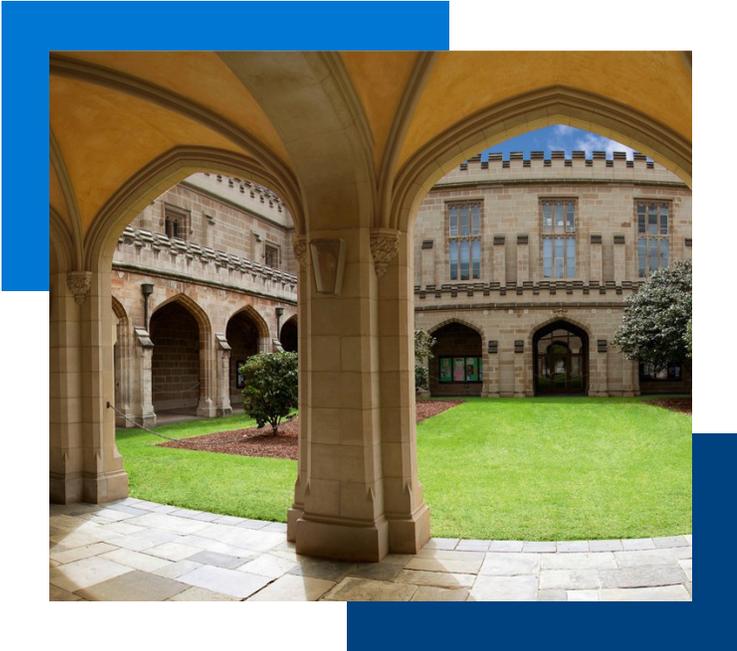


## Accelerating scientific discovery

University of Melbourne puts the power of high performance computing to work to support thousands of researchers.



Customer profile



THE UNIVERSITY OF  
**MELBOURNE**

Scientific Research | Australia



“We have more than 4,500 researchers who use the system, and around about 1,500 different research projects. To date, we have completed close to 30 million jobs on Spartan.”

**Lev Lafayette**

Senior High Performance Computing Development and Operations Engineer, University of Melbourne

## Business needs

The Research Computing Services group at the University of Melbourne provides high performance computing systems and services to support researchers across all academic disciplines.

## Business results

- Supporting diverse research across the university
- Enabling data-intensive scientific investigations
- Simplifying access to HPC systems
- Maintaining the University’s commitment to research excellence

## Solutions at a glance

- Hybrid system with traditional HPC connected to cloud resources
- Dell EMC PowerEdge servers with Intel<sup>®</sup> Xeon<sup>®</sup> processors
- Linux operating system with a SLURM workload manager
- OpenStack cloud environment
- Open OnDemand web-access portal

## Solving pressing societal challenges

The University of Melbourne is Australia's leading research university, with a 165-year-long tradition of higher education in the arts, sciences and professional disciplines. Its enduring purpose is to benefit society through the transformative impact of education and research.

To that end, research conducted at the University helps solve pressing social, economic and environmental challenges. From climate change to COVID-19, from cultural preservation to artificial intelligence, research at the University of Melbourne is adding to human knowledge and understanding to help society thrive. At the same time, the University's research program is translating discovery into meaningful, practical impact to benefit all of us.

To carry out much of this advanced research, the University of Melbourne's academic community requires leading-edge high performance computing systems, and that's where the Research Computing Services group makes all the difference.

## The HPC environment

The Research Computing Services group at the University of Melbourne provides high performance computing systems and services to support researchers across all academic disciplines. The centerpiece of these offerings is an innovative hybrid HPC system named Spartan.

Launched in 2016, the Spartan cluster from Dell Technologies combines traditional HPC capabilities with cloud computing systems to provide researchers with a shared pool of scalable resources that meets a wide range of research demands and is ready to grow with their evolving needs. The general-purpose on-premises Spartan system and connected cloud systems operate together as a single HPC environment.

Spartan is based on Dell EMC PowerEdge servers with Intel® Xeon® processors. Other key components include server accelerators, networking switches from Mellanox, a Linux operating system with a SLURM workload manager, and an OpenStack cloud environment.

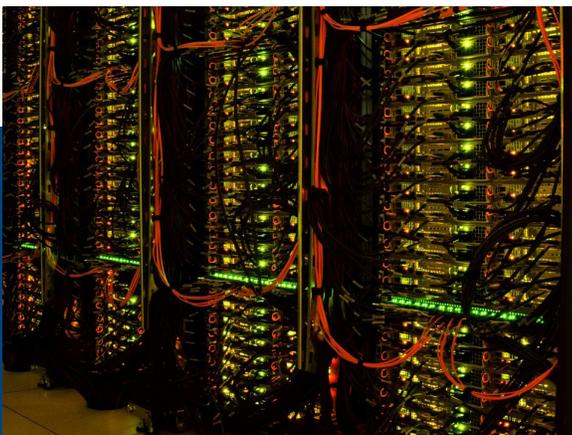
Following a 2020 upgrade, Spartan has 162 nodes that deliver peak performance of 1,698 teraflops. The system has 5,100 physical cores, 2.3 petabytes of primary storage and an additional 550 terabytes of flash. Other enhancements to the system include FastX, which is a service that allows users to run graphical applications, and Open OnDemand, a portal that provides web access to HPC resources.

In its first year in service, Spartan ran more than a million jobs, and the usage has risen steadily ever since, according to Lev Lafayette, the Senior High Performance Computing Development and Operations Engineer with the Research Computing Services group.

"Although we may have been excited by completing a million jobs in our first year, we now talk about completing 10 million jobs a year," Lafayette says. "So that's quite a huge change, and we intend to continue to make improvements to the system."

The enormous popularity of the Spartan system is evident in system utilization metrics.

"Today, every single one of our nodes is allocated, and nearly all of our cores and GPU cards are in use," Lafayette says. "That usage gives you an idea of the amount of research that's going on in the system. We have more than 4,500 researchers who use the system, and around about 1,500 different research projects. To date, we have completed close to 30 million jobs on Spartan."



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## Fueling amazing research

The Spartan system and other HPC resources provided by the Research Computing Services group power research projects that extend across diverse disciplines, from mathematics, life sciences and engineering to astronomy, economics, finance and more.

Here are a few examples of recent and ongoing research initiatives.

### Molecules in motion

In the realm of biophysics, researchers at the university are using cryo-electron microscopy (cryo-EM) processes that speed-freeze molecules to create images that can shed light on human cell behavior. This research requires powerful computational systems and software tools to align and combine millions of 2D images in order to generate 3D representations of the molecules.

Research of this type generates an enormous amount of data from scientific instruments. To deal with this challenge, the Research Computing Services group has a workflow and network to move the data directly from the laboratory instruments into storage systems, and then move the data into the Spartan system to run simulations and build the 3D models.

### Wildfire resilience

In one of many notable climate-related projects conducted at the university, researchers developed nine principles for urban design and planning to reduce risk and improve the resilience of communities in bushfire-prone areas. For the next steps, the researchers are now looking at how urban planners can improve their understanding of building codes and associated development to enhance resilience.

### Singing at the moon

And then there is the willie wagtail study conducted by a biosciences team from the university. The willie wagtail is an Australian songbird known for its wagging fan-shaped tail and pleasantly squeaky song. By recording birds across Victoria, the researchers confirmed the popular notion that willie wagtails sing out the most during full moon nights.

In this study, published in the journal Behavioral Ecology and Sociobiology, the researchers recorded the nocturnal singing of willie wagtails over eight complete lunar cycles in four rural locations across Victoria. They found that the willie wagtails did indeed increase the amount of time they sang in line with the brightness of the moon — essentially making sure they are both seen and heard, according to the researchers.

## Working with Dell Technologies

Dell Technologies provided the majority of the equipment used in the Spartan cluster — from the main chassis for the cloud system to the bare-metal compute nodes. And that equipment has proved to be highly reliable, according to Lafayette.



“I want to emphasize that we are very, very pleased with the kit that we got from Dell Technologies.”

**Lev Lafayette**

Senior High Performance Computing  
Development and Operations Engineer,  
University of Melbourne

“It was absolutely so important to have a reliable supplier who offered good warranties on their system and for whom, if something did go wrong, it was no trouble to say, ‘Hey, look, this node has gone out. We think we’ve got a faulty processor or a faulty DIMM,’” he says. “And I must add that doesn’t happen very often at all. But it’s good to have the security of knowing that should we have a problem, techs will come out, find the issue and fix it.”

Ultimately, the Research Computing Services group has had a very good experience working with the Dell Technologies team and its products in the Spartan system.

“I want to emphasize that we are very, very pleased with the kit that we got from Dell Technologies, and with the response that we get to any issues, rare as they are, from the same body.”



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