

NeCTAR

Enhancing Australian Research Innovation

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.



NCRIS
National Research
Infrastructure for Australia
An Australian Government Initiative

Australian eResearch Infrastructure

Super Science eResearch Investments - 2009-2014:

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

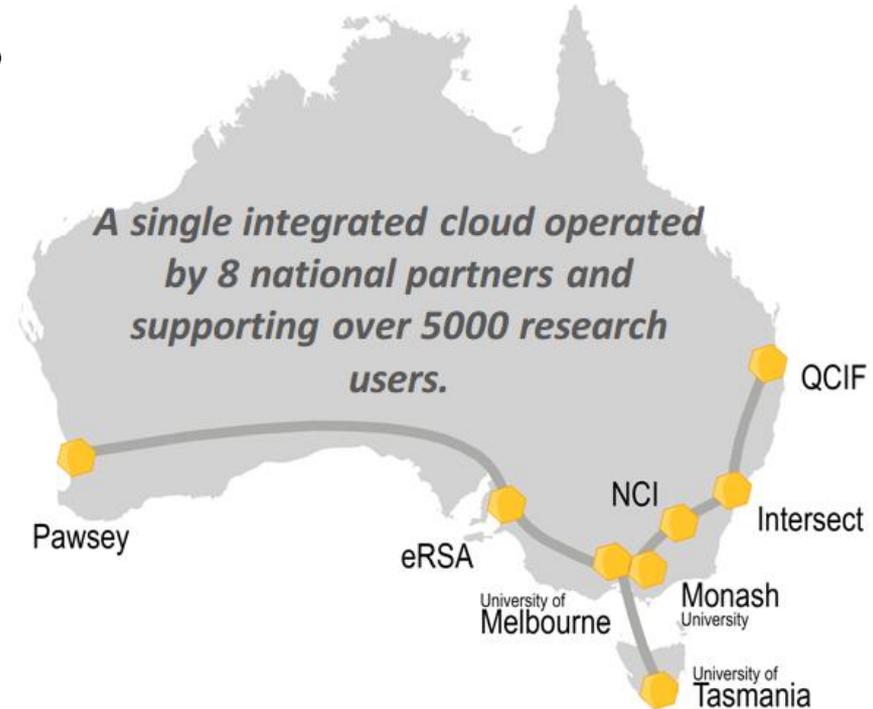
- National Research Network (NRN) AU\$37M

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.

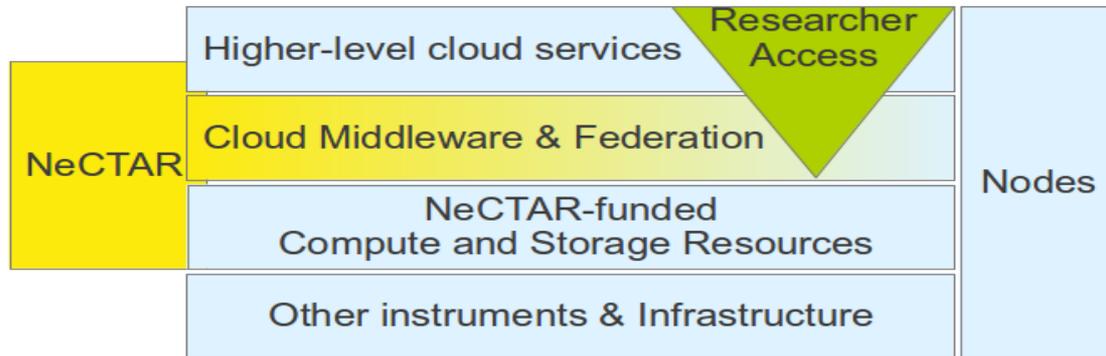
- University of Melbourne
- National Computation Infrastructure (NCI)
- Monash University
- Queensland CyberInfrastructure Foundation (QCIF)
- eResearch SA (eRSA)
- University of Tasmania
- Intersect, NSW
- iVEC, WA



A single, federated infrastructure

An OpenStack based cloud infrastructure

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

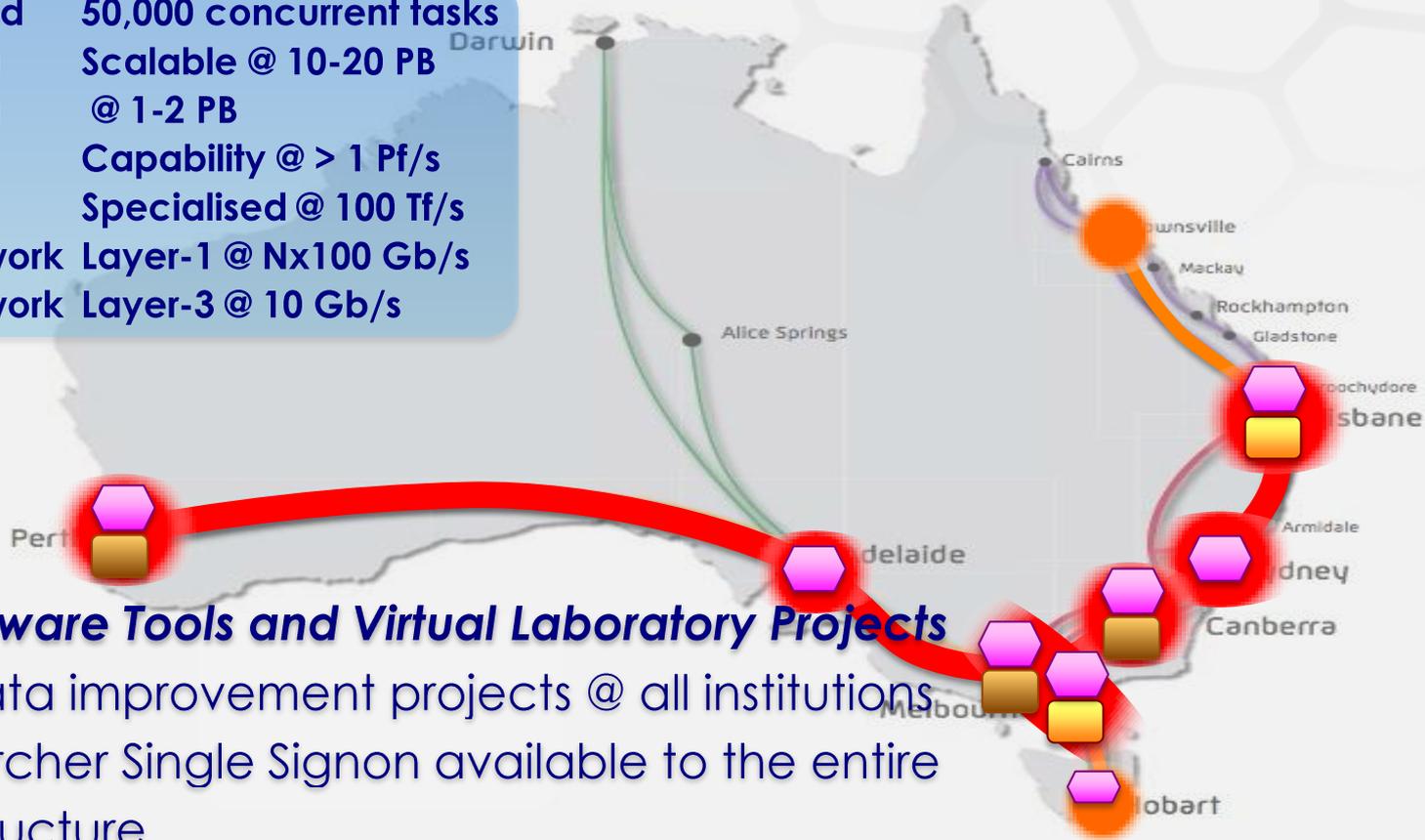


Nodes of the cloud are able to differentiate on a number of levels, while being part of a federation. Researchers will mainly use higher level services.



Australian eResearch Backbone

- Cloud 50,000 concurrent tasks
- Data Scalable @ 10-20 PB
- Data @ 1-2 PB
- HPC Capability @ > 1 Pf/s
- HPC Specialised @ 100 Tf/s
- Network Layer-1 @ Nx100 Gb/s
- Network Layer-3 @ 10 Gb/s



40 Software Tools and Virtual Laboratory Projects

250 Data improvement projects @ all institutions

Researcher Single Signon available to the entire infrastructure

NeCTAR Research Cloud...

Providing research compute capacity

Operating since January 2012

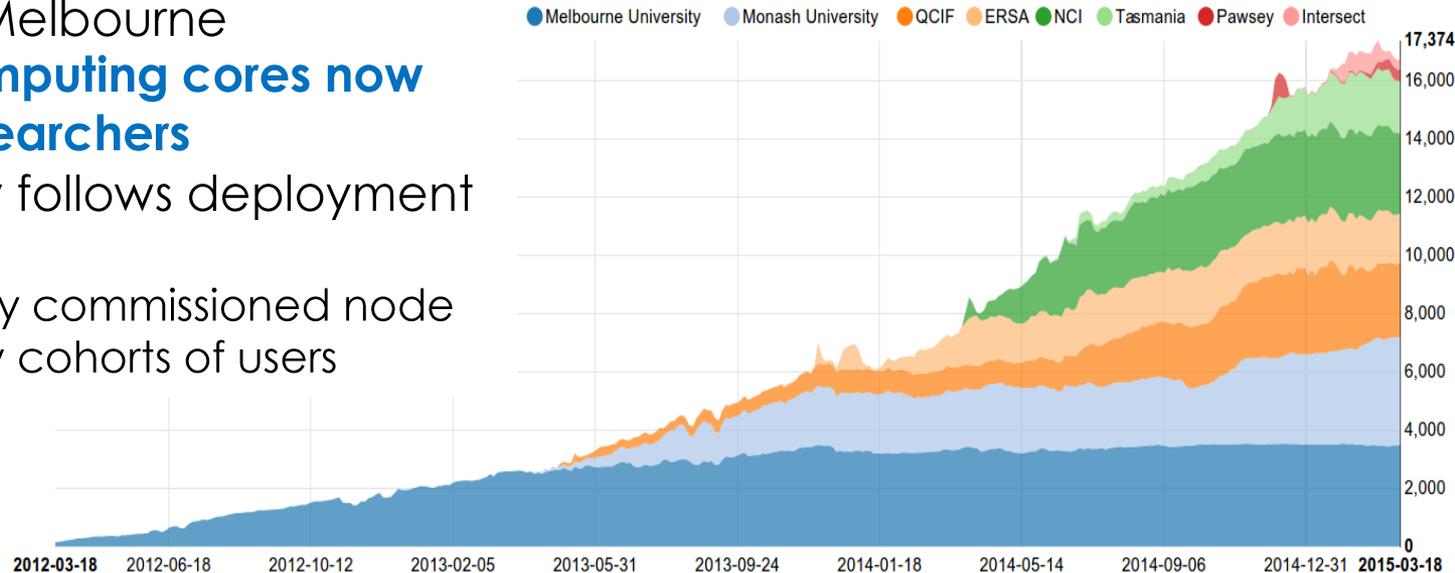
- Based on the initial node at the University of Melbourne

Over 30,000 computing cores now available to researchers

- Usage closely follows deployment and supply
 - Each newly commissioned node brings new cohorts of users

status.rc.nectar.org.au

CPU Usage by Cloud Node



NeCTAR Research Cloud...

Supporting Australian researcher needs

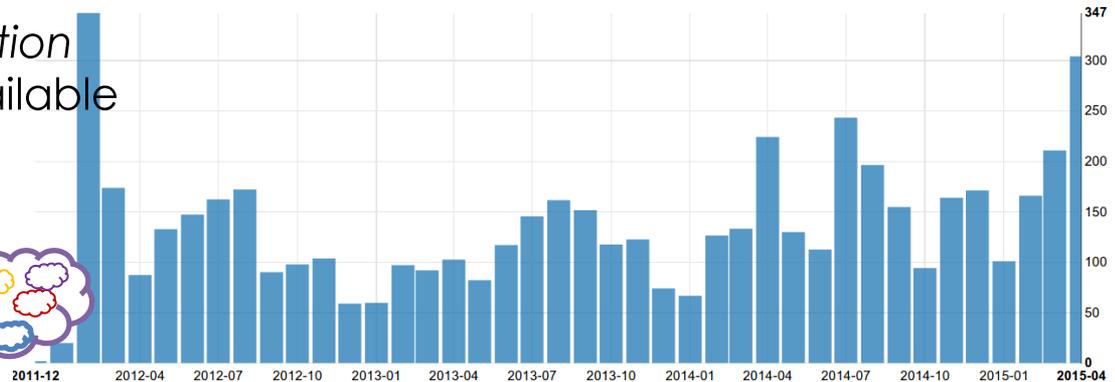
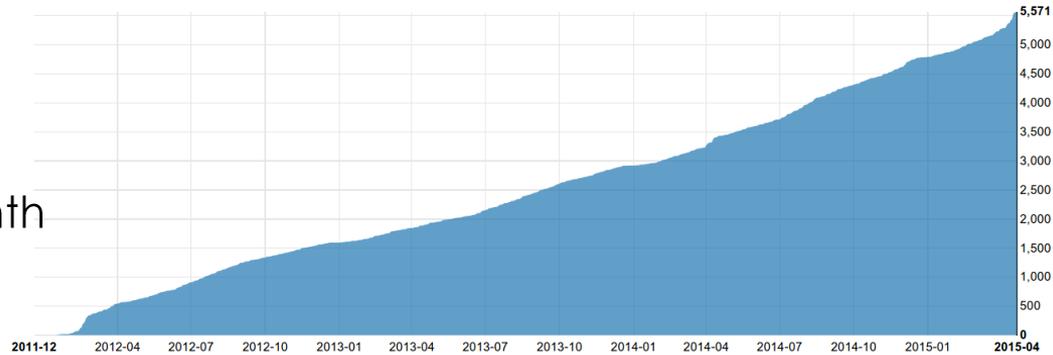
Sustained user growth

- Over 5,500 research users since January 2012
 - Up to 300 new users per month

Low barriers to access:

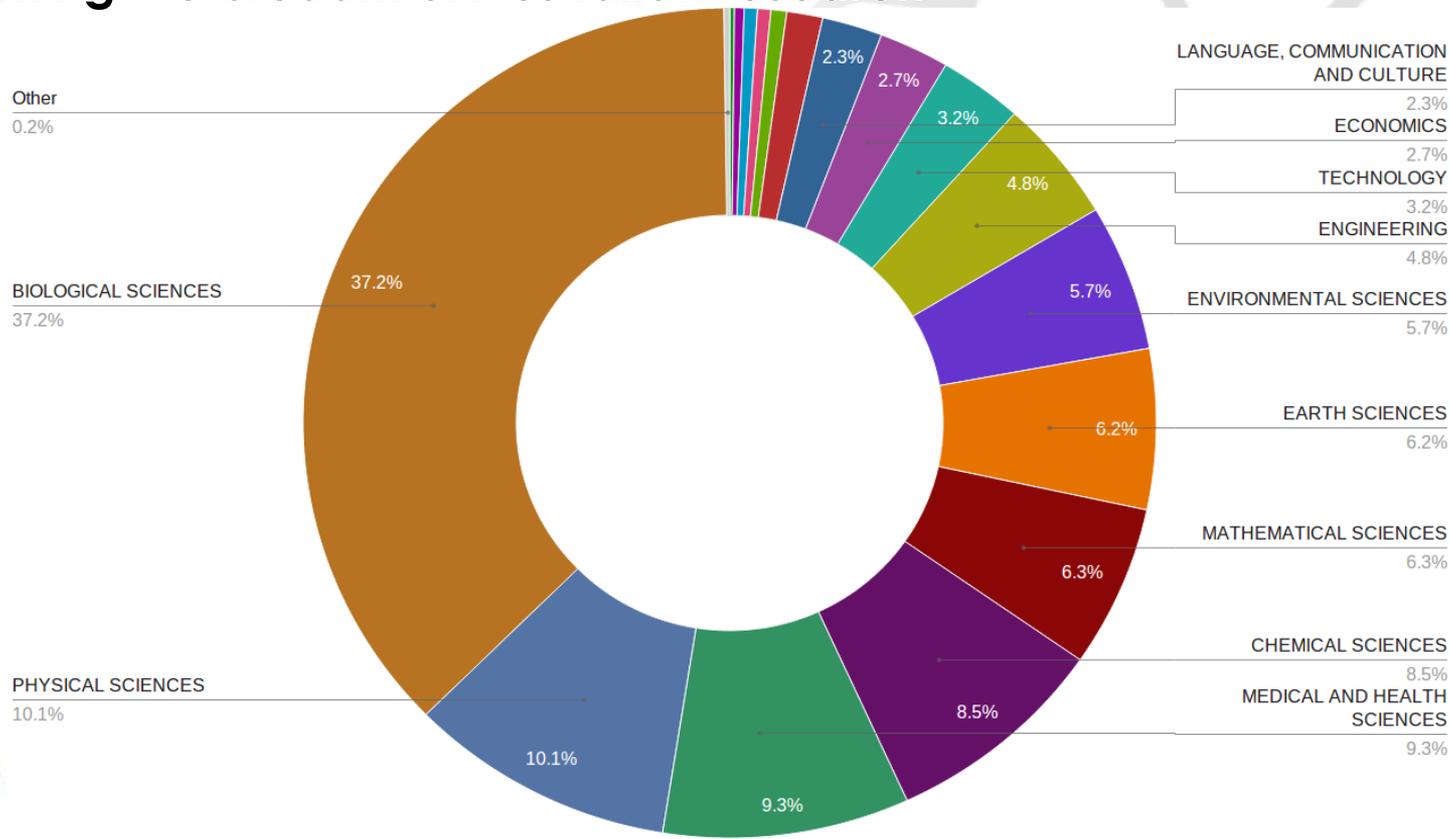
- **Dashboard login with University username and password**
 - *Australian Access Federation*
- Small resource allocations available on demand.

Any researcher, anywhere



Research Cloud Usage

Supporting the breadth of Australian research



Plant Energy Biology – On the Cloud

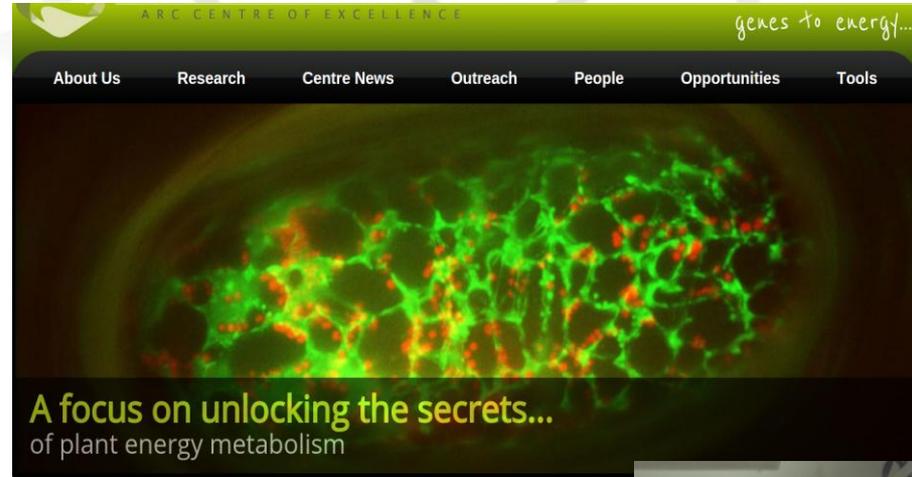
Plant Energy Biology Centre of Excellence – Building collaboration on the Cloud.

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.



NeCTAR - Research Cloud - *Why???*

A platform for innovation...

- Reducing barriers to rapid deployment and wide sharing of research apps and services... *successful services can scale to demand.*
- ...and reducing the cost of failure – fast fail.

Hosting research applications *in the cloud*...

- A robust, scalable platform for research apps
 - Any Researcher, Any Discipline, Any Where
- Supporting cross-institution **collaborative** access
 - ... including shared research workflows across institutional and national boundaries



Computational resource ... complementing SuperComputing

- A computational infrastructure for many computation needs
 - Cost effective and scalable for many classes of computation
 - Freeing up resources on HPC facilities
 - High throughput computing, Bag of Tasks, Parameter sweep, Optimisation ...

Research Collaboration is NeCTAR's Business

Research is *highly competitive*

- Brilliant people solving increasingly complex problems

Collaborate – *to compete*

- To share access to expensive resources
 - Particle Physics, Astronomy, Genome Sequencing,....
- To share knowledge and insight
 - Strategic partnerships - Choose your collaborators carefully
-and ***Compete*** within Collaboration.

NeCTAR is Building ***Knowledge Sharing Platforms***

- Research Cloud is our national platform for *Shared Access*
 - Research Data, Tools, Applications and Platforms
 - across organisational and national boundaries

Software is eating the Research World too...

Research Software – Tools, Models and Applications

Encoding our understanding of the Human and Natural World

- **Models and Simulation**

- Embody scientific and human knowledge

- **Data Analysis Tools and Algorithms**

- To understand and interpret the **Research Data Deluge**
- Extract *Knowledge* from *Data*

Need for ongoing rapid refinement and *innovation*

- To remain competitive – *at the bleeding edge*
- Understand and solve complex problems – *Wicked Problems*

Improving Research Software quality, reliability and sustainability

- Partnerships between researchers and software development expertise
 - Research Communities and **eResearch** Communities

NeCTAR Virtual Laboratories

Formed around engaged Research Communities...

- Collaboratively creating collaborative infrastructure
 - *Approaching national in scale*
- 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
 - » NeCTAR Research Cloud, Single Signon, Data Storage, High Performance Computing

Supporting research workflows

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

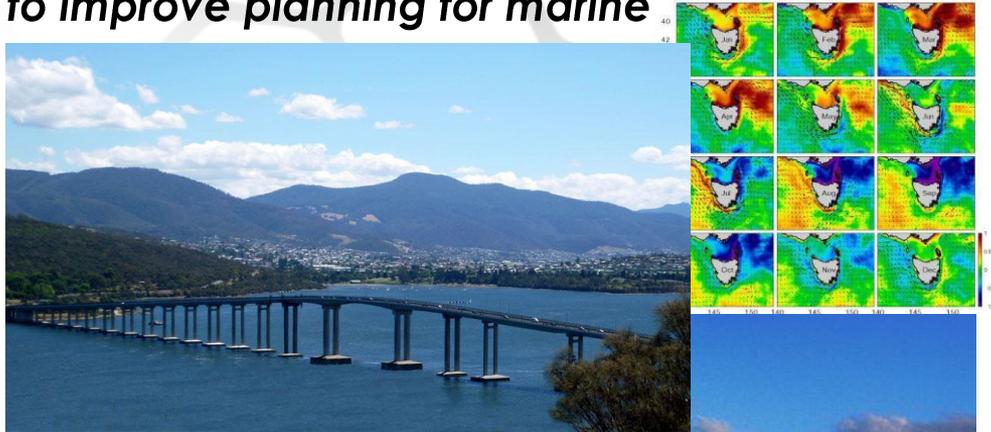


Marine Virtual Laboratory - MARVL

Ocean observations and modelling to improve planning 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.



“MARVL enables you to start thinking about your problem sooner.”

Dr Roger Proctor, Director e-Marine Information Infrastructure Facility.



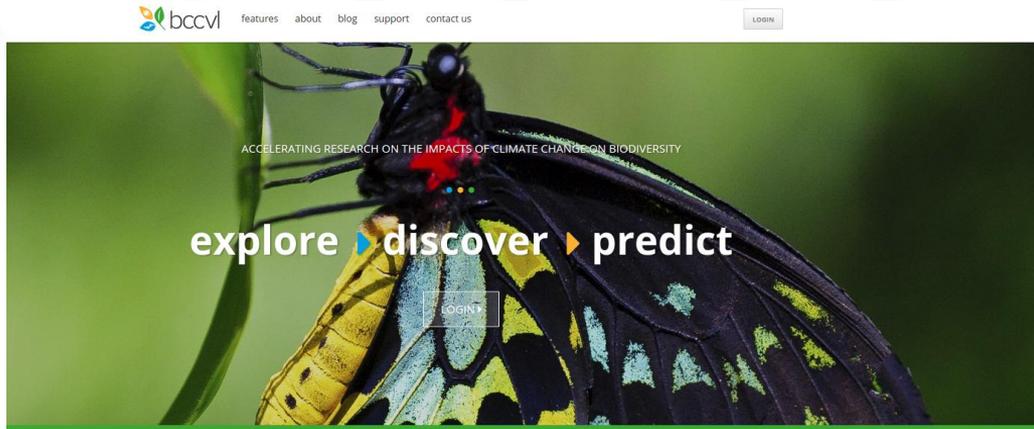
Biodiversity and Climate Change VL

Simplifies biodiversity-climate change modelling.

The Virtual Laboratory accelerates biodiversity modelling, allowing researchers to integrate, analyse and model across large disparate datasets quickly and easily.

“BCCVL decreases the time to complete biodiversity and climate analysis from 2 months to 5 minutes, supporting new applications in research, government and industry.”

Professor Brendan Mackay,
Director, Griffith Climate Change Response Program



Explore our datasets

1. Explore our datasets from the past and climate (including future scenario) data sets. You can view all of these on our [datasets](#) page.



Discover patterns and trends faster

Speed up your research by concurrently running statistical analyses on your data without burdening your personal computer. The BCCVL offers many [algorithms](#) for your use.



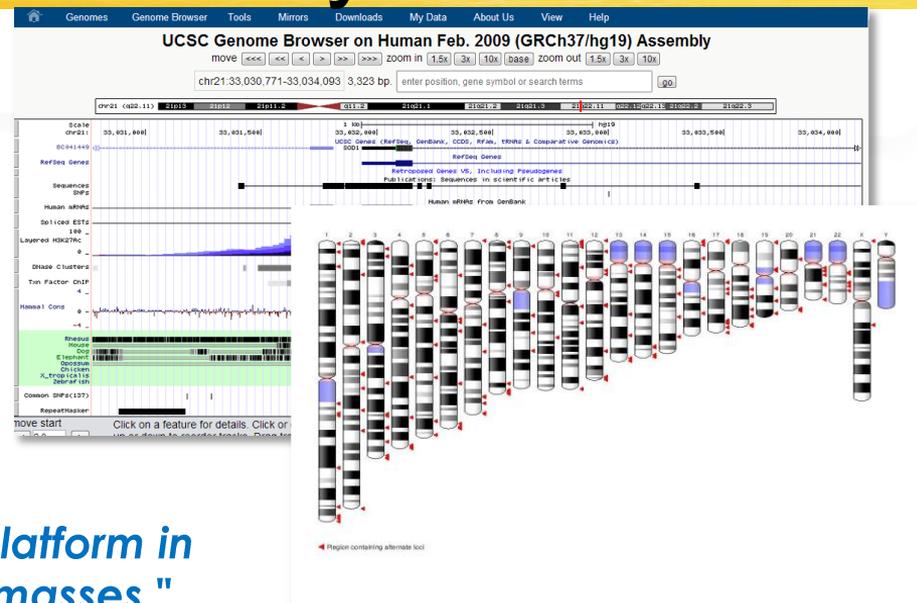
Genomics Virtual Laboratory - GVL

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, Director, Victorian Life Sciences Computation Centre.



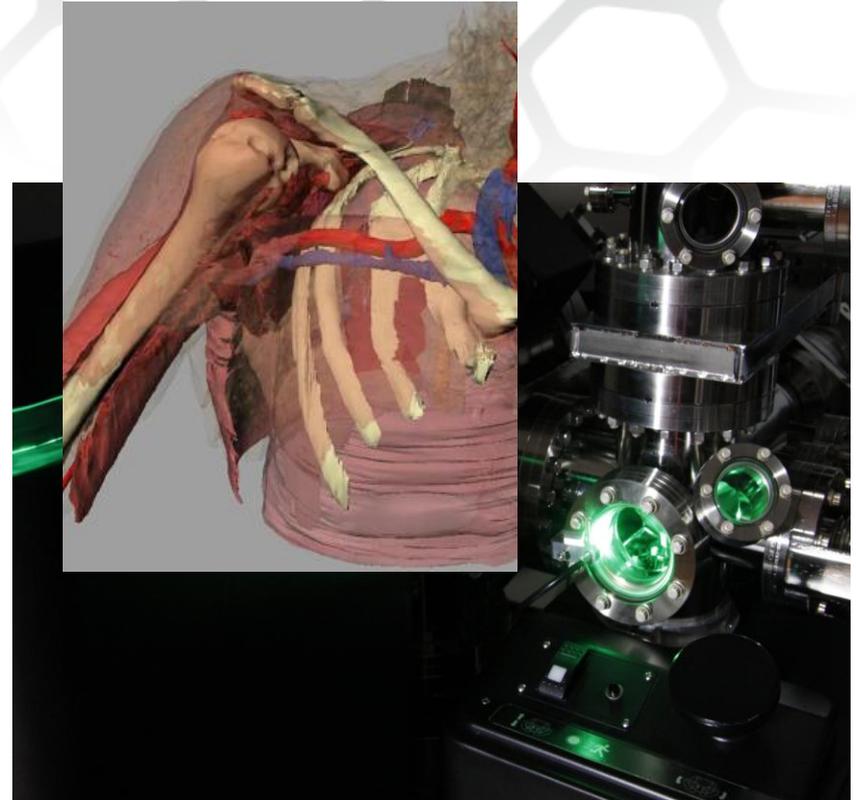
Characterisation Virtual Laboratory - CVL

Integrating Australia's key research imaging instruments with data and analysis tools on the cloud.

Building collaborative analysis workbenches in the cloud for **neuroscience**, **structural biology**, **atom probe** and **X-ray science**.

“The CVL project is leading the effort to move science data analysis to the cloud and provide a more flexible and more powerful research environment.”

Dr Anna Ceguerra, University of Sydney



Virtual Geophysics Laboratory

Easy access to geophysics workflows, simulations and datasets.

“The speed at which we carry out geophysical inversions was not possible before. Now the VGL does the cropping and re-projecting the data on the fly. We can complete our work in a matter of hours, instead of months.”

Dr. Carina Kemp,
GeoScience Australia

Virtual Geophysics Laboratory

Help VGL Portal Submit Jobs Monitor Jobs

Featured Layers

Search: [] Visible

- Onshore Only Bouguer Geodetic
- Onshore and Offshore Gravity Anomaly Geode...
- RadMap Totaldase
- MagMap V5 2010

Others (2 Items)

- GOCAD Models
- GA Geophysics Projects

Add Layer to Map

Active Layers

	Layer Name	Visible
<input checked="" type="checkbox"/>	MagMap V5 2010	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	GA Geophysics Projects	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	Onshore and Offshore Gravity Ano...	<input checked="" type="checkbox"/>

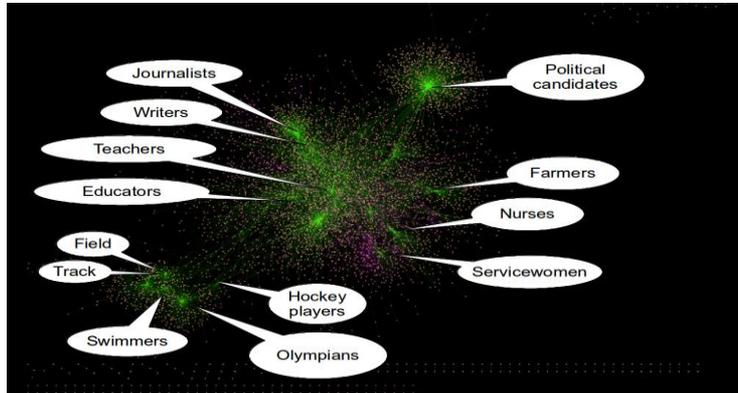
Base Layer

- Google Satellite
- Google Streets
- Google Physical
- Google Hybrid

Humanities Networked Infrastructure - HuNI

Integrating 28 of Australia's most important cultural datasets

2 million authoritative records relating to people, objects and events



Unlocking and uniting Australia's cultural datasets *Try searching the HuNI data using the latest HuNI virtual lab prototype* [Search HuNI](#)

Innovative
HuNI will provide cutting-edge analytical tools

Introducing HuNI

HuNI (Humanities Networked Infrastructure) is a major new digital service for humanities researchers. Developed in Australia, with funding from the NeCTAR (National eResearch Collaborative Tools and Resources) program, it aggregates data from 28 different cultural datasets from a variety of disciplines, makes them available for external re-use through an API and as Linked Open Data, and provides a set of tools for researchers to work with the data.

News

May newsletter published
Catch up on news from HuNI and partners in our [May issue](#).

Recent blog posts [see all posts](#)

- And 2013 comes to an eventful close
- AUSTLANG: exploring indigenous languages
- Mura: cataloguing indigenous cultural materials

Upcoming events [see all events](#)

Welcome to HuNI News

The HuNI Project is supported by 28 of Australia's most important cultural institutions in a "Virtual Laboratory" which have agreed to provide all the project's progress and other information to the right holders.



... and more Virtual Laboratories

Climate and Weather Science Laboratory – Bureau of Meteorology

- Integrated environment for climate and weather science modelling and data

Endocrine Genomics Virtual Lab – University of Melbourne

- Statistical power for clinical research

Humanities Networked Infrastructure - HuNI – Deakin University

- *Integrating 28 of Australia's most important cultural datasets*

Human Communications Sciences – Alveo – U Western Sydney

- *Studying speech, language, text, and music on a larger scale*

All Sky Virtual Observatory – Astronomy Australia Limited

- *Theoretical and observational astronomy data, simulations and tools accessible from your desktop*

Industrial Ecology Virtual Laboratory – Sydney University

- Supporting comprehensive environmental carbon footprinting and sustainability assessments

...and 16 Research Tool Software Projects across broad research disciplines

Research Cloud – Next Steps

Broadening the partnership

- Federating with *international* research cloud infrastructures
 - NeCTAR has been a pioneer, but others are moving in the same direction
 - *Eg. Federate with the EU funded EGI Federated Cloud.*
- Support access to commercial cloud platforms
 - Future capacity growth may be in partnership with industry partners

Strengthen relationships with industry partners

- *NeCTAR works with and is active in the OpenStack community*
 - *Seek to strengthen mutually beneficial relationships with industry partners*



Thank you



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

NeCTAR



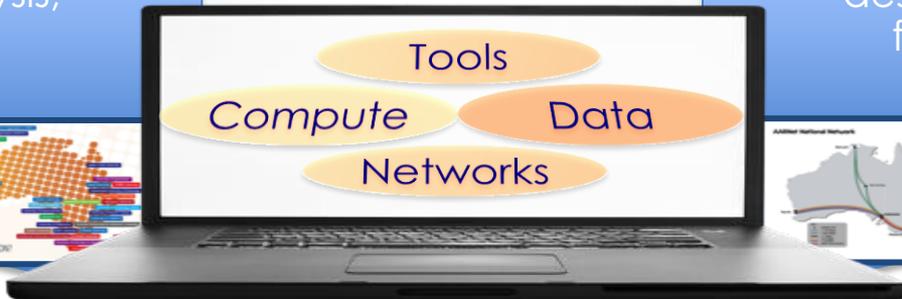
eResearch Infrastructure

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

Endocrine Genomics Virtual Laboratory

Statistical power for clinical research.

EndoVL contains a registry with information on more than 6,000 adrenal tumour cases.

Giving endocrinologists statistical power to improve clinical research into endocrine disorders.

EndoVL enabled the investigators to learn from the data in ways they had not envisaged at the beginning of the study.

Associate Professor Maria Craig,
Australasia Diabetes Data Network.



Endocrine Virtual Laboratory

ADDN Patient Listing Search Summary Home

Patient Id	Local Id	Date of Birth	Gender	Diabetes Type	Date of Diagnosis	Last Visit Date
ADDN-1	NUMBER1	01/01/2005	Male	Type 1	19/08/2013	19/08/2013

Edit Visit

Date of visit:	19/08/2013
Diagnosis visit:	No
Centre:	NSW-SYD-WESTMEAD
HbA1c (NGSP) (%):	15.0
HbA1c (IFCC) (mmol/mol):	140.4
Height (cm):	30.0
Weight (kg):	

NAVIGATION

- Patients
- Patient
 - Comorbidities
 - Family History
 - Other Medications
 - Studies
 - Visits
- Visit
 - Adult Data
 - Puberty Data
 - Screening Data

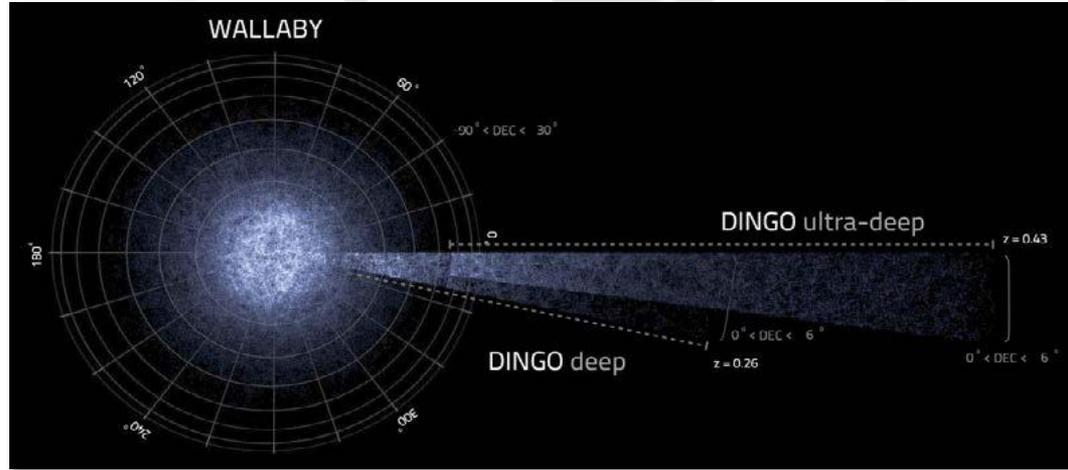
All Sky Virtual Observatory

Theoretical and observational astronomy data, simulations and tools accessible from your desktop.

ASVO provides access to cosmological simulations, galaxy formation models, and a comprehensive environment for analysis and exploration of the SkyMapper Southern-Sky Survey.

“The stars we are finding number one in a million... the ANU SkyMapper telescope is unique.”

Professor Mike Bessell,
Australian National University



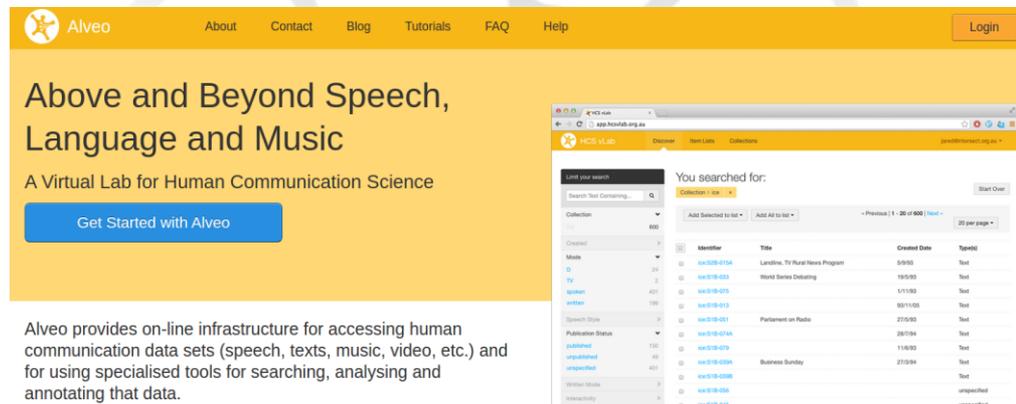
Alveo – Human Communication Science

Studying speech, language, text, and music on a larger scale.

Human communication scientists can now study speech, language, text, and music. Alveo brings together data collections, analysis tools, and workflow in a common environment.

“All of it—the workflow and analysis is nicely automated in Alveo, and the results are reproducible. This is really exciting for me.”

Professor Denis Burnham, Lead Chief Investigator



The screenshot shows the Alveo website interface. At the top is a navigation bar with the Alveo logo, links for About, Contact, Blog, Tutorials, FAQ, Help, and a Login button. The main heading reads "Above and Beyond Speech, Language and Music" with the subtitle "A Virtual Lab for Human Communication Science" and a "Get Started with Alveo" button. Below this is a search results page for "HCS VLAB" showing a table of collections. The table has columns for Identifier, Title, Created Date, and Type. The results include items like "Landscape, TV Rural News Program", "World Series Debating", "Parliament on Radio", and "Business Sunday".

Identifier	Title	Created Date	Type
hcs-19-0154	Landscape, TV Rural News Program	5/5/20	Text
hcs-19-0153	World Series Debating	10/3/20	Text
hcs-19-0152		1/11/20	Text
hcs-19-0151		03/11/20	Text
hcs-19-0150	Parliament on Radio	27/5/20	Text
hcs-19-0149		28/7/24	Text
hcs-19-0148		11/8/20	Text
hcs-19-0147	Business Sunday	27/3/24	Text

Alveo provides on-line infrastructure for accessing human communication data sets (speech, texts, music, video, etc.) and for using specialised tools for searching, analysing and annotating that data.

★ Data Discovery Interface

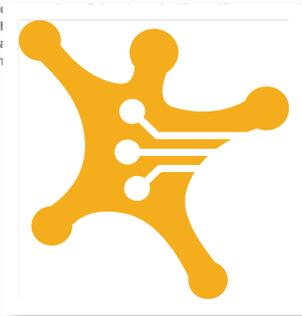
Browse and search collections, view documents and create lists of items for further analysis. The Data Discovery Interface provides the jumping-off point for further analysis using the Galaxy Workflow Engine, the NeCTAR Research Cloud, the R statistical package or any other preferred tool or platform. A fully featured API underpins the Data Discovery Interface, providing opportunities to extend the functionality of the Virtual Laboratory.

[Go to Alveo web app >](#)

★ Galaxy Workflow Engine

Initially targeted at genomics, the Galaxy Workflow Engine is a friendly interface to run a sequence of steps in an

[Go to Galaxy >](#)



which is ser-
fining a
hers.