Bringing cloud-based HPC to business

The FORTISSIMO project is opening up simulation services for European industry

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Celebrating 25 years of EPCC
From the Directors

Welcome to the Summer 2015 issue of EPCC News. This summer is an important moment in EPCC’s history. Not only are we 25 year’s old but we’re also going through one of our growth spurts.

With 80 staff today, we intend to grow over the next year to closer to 100. This is a result of our recent successes, particularly in winning European Union Horizon 2020 projects, which you’ll find outlined on page 6.

We are also seeing much more interest in HPC and data analytics projects from the medical research community – a strategic growth area for EPCC over the next 5 years.

The Farr Institute, described on page 10, is the most obvious example, but we’ve also recently been assisting with human genome data processing for the first time.

With this in mind, now seems the right time to undertake a strategic review of EPCC. An international panel will review EPCC in September this year, advising on our governance, structure and long-term strategy. We’ll report the results of this review in the next EPCC News.

We’re very proud to be at the helm of EPCC at this point in its history. Here’s to the next 25 years!

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For Life Sciences, Bio and Pharma companies struggling with data discovery... We can help!

Our Accelerator programme provides access to a comprehensive range of HPC and Big Data services that can deliver significant benefits, allowing our customers to:
• Optimise the management of large data sets
• Speed up existing data analysis
• Impose new and novel structures on raw data sets
• Discover deeper, more valuable insights into data
• Generate important correlations, patterns and knowledge.

What we offer
• Access to HPC and large-scale data facilities
• Big Data management, analytics and consultancy
• Code design, development, optimisation and reengineering
• Training in HPC and Big Data
• Formal MSc and custom training courses for industry.

Find out more
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EPCC is a supercomputing centre based at The University of Edinburgh, which is a charitable body registered in Scotland with registration number SC005336.
The biennial ParCo conference, which first took place in Berlin in 1983, is one of the longest running international parallel computing events. Over the years, it has established itself as the foremost platform for exchanging know-how on the newest parallel computing strategies, technologies, methods, and tools.

ParCo’s purpose is to give an overview of the state of the art of the developments, applications, and future trends in parallel computing for the whole range of platforms.

The conference addresses all aspects of parallel computing, including applications, hardware and software technologies as well as languages and development environments.

Keynote speakers
ParCo conferences feature presentations from leading figures in the parallel computing field. This year we are pleased to announce the following keynote talks:

- “Bio-Inspired Massively-Parallel Computation”: **Stephen Furber**, ICL Prof of Computer Engineering, School of Computer Science, University of Manchester, UK
- “Scientific Software Challenges in the Extreme Scaling Era”: **Simon McIntosh-Smith**, Head of the HPC Research Group, University of Bristol, UK
- “Parallel Program = Operator + Schedule + Parallel data structure”: **Keshav Pingali**, Professor in the Department of Computer Science, University of Texas at Austin, USA
- “How might future HPC architectures utilize emerging neuromorphic chip technology?”: **Rick Stevens**, Associate Laboratory Director, Argonne National Laboratory and Professor, Department of Computer Science, University of Chicago, USA.

The conference programme will include over 50 papers from international authors, together with 9 mini-symposia covering subject areas including: reconfigurable computing; coordination programming; data-intensive computing, and energy and resilience in parallel computing.

EPCC and the University of Edinburgh’s School of Informatics will host the International Conference on Parallel Computing (ParCo) this September.

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Join us at ParCo
ParCo will run from 1-4 September at the Informatics Forum in Edinburgh.

Provisional programme: http://edin.ac/1KVHcYs
Parco website: www.parco2015.org
In 1980, the University of Edinburgh formally inaugurated the Edinburgh Parallel Computing Centre as a technology transfer centre with a handful of staff tasked with a mission to promote parallel computing in both academia and industry. We now have around 80 technical staff with expertise in applications, data and systems. EPCC is a self-funding, not-for-profit organisation whose expansion has come about largely through the efforts and interests of individual staff members who generate 95% of our income through external project and industrial funding. This has enabled us to participate in a myriad of different types of projects, spanning research, service provision and technology transfer, some of which are described in this edition of EPCC News.

Of particular importance is our involvement in many European Commission-funded projects.

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EPCC is 25 years old in September. During that time, the Centre has evolved from the experimental ‘Edinburgh Concurrent Supercomputer Project’ into one of the world’s leading centres for transferring HPC technology to industry and academia.

EPCC’s Silver Jubilee: 25 years at the forefront of HPC
which has allowed us to play a full and active role in delivering the vision of the European Research Agenda. We have run successful visitor programmes through TRACS (Transnational Access to Major Infrastructure) and HPC-Europa, participated in major infrastructure projects such as PRACE for HPC and EUDAT for data, co-ordinated large exascale research projects such as CRESTA (see p16) and led technology-transfer to industry projects such as FORTISSIMO (p8).

Since 1993, we have run national HPC services on behalf of the Engineering and Physical Sciences Research Council – most recently the HECToR and ARCHER services – from our purpose-built Advanced Computing Facility.

We pride ourselves on being vendor-independent and neutral, and through the years have built strong working relationships with many companies. Our project activities with Cray, IBM, Fujitsu, NVIDIA and Intel are recent examples of this approach.

Training the next generation of HPC professionals is also a major commitment for us. In addition to offering two successful MSc programmes – in HPC and in HPC with Data Science – we run national training for the ARCHER service and we’re one of the six European PRACE Advanced Training Centres.

EPCC’s strength has always been its people. Our hiring policy is to look for clever people with enquiring minds who buy into the EPCC ethos.

Over the past quarter century, a number of staff have inevitably moved on to roles elsewhere but they, as much as the current staff, have played their part in shaping and forming the organisation that EPCC has become.

We look forward to the Golden Years of EPCC with confidence!

Party!

We will be holding a Silver Jubilee party in September to celebrate EPCC’s position as one of the very best academic HPC and data centres in the world.

For a while now, we have asked past and present employees of EPCC to register online for an invitation to the party. The response has been so enthusiastic that we have had to close registration for past employees. If you are a past employee and would like to be put on the waiting list, email: m.simpson@epcc.ed.ac.uk.

For those who have registered, you will shortly receive a formal invitation by email.

It’s going to be a great night!
EPCC has been involved in European projects for almost its entire 25 year history – our first project, TRACS, being funded in 1992. This visitor programme ran for a decade, with over 400 researchers using our HPC systems to further their research.

Our engagement in the European Commission’s funding programmes continues today within Horizon 2020, and the winter of 2014/2015 was a busy, and successful, bidding time. The EC’s funding models have changed over time. While winning a €400,000 project in 1995 would have been a major event, today success is measured in millions, with much larger consortia from across the enlarged European Union.

### e-Infrastructure

On the e-Infrastructure side we have been successful with the next incarnations of EUDAT (EUDAT 2020) and PRACE (PRACE-4IP). These projects are implementing the infrastructure for research data services and high performance computing in Europe. EPCC is a major contributor to each of them.

### Exascale research

On the Exascale research front we were involved in a number of proposals to the FETHPC call. We lead the NEXTGenIO and INTERTWinE projects and are involved in the ExaFlow project. We are also involved in two support projects called EXDCI and EuroLab-4-HPC which are supporting the collaboration of projects across the Exascale research and infrastructure domains. The FETHPC programme was particularly successful for EPCC. NEXTGenIO is an €8.1m project, led by EPCC, which will focus its research on improving IO provision for Exascale applications. NEXTGenIO will investigate the development of a prototype server that uses non-volatile memory technology. Fujitsu and Intel will work together on the prototype system, which will be used to research new models of I/O.

### e-Infrastructure Centres of Excellence for HPC

Although EPCC didn’t lead any of the e-Infrastructure Centres of Excellence for HPC bids, we are very pleased to be involved in the BioExcel CoE led by KTH from Sweden. This CoE, will support the use of bio-molecular modelling across Europe. EPCC is working in collaboration with the Roslin Institute to improve the processing workflows and modelling applications used by the world-renowned institute.

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management for HPC systems including systemware aspects such as data-aware scheduling of jobs. Non-volatile memory technology has the potential to transform HPC, blurring the distinction between HPC and data-intensive computing and profoundly changing the way we manage and manipulate data on such systems.

Fujitsu and Intel working together in the project will deliver the prototype system which will be used to research new models of I/O management for HPC systems. This technology is likely to transform HPC, blurring the distinction between HPC and data intensive computing and profoundly changing the way we manage and manipulate data on such systems.

INTERTWinE is a €3.9m project, again led by EPCC, which focuses on interoperability of programming models for Exascale systems. It aims to enable a set of key programming models to interoperate efficiently and effectively in a scalable manner, to allow European scientists to exploit the next generation of Exascale platforms.

Finally, EPCC is a major partner in the ExaFlow project, led by KTH from Sweden, which focusses on the development of next generation computational fluid dynamics algorithms and software for the Exascale. We are particularly pleased to be working with Prof Spencer Sherwin of the Department of Aeronautics at Imperial College and McLaren F1 in this project.

Fortissimo 2

Fortissimo is EPCC’s €22 million flagship project supporting the adoption of HPC by small to medium-sized enterprises (SMEs) across Europe as part of the EC’s Factories of the Future programme. With some 128 partners, Fortissimo is one of the most complex project that EPCC has ever run.

In February we successfully bid for Fortissimo 2, a €11.2m follow-on project very similar to its predecessor. To Fortissimo’s focus on HPC, it adds the use of coupled applications and data analytics. The project starts with 14 new ‘Experiments’ with SMEs and will add a further 20 or so through two Open Calls.

European Commission funding is a key underpinning for EPCC. It supports our position as one of the major HPC centres in Europe, but more importantly engages us with partners from across the European Union who are a pleasure to collaborate with.
In July this year, the Fortissimo project marked the start of its third year with a third wave of experiments that will demonstrate the benefits of cloud-based HPC for business, particularly small and medium-sized enterprises.

This brings the total number of experiments running in Fortissimo to over 50, involving close to 100 businesses.

The importance of advanced simulation to the competitiveness of both large and small companies is well established. However, the simulation of, for example, high-pressure gas cylinders or the moulding of plastics requires enormous computing power and specialised software tools and services.

Large companies generally find it easier to make use of advanced simulation than smaller companies, which face both technological hurdles and financial challenges. This means that small and medium-sized enterprises are often not able to take advantage of advanced simulation, even though it would clearly make them more competitive.

The goal of Fortissimo is to overcome this impasse through the provision of simulation services and tools running on a cloud infrastructure. A “one-stop-shop” will greatly simplify access to advanced simulation. This will make hardware, expertise, applications, visualisation and tools easily accessible.

The initial services will be based on the results of the experiments and targeted at the market sectors currently covered by them (which includes automotive, aerospace, construction, oil and gas energy, renewable energy, environmental, maritime, metal processing and pharmaceutical) but will be looking to expand based on industry demand.

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Fortissimo Marketplace
To complement the set of experiments, there are plans to open up the Fortissimo services via the Fortissimo Marketplace. The Marketplace will be open to everyone and will offer commercial cloud-based HPC services to businesses that need advanced simulation but can’t meet the costs or lack the skills to own and operate their own.

The initial services will be based on the results of the experiments and targeted at the market sectors currently covered by them (which includes automotive, aerospace, construction, oil and gas energy, renewable energy, environmental, maritime, metal processing and pharmaceutical) but will be looking to expand based on industry demand.
available and affordable on a pay-per-use basis. In doing this Fortissimo will create and demonstrate a viable and sustainable commercial ecosystem.

**Excellent results**

The experiments that have already finished have produced some excellent results that demonstrate the value of the Fortissimo approach.

Slovenian designer and manufacturer of light aircraft Pipistrel, for example, faces the challenge of performing simulations of airflow over its aircraft that are sufficiently detailed to model real physical effects accurately. Such simulations require expensive computer resources. The costs of owning and operating the necessary computing resources are beyond the means of Pipistrel. However, the use of cloud-based HPC offers the possibility of running such simulations on an affordable, pay-per-use basis. The challenge was therefore to demonstrate the feasibility of this approach.

During the experiment Pipistrel learned how to run, handle and post-process big computations on a cloud-based HPC system. A typical large model would take approximately 2 to 3 days to run on the HPC system. Such a problem would either be too big for the in-house systems or would take too long to run (around 20 to 30 days) to be part of an effective design process. The use of HPC therefore enabled Pipistrel to obtain results of much more complex simulations in a reasonable time. It also offered a cost-effective solution to running such large simulations.

**Considerable savings**

The company estimates that it is 10 times cheaper to use cloud-based HPC simulations than have a suitably powerful in-house system that is only used for part of the time. The indicative annual costs of using Cloud-based HPC simulations are approximately €30k compared with in-house costs of €300,000, which shows that this saving is considerable.

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**About Fortissimo**

Fortissimo provides simulation services and tools running on a cloud infrastructure.

The Fortissimo project is funded by the European Commission within the 7th Framework Programme and is part of the I4MS Initiative.

For more information see www.fortissimo-project.eu
The UK-wide Farr Institute aims to harness health data for patient and public benefit by setting the international standard for the safe and secure use of electronic patient records linked to other population-based datasets for research purposes.

This will support innovation in the public sector and industry, leading to advances in preventative medicine, improvements in NHS care and better development of commercial drugs and diagnostics.

The Farr Institute in Scotland has two initial sites, one in Dundee and one in Edinburgh at the new BioQuarter next to the city’s Royal Infirmary (see picture above). The Farr sites aim to be research hotels, bringing together mixed populations of NHS staff, data scientists, informaticians, statisticians and researchers to encourage innovation in big data research.

Security of access

Farr Scotland has purchased IT infrastructure which is housed at the University of Edinburgh’s Advanced Computing Facility and managed by EPCC.

The IT infrastructure will securely provision anonymised research datasets which will be accessed remotely using VPN connections and secure thin client terminals. Data will only be provided after the necessary permissions have been obtained from data controllers (eg NHS, Local Authorities, Scottish Government Directorates).

The original datasets from which the research data are created will always remain under the control of the legal data controller. Once the particular research question has been answered, the data will be archived and then eventually securely destroyed, following the
Scottish Data Linkage Framework principles.
Considerable care is going into the configuration and management of the IT environments because of the sensitivity of the data, and stringent security and information governance requirements.

New national research database

Work is currently underway to create a new national anonymised PACS research dataset (X-ray and scan image data), under the control of the NHS. This will be housed securely and separately on the Farr IT infrastructure, as the size of the image dataset is too large to pull data from a remote storage location.

This is a completely new dataset, the largest of its kind in Europe, and the prospect of its use for research purposes is generating much excitement. The size and complexity of the task to extract and create the dataset is considerable!

Data security lies at the heart of the infrastructure design, with capacity and performance close seconds. Once operational, the anonymised PACS archive will grow at around 20 TB/month as it accumulates image data from across Scotland. The IT infrastructure needs not only to store these images but also to process them quickly enough to remove any personally identifiable information before the next batch arrives.

Tests of the live system over the summer will prove decisive, before the full power of the analytics platform and PACS dataset are made available to authorised researchers later this year.

Scotland is a world-leader in electronic patient records, and EPCC is delighted to be playing a role in delivering new capabilities in data-driven health research.
Introducing our new distance-learning online courses

We are delighted to announce the launch of two new online courses that offer a thorough introduction to the fundamental concepts of HPC and data science.

These online courses build on the success of our MScs and will appeal to anyone working in applied computing who wants to learn about leading-edge hardware and software technologies.

The courses are at postgraduate level, fully accredited by the University of Edinburgh, and designed to enable flexible study to fit around work and family life.

Practical Introduction to HPC

High Performance Computing (HPC) is a fundamental technology used in solving scientific and commercial problems.

Many of the grand challenges of science depend on simulations and models run on HPC facilities, for example protein folding, the search for the Higgs boson and developing nuclear fusion. In industry, sophisticated computer models are integral to the development of products such as jet engines, wind turbines and new drugs.

Modern supercomputers are parallel machines with many thousands of individual processors. Running software on these systems requires new parallel programming techniques.

This course will cover all the fundamental concepts that underpin modern HPC. Students will explore these topics by running parallel programs on real HPC systems such as ARCHER, the UK national supercomputer. The same techniques can also be applied to smaller systems such as multicore desktops and computing clusters.

Practical Introduction to Data Science

Data science is a rapidly-emerging, interdisciplinary field which brings together ideas from computer science, mathematics, statistics, software engineering and beyond.

It is concerned with the manipulation, processing and analysis of data to extract knowledge. Data Science is key to making the most of the increasingly large, complex and challenging data sets that are now generated across science and business.

This online course will introduce the important ideas and concepts of data science and will allow students to gain the basic skills that would be expected of a data scientist. It has two broad themes: the importance of looking after data (so that it can be analysed) and data analytics techniques.

It is a practical course and students will get to try out such techniques and explore these ideas using common data science tools and languages including R and Python.
Pre-requisites
The standard postgraduate entry requirements apply: a UK 2:1 honours degree or its international equivalent in a relevant subject, or equivalent work experience.

The courses will not require any substantial prior experience in programming; only basic IT literacy is assumed. For example, on the HPC course all parallel software will be provided. However, those who can program will be able to further develop their skills by examining the supplied source code. Those who cannot program will learn the basic concepts by writing simple examples in Python.

Assessment and Award
Both courses are fully assessed by coursework with no exams. On successful completion of each course, students will receive a Postgraduate Professional Development Award of Academic Credit, corresponding to 20 SCQF credits.

Course structure
The course will use Edinburgh University’s standard online platform, Blackboard Learn. This will be the course hub from which all material will be accessed and submitted.

Courses will run from early 2016 for a period of 5-6 months. It is expected that students will undertake the course activities on a weekly basis. Since this is a part-time distance-learning course, we appreciate that students may also have other commitments so we will maintain as much flexibility as possible. We will suggest a week-by-week programme of study, but material will be posted in advance to allow students to schedule the work around other commitments.

Although we set deadlines for various activities such as course assessment exercises, we will ensure that students always have sufficient time between the announcement of the coursework and the hand-in date. For online tutorials, alternative time slots will be offered to accommodate students in different time zones.

The course content will include video lectures (usually delivered in clips of 10-15 minutes), self-assessment tests, practical exercises, online office-hours with course tutors and three pieces of assessed coursework.
Many of us working in HPC already know its value to research, what it can achieve and how important it is for addressing key social challenges such as the digital economy, energy, global uncertainties, and managing environmental change. However, beyond user communities, the vital role of HPC is less well-known.

The ARCHER outreach project will demonstrate the value of HPC-based science and technology to a broader audience. It also intends to widen participation by enthusing the next generation about science and HPC, and introducing them to the scientific applications that run on HPC platforms such as ARCHER.

During the next three years this project will undertake an ambitious programme to train a generation of ‘HPC Outreach Ambassadors’, providing them with resources, support and training to go into their local communities, schools and science festivals to promote HPC and their work in HPC science.

We will also work with schools to develop lessons on HPC and its applications, its uses and how to

Our principle goals:

• Raise the profile of existing ARCHER users
• Promote science and provide role models for future HPC users
• Improve public outreach of the work being done on ARCHER and promote its use in new communities.
pursue a career using HPC, providing teachers with a freely-accessible online resource and the support of the ARCHER team. We hope that this work will encourage a future generation of scientists to get involved with HPC technologies.

There will be an active emphasis on diversifying participation. Throughout all our work we will engage new communities: both those who have not previously considered using HPC, as well as scientists who may benefit from larger machines.

We will run a series of events to support this, including training local champions who can inform local groups of the benefits of HPC for their specific research needs.

An additional aspect of this will be broadening participation by providing diverse role models and showcasing their work to inspire upcoming scientists. This will include launching a ‘Diversity in HPC’ website as well as continuing to run events in collaboration with the Women in HPC network set up by EPCC in 2013.

ARCHER Outreach is funded by EPSRC.

Upcoming events

Women In HPC workshop & BoF
14 & 16 July 2015
www.womeninhpc.org.uk/isc15

This event will bring together female early-career researchers with a focus on European participation, providing them with an opportunity to showcase their work and to meet role models and peers in an environment designed to move beyond the stereotype of HPC as a male-dominated field. It will open with an introduction to current research by the Women in HPC (WHPC) network, and the different experiences of men and women in the field.

This event is a collaboration with the WHPC network and ISC2015.

Panel discussion

We will also host a panel discussion, focusing on “How can women fulfill their dreams in HPC, combining work with having a family and working in a male-dominated environment?”.

If you wish to take part in either the BoF or workshop please register through the ISC15 website: www.isc-hpc.com/passes-fees.html

Do you have a story to tell?

Did you follow an unusual route to HPC, have you taken a career break or moved into the field late in your career?

We are looking for stories highlighting the diverse background of the HPC community. If you would like to be involved please get in touch!

Contact Toni Collis at EPCC: acollis@epcc.ed.ac.uk
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The newsletter of EPCC, the supercomputing centre at the University of Edinburgh
CRESTA finishes on a high note

It hardly seems any time since I wrote an article for EPCC News introducing the newly-funded CRESTA project. But it was actually 2012, and it was at an exciting moment in the world of HPC.

The community had started talking about Exascale computers and the challenges associated with building and using such systems. An international group (IESP: the International Exascale Software Project) met regularly to understand the challenges, ultimately developing a software roadmap for Exascale systems. Within this environment the European Commission (EC) was one of the first to publicly invest in Exascale software and hardware development. CRESTA was one of three projects funded by the commission at that time.

The CRESTA project funded 13 partners across Europe to develop software, tools and applications for future exascale platforms. The scale of investment (11.3M euros) was unusually large for a software project, and it allowed a broader than usual range of software to be developed in collaboration. This major financial backing, together with a critical mass of experts, helped CRESTA deliver more innovative products than most such projects.

**Successful delivery**

CRESTA finished at the end of 2014, obtaining an excellent rating from the EC. The project successfully delivered all its objectives and outputs, which fell into four areas:

- To progress state-of-the-art research in exascale development.
- To develop and produce software for future exascale platforms.
- To enable a set of key co-design applications for exascale.
- To demonstrate the success of the co-design process.

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Underpinning all these outcomes has been the use of a co-design approach.

As one of the first projects to use a co-design process in practice, CRESTA was an important demonstrator for the exascale community. We successfully utilised the co-design methodology to deliver CRESTA’s key objectives. In addition, we designed a series of metrics to assess the impact of co-design on overall delivery.
CRESTA has produced a significant research portfolio of novel algorithms and techniques. Building on this, the project created a tailored software collection. Designed to allow applications to exploit future exascale platforms effectively, this collection also shows significant benefit for current petascale resources.

Finally, CRESTA has produced a set of applications able to exploit today's largest systems and tomorrow's exascale platforms. These applications have demonstrated clear socio-economic benefit, ranging from new drug design through to advance warning of extreme weather events.

Although CRESTA has now finished, there are many examples of other projects using its outputs and new funding secured to build on our work.

It is again an interesting time for the community, with early projects now delivering results and generally there is a more realistic understanding of the timescales and challenges associated with producing exascale technologies.

Current exascale research

The EC has again invested in exascale technology development and a range of the newer projects build on work from the CRESTA project. A couple of highlights include:

- NextGenIO: the next generation of IO technologies for exascale.
- INTERTWinE: interoperability between programming models to prepare for future exascale platforms.
- ExaFLOW: enabling Fluid Dynamics Simulations for Exascale.

All of which show the importance of the work carried out by CRESTA.

You can find out more about CRESTA's work on the project website. You can also download software from the site: www.cresta-project.eu
The future of HPC-led competitive advantage

The next phase of the Supercomputing Scotland programme will strengthen our engagement with Scottish companies, bringing them significant competitive advantage through the use of HPC.

The initial three-year Supercomputing Scotland programme had a considerable impact on the uptake of HPC by Scottish business. By using our expertise and facilities, participating companies improved their work processes: for example, faster simulations have reduced project timescales. The ability to repeat analysis within budget and time constraints has enabled cost-effective product optimisation. And more complex simulations, with greater precision and accuracy, have greatly improved product performance and quality.

These benefits have had a direct effect on overall competitiveness by improving product development processes, reducing costs, improving time to market, reducing risk, and growing revenues and margin through service differentiation.

Real benefits

Companies such as Xi Engineering and Abbott Risk Consulting have benefited from using HPC to speed up modelling, allowing them to expedite client projects.

Built-environment consultancy IES has achieved considerable service differentiation through implementing novel, as-a-service business models based on an HPC cloud, increasing accessibility and reach for its software services.

And access to HPC infrastructure has provided wave-energy company Albatern with the ability to undertake complex simulations with even greater accuracy and precision. This has reduced the need for physical prototyping and has been directly responsible for reducing development risk, costs and timescales.

The next phase

Having demonstrated the business benefits of HPC, we will use a re-shaped Supercomputing Scotland programme to encourage mass adoption of HPC by Scottish industry over the next few years. We will continue to work with our partner Scottish Enterprise (SE), and in particular its account managers and innovation specialists, to reduce barriers to HPC adoption by signposting appropriate SE funding options.

We are confident that a continued focus on HPC-led competitive advantage could significantly benefit the Scottish economy.
In April, EPCC hosted the third Exascale Applications and Software Conference (EASC 2015), which brought together stakeholders working to solve the software challenges of the Exascale.

A very welcome (if unexpected) feature of EASC was the glorious sunshine, which bathed Edinburgh throughout the event and gave the many international attendees the best possible impression of the fantastic location.

Pete Beckman, Director of the Exascale Technology and Computing Institute at Argonne National Laboratory, set the tone in the opening keynote by describing recent progress as well as the challenges we face as we approach the Exascale.

The many contributed talks, posters and informal discussions allowed ideas to be shared and collaborations to be built.

The relaxed conference dinner rounded off this successful event.

Mark Taylor, Head of CFD at McLaren Racing (right), discussed the challenges faced by Formula 1 racing and the sport’s use of HPC.

The other invited keynote presentations were:

- **Simon Portegies Zwart** (Professor of Computational Astrophysics, Leiden University): massively parallel GPU-accelerated galaxy simulations
- **Xue-feng Yuan** (Director of The National Supercomputer Centre at Guangzhou): his experience of managing Tianhe-2, the world’s largest supercomputer
- **Cynthia McIntyre** (Senior Vice President, Council on Competitiveness): the value of HPC engagement with industry.

We’re looking forward to EASC 2016 in Stockholm next year!

www.easc2015.ed.ac.uk
Postgraduate Master’s Degrees in High Performance Computing

These MSc programmes are offered by EPCC, an institute at the University of Edinburgh.

EPCC is one of Europe’s leading supercomputing centres and operates ARCHER, a 118,080-processor Cray XC30 system.

ARCHER is the new UK academic High Performance Computer System.

These programmes equip participants with the multidisciplinary skills and knowledge to lead the way in the fields of High Performance Computing and Data Science.

Through our strong links with industry, we also offer our students the opportunity to undertake their Master’s dissertation with one of a wide range of local companies.

The University of Edinburgh is consistently ranked among the top 50 universities in the world*.

*Times Higher World University Ranking

www.epcc.ed.ac.uk/msc