

## CASE STUDY

### Intel® Xeon® Processor E5 Family

High-Performance Computing



# Driving innovation and growth

## Daresbury Science and Innovation Campus builds a new supercomputer based on the Intel® Xeon® processor E5 family

The Science and Technology Facilities Council (STFC) at Daresbury Science and Innovation Campus (Daresbury SIC) recently unveiled a world-leading high-performance computing (HPC) facility for the UK scientific community. IBM System x iDataPlex® dx360 M4 servers powered by Intel® Xeon® processors E5-2670 provide data-intensive computing performance, while a software virtualization layer offers a unique, dynamically-assigned shared-memory capability. Already up and running, the HPC facility supports a broad range of research projects.



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“The less money we spend on electricity, the more we have to pour back into our ongoing research projects and people. IBM and Intel support this approach by providing us with the most compelling total cost of ownership (TCO).”

John Bancroft,  
Project Director,  
Daresbury Research Collaboratory

### CHALLENGES

- **Cash injection.** Using a UK government investment, the STFC wanted to build a new HPC facility to drive growth and innovation across a range of disciplines
- **Two objectives.** STFC wanted the HPC facility to be easy to use while performing extremely data-intensive computing

### SOLUTIONS

- **Compute density.** Deployed 512 nodes comprising IBM System x iDataPlex dx360 M4 servers powered by Intel Xeon processors E5-2670 and running on a Red Hat® Linux operating system
- **Unique capability.** Platform Computing HPC scheduling software, together with ScaleMP Versatile SMP\* (vSMP\*) architecture, is enabling the STFC to dynamically assign large shared-memory domains

### IMPACT

- **World-class facility.** The new supercomputer is already supporting research into advanced manufacturing, life sciences, energy and the environment, and the digital economy
- **Future growth.** Expected to generate new research collaborations, driving UK growth and innovation

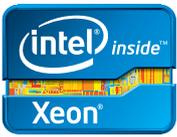
### Research at Daresbury

The STFC is one of Europe's largest multidisciplinary research organizations supporting scientists and engineers. It ensures the UK scientific community has access to large facilities that enable it to perform high-quality, world-class research. Daresbury Laboratory, located at the Daresbury SIC, is one of the two main laboratories of STFC.

The UK government recently announced the STFC would receive GBP 37.5 million (USD 57.5 million) to upgrade the Daresbury SIC computing infrastructure to host the next generation of HPC systems. The investment is part of a GBP 145 million (USD 222 million) e-Infrastructure initiative announced by the Department of Business, Innovation and Skills (BIS) and supported by leading IT vendors like Intel and IBM. It is designed to drive growth and innovation across a range of sectors that rely heavily on HPC, such as manufacturing, engineering and life sciences.

### Key hardware requirements

The STFC decided to split these funds across two key research areas: accelerator science and research and computational science and engineering. For the latter, STFC needed the new HPC infrastructure to fulfill two key objectives. John Bancroft, project director at Daresbury Research Collaboratory, explains: “Firstly, we wanted the new infrastructure to make HPC facilities much easier to use, and secondly, we needed it to perform extremely data-intensive computing, pushing the boundaries of scientific research to address grand-challenge problems.



## Blue Wonder is fulfilling its role to drive growth and innovation

Four original equipment manufacturers (OEMs) submitted proposals for the bid: IBM, Fujitsu, SGI and T-Platforms, with offerings based on a variety of processor technologies including Intel, AMD, NVIDIA and proprietary technology. Performance was the most crucial requirement and the STFC set a minimum standard each company needed to meet. After numerous assessment rounds and extensive evaluation using the HPC Challenge\* and Graph500\* benchmarks, the STFC chose IBM hardware based on Intel Xeon processors<sup>1</sup>.

The HPC will be known as Blue Wonder, a reference to the breakthrough science that the systems will achieve and also the Alice in Wonderland stories written by Lewis Carroll who originated from Daresbury.

Energy efficiency was also a key consideration for the STFC. By using innovative, energy-aware scheduling, Intel-based IBM servers offered the best power savings. Bancroft explains: "The less money we spend on electricity, the more we have to pour back into our ongoing research projects and people. IBM and Intel support this approach by providing us with the most compelling total cost of ownership (TCO). Last, but by no means least, they were also able to offer us superior support and collaboration, forging a harmonious working relationship."

### Data-intensive HPC

Working with HPC server and storage cluster integrator OCF, IBM and Intel, the STFC deployed 512 nodes comprising IBM System x iDataPlex dx360 M4 servers powered by Intel Xeon processors E5-2670 and running on a Red Hat Linux operating system. Each server runs on two eight-core processors, totaling 8,192 cores. Intel's latest Intel Xeon processor E5 family offers the best combination of performance, built-in capabilities, flexibility and cost-effectiveness.

Using ScaleMP vSMP architecture, the STFC can create multiple, simultaneous shared memory domains across up to 384 of Blue Wonder's System x iDataPlex dx360 M4 servers. This allows a maximum domain size of 6,144 cores and 48 TB of shared RAM, making Blue Wonder the largest shared memory system in the UK and ideal for loading and crunching huge datasets – for example, the human genome database.

Also, Platform Computing HPC scheduling software, together with ScaleMP vSMP\*, is enabling the STFC to offer something really unique. "Combining these two solutions, we are able to assign our shared memory domain dynamically to specific jobs. For example, when a user submits a job into Blue Wonder, the Platform Computing software can provision and automatically assign an appropriately-sized shared memory domain for that job using vSMP. Once the job is over, the memory is reassigned back to the pool. Ultimately, it is this sort of feature that is helping us make Blue Wonder even easier to use," says Bancroft.

### Spotlight on Daresbury

Daresbury Science and Innovation Campus (SIC) is a world-class location for high-tech business and leading-edge science. It provides a unique environment for innovation and business growth, with knowledge sharing, collaboration and networking.

The campus is home to the ground-breaking Daresbury Laboratory and the Cockcroft Institute as well as over 100 high-tech companies in areas such as advanced engineering, biomedical technologies, renewable energy solutions and digital, ICT and mobile technologies. In 2011 the Prime Minister, David Cameron, awarded the Daresbury SIC Enterprise Zone status.

### Investing out of a recession

Already up and running, Blue Wonder is being used to support a broad variety of research projects including advanced manufacturing in the automotive and aerospace industries; molecular modeling for virtual drug discovery and genome sequencing for life sciences; nuclear modeling for research into energy, meteorology and climate change; and advancement in the digital economy across gaming and CCTV, among others.

Bringing together the STFC's application expertise with leading developments in hardware and systems software, Blue Wonder is now one of the world's leading software development and demonstration facilities. Over the coming years, it is expected to generate new collaborations and services in simulation and modeling for industrially-relevant projects, fulfilling its role to drive growth and innovation in the UK.

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