eScience Activities in Ausrralia

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 Investments - 2009-2014 (Super Science):

Shared Data:

- Australian National Data Service (ANDS) — AU$48M

Research Apps, Collaboration, Cloud

- ***NeCTAR*** — **AU$47M**

Data Storage

- Research Data Storage Infrastructure (RDSI) — AU$50M

High Performance Computing

- National Computational Initiative (NCI) — AU$50M
- Pawsey Centre — AU$80M

Networks

- National Research Network (NRN) — AU$37M

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Use new tools, apps, work remotely and collaborate in the cloud

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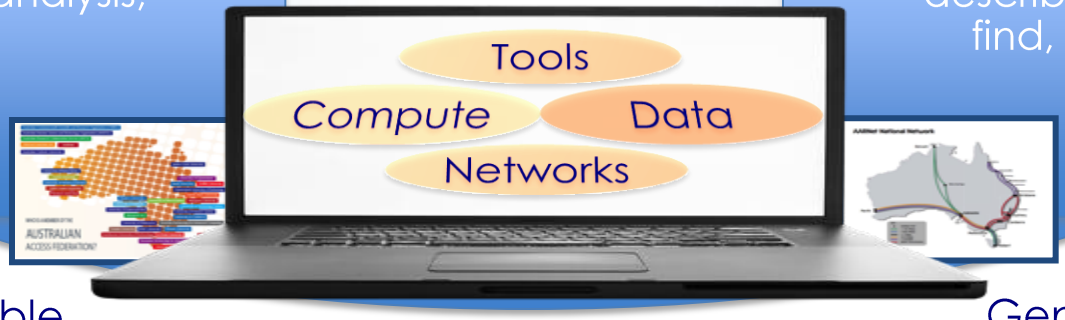
eResearch Infrastructure

Do computational modeling, complete data analysis, visualize results

NCI
Pawsey

Keep data and observations, describe, collect, share, find, and re-use them

ANDS
RDSI

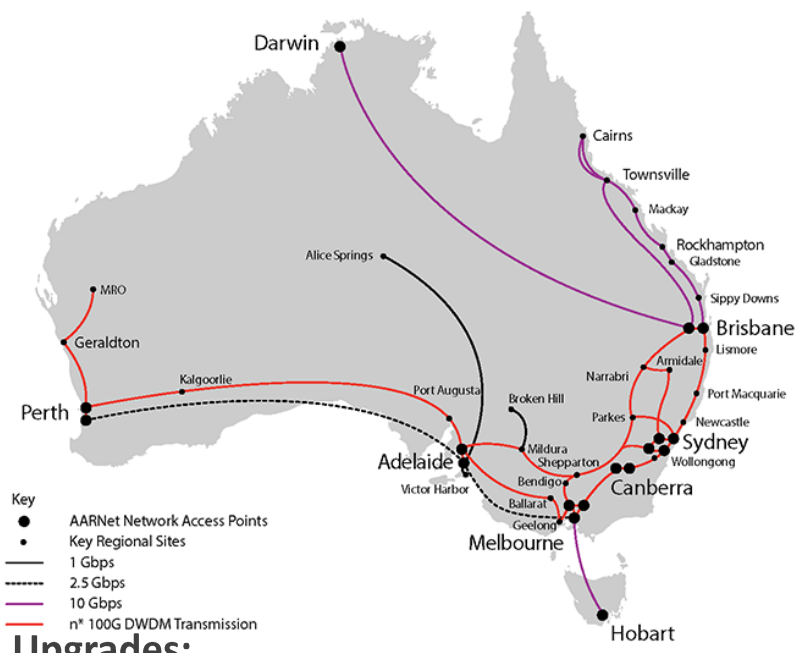


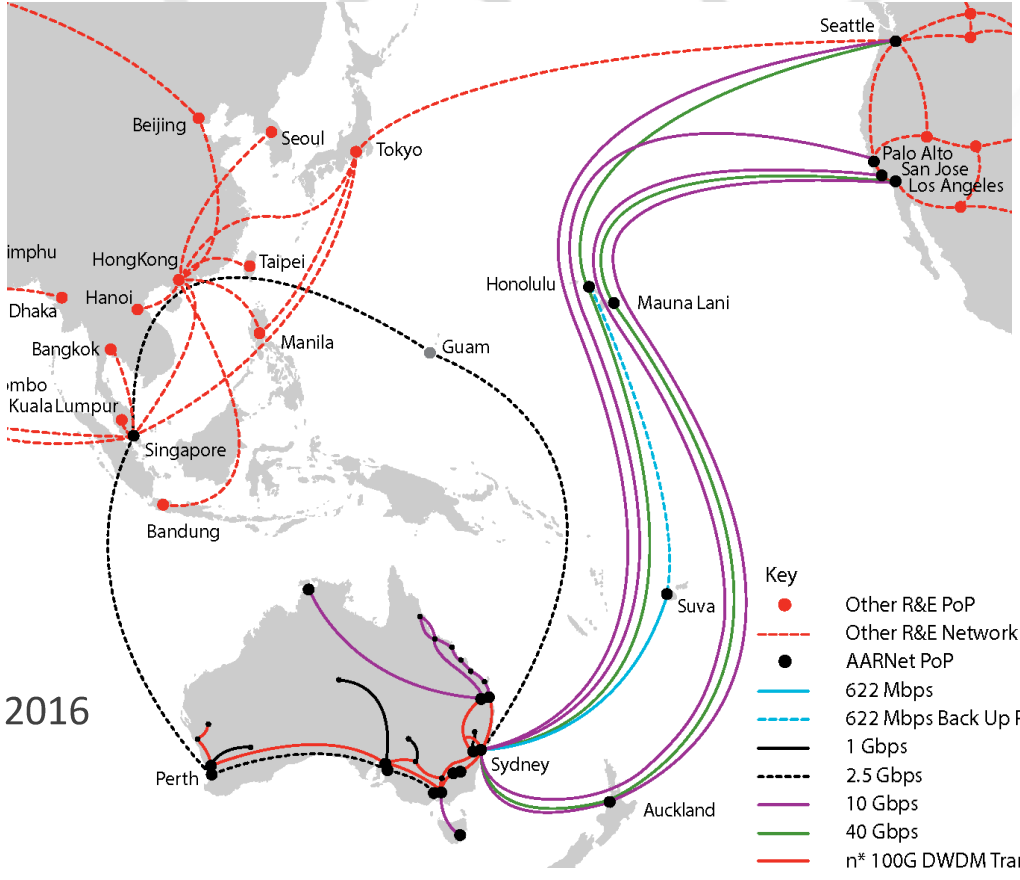
Understand mechanisms impossible to observe or experiment with directly

Undertake novel research studies more extensive than ever before

Generate new theories using data at scales previously inconceivable

Research Networks – AARNet





- **Upgrades:**
  - 2x40G SXTransPORT links to 100G – July 2016
  - Brisbane to Cairns to 100G by end 2016.

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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 being installed for astronomy, ASK

Numerous other HPC around the nation:

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

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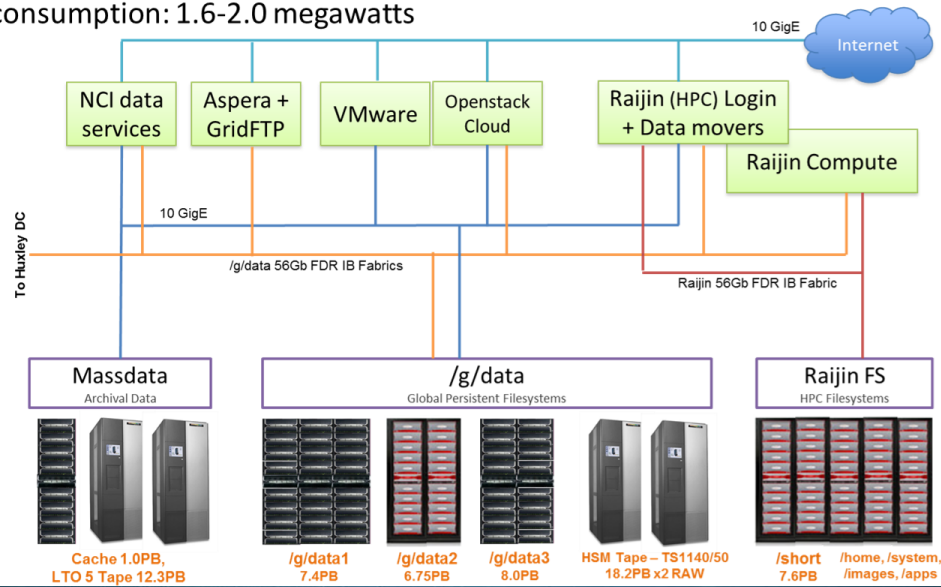
NCI Collaboration in 2016

- NCI Collaboration Agreement (2012–)
  - Major Partners: ANU, CSIRO, Bureau of Meteorology, Geoscience Australia
  - Universities: Adelaide, Monash, UNSW, UQ, Sydney, Deakin, RMIT, UoW, UTS, ANU
  - University Consortia: Intersect (NSW), QCIF (Queensland)
  - CRCs and MRIs: ACE CRC, Garvan Institute, Victor Chang

- Co-investment
  - ***2007: $0M; 2008: $3.4M; 2009: $6.4M; 2011: $7.5M; 2012: $8.5M; 2013: $11M; 2014: $11+M; 2015/16: ~$12M;***
    provides for approx. 66% of recurrent operations ($17-18M p.a.)

- International Collaborations
  - ESGF, UK MetOffice, RIKEN, NOAA, NASA, USGS, EUMETSAT, etc, …
  - Fujitsu, Mellanox, SGI, DDN, Amazon
  - FEI, DHI, and other companies

- Supercomputer Raijin — *Australia's highest sustained performance research supercomputer*
  - 1.2 petaflops , 57,492 cores, 160 Tbytes memory, 10 PB filesystem, 200+Tbit/sec IB backplane
- HPC Cloud: 3,200 cores, supercomputer spec. for orchestrating data services
- Global integrated storage (*highest performance filesystems in Australia*)
  - 36 PB disk (up to 120 Gbytes/sec b/w); 40 petabytes of tape for archive purposes
- Power consumption: 1.6-2.0 megawatts

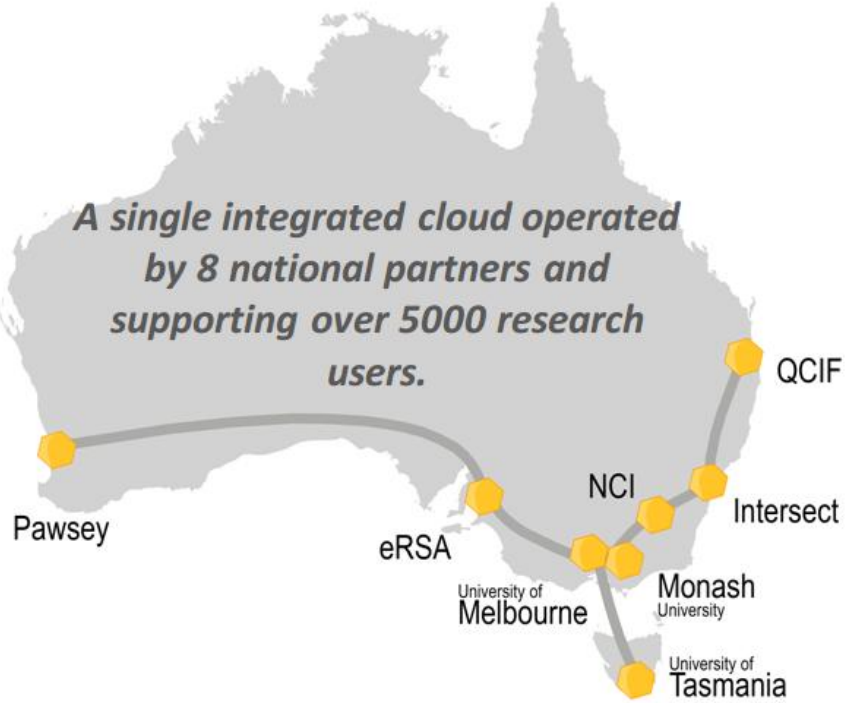


The NeCTAR Research Cloud…

A world first…

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

- University of Melbourne
- National Computation Infrastructure (NCI)
- Monash University
- Queensland CyberInfrastructure Foundation (QCIF)
- eResearch SA (eRSA)
- University of Tasmania
- Intersect, NSW
- iVEC, WA



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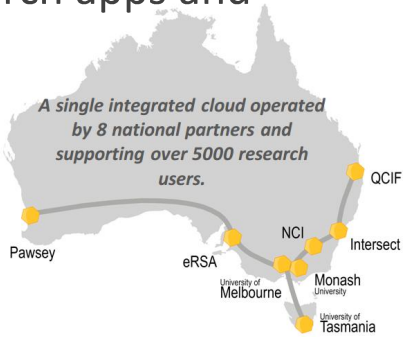
NeCTAR - Research Cloud - *Why???*

A platform for innovation…

- Reducing barriers to rapid deployment and wide sharing of research apps and services…..

Hosting research applications *in the cloud*…



- A robust, scalable platform for research apps
- Supporting cross-institution **collaborative** access

Computational resource … complementing *HPC*

- A computational infrastructure for many computation needs
  - Cost effective and scalable for many classes of computation

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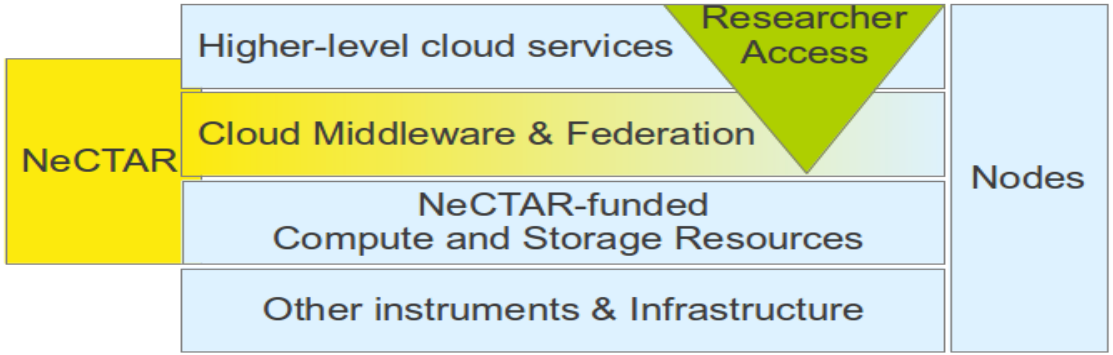
A single, federated infrastructure

An OpenStack based cloud infrastructure

- A single cloud deployed across 8 host organisations
  - Implemented using OpenStack Cells



Nodes of the cloud are able to differentiate on a number of levels, while being part of a federation. Researchers will mainly use higher level services.

NeCTAR Research Cloud…

Supporting Australian researcher needs

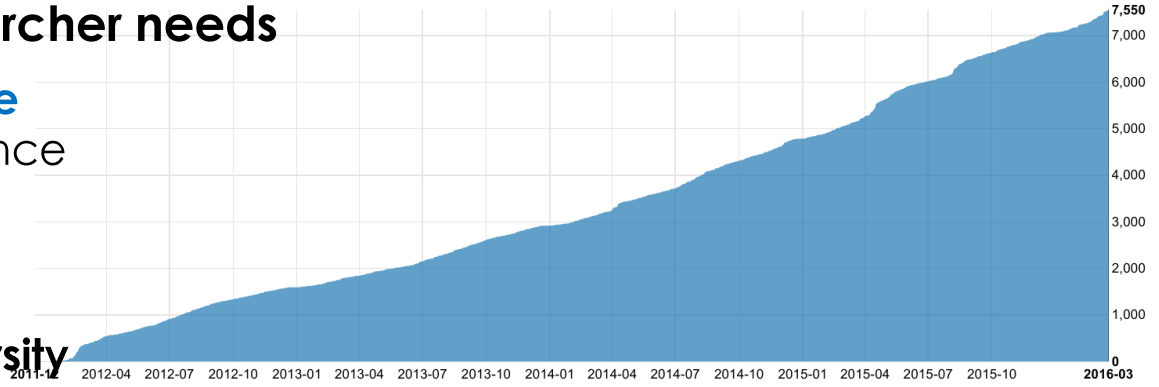
Supporting researchers at scale

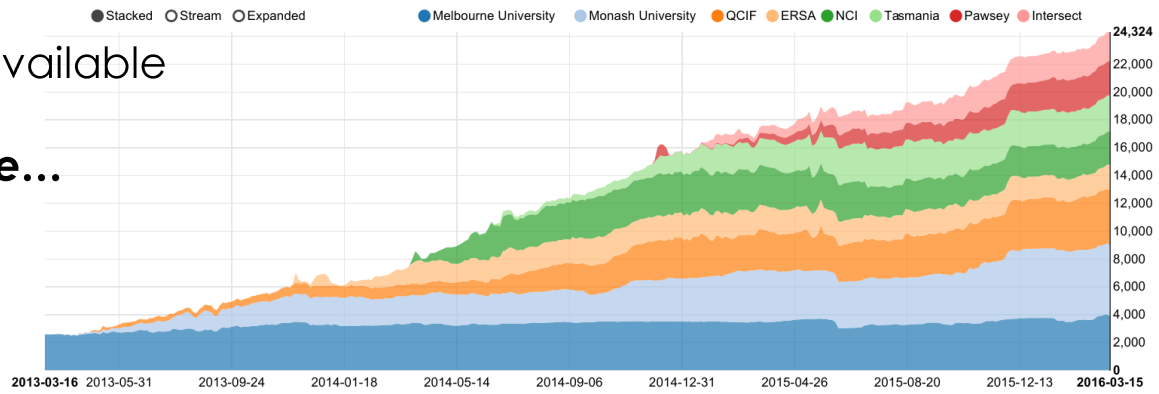
- Over 7,500 research users since January 2012
- 34,000 CPU cores available

Low barriers to access:

- **Dashboard login with University username and password**
- Small resource allocations available on demand.

Any researcher, anywhere…





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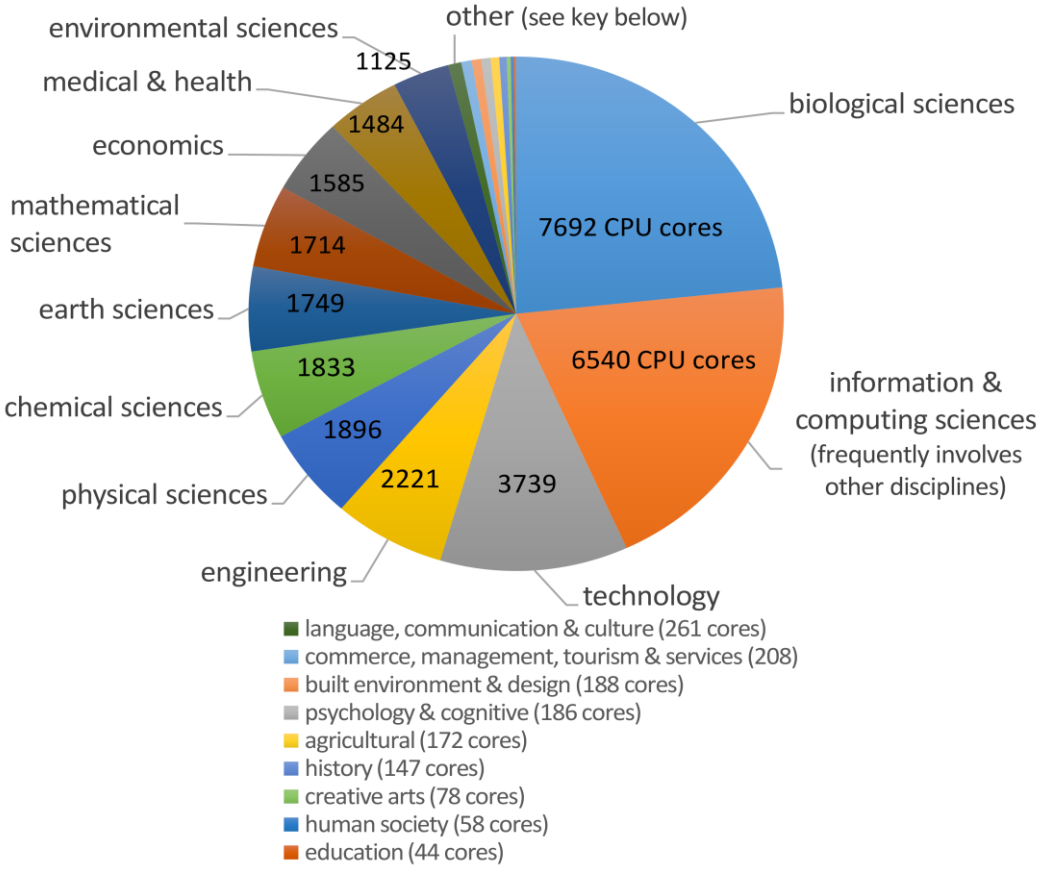
openstack™
CLOUD SOFTWARE

Supporting the breadth of Australian research



NeCTAR Virtual Laboratories

Formed around engaged Research Communities…

- Collaboratively creating collaborative infrastructure
- Exemplars for sector adoption of capability

Building on existing research capabilities

- Instruments and Data, Compute and Tools, Modelling, Analytics
- Integrating access to national and institutional research infrastructure:
  - » Research Facilities, Instruments, Laboratories, Collections, Applications, Sensor networks, Repositories, Data, Computing, Remote Access, Research Workflows

Supporting research workflows

- Automating and sharing research methodologies
- Across institutional and discipline boundaries

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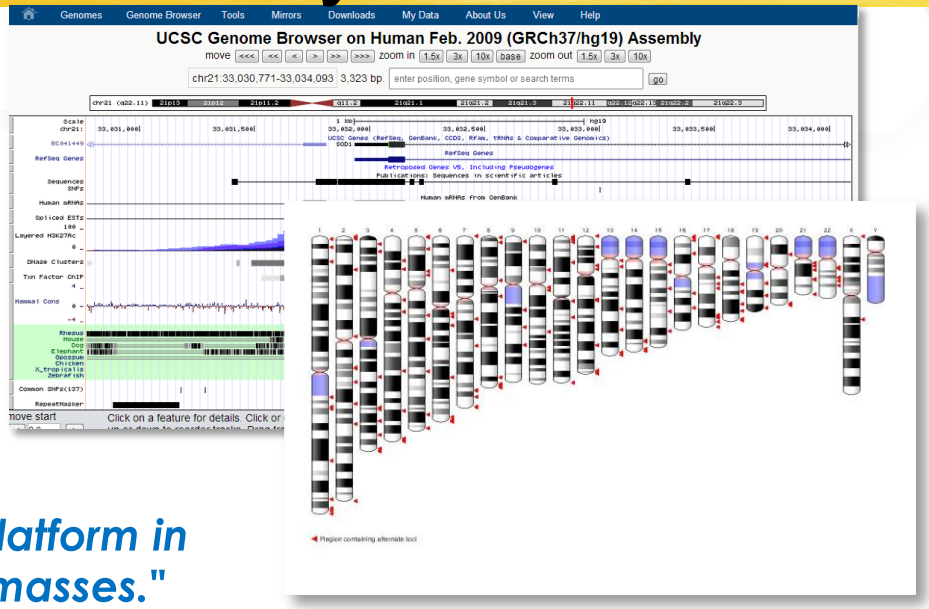
Lead: University of Queensland

Genomics Virtual Laboratory - GVL

Easy access to Genomics tools and resources for Australian biologists.

The Peter MacCallum Cancer Centre is using the GVL in the NeCTAR Cloud, allowing researchers to collaborate easily and to access their data no matter where they are.



"This is the best exemplar of this kind of platform in the world… Genomics capability for the masses."
Associate Professor Andrew Lonie, Head of the Life Sciences Computation Centre at VLSCI.

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NeCTAR Virtual Laboratories

Climate and Weather Science Laboratory – Bureau of Meteorology
- Integrated environment for climate and weather science modelling and data

Genomics Virtual Lab – University of Melbourne
- Easy access to Genomics tools and resources for Australian biologists.

Endocrine Genomics Virtual Lab – University of Melbourne
- Statistical power for clinical research

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

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

Biodiversity and Climate Change Virtual Lab – Griffith University
- Simplifies biodiversity-climate change modelling.

Humanities Network Infrastructure - HuNI– DeakinUniversity
- Integrating 28 of Australia's most important cultural datasets

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

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

Human Communications Sciences – Alveo – U Western Sydney
- *Studying speech, language, text, and music on a larger scale*

Industrial Ecology Virtual Laboratory – Sydney University
- Supporting comprehensive environmental carbon footprinting and sustainability assessments

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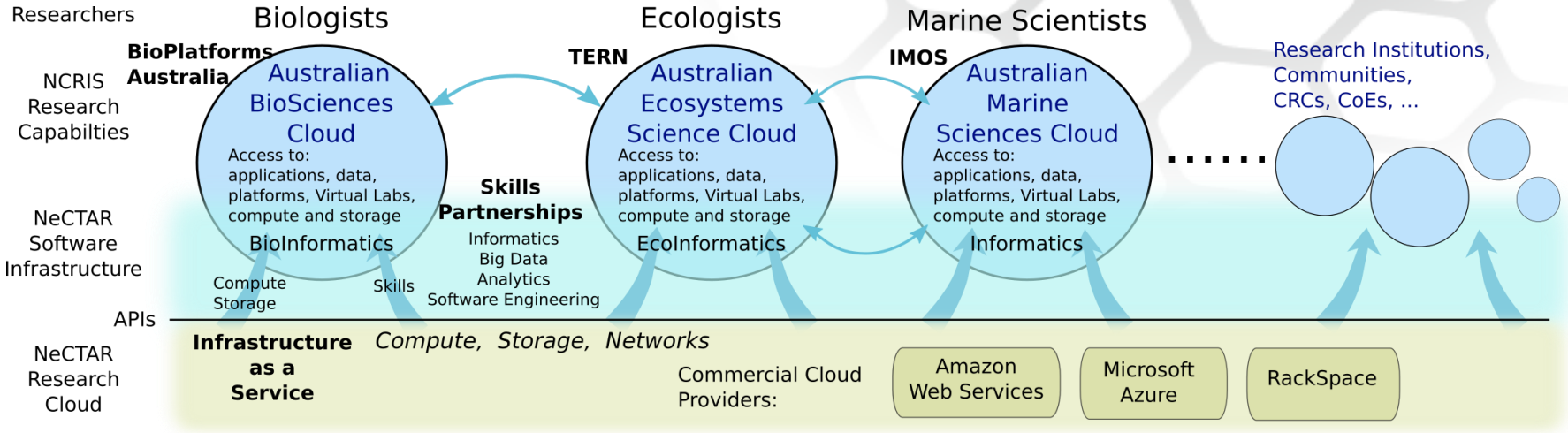
More details at:
http://nectar.org.au

The Future – Research Community Clouds?



Partnering with Research-domain focussed infrastructure investments (NCRIS):

- Co-plan and co-deliver e-infrastructure with research infrastructure

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The Future – Simplifying eResearch

eResearch Framework planning process underway:

- Simplify eresearch infrastructure investments
- Improve alignment of delivery within the sector
- Inform roadmapping for future national research infrastructure investments

Thank you

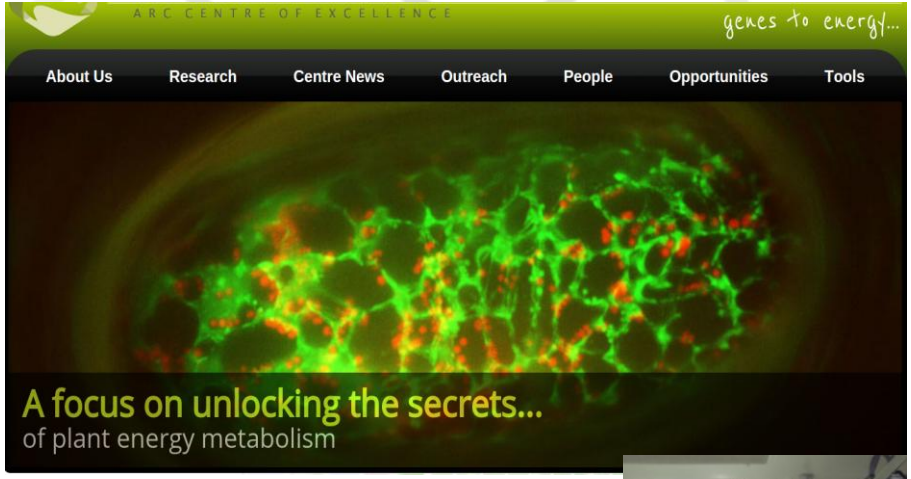
Lead: University of Western Australia

Plant Energy Biology – On the Cloud

Plant Energy Biology Centre of Excellence – Building collaboration on the Cloud.

Researchers study how plants capture energy from sunlight, how they store that energy, and how they use that energy to grow and develop.

Researchers are 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, Director, Laureate Fellow, West Australian Scientist of the Year.

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