

# TO INFINITY AND BEYOND! ACCELERATING THE SEARCH FOR THE FIRST STARS AND GALAXIES.

## Background

The Square Kilometre Array (SKA) project is one of the largest international scientific research projects in history—a multi-billion dollar effort to build the world's largest radio telescope.

ICRAR (International Centre for Radio Astronomy Research) researchers have been studying the early universe with the Murchison Widefield Array (MWA) telescope, a precursor to the SKA.

## Challenges

The MWA telescope had amassed terabytes-worth of data backlog that was awaiting processing, which was impeding research efforts.

## Solutions

In two weeks, our high-performance computing (HPC) experts onboarded and optimised ICRAR's code for processing the MWA data.

## Results

Our HPC experts achieved runtimes that were 125 times faster!

ICRAR were able to process their data backlog within three hours, using just a fifth of our compute resources in Perth - having previously managed to process only a sixth of its backlog over two years.

Using these results ICRAR published a new paper based on the findings of this research.

ICRAR credited our green HPC for lowering their carbon emissions.



# SUPERCHARGING MEDICAL RESEARCH TO ADVANCE HUMAN HEALTH.

## Background

The Harry Perkins Institute of Medical Research ("Perkins") applies innovative bioinformatics - a field combining biology, computer science and mathematics - to tackle chronic diseases including cancer and rare genetic disorders.

To keep pace with the rapid evolution of bioinformatics, scientists must constantly develop new algorithms and methodologies, resulting in high data throughput.

## Challenges

Bioinformaticians use data in unconventional ways - their mathematical methods are unstructured, with colossal amounts of genomic data stored and analysed via complex access patterns.

Perkins said:  
"We require a fully supported high-performance computing (HPC) system designed to let us store, process and analyse data our way."

## Solutions

We provided Perkins researchers with our tailored HPC expertise and code-optimisation support to ensure their workflows could leverage our state-of-the-art processors and storage systems.

## Results

Our bespoke HPC solution gave Perkins scientists quick and easy access to their huge datasets without computational restriction.

Perkins said:  
"Trusting the technology to the experts at DUG, we can now get back to our number one priority - saving lives."



# OUTSMARTING BUSHFIRES WITH ARTIFICIAL INTELLIGENCE.

## Background

Earth's changing climate is exacerbating bushfires, as evidenced by Australia's devastating 2019/20 bushfire season.

The Frontier Development Lab (FDL) AusNZ approached us to provide the high-performance computing (HPC) service and support for their Data Quest 2020 - a research sprint to incorporate artificial intelligence (AI) into firefighting.

## Challenges

The complexity of predicting bushfire behaviour, coupled with obsolete tools that require manual input, makes predicting and preventing modern day bushfires arduous tasks.

## Solutions

As a proud partner we supplied our HPC resources and data science expertise, enabling the Data Quest 2020 researchers to efficiently test AI-powered systems for detecting, monitoring and modelling bushfires using satellite data.

## Results

Our tailored solution enabled terabytes of satellite imagery data to be leveraged.

The sprint succeeded in developing a number of innovative AI solutions for bushfire prevention and management.

The results included clear, demonstrable pathways and deployable tools for future use by fire experts and first responders.



# SHARPENING EYES IN THE SKY.

## Background

LatConnect 60 ("LC60") is an Australian smart-satellite provider that offers high-resolution Earth observation analytics services with high accuracy in near real-time.

LC60 is partnering with a Malaysian governmental organisation to promote a subscription-based monitoring service to enhance crop management.

## Challenges

The inflexibility of other cloud providers was increasing the time and costs required for LC60 to run its data-processing workflows efficiently.

To sustain a large-scale deployment of its monitoring service, LC60 required a tailored, cost-effective and efficient solution.

## Solutions

We provided LC60 with the required compute capacity and latest hardware—all configured for its workflows.

Through professional services such as code onboarding and optimisation, our high-performance computing (HPC) experts built an optimal software environment for LC60 to run its analyses.

## Results

CEO of LC60 Venkat Pillay said: "We have been thoroughly impressed by the speed and scale at which DUG's HPC offering has been able to support our agriculture analytics services. Data-processing tasks which took us weeks in the past can now be completed in a few hours. This is a game-changing development for us."

Through our reliable and bespoke HPC solutions, LC60 has had a step change in compute capabilities, which will further enhance its services and products for clients.



# STEERING BETTER AND GREENER SHIPBUILDING.

## Background

Austal is an Australian shipbuilder and defence prime contractor specialising in the design, construction and support of some of the world's most advanced defence and commercial vessels.

Austal's product range includes naval vessels, high-speed passenger and vehicle ferries, and specialist utility vessels for offshore windfarms and crew transfer.

Ship design specialists at Austal perform resource-intensive computational analyses to improve the efficiency and performance of its industry-leading vessels.

## Challenges

With a need to bolster its on-premise resources, Austal required quick access to different hardware and an efficient, flexible cloud platform to meet its increasing computational demands while reducing its greenhouse-gas emissions simultaneously.

## Solutions

We provided Austal ship design specialists with our tailored high-performance computing (HPC) expertise and bespoke optimisation support to ensure their vessel-design software and workflows could efficiently leverage our green cloud platform, DUG McCloud, powered by state-of-the-art hardware.

## Results

Driven by our bespoke HPC solution and expert support, Austal has fully embraced cloud computing for its research and design processes.

Austal credited our HPC and expertise for supporting its research papers.

Slashing power consumption by up to 51%, our 'DUG Cool' immersion-cooling technology helps Austal meet its environmental, social and governance (ESG) requirements.



# UNLOCKING NEW SOLUTIONS FOR NEURODEGENERATIVE DISEASES.

## Background

Biotech company GenieUs Genomics (GenieUs) developed the Deep Integrated Genomics Analysis Platform (DiGAP™), a comprehensive bioinformatic tool for analysing short-read and long-read whole-genome sequencing, paving the way for breakthrough treatments for neurodegenerative diseases.

## Challenges

Some of the biggest challenges GenieUs faced were the long process times for each sample, which were taking around three days to complete, and the large size of datasets making unit testing difficult. These resulted in a backlog of unprocessed samples that were impeding research efforts.

## Solutions

We provided GenieUs researchers with our tailored high performance computing (HPC) expertise and workflow-optimisation support, which enabled the dynamic allocation of compute nodes and storage as demand required.

We also crafted a compliant environment that supported continuous integration with GenieUs' preferred development and version-control software.

## Results

The dynamic, on-demand allocations allowed GenieUs researchers to identify how to optimise the use of HPC resources for their specific genomic data analysis needs—improving the speed and efficiency of their computational workflows.

With substantial performance improvements and reductions in memory consumption, they were able to process significantly more genomic samples in a shorter time frame—with some parts of the workflow up to 60 times faster!



# BETTER HEALTHCARE FOR INDIGENOUS AUSTRALIANS

## Background

Computational biologists at Indigenous Genomics (IG) at the Telethon Kids Institute are developing novel healthcare solutions for Indigenous Australians.

Their research involves analysing a range of large, complex and sensitive datasets using custom bioinformatics workflows.

## Challenges

Configuring a high performance computing (HPC) environment with respect to software, scalability and data pipelines takes time and effort, and can slow research progress. Clinical applications need timely results and require data to be processed immediately.

The IG research group required a new HPC cloud solution that could deliver both secure data management and rapid processing, while allowing collaboration with research partners.

## Solutions

Our HPC Experts optimised their workflows so they could scale up with DUG HPC Cloud.

Our powerful, bare-metal compute and storage delivered efficiency, security and privacy.

## Results

In one particular study, our tailored HPC solution enabled the IG group to process 1287 whole genomes in 140 hours—a workload that was historically taking many weeks to complete.

IG researchers are investigating how the genetic architecture of Indigenous Australians relates to the incidence of type-2 diabetes—driving the development of precision medicine, new treatments to mitigate disease progression, and improved healthcare outcomes for the community.