



THE UNIVERSITY
of ADELAIDE

University of Adelaide research soars to new heights with Lenovo supercomputer

Lenovo™



Overview

The University of Adelaide, one of Australia's leading research universities, wanted to better support researchers from a wide range of disciplines. Previously, researchers had to compete for limited external HPC facilities, which often left groups without enough compute resources or resulted in delays in securing access. With Phoenix, a supercomputer based on a Lenovo NeXtScale System M5 cluster with over 3,800 Intel® Xeon® processor cores, the university can now offer researchers a powerful, state-of-the-art research tool, helping to enhance its status as a world-class research center.

The University of Adelaide is a world-class tertiary education and research institution committed to delivering high quality and distinct learning, teaching and research experiences. A member of the Group of Eight (Go8), Australia's eight leading research universities, the University of Adelaide consistently ranks in the top 1 percent of universities worldwide. Over 25,000 students and 3,500 members of staff work across four main campuses.

Mark Gregory, CIO at the University of Adelaide, begins: "As one of Australia's foremost research institutions, we see extremely high demand for modern, cutting-edge facilities. Over the last five years, requests for high performance computing (HPC) resources have skyrocketed as research becomes increasingly compute-intensive. We knew that to continue supporting world-leading research, we needed to increase the computation power available."

Demand outstrips supply

Home to five world-class research institutes and almost 50 specialist research centers, the University of Adelaide supports research across a wide range of disciplines, covering everything from neuroscience to agriculture.

"Our supercomputer enables researchers to access a facility exponentially larger than the limited portions of shared facilities they previously relied on."

—Mark Gregory,
CIO,
University of Adelaide



Derek Leinweber, Professor of Physics and Associate Director of the Special Research Centre for the Subatomic Structure of Matter (CSSM) at the University of Adelaide, relies on HPC resources to delve deeper into the theory of Quantum Chromodynamics (QCD). He explains: “We use supercomputers to create numerical simulations of QCD, which describes the interactions of quarks and gluons as they compose particles such as protons and neutrons. With HPC resources, we can take fundamental theories of particle physics and create visualizations to help us better understand the origin of mass and the complex phenomena emerging from the Standard Model of the Universe.”

Lewis Mitchell, Lecturer in Applied Mathematics at the University of Adelaide, on the other hand, is currently using HPC resources for the study of happiness. He elaborates: “By blending algorithms to geo-located Tweets, for example, we are able to analyze Twitter users’ language and see how happiness varies geographically – this correlates well with demographics, such as socio-economic status and levels of health. We use supercomputers to collect and analyze millions of Tweets, processing tens of millions of individual words, and then to map the findings and see how happiness levels vary by region. By integrating mathematical models with open data, we can also predict things as diverse as the outcome of elections, where and when protests and civil unrest will occur, and the spread of infectious diseases.”

For the last five years, researchers at the University of Adelaide had been accessing external, shared HPC resources, such as eResearch SA and the National Computational Infrastructure (NCI). Mark Gregory recalls: “Relying only on external resources was less than ideal. This meant that researchers were only allocated a fraction of the compute resources they really needed, which meant that their research outcomes would be delayed.”

Derek Leinweber says: “In the past, we were allocated supercomputing time once a quarter. Given the resource-intensive nature of our numerical simulations, researchers would quickly use up the available computer power. Once used up, you had to wait until the next quarter for more resources, which stalled research.”

Phoenix rising

Aware of how demand for fast computing exceeded supply, the university wanted to improve access to HPC resources and support services. Mark Gregory comments: “Demand was such that many researchers were buying and trying to manage their own compute. It was clear that a well-managed, central university resource was a better way forward – we needed capacity and also a few skilled staff that could help researchers best use the resources.”

After evaluating offerings from several vendors, the university chose to partner with Lenovo to secure an HPC solution that would support cutting-edge research for years to come.

Solution components

Hardware

Lenovo NeXtScale System M5

Lenovo NeXtScale nx360 M5

compute nodes with Intel® Xeon®
processors E5-2600 v3 series

Lenovo NeXtScale n1200 Enclosures

Mellanox SB7790 EDR IB Switches

NVIDIA Tesla K80 GPU Accelerators

Software

Red Hat Enterprise Linux

“The Lenovo team went the extra mile and were very easy to work with. Lenovo has proven to be an outstanding partner in all areas – from planning and procurement, to shipping, to build and technical support.”

— Mark Gregory,
CIO,
University of Adelaide



“We wanted to ensure we got the most bang for our buck – and that we were up and running as soon as possible,” says Mark Gregory. “Not only did Lenovo offer the most compute performance at the most attractive price, it was also able to work with us to build, test, and deliver the system for research use in just six weeks. The Lenovo team went the extra mile and were very easy to work with. Lenovo has proven to be an outstanding partner in all areas – from planning and procurement, to shipping, to build and technical support.”

Working closely with Lenovo, the university deployed a cluster based on 120 NeXtScale nx360 M5 compute nodes with 3,840 powerful, yet energy-efficient, Intel® Xeon® processors E5-2600 v3 series. The system is also equipped with 144 NVIDIA K80 GPUs and 15,360 GB of memory and is connected with Mellanox SB7790 EDR IB interconnect switches. The Lenovo system – named “Phoenix” by the university – runs Red Hat Enterprise Linux and benchmarks at 300 TFLOPS.

Mark Gregory says: “Equipped with 144 NVIDIA K80 GPUs, we expect our Lenovo solution to be one of the most GPU-intensive supercomputing facilities dedicated to supporting Australian research endeavors. Increasingly we are finding that our researchers can take advantage of the GPU acceleration and we are helping them code to the platforms strengths.”

He adds: “Around two-thirds of the costs for Lenovo system was contributed by researchers and departments motivated to excel in their fields. The Phoenix HPC service enables computational researchers to leverage their grant funds by shifting the compute power they need out from under their desks into a well-managed university facility.”

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Close-up of Lenovo NeXtScale System M5. Photo credit: University of Adelaide.



Supporting world-class research

Today, the university manages the provisioning of compute resources with a growing support team dedicated to helping develop new and use existing research applications, enabling more researchers than ever before to take advantage of HPC resources.

The new Lenovo cluster supports the computational workloads of researchers across the university's research institutes and centers. From developing machine learning algorithms to processing data from CERN, researchers of all disciplines use the Lenovo system to further their work.

Mark Gregory comments: "Our Phoenix platform gives researchers the certainty that they can immediately access a facility many times faster than the allocations of regional or national facilities they were previously limited to. We are very pleased with the Lenovo hardware on a technical level, as actual computing performance is quite close to theoretical performance maximums. The cluster runs at an impressive 85 percent efficiency."



Researcher using the Lenovo supercomputer, called "Phoenix". Photo credit: University of Adelaide.

Operating at 300 TFLOPS in its initial configuration, Phoenix offers researchers extremely high levels of performance. Derek Leinweber elaborates: "Previously, the CSSM was typically allocated around 1 percent of the NCI's 1,000 TFLOP resources per quarter. With Phoenix, we can now schedule access to 300 TFLOPS, giving us roughly 30 times more compute power."

PhD Candidate Adrian Kiratidis explains: "We've found that calculations that would previously have taken three months now run in under a week. Increased speed and performance levels enable us to work much more efficiently and productively." Waseem Kamleh, CSSM Senior Research Associate, adds: "Because the facility is

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—**Derek Leinweber**,
Professor of Physics and Associate Director
of the Special Research Centre for the
Subatomic Structure of Matter (CSSM),
University of Adelaide



managed by the university, researchers are no longer forced to wait for weeks for resources to become available. As new research trends emerge, Phoenix will help us to stay on top of our game.”

Derek Leinweber emphasizes: “With the Lenovo system, we are now better equipped to study the interplay of strong and electromagnetic forces, for example. The system enables us to run advanced, highly precise calculations, which helps to put us ahead of international competitors.”

Lewis Mitchell remarks: “As well as taking advantage of parallelized computation capabilities – being able to process multiple jobs on multiple nodes simultaneously – we are also planning to use Phoenix for simpler calculations. To discover things in a large data set, you need time and the ability to experiment. With easy access to HPC resources, we will be able to play around with data in a way that simply was not possible in the past. When an idea strikes, we can run analyses without having to wait a week to get the results back. This speed and flexibility gives us more opportunities to explore our data and gain new insights.”

Mark Gregory concludes: “Researchers are getting real value from the new system. With resources at their fingertips, they are shortening their time to results. The Lenovo system’s capacity for computational analysis makes them more competitive, improves the impact and accuracy of their findings, and ultimately helps the University of Adelaide deliver world-class research.”

For more information

To learn more about Lenovo Enterprise Systems, contact your Lenovo Sales Representative or Lenovo Business Partner, or visit: lenovo.com/systems

For more information about the University of Adelaide, visit: www.adelaide.edu.au or connect with @UniofAdelaide



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