spanish SME specialising in the manufacture of camshafts. These are critical components in high power engines, where tolerances are very small. For this reason, EPC is always working to improve its quality-control process, integrating the latest innovations in hardware and software. The integration and exploitation of 3D optical scanning systems for dimensional quality control in manufacture results in significant benefits in terms of time and dimensional information generated compared to traditional tactile technologies. The use of Cloud-based HPC has the potential to provide a detailed and quick analysis of manufacturing processes enabling significant improvements in the control of quality in production processes.

End User	Domain Expert	ISV	HPC Provider
epc Engine Power Components	UNIMETRIK METROLOGY AND CALIBRATION	DATAPIXEL QUALITY CONTROL ENGINEERING	CESGA
www.engpwr.com	www.unimetrik.es	www.datapixel.com	www.cesga.es

THE CHALLENGE

The challenge of this case study was to develop a service which enables companies, particularly SMEs, to control manufacturing processes with very high accuracy using optical scanning techniques. This requires intensive analysis of the parts to be manufactured using 3D digital information. The combination of scanning, measurement and analysis can identify any problems in the manufacturing process early enough for necessary corrections to be made.



The combination of scanning, measurement and analysis can identify any problems in the manufacturing process early enough for necessary corrections to be made.

Cloud-based-HPC resources enabled new methods of analysis such as large-scale geometry extraction and temporal analysis of the dimensional quality of large batches.

THE SOLUTION

Cloud-based-HPC resources were used, enabling new methods of analysis such as large-scale geometry extraction and temporal analysis of the dimensional quality of large batches. Moreover, traditional tasks such as reverse engineering are now optimised enabling the much faster generation of control data for the production line. This allows the generation of additional information concerning the manufacturing quality at both the part and system levels.

EXPERIMENT #509 HIGHLIGHTS

Industry Sector: Camshaft Production

Country: Spain

Software used: M3

End Date: May 2016

BUSINESS IMPACT

A typical file size for manufacturing data is around 300 Megabytes, representing 15 million points. This means that a single company generates several Terabytes of information in short periods of time to be processed by a service provider such as Unimetrik. At the same time, software developers such as Datapixel have to work on the optimisation of their processing algorithms to enable quicker access to the information contained in the data collected. The use of the HPC-cloud-based service enables a reduction in the time needed to extract dimensional information from 5 minutes to 1 minute. Due to this time reduction:

EPC
Spain

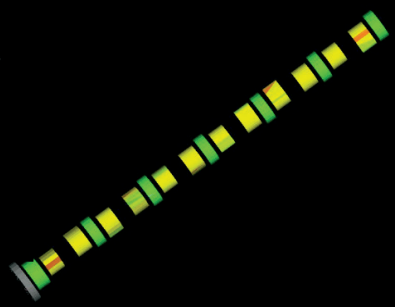
- Unimetrik will increase its service business by 30% and its portfolio of international customers by 20%. This is expected to lead to an increased turnover of €400K over the next five years due to the commercialisation of these advanced services and the creation of two new positions within the company.

- Datapixel, expects an increase of 25% in new licences, representing an additional turnover of €750K over the next five years, due to the commercialisation of the optimized data-processing software developed in this case study.

- The end-user, EPC, expects to improve the quality of its manufacturing process reducing the production of defective parts down to 0%. This would result in a cost reduction of €1.5M over the next five years.

Real part

Virtual part



Quality and Manufacturing Knowledge

FORTISSIMO

HPC Cloud-based Additive Manufacture

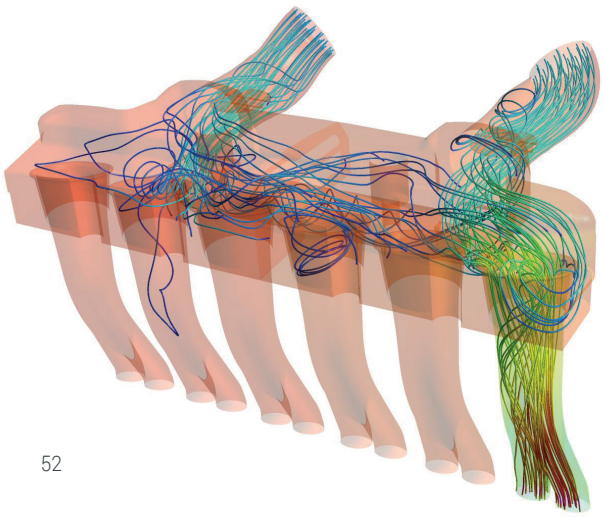
ORGANIZATIONS INVOLVED

HSL is an SME and a market leader in both Additive Manufacturing and the rapid production of prototypes. In recent years Additive Manufacturing has emerged as a viable mainstream production technology. Overcoming technical and bureaucratic obstacles has allowed 3D printing to grow as a cost-effective option for small and medium scale production together with the ability to produce complex shapes not achievable by standard manufacturing processes. This flexibility in design enables the optimisation of components, a reduction in manufacturing time by almost a third and a halving of production costs by reducing the waste of materials and energy.

End User	Domain Expert	ISV	HPC Provider
www.hsl-italia.it	web.uniroma2.it	www.rbf-morph.com	www.cineca.it

THE CHALLENGE

Computer-aided engineering (CAE) tools are able to suggest new shapes and accurately predict the behaviour of components, making them a natural choice in the design chain, but can be prohibitively expensive for SMEs. This is especially true when dealing with complex Computational Fluid Dynamic (CFD) simulations. The goal is to demonstrate the validity of an optimisation service using CAE by optimising a Lamborghini 12-cylinder airbox.



Numerical grid parameterisation using a mesh morpher avoids the time consuming task of mesh generation. Access to CFD simulation through the Fortissimo HPC Cloud allows a speed-up in calculation times reducing the time to market and to return on investment.

THE SOLUTION

Numerical grid parameterisation using a mesh morpher avoids the time consuming task of mesh generation (that can take up to 70% of the total analysis cost). Access to CFD simulation through the Fortissimo HPC Cloud allows a speed-up in calculation times reducing the time to market and to return on investment. Using a collaborative, interactive, cloud interface helps analysts and clients to work together, increasing customer satisfaction and building better products more effectively.

EXPERIMENT #515 HIGHLIGHTS

Industry Sector: Automotive

Country: Italy

Software used: RBF Morph

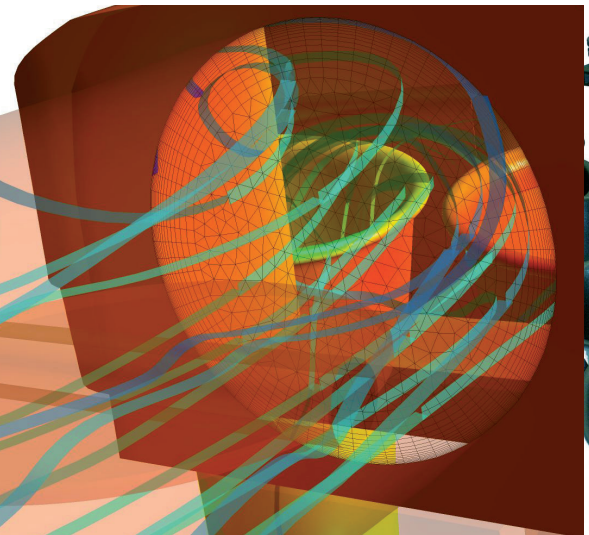
End Date: June 2016

BUSINESS IMPACT

HSL expects that the new service will see the development of a business department with two to three staff, potentially growing to five to six staff after three to four years. For UTV it is estimated that thanks to the new know-how acquired the relevant department will increase its industrial research services. The economic benefit is estimated to be between 40k and 70k € per year in a five-year plan. Finally, this case study comprises a success story for CINECA, in the application field of high fidelity CFD, that is estimated to bring in at least two new SME customers per year, with an approximate 5% increase in revenue for commercial services.

HSL
Italy

Having access to the RBF Morph morphing tool combined with CFD analysis powered by HPC opens a wide range of business opportunities. In parallel with existing rapid prototyping services, HSL can now propose to its clients alternative component designs corresponding to appropriate performance indicators. For HSL, offering a shape optimisation service in parallel with its existing core business of rapid prototyping activities, represents an opportunity to establish customer activity over a range of key R&D areas. HSL is ready to offer the developed tool to a range of existing clients in the automotive industry, anticipating for the next two years, a total revenue growth of 16% per year in that sector.



FORTISSIMO

Cloud-based optimisation of water turbines for power generation

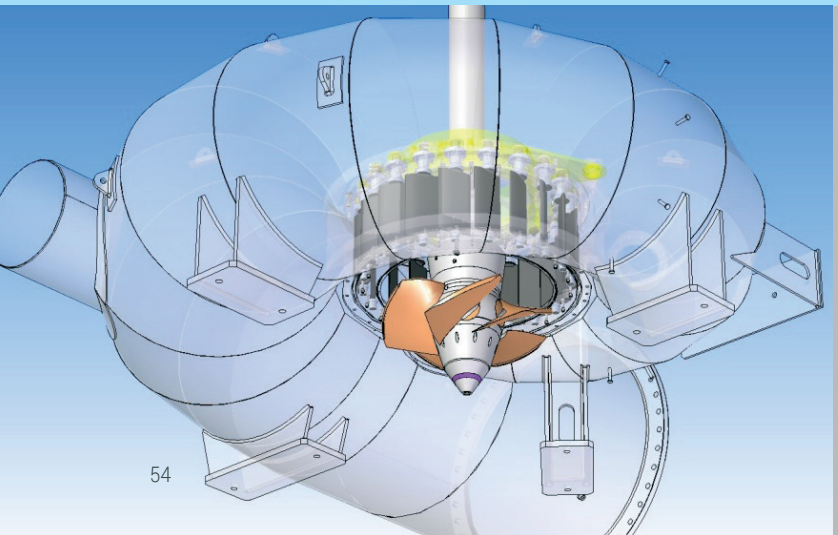
ORGANIZATIONS INVOLVED

Zeco is an Italian SME in the renewable energy sector. It specialises in the production of different types of water turbine. SMEs like Zeco must develop and innovate their products to remain competitive. High-fidelity simulation using Computational Fluid Dynamics (CFD) has become an essential tool for turbine designers because it results in better designs for less effort and lower cost. However, for Zeco and, in general for SMEs, full exploitation of CFD tools is often not possible as they lack the necessary computing power, and the skills to exploit it effectively. The objective here is to demonstrate how all the necessary resources can be assembled to give ZECO a one-stop-shop for the simulation of turbines leading to business benefits across the whole value chain.

End User	HPC Expert	ISV	HPC Provider
www.zeco.it	www.enginsoft.com	www.ansys.com	www.cineca.it

THE CHALLENGE

Current practice in the design of hydro-power plants is to determine the most suitable design in a series of time-consuming experiments. However, SMEs in this sector face stiff completion and tight deadlines to sell their turbines in both national and global markets. The challenge facing Zeco is to improve its design processes by the use of HPC-based high-fidelity simulations of flow in its turbines through the use of CFD-based tools.



Current practice in the design of hydro-power plants is to determine the most suitable design in a series of time-consuming experiments.

High-fidelity simulations and the availability of HPC significantly reduced the development costs of prototypes, so the time to market is significantly lower.

THE SOLUTION

A CFD-based HPC application has been developed which enables the design of a small hydro power plant in a very fast and reliable way, compared to current practices. The use of this application can contribute significantly to savings in time and money in the development of new water-turbine systems. High-fidelity simulations and the availability of HPC significantly reduce the development costs of prototypes, so the time to market is also significantly lower.

EXPERIMENT #519 HIGHLIGHTS

Industry Sector: Hydraulic Turbines

Country: Italy

Software used: ANSYS CFD

End Date: March 2016

BUSINESS IMPACT

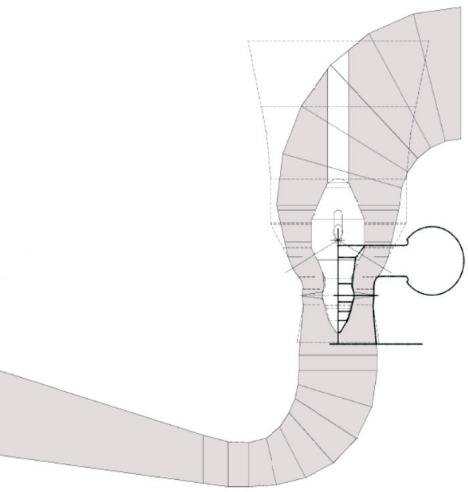
HPC-based CFD calculations have reduced the design time of a turbine from 1 year to 3 months. As manufacturing the turbine takes 8 months, the time to market can be reduced from 20 to 11 months. Without the use of HPC, the development process could take up to two years, which is no longer a competitive time frame in this sector.

Using such turbines, a medium-sized hydropower plant costing 1.5M€ can reduce operational costs by 350k € per installation over two years. Furthermore, the optimization through HPC leads to a 1% increase in plant efficiency, with a 50% reduction in the total number of days required for maintenance. This means an increase of the revenue related to energy production of up to 40 k€ per year per installation. Due to these improvements, Zeco expects to increase its market share by at least 5% with an additional profit of 50 k€ per year.

Zeco
Italy

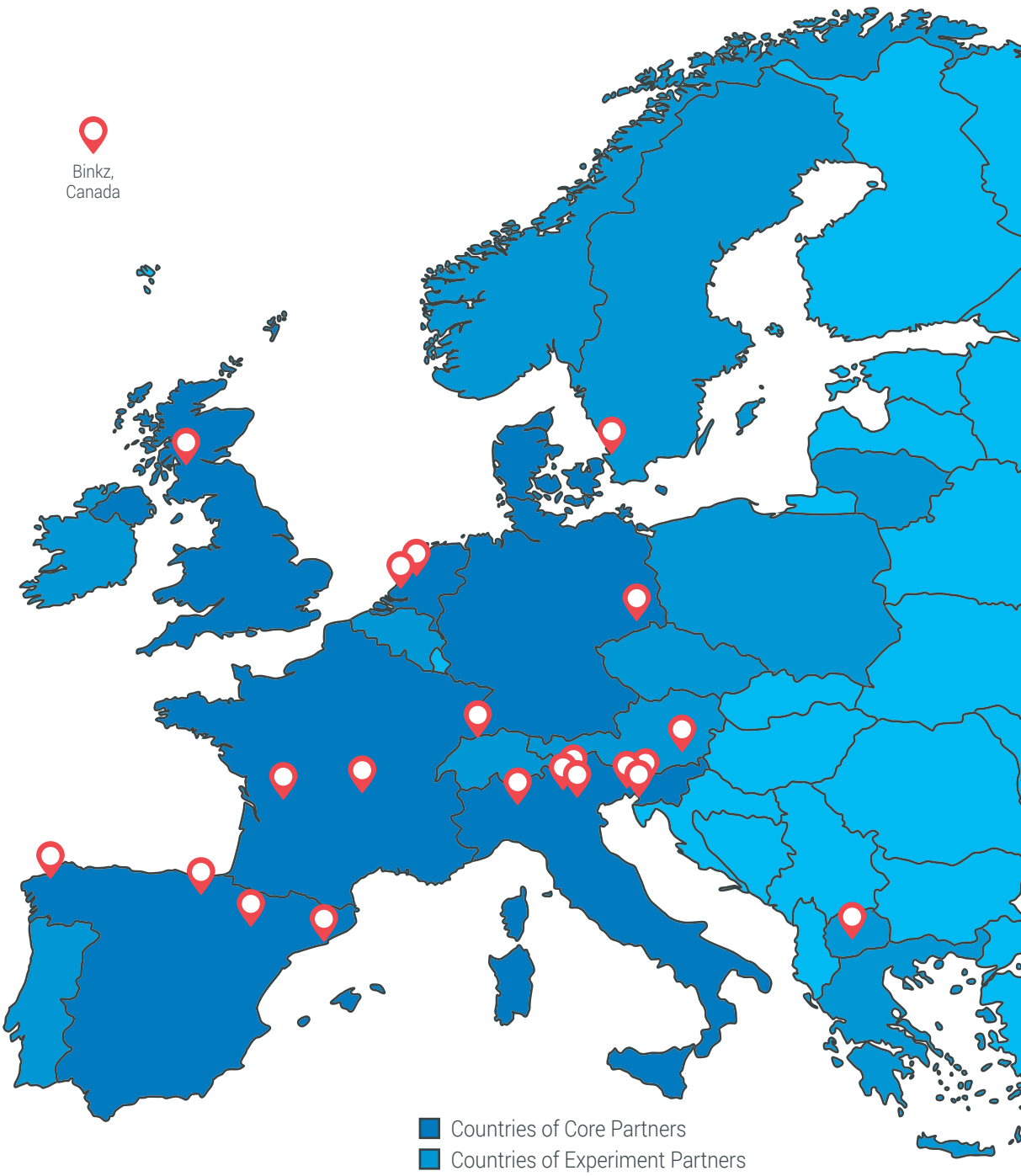
As a result of the increased market for advanced simulation using HPC, EnginSoft expects a growth of 10% in business related to the turbo-machinery market sector, which means an additional profit of around 50 k€ per year.

CINECA estimate potential revenues for the HPC service of 100 k€ per year. The workflow developed here is applicable to other sectors as well, so there is a large potential market. CINECA's target is to acquire two customers for this service per year for the next three years, with an estimated increased revenue of 900 k€ and a profit of around 100 k€.



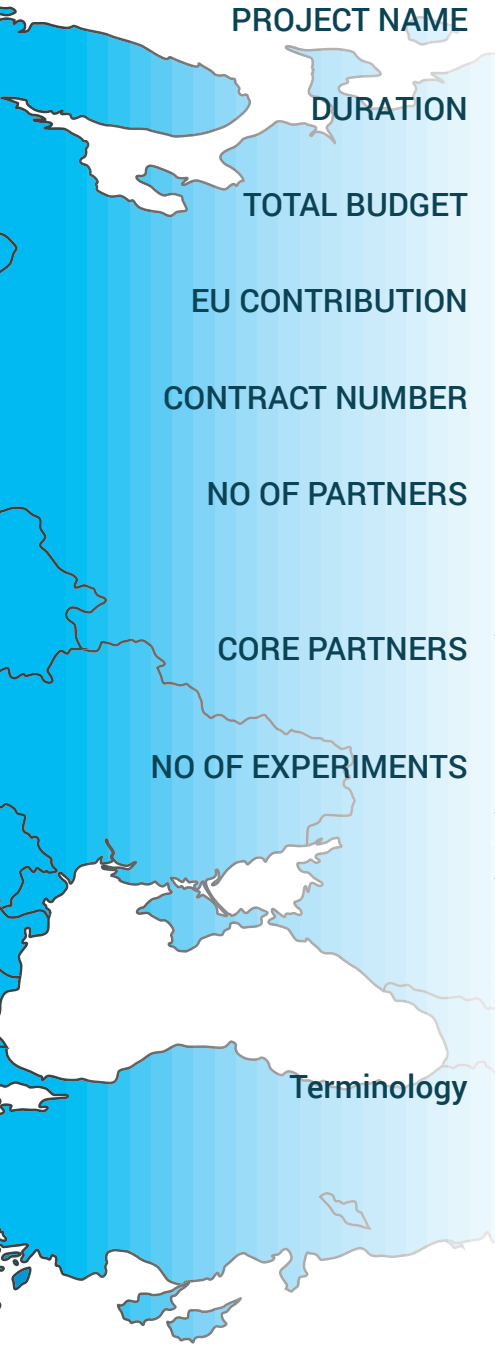
FORTISSIMO

Map of Success Stories



Projects at a Glance

FORTISSIMO



PROJECT NAME

Fortissimo - Factories of the Future Resources, Technology, Infrastructure and Services for Simulation and Modelling

DURATION

Fortissimo: July 1st 2013 - December 31th 2016

Fortissimo 2: November 1st 2015 - October 31st 2018

TOTAL BUDGET

Fortissimo: 21,7 M€

Fortissimo 2: 11,1 M€

EU CONTRIBUTION

Fortissimo: 16 M€

Fortissimo 2: 10 M€

CONTRACT NUMBER

Fortissimo: 609029 under the 7th Framework Programme

Fortissimo 2: 680481 under the H2020 Framework Programme

NO OF PARTNERS

Fortissimo: 123 in total (14 Core Partners and 109 Partners in Experiments)

Fortissimo 2: 38 in total (13 core Partners and currently 25 Partners involved in Experiments)

CORE PARTNERS

The University of Edinburgh (EPCC), Arctur, Atos, Bull, CESGA, CINECA, GENCI, Gompute, University of Stuttgart (HLRS), INRIA, Intel, Scapos, Sicos BW, SURFsara and Xlab.

NO OF EXPERIMENTS

Both phases comprise in total 77 experiments, of which 42 have been finished already and 35 are currently running. The first phase included 53 experiments in total, 33 of which were added as the result of two open calls.

The second phase (Fortissimo 2) includes currently 24 experiments, 10 of which have been added through the first open call from early 2016. It is expected that the second open call (from late 2016) will add at least another 10 experiments to Fortissimo 2.

Terminology

Experiment: Is a real use case of an industrial use of CloudHPC simulations to aid the end-user SME to improve its products or procedures.

Open Call: Is a tender within the Fortissimo project that is aimed ad bringing and incorporating new end-user partners and experiments.

Success Story: Is an resume of an experiment that has been conducted within the Fortissimo project. The success stories describe only the selected best out of a large array of experiments.

ICT Innovation for Manufacturing SMEs
http://i4ms.eu

Seventh Framework Programme
http://cordis.europa.eu/fp7

Horizon 2020
https://ec.europa.eu/programmes/horizon2020/

European Commission
http://ec.europa.eu

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For further information, please visit:

https://www.fortissimo-project.eu/

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