NCI AUSTRALIA

An NCI overview

National Computational Infrastructure

Powering Leadership-Class Computing and Data Science for Australia

We acknowledge and celebrate the First Australians on whose traditional lands we meet and pay our respect to the Elders past and present.

Artist: Lynnice Letty Church – Tribes: Ngunnawal, Wiradjuri & Kamilaroi (ACT and NSW)
Gadi - "to search for" in Ngunnawal language - January 2020 for NCI Gadi Supercomputer

What is NCI?

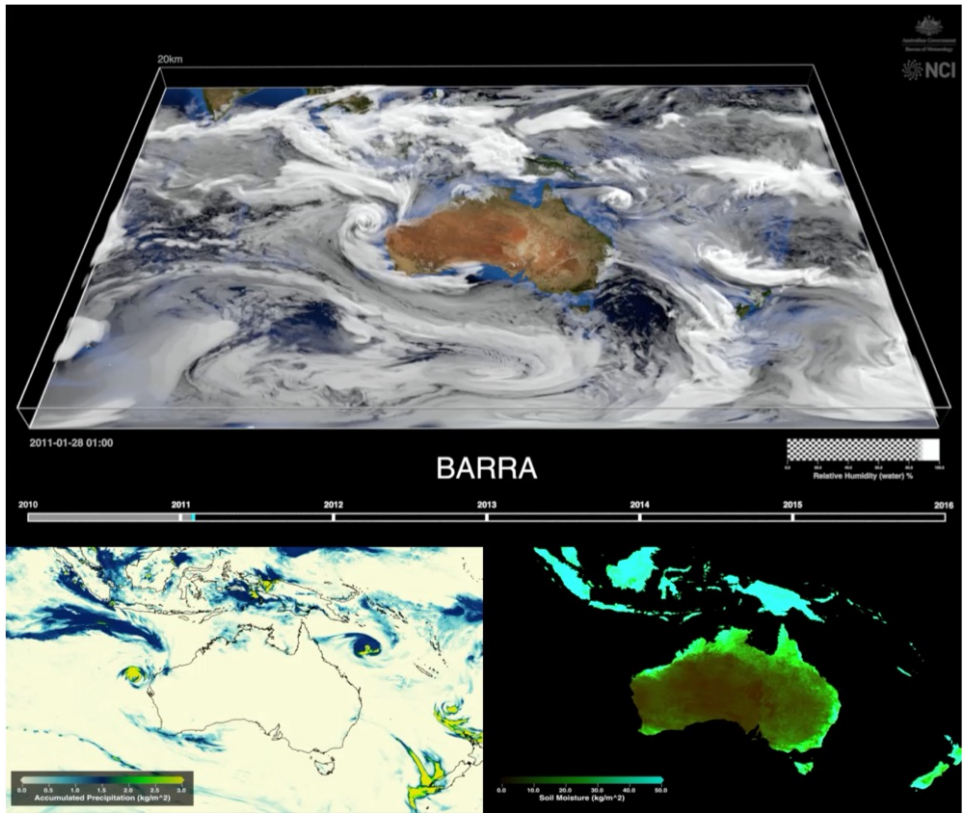
A world-class, high-end supercomputer and data science hub

- NCI is the premier facility in Australia providing:
  - High-performance computing (supercomputing)
  - Cloud computing
  - Data storage and services
- We support over 8000 Australian researchers.
- We enable transformative research that informs policy
- We deliver outcomes with national benefits

Why do we need this?

A world-class, high-end supercomputer and data science hub

- Supercomputers are useful when experiments are:
  - **Too small** (nanotechnology)
  - **Too large** (ocean modelling, genomics)
  - **Too short** (fundamental physics)
  - **Too long** (climate science)
  - **Too expensive** (vehicle design)
  - **Too dangerous** (nuclear technology)



How is NCI funded?

A world-class, high-end supercomputer and data science hub

NCI is funded directly by the Australian Government, through the Department of Education, Skills and Employment's National Collaborative Research Infrastructure Strategy (NCRIS).

Australian Government
Department of Education, Skills and Employment

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Australian Government
Australian Research Council

NCI has been largely supported by its Major Collaborators since 2007.

Australian National University

CSIRO

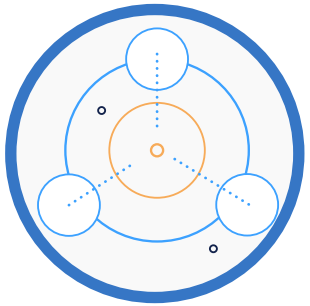
UNSW SYDNEY

Australian Government
Bureau of Meteorology

Australian Government
Geoscience Australia

Spectrum of Science

FUNDAMENTAL



- Physics
- Chemistry
- Mathematics
- Astronomy

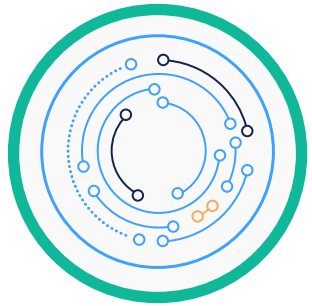
STRATEGIC

- Environment
- Medical
- Geoscience
- Agriculture
- Materials

APPLIED

- Weather forecasting
- Extreme weather
- Material design
- Disaster management and mitigation

INDUSTRY



- Hydrological modelling
- Medical research institutes

How does NCI enhance Australian research?

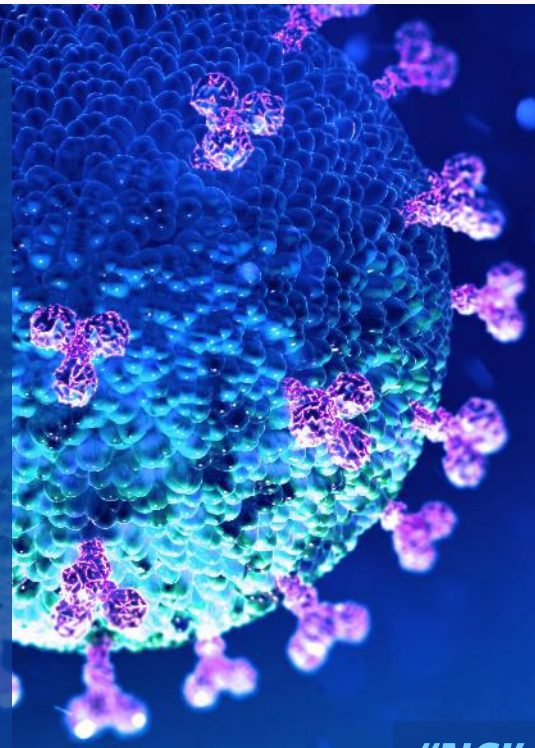
Protecting lives and property from extreme bushfire

- UNSW researchers used Gadi to discover an unknown mode of fire propagation
- Simulations were derived from existing data (2003 Canberra bushfires), numerical weather prediction models and computational fluid dynamic (CFD) models
- Research into bushfire behaviour may aid communities and firefighters during catastrophic fire conditions
- The research could not have been completed within a reasonable timeframe without the Gadi supercomputer

"The facilities and support at NCI are critically important for the core research of our group"

- Professor Jason Sharples, UNSW Canberra

Enabling time-critical research to develop a COVID-19 vaccine



- Gadi supports four Australian research groups investigating COVID-19
- Researchers were chosen from a large pool and allocations based on merit
- For example, some researchers simulate protein structures and human cell receptors
- NCI was able to provide 40 million compute hours at very short notice
  - 40 million compute hours is equivalent to 4000 years of computation on desktop PCs

"NCI's new Gadi supercomputer is the only supercomputer in the Southern Hemisphere powerful enough to do these simulations."

- Professor Megan O'Mara, The Australian National University

Supporting climate research nationally and internationally

- NCI is home to CMIP6, a multi-petabyte climate modelling resource used by the Intergovernmental Panel on Climate Change (IPCC)
- CMIP6 informs researchers from more than a dozen different research organisations across Australia
- Some of the data is relevant globally, connecting NCI to the global research community
- NCI is the only facility of its kind in Australia that can support the intensive data analysis and simulation that CMIP6 requires

"CMIP6 is the most comprehensive suite of climate science experiments ever conceived. We hammer the NCI peak-system... Gadi is a credit to Australia."

- Dr Simon Marsland, CSIRO

Reducing the risk of ship grounding in real time

- Global not-for-profit water and maritime engineering organisation DHI is using NCI to model currents and waves to understand the risks of ships coming aground on the Australian coast
- Ships going aground often cause a lot of damage, have the potential to create oil spills and are expensive to rescue.
- Working with the Australian Maritime Safety Authority (AMSA), DHI is trying to help them understand where the risk of ships going aground is the greatest.
- DHI needs to forecast what waves and currents are doing in the ocean at a continental scale, requiring an enormous amount of compute.

"Working with NCI has allowed us to model longer and wider than we ever have before... DHI are envisioning an even stronger partnership with NCI in the future."

- Simon Mortesen, DHI Group Executive for Port and Navigation

Reprocessing genomic datasets

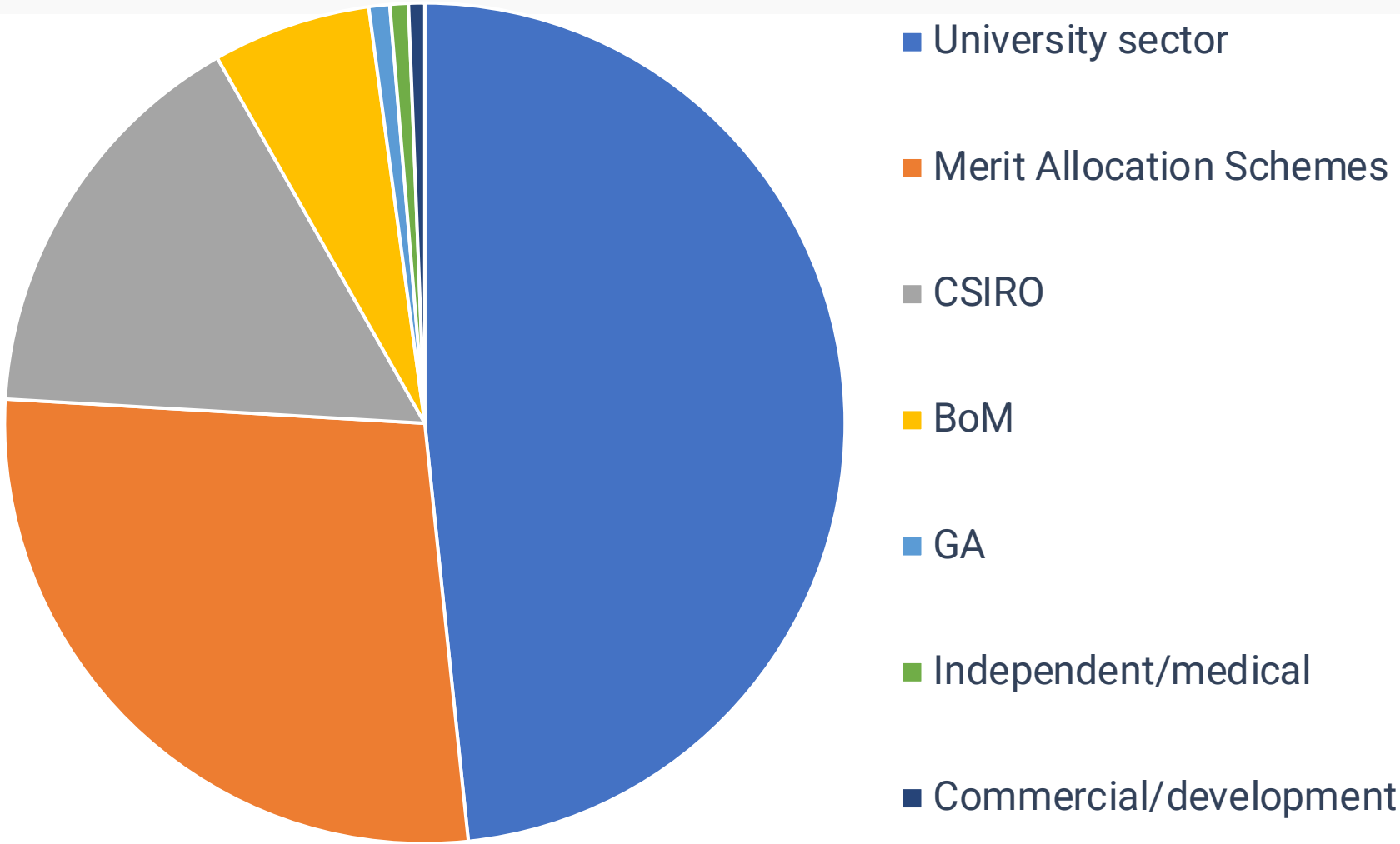
- Garvan Institute of Medical Research uses NCI for reprocessing of human genomes
- 4,000 anonymous genomic samples of healthy seniors are processed and stored at NCI as part of the Medical Genome Reference Bank (MGRB)
- These 4,000 samples can be easily processed at NCI in one batch using HPC
- Reprocessing is needed to further refine the sample and produce a more accurate representation of a healthy human
- The MGRB can be compared against the sequenced genome samples of those seeking treatment

Garvan Institute of Medical Research

"Aligning that many genomes in one night is a clear demonstration of might of the NCI computational capacity - that couldn't have been done elsewhere in Australia."

- Dr Dan Andrews, Program Manager AGHA (2016)

HPC resource usage by organisation



How can you use NCI's facility and services?

- The National Computational Merit Allocation Scheme
- The ANU Merit Allocation Scheme (ANUMAS) annual call (close 28 Nov)
- Adapter Scheme (Quarterly call)
- Help desk: help@nci.org.au
- Training events (basic programming C, Python, R, Julia; parallel programming OpenMP, MPI, OpenACC, CUDA; Introduction to Gadi/ARE/Nirin)
- National data collections

Future directions (not a complete list…)

- Expanding our services beyond non-traditional STEM domain
- Quantum computing
- AI/ML focused research support
  - Set up development environment on Gadi
  - Provide skills training in AI algorithms, libraries, applications and use cases
  - Build instances for AI/ML workflow, prototype for potential SME business

Stay connected with us

- Subscribe our newsletter
  - you will hear training opportunities
  - scheme application announcements
- NCI online teaching portal (building)
  - enroll with your organizational email please
- Australian Research Environment (ARE)
  - You need a valid project to be mounted to ARE before you can use it
  - See documentation here
  - No internet access at the moment, you need to build your Python virtual environment on Gadi first
- NCI training events

Questions ?

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