Irish Centre for High-End Computing Upgrades SGI ICE HPC System Without Interruption

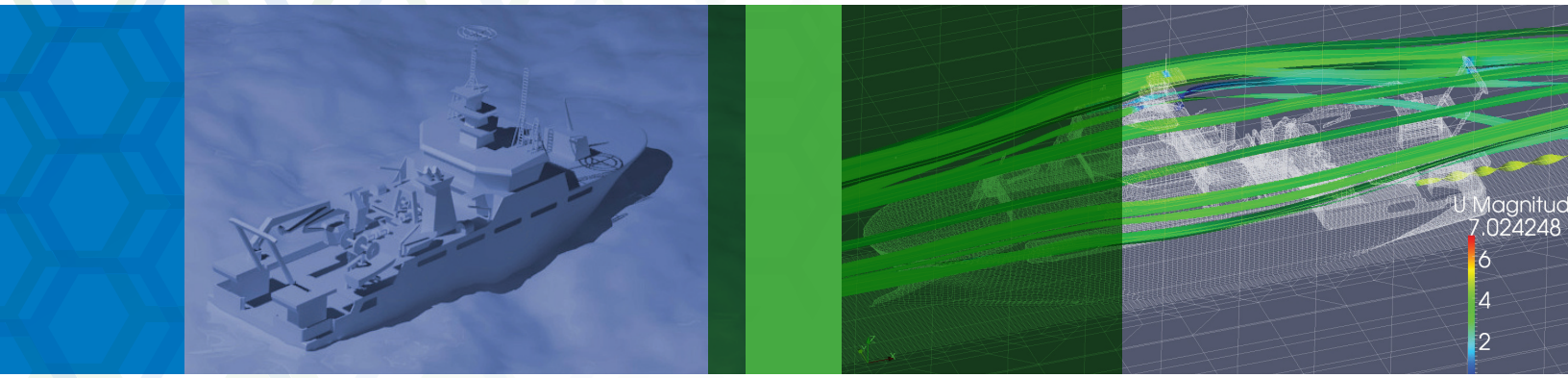
Management Thrilled with Speed from Order to Production

Key Facts

Organization:
Irish Centre for High-End Computing

Locations:
Dublin and Galway, Ireland

Application:
Government - Shared Resource



There comes a time when high performance computing (HPC) users require additional computational capacity, power, and performance, yet demand minimal disruption and impact on their scientific output and productivity. SGI® ICE systems are uniquely engineered to scale seamlessly, with no downtime nor contention to service. SGI and the Irish Centre for High-End Computing (ICHEC) demonstrate this "ease of scaling" when supporting the HPC National Service in Ireland.

ICHEC, dedicated to addressing the need for HPC facilities and support at the national level and to act as the national access point to trans-national European HPC facilities, invested in a 10-rack SGI ICE system in December, 2008. The system was completely installed and running within a 24-hour period, proving SGI as the industry leader in installing systems of different sizes and complexities in the shortest possible time, thus enabling fast deployment for their end users with a focus on maximizing their productivity and output. In August, 2010, ICHEC upgraded the system and staffers were, yet again, highly impressed by the speed and ease of upgrade of the system.

The Stokes System

The National Service supercomputer in Ireland, named "Stokes" and now in its second generation, is an SGI ICE 8200EX cluster with 320 compute nodes. Each compute node has two Intel® Xeon® E5650 processors and 24GB of RAM. This results in a total of 3,840 cores and 7,680GB of RAM available for jobs. The nodes are interconnected via two planes of ConnectX InfiniBand® (DDR), providing high bandwidth and low latency for both computational communications and storage access.

Smooth Upgrade with no Service Interruption

Initial system implementation in 2008 consisted of 2,560 processor cores with 100TB of storage. ICHEC selected the system after a competitive evaluation in which the SGI ICE 8200 delivered the highest performance in benchmark tests. Other factors included low cost of ownership, renowned application support and training to bring users up-to-speed rapidly, collaborative input with worldwide customers, considerable funding support to help hire new ICHEC climatology applications staff, positive assessments from other SGI ICE users, and the reliability and scalability of the acclaimed integrated blade platform. The purchase was financed mainly through e-INIS, a national collaborative project coordinated by the Dublin Institute for Advanced Studies and funded by Ireland's Higher Education Authority, together with contributions from University College Dublin (UCD) and the National University of Ireland, Maynooth.

The second phase, installed in August, 2010, again proved the ability of SGI to upgrade a system quickly and easily. Because SGI ICE systems scale seamlessly with just racks and nodes (no core switches needed), with nominal service disruption, the ICHEC system upgrade, which involved swapping out all 10 racks from Intel® Xeon® processor 5400 series (quad-core) to Intel® Xeon® processor 5600 series (six-core), was another great success. According to ICHEC President, Professor Jim Slevin, "The system was taken down on a Tuesday morning in August, and the 320 blades arrived from the Amsterdam airport on Wednesday morning. Removal of the old blades and installation

of the new blades began at around 10:00 a.m., with SGI engineers, ICHEC staff and UCD staff working together, and by 4:00 p.m. the hardware installation was complete."

Slevin continued, "Testing began immediately and continued over the next few days, running a number of diagnostics. This period concluded by running the Linpack benchmark. By Friday evening, the SGI engineers had tuned the system to deliver 89% of the theoretical peak performance, a figure that, in itself, is significantly higher than normal in these situations. To bring this into context, the "old" Stokes ICE system had "only" achieved 87% of the peak, but even this was sufficient to make it the most efficient x86-based computer worldwide in the November, 2008 TOP500 (www.top500.org)."

Professor Slevin was pleased that project planning, manufacturing, shipping from the U.S., hardware installation, software configuration and acceptance all took place within a three-week period, with only minimal disruption. The upgraded Stokes system additionally offered a 50% increase in capacity and measured performance, yet with less electrical power than before its upgrade. "After some more tweaking and testing over the weekend, SGI handed over a working system to us on Monday! Quite an achievement, as the decision to install the system over this period was made just a couple of weeks prior," Slevin concluded.

From initial ordering of the ICE upgrade by ICHEC, the total duration from shipment, installation, delivery and testing through handover to the users occurred inside a four week window. Downtime of the system was minimized because of the effectiveness of both the ICE system architecture and capabilities of SGI service teams. When institutions are looking to scale their systems with SGI, they can be assured this will be achieved in a minimal amount of time, with a focus on the user and uninterrupted productivity.

Research Results Have Worldwide Implications

The ICHEC system is used by a wide range of scientists and engineers from various research fields, including scientists from the weather & climate and medical communities. Some examples of research being done using the system are:

- Simulating the global climate with the EC-EARTH Coupled Atmosphere-Ocean-Ice Model
- Evolution of tissue-specific genes and their regulatory elements
- Quantum Monte Carlo calculations for spin-crossover molecules
- Particle acceleration in a turbulent magnetic field
- Coronary stent analysis and design using the finite element method

OpenFOAM® Used for Multiple Studies on Stokes

OpenFOAM software is one of the many applications available on Stokes, and is used by a number of researchers who have access to the system.

One study currently being undertaken regards the subject of gravity-driven water waves interacting with moored, fixed or floating structures. This is an important field of research in mathematics, ocean engineering and mechanical engineering. For large objects with characteristic dimensions of the order of the wave length, viscous effects, compressibility and surface tension of the fluid flow can be neglected. Under the additional assumption of irrotational fluid flow, a velocity potential can be introduced to describe the flow characteristics.

When the characteristic dimension of the structure is less than the wave length, viscous effects become more important and vorticity can be generated at rigid walls. Experimental work on water waves has aimed to minimize viscous effects. The question is how one can extrapolate the laboratory results from model scale to full scale when viscosity plays an important role in the dynamics of the rigid body motion. OpenFOAM software is being used to answer this question.

About ICHEC

The Irish Centre for High-End Computing (ICHEC), founded in 2005, is Ireland's national high performance computer centre. Its mission is to provide High-Performance Computing (HPC) resources, support, education and training for researchers in third-level institutions, and through technology transfer and enablement, to support Irish industries large and small to contribute to the development of the Irish economy.

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