eScience Activities in Australia

National eResearch Collaboration Tools and Resources

nectar.org.au

NeCTAR is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy to establish eResearch infrastructure in partnership with Australian research institutions, organisations and research communities. The University of Melbourne has been appointed as the Lead Agent,

Objectives: to enhance research collaboration through the development of eResearch infrastructure.

Australian eResearch Infrastructure

NCRIS eResearch Infrastructure Portfolio

Shared Data:

- Australian National Data Service (ANDS)

Research Apps, Collaboration, Cloud

- ***NeCTAR***

Data Storage

- Research Data Services (RDS)

High Performance Computing

- National Computational Initiative (NCI), Pawsey Centre

Networks

- National Research Network (NRN) – *delivered and operated by AARNet*

Authentication

- The Australian Access Federation (AAF)

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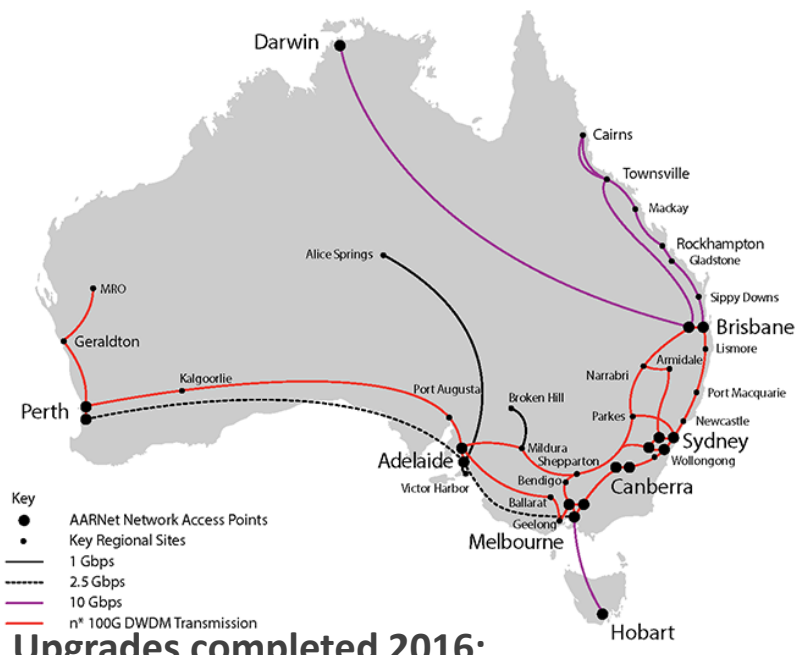
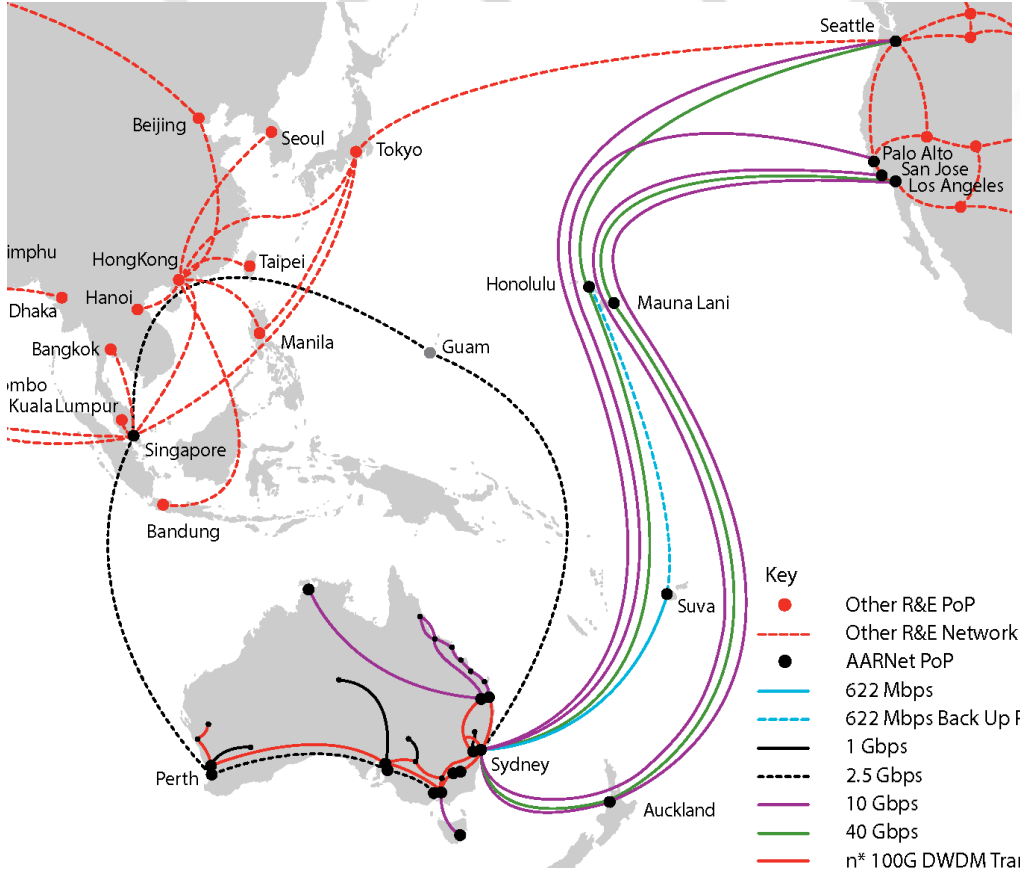
Research Networks – AARNet





- **Upgrades completed 2016:**
  - 2x40G SXTransPORT links to 100G
  - Brisbane to Cairns to 100G.

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High Performance Computing

National Computational Infrastructure (NCI), Canberra:

Current peak system @ 1.2 Petaflops plus other smaller systems

Pawsey Supercomputing Centre

> 1 Petaflop:

Various HPC for astronomy, ASKAP

Numerous other HPC around the nation:

VLSCI @1 Petaflop, MASSIVE, CSIRO, Swinburne & many smaller HPC systems

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NCI Environment: January 2017

Supercomputer — Raijin (Fujitsu and Lenovo) — peak perf. ~2 Pflop — Linpack 1.672 Pflop (Jan 2017)

- 84,376 cores (Intel Xeon Sandy Bridge ~57.5 K / Broadwell ~23K + …) — 330 Tbytes of memory
  - Also incl. 120 nVIDIA Tesla K80 (in 30 Dell nodes) + 32 SGI Intel Xeon Phi KNL nodes
- Infiniband FDR and EDR interconnect (Full fat tree)
- 10 Petabytes of dedicated high-performance storage (150 GB/sec)

Cloud (for data-intensive workloads)

- Dell 3,200 cores (Sandy Bridge); 50 Tbytes memory;

Collection storage

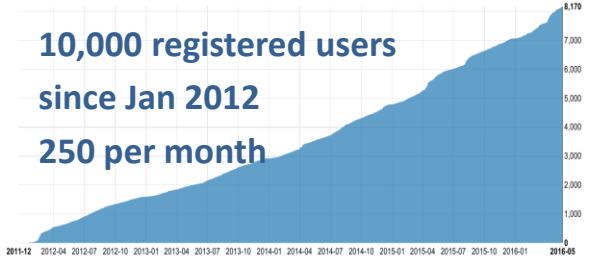
- 22.6 Petabytes (Lustre — three filesystems: 50 GB/sec, 70 GB/sec, 120 GB/sec: DDN/Netapp) — soon to grow by 13 Pbytes
- 4 x Spectra T950 tape libraries (provide archive and HSM) on dual sites — presently 2x30 petabytes (capacity 2 x 100 Pbytes)

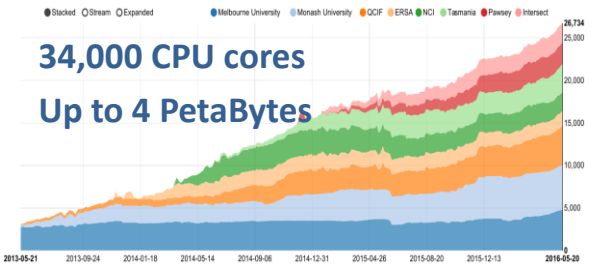
The NeCTAR Research Cloud…

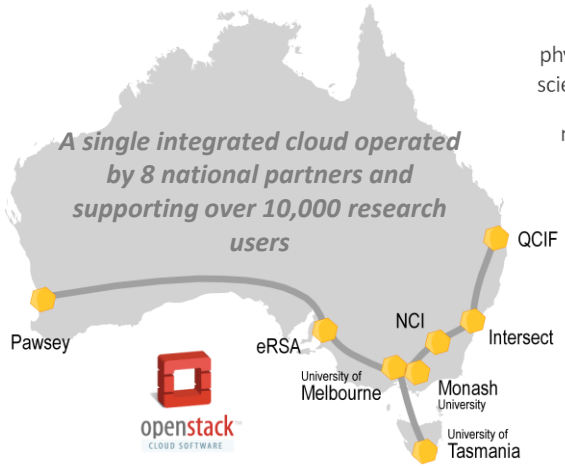
The NeCTAR Research Cloud is a partnership between 8 institutions and research organisations who are deploying and operating Australia's first federated research cloud.

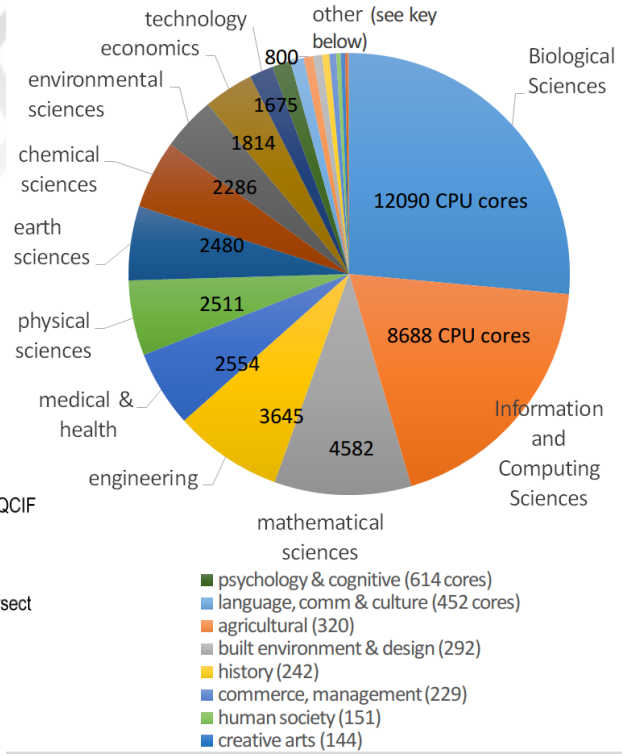
Provisioning compute and storage resources at scale

- Supporting diverse needs across the breadth of Australian research









nectar · The University of Melbourne · Monash University · qcif · eResearchSA · NCI National Computational Infrastructure · UTAS · Pawsey Supercomputing Centre · Intersect

Cancer Therapeutics CRC

Access to cancer research data, tools and visualisation on the NeCTAR Cloud

Providing access to analysis and visualisation tools, and over 30TB of cancer research data **on the Research Cloud.**
The Nectar choice was easy, and the migration process seamless.

"The service, support and responsiveness that we have received from the Nectar team has been first class, and feels like an extension to our own internal support services."
Paul Reeve, Director of Operations, Cancer Therapeutics CRC.

Plant Energy Biology CoE

Building collaboration on the Research Cloud.

Researchers study how plants capture energy from sunlight and how they use that energy to grow and develop.
Hosting collaborations with the Max Planck Institute and the Beijing Genomics Institute – ***on the NeCTAR Research Cloud.***

"NeCTAR makes it much easier, much faster. It means more collaborations — projects that would have just been too hard to go ahead."
Professor Ian Small, Laureate Fellow, West Australian Scientist of the Year 2015.

NeCTAR Research Cloud

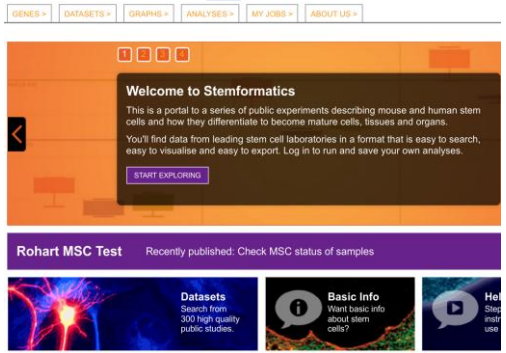
Supporting national priority research

Stemformatics

Stem Cell data visualisation on the Cloud.

Find and visualise interesting genes in datasets from leading stem cell laboratories on the Research Cloud.

- Over **400 users** nationally
- **100 cores**, multi-site
- NCRIS (BPA) supported.



Virtual Laboratory Case Studies

Genomics VL

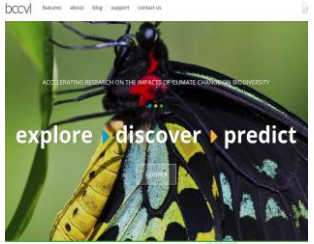
"This is the best exemplar of this kind of platform in the world… Genomics capability for the masses."
Associate Professor Andrew Lonie, Director, EMBL-ABR.

The **Peter MacCallum Cancer Centre** is using the GVL in the NeCTAR ***Research Cloud***, providing instant access to Genomics tools and data for Australian biologists

BPA

Biodiversity and Climate Change VL

"..decreases the time to complete biodiversity analysis from 2 months to 5 minutes, supporting new applications in research, government and industry."
Professor Brendan Mackay, Director, Griffith Climate Change Response Program



Accelerating biodiversity–climate change modelling across large disparate datasets quickly and easily on the ***Research Cloud***.

TERN

Virtual Laboratories are:

- *Accelerating* research
- Bringing together **observation** and **modelling**
- Removing barriers to collaboration
- Leveraging the Research Cloud for wide access

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Marine VL

"MARVL enables researchers to start thinking about their problem sooner."
Dr Roger Proctor, Director e-Marine Information Infrastructure Facility.

Ocean observations and modelling for marine and coastal environments
Ian Coghlan is studying coastal erosion. **MARVL saves him 3 months effort** to access local data, wave model simulations and computing resources.

IMOS

NeCTAR Virtual Laboratories

Climate and Weather Science Laboratory – Lead: Bureau of Meteorology – 6 Partners
- *Integrated environment for climate and weather science modelling and data*

Genomics Virtual Lab – Lead: University of Queensland/University of Melbourne – 9 Partners
- *Easy access to Genomics tools and resources for Australian biologists.*

Endocrine Genomics Virtual Lab – Lead: University of Melbourne – 7 Partners
- *Statistical power for clinical research*

Marine Virtual Lab – Lead: University of Tasmania – 8 Partners
- *Ocean observations and modelling to improve planning for marine and coastal environments.*

All Sky Virtual Observatory – Lead: Astronomy Australia Limited – 4 Partners
- *Theoretical and observational astronomy data, simulations and tools accessible from your desktop*

Biodiversity and Climate Change Virtual Lab – Lead: Griffith University – 18 Partners
- *Simplifies biodiversity-climate change modelling.*

Humanities Network Infrastructure – HuNI – Lead: Deakin University – 13 Partners
- *Integrating 28 of Australia's most important cultural datasets*

Characterisation Virtual Lab – Lead: Monash University – 11 Partners
- *Integrating Australia's key research imaging instruments with data and analysis tools on the cloud.*

Geophysics Virtual Lab – Lead: CSIRO – 7 Partners
- *Easy access to geophysics workflows, simulations and datasets.*

Alveo – Human Communications Sciences – Lead: Western Sydney University – 16 Partners
- *Studying speech, language, text, and music on a larger scale*

Industrial Ecology Virtual Laboratory – Lead: Sydney University – 9 Partners
- *Supporting comprehensive environmental carbon footprinting and sustainability assessments*

Infrastructure partnerships

- High demand
  - Funded ¼ of proposals
- Research institution led
  - Addressing identified research priorities
- Highly networked
  - Over 35 universities and research orgs participating
  - Over 1:1 co-investment
- Collaboratively building collaborative infrastructure

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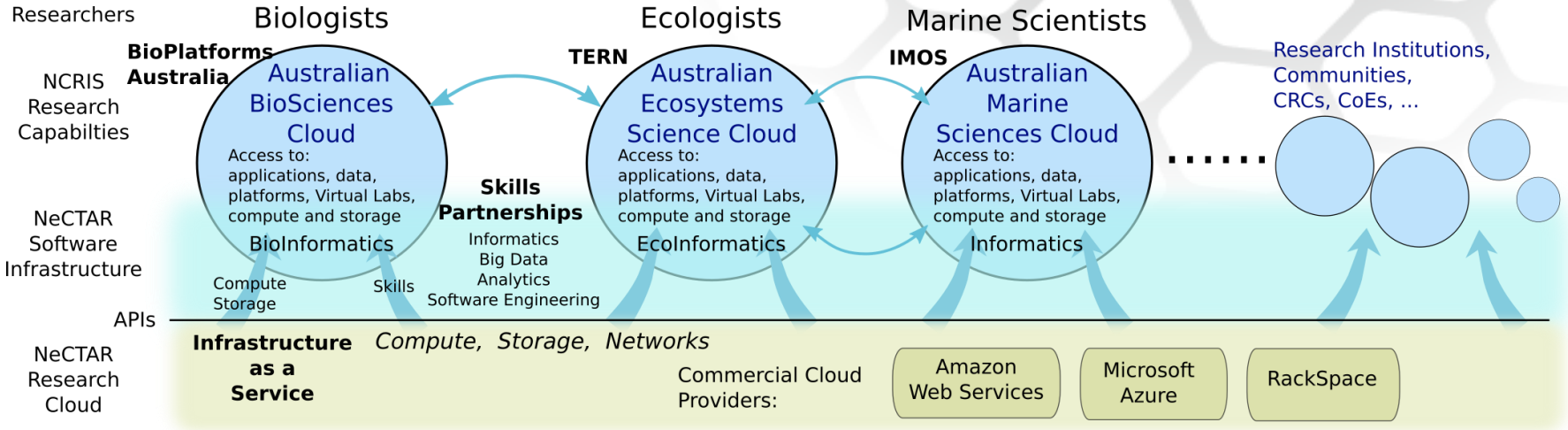
More details at:
http://nectar.org.au

Australian Science Clouds - 2016



Partnering with Research-domain infrastructure investments (NCRIS):

- Co-plan and co-deliver e-infrastructure with research infrastructure
- Underpinned by the national NeCTAR Research Cloud
  - Established in 2016 through NCRIS Agility Funding allocation

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A ROADMAP FOR THE FUTURE

National Research Infrastructure Roadmap

Draft Roadmap released December 2016

- Led by Australian Chief Scientist, Professor Alan Finkel
- $150m commitment per annum for 10 years – *maintain existing funding*
  - Requests for additional major capital uplift

Key recommendations for *Digital Data and eResearch*

- Enhance existing national HPC. Explore governance integration of NCI and Pawsey HPC facilities
- Create an **Australian Research Data Cloud**
  - **ANDS, NeCTAR and RDS** to establish an integrated data-intensive infrastructure system, incorporating physical infrastructure, policies, data, software, tools and support for researchers
- Enhance the capability and capacity of the AREN… and access, authentication and authorisation services.

Toward an Australian Research Data Cloud

Four key transformations:

1. A world leading data advantage

Accessible data and methods enable researchers to address challenges in new ways - *FAIR data creates new research and innovation opportunities.*

2. Innovation is accelerated

An environment to reduce the innovation burden - researchers will create the data tools and services that they need.

3. Collaboration for borderless research

Research communities will work in a data-rich environment with all of the underlying data, methods, and services to enable collaboration.

4. Enhanced translation of research

Reliable and available data, methods and models will enable translation across industry, policy and national research priorities.

nectar RDS www.rds.edu.au ands AUSTRALIAN NATIONAL DATA SERVICE

First Steps – Alignment in 2017-18

Deeply integrated investment by ANDS, Nectar and RDS in 2017-18:

builds on and integrates our existing investments.

Proposing three key programs of investment

1. **Research Domain Program:**

   Responding to research domain and research community data-intensive infrastructure needs.

2. **Research Data Platforms:**

   Underpinning **cloud**, **storage** and **data services** infrastructure to support the data and informatics needs of Australian research and industry.

3. **Sector-wide Support and Engagement:**

   Planning and coordination to further policy development, international engagement and a national skills strategy.

The future will be decided through broader consultation and planning

Will be informed by international initiatives and partnership opportunities.

Thank you

Research Cloud Resource Allocations

Since February 2012:

- **1497** resource allocations approved
- From over **50** research organisations

Since November 2015:

- **1200** new registered users
- **362** resource allocations (252 new)
  - Supporting up to **17,350** research users
  - **61** are multi-institutional (2-12 institutions)
  - **26** allocations supporting “national” services
  - **58** support national research organisations

Allocation request word cloud