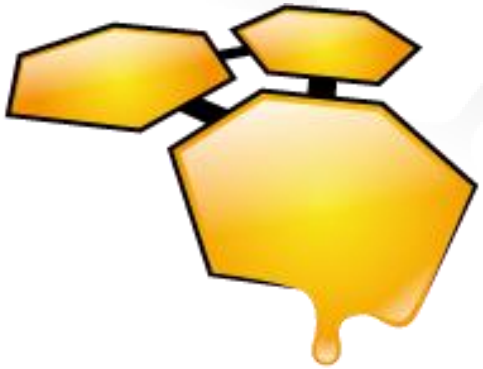

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National eResearch Collaboration Tools and Resources

nectar.org.au

NeCTAR is an Australian Government project conducted as part of the Super Science initiative and financed by the Education Investment Fund. The University of Melbourne has been appointed the lead agent by the Commonwealth of Australia, Department of Industry, Innovation, Science, Research and Tertiary Education.

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

The NeCTAR Project

National eResearch Collaboration Tools and Resources

- Funded through the Australian Government Super Science Initiative
- Financed by the Education Investment Fund (EIF)
  - $47 million (2010 – 2013)
- The University of Melbourne has been chosen as Lead Agent by the Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE).

Objectives

- Enhance research collaboration through the development of eResearch infrastructure.

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NeCTAR

…. a point of engagement for researchers

Tools and Services to support Research Communities…

- Collaboration, Innovation, Capability building, Leveraging existing investments
- Sector Driven – *NeCTAR is responsive to the research community*.

Connecting researchers to…

- Underlying capabilities…
  - Research Facilities, Instruments, Laboratories, Collections, Applications, Sensor networks, Repositories, Data, Computing, Remote Access, Research Workflows
  - RDSI, NCI, Pawsey, ANDS, NCRIS, State and Institutional infrastructure
- Each other…
  - Collaborative environments, Improving Access, Communications

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A National eResearch Platform

Nectar is building an open, scalable national platform for

- Hosting, deploying and sharing research software infrastructure
  - Supporting collaboration and innovation in research software and services
    - Early, rapid deployment and sharing of research applications on a national scale
    - Reducing barriers to success .... *and reducing the cost of failure!*
- Research computation which complements HPC investments
  - Information intensive research tasks
  - Cost effective and scalable for many classes of computation
    - Freeing up resources on HPC facilities

Two underlying platforms

- Research Cloud – *first node live at University of Melbourne*
  - On-demand, scalable, cost-effective
- National Server Program (NSP) – *first node live at UMelbourne*
  - Higher service levels – robust, enterprise-grade, high availability

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Research Software Infrastructure

Virtual Laboratories Program

Formed around engaged Research Communities…

- Well-described, significant research challenges
- Exemplars for sector adoption of capability

Integrating existing research and eresearch capabilities.

- Across institutional and discipline boundaries
- Leveraging national and institutional capabilities:
  - » Research Facilities, Instruments, Laboratories, Collections, Applications, Sensor networks, Repositories, Data, Computing, Remote Access, Research Workflows
  - » AAF, ANDS, RDSI, NCI, Pawsey, ARCS Services, NCRIS capabilities

eResearch Tools Program

Enhancing existing Research Tools

- To make them more collaborative, accessible and scalable.
- Support research workflows
- Bringing them *into the cloud.*

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Request For Proposals

NeCTAR is responsive to the research sector

- Elicit proposals through a Request For Proposal (RFP)
- Open, accessible to all – fair and equitable treatment of all
- Encouraging and fostering collaborative, multi-party proposals
  - Partnerships – research communities, institutions, infrastructure builders and operators
- Transparent, published selection criteria
- Open call for nominations for selection panels

- **Stage 1 RFP – September 2011**
- **Stage 2 RFP – April 2012**

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NeCTAR Timelines

Research Cloud Pilot August 2011

- A single node… at the University of Melbourne

Stage 1 Request For Proposals *September 2011*

- Research Cloud Nodes, National Server Program Nodes
- Virtual Laboratories, eResearch Tools

Research Cloud Full Access Phase Go Live *January 2012*

- 4000 CPU cores at University of Melbourne

Stage 2 Request for Proposals April 30 2012

- Research Cloud Nodes, Virtual Laboratories

Project End Date *December 31 2013*

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Stage 1 Request For Proposals

A substantial response from the sector.

The NeCTAR Expert Panels recommended for funding

- 5 Virtual Laboratory proposals (21 submitted)
  - $35M proposed, $8M available
- 16 eResearch Tool proposals (48 submitted)
  - $34M proposed, $9M available
- 3 Research Cloud nodes (6 submitted)
  - $12M proposed, $6M available

Successful proposals on Nectar website:

- *http://nectar.org.au/nectar-projects-negotiation-phase*

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Stage 2 Request for Proposals

NeCTAR will issue a second Request for Proposals:

- Virtual Laboratories
- Research Cloud nodes

...to be issued 29 April 2012. Closes 29 June 2012

Funding available – indicative (to be confirmed)

Virtual Laboratories	Funding per Proposal	Total Funding
• Virtual Laboratories	$1M - $1.5M	$6.0M
Research Cloud		
• Research Cloud Node Proposals (Three) • Research Cloud Application Migration support	$1.5M $333k	$4.5M $1.0M
TOTAL		**$11.5M**

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Why a Cloud for Researchers?

An open, accessible platform

- Supporting research collaboration across institutional and national boundaries
- Especially to support the needs of a diverse research community
  - Any researcher, Any Discipline, Anywhere, Any time
- Seek to establish a sustainable, cost-effective infrastructure

An Innovation Platform

- Putting the compute hardware infrastructure *under the hood*.
  - Increasing focus on research software and services
- Self-service and scalable for researchers
  - Empowering researchers – control over their online environments
- Supporting the early sharing and deployment of innovative software and services
  - Reducing the barriers to success ..... *and reducing the cost of failure!!*

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Why build our own Research Cloud?

Proximity to existing and new research infrastructure

- Australian Research and Education Network (AREN)
- Research Data Storage Infrastructure (RDSI Project)
- High Performance Computing
  - NCI, Pawsey, MASSIVE, VLSCI, ...
- Laboratories, facilities
  - Australian Synchrotron, Telecopes, Microscopes, Medical Research, ...
- Specialisation to meet specific research needs:
  - GPUs, Large Memory, High Throughput Computing, ...

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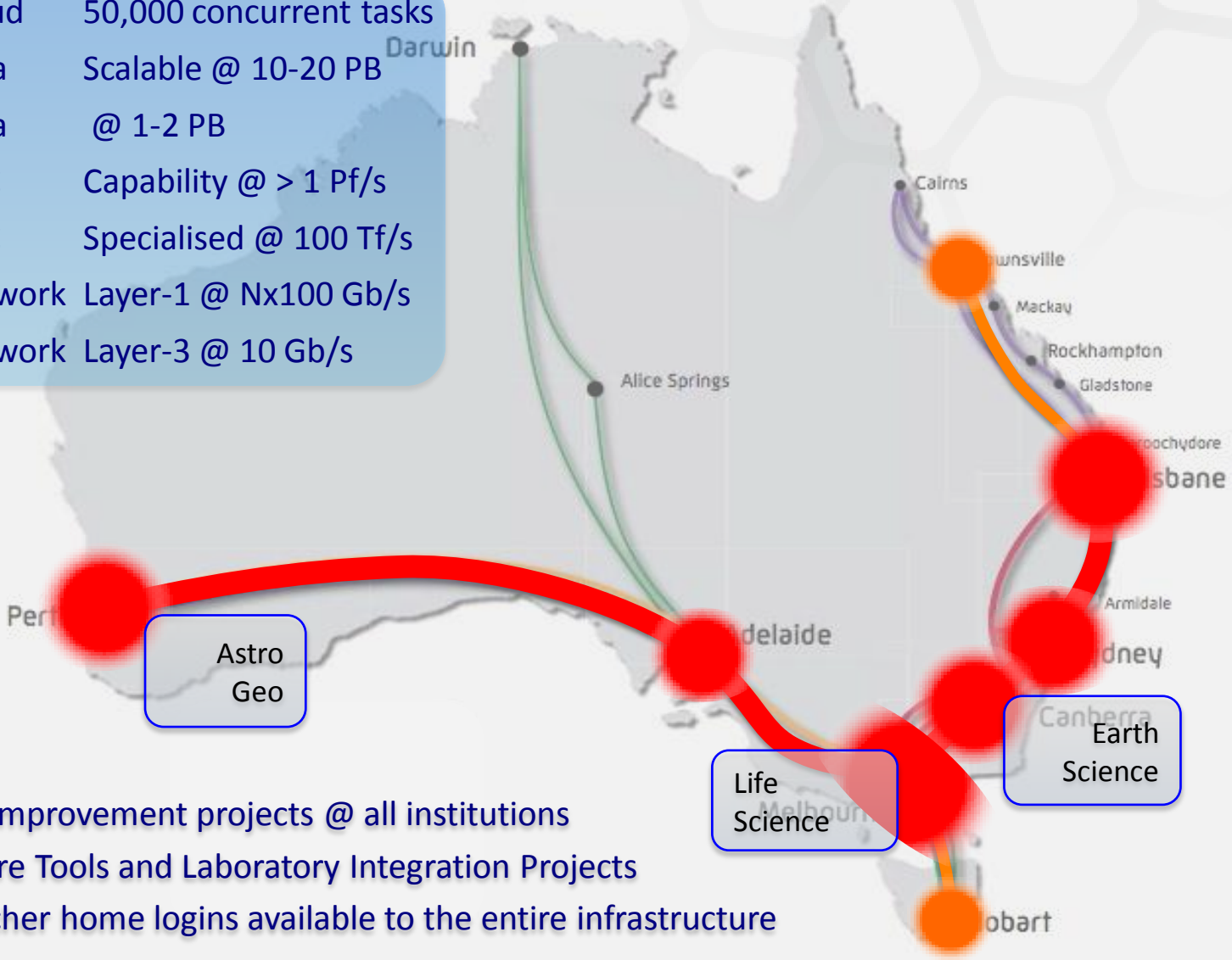
The Australian eResearch (Backbone) Infrastructure @ 2013

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



250 Data improvement projects @ all institutions

40 Software Tools and Laboratory Integration Projects

All researcher home logins available to the entire infrastructure

NeCTAR Research Cloud

… a robust, scalable national platform for deploying research applications and workflows.

Fund Cloud Nodes to form a *National Research Cloud*

- Based on Open Calls for Node hosts…
  - eResearch providers, Universities, Research Organisations,
  - Support co-location of Cloud Nodes with Data Storage Nodes (RDSI).
- Based on maturing, open-source cloud middleware…
  - **OpenStack:** from collaboration between:
    - RackSpace's *Swift Object Storage Cloud* – an enterprise data cloud provider
    - NASA's *Nova Compute Cloud*

    http://openstack.org
  - Very large scale deployments
  - Major commitment from large technology enterprises

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The NeCTAR Research Cloud

Built on OpenStack Cloud Middleware

- Selected at a NeCTAR Cloud workshop in April 2011
  - International research cloud initiatives to share experiences:
    - Including Eucalyptus, OpenNebula, OpenStack
  - OpenStack for Governance Model, Open Roadmap, Sustainability.

A single national cloud - regional deployments

- Single access point, central scheduler, monitoring, support, operations, ...
  - Overseen/advised by Steering Committee, Technical Advisory Group

Focus on commodity class hardware deployments

With Availability Zones to target:

- Particular nodes (sites)
- Particular capabilities at nodes:
  - eg. GPU, Large Memory, High Throughput

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NeCTAR Research Cloud *is Live!!!*

Based on a single node at the University of Melbourne

- Commissioned on January 31 2012
  - Available from Nectar website
  - 2000 CPU cores available – 2000 more from end April.Ausr
- Access available on-demand to Australian researchers
  - Via the Australian Access Federation – *AAF*
    - Dynamic account creation with your institutional username and password
  - Up to two Virtual Machines per user – *On Demand.*
- Larger allocations available on request
  - Merit allocation procedures to be established

Additional Nodes identified from Stage 1 RFP:

- Australian National University, *Canberra*
- University of Queensland, *Brisbane*
- Monash University, *Melbourne*

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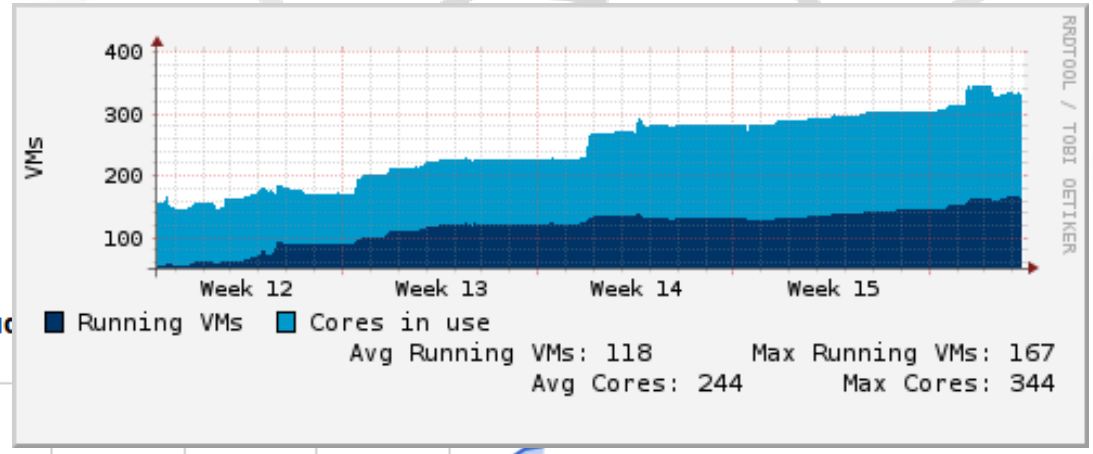
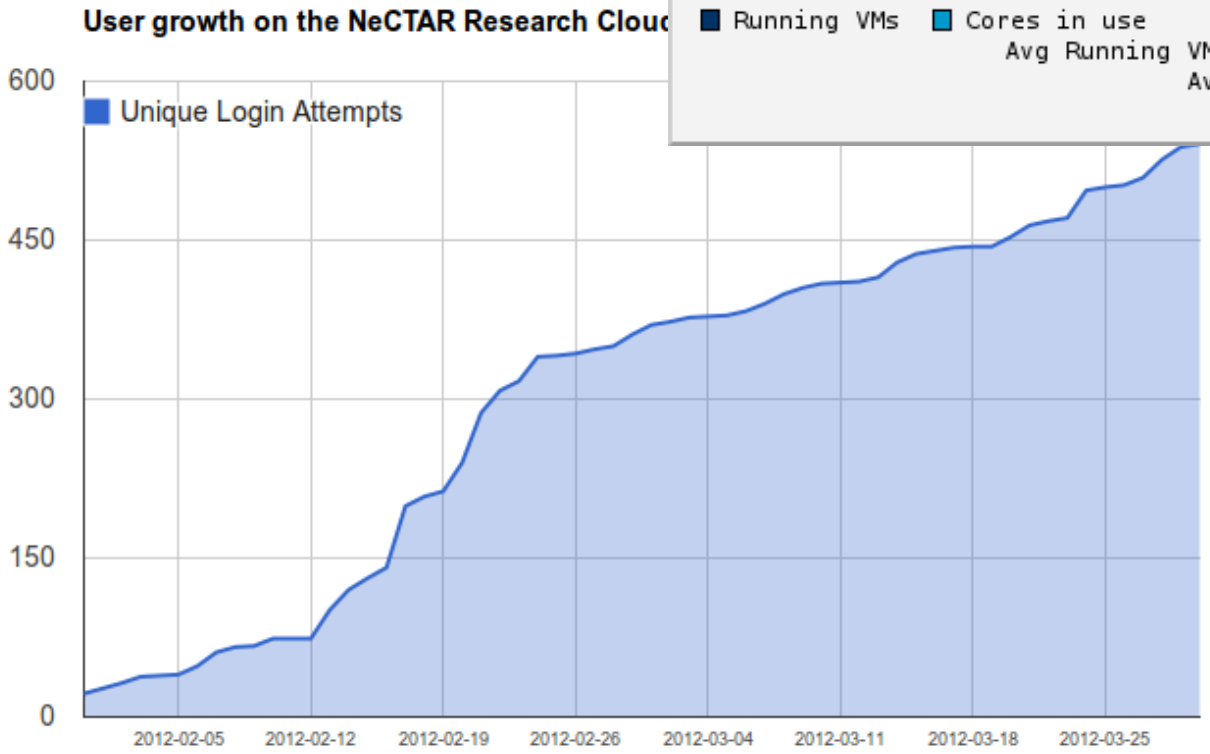
NeCTAR Research Cloud is Live....





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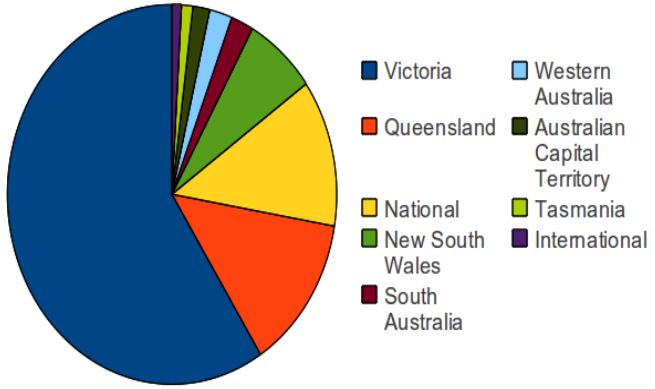
Build community at all levels

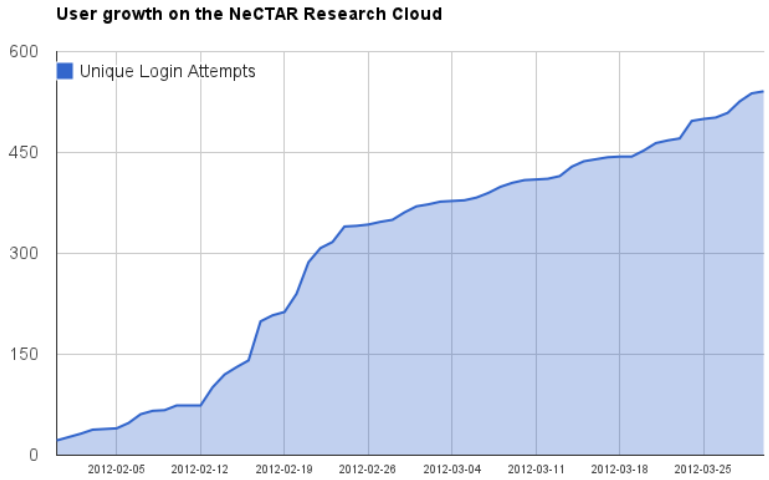
Research Cloud Users

- #NADojo full day Developer workshops
- Starting monthly meet-ups



OpenStack DevOps Community

- Mailing lists
- Beginning to contribute code back
- Australian chapter



What do we expect to see on the Cloud?

- **Research Analysis and Simulation environments**
  - Desktops in the Cloud!!!
    - Reference and derived research environments, shared access
- **Virtual Clusters**
    - For research computation
- **Workflow engines**
    - Bridging cloud, laboratories, HPC, Data
- **Portals, Databases, Visualisation**
- **Collaborative Environments**
- **And others we can't foresee:**
    - Cloud as an Innovation Platform – Research Software as a Service

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NeCTAR Successes

NeCTAR has

- Elicited outstanding, collaborative proposals for the creation of research software infrastructure
  - Delivering value across a range of research disciplines and domains
- Established for the first time a national research cloud platform
  - Ushering in new innovations in research software applications
- Established a National Server Platform for hosting robust, core eResearch services

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Challenges

Research Cloud

- Successfully establish governance to ensure coherence and coordination between cloud nodes
- Accelerate the “ecosystem” of applications and services on the cloud
  - Work with service providers and research communities to bring research applications *into the cloud*
- Ensure required capabilities are delivered through partnership with international OpenStack community

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Challenges

Virtual Laboratories and eResearch Tools

- Ensure successful delivery of promised software infrastructure
- Ensure strong engagement with and uptake by research communities
  - Require early delivery of production infrastructure
  - Projects are responsible for monitoring and ensuring uptake
- Identify common challenges and dependencies across projects
  - Strong communication between projects
- Federated Authorisation challenges
  - Research workflows spanning multiple institutions and capabilities
    - Require credential management for automated authentication
  - Delegated Authorisation so research groups can manage their own authorisation requirements – improving research engagement

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NeCTAR Infrastructure in 2014

A Possible Scenario:

8-12 Virtual Laboratories

- Providing deeply engaged researcher-driven exemplar projects

Suite of Research Tools built, deployed and operating

- Encompassing workflow capabilities, data transformation, visualisation, …

6-7 Nodes of the Research Cloud… *up to 24,000 CPU cores*

- Fostering innovation in research apps and services

A National Server Program platform

- Hosting core national eresearch services

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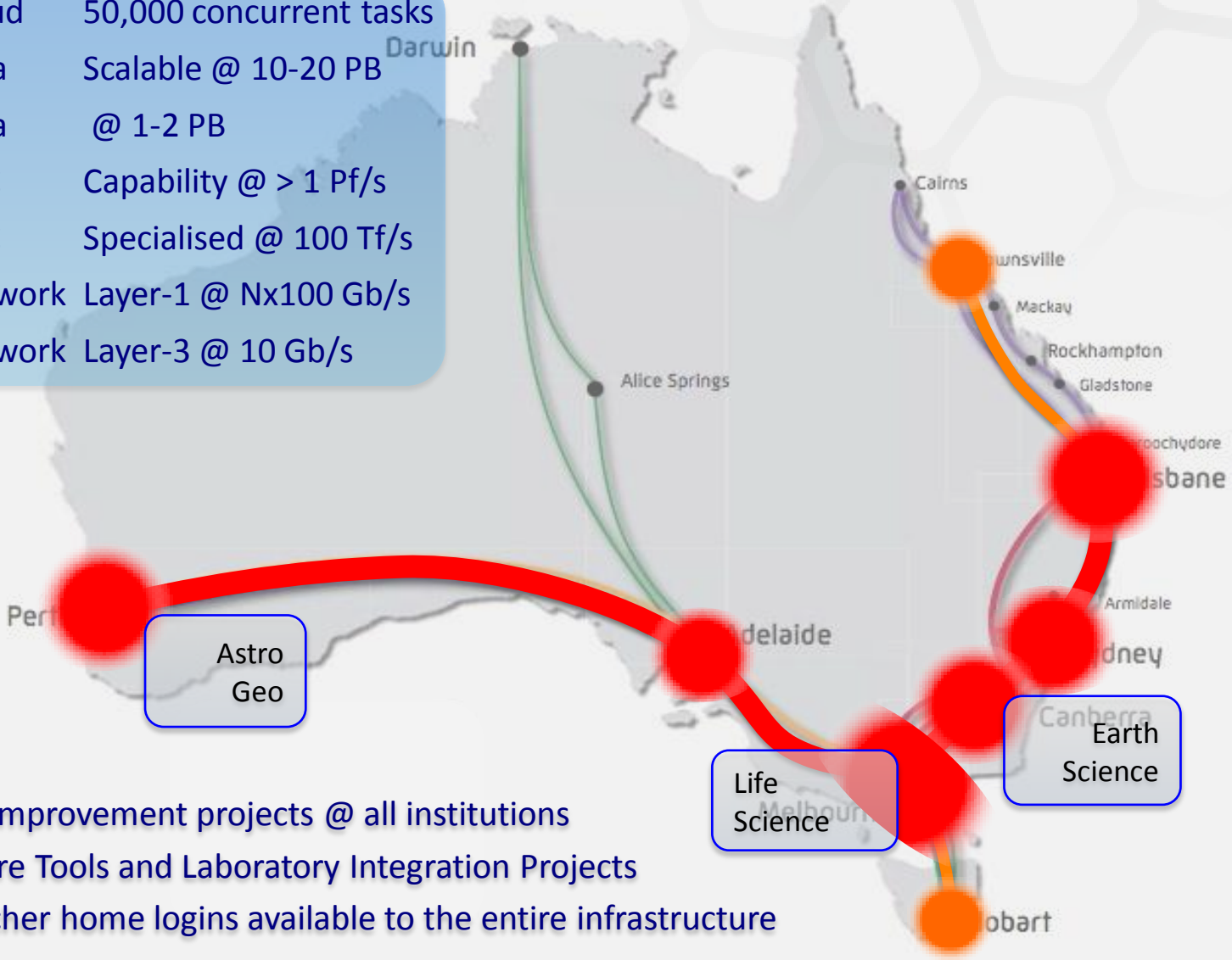

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