

National eResearch Collaboration Tools and Resources

Final Project Plan

August 2011



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 Innovation, Industry, Science and Research.

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i. Executive Summary

The National eResearch Collaboration Tools and Resources (NeCTAR) Project is a \$47M national research infrastructure initiative funded by the Federal Government's Super Science scheme.

The University of Melbourne (UoM) is Lead Agent for the delivery of the NeCTAR Project, which will have a national impact.

The primary objective of the Project is to enhance research collaboration and research outcomes by providing Information and Communication Technology (ICT) infrastructure that creates new information centric research capabilities and that significantly simplifies the combining of instruments, data, computing, and analysis applications and that enables the development of research workflows based on access to multiple resources. The intention is to support the so-called "connected researcher" who at the desk-top or the bench-top has access to a full suite of digitally enabled data, analytic and modelling resources, specifically relevant to their research.

NeCTAR will pursue these objectives by focusing on the development of infrastructure that improves service provision for the national research community, and the creation of new or improved eResearch tools, applications, workflows, and underlying infrastructure.

The NeCTAR infrastructure will be built through a balanced portfolio of Sub-projects, which will be delivered by institutions, organisations, or research groups drawn from across the research community, selected from responses to an open Request For Proposal (RFP) process.

Sub-projects will be formed under each of the four NeCTAR Programs:

- eResearch Tools,
- Virtual Laboratories,
- Research Cloud, and
- National Servers.

The Sub-projects will be enacted through Sub-contracts signed between the University of Melbourne (as Lead Agent) and the institution, organisation, or research group that undertakes to deliver the Sub-project. Where Sub-projects are to be undertaken by the University of Melbourne, the Sub-project will be enacted via a Memorandum of Understanding.

The NeCTAR Project Board has been established as an independent body to provide strategic guidance to the University of Melbourne and the NeCTAR Director with regards to the NeCTAR Project objectives, delivery and progress. It will establish sub-committees (including expert panels) with suitable membership drawn from across the research community to provide targeted advice on specific issues as required.

1 Background and Context

1.1 Project Funding

In May 2009, the Australian Government announced funding¹ of \$97M under the Super Science initiative to fund Data Storage and Collaboration Infrastructure.

In response to consultation with the research community, the Department of Innovation, Industry, Science and Research (DIISR) determined to direct this funding through two separate funding agreements:

- \$47M for the development of electronic collaboration infrastructure to be delivered through the National eResearch Collaboration Tools and Resources (NeCTAR) Project
- \$50M for the development of data storage infrastructure to be delivered through the Research Data Storage Infrastructure (RDSI) initiative.

The NeCTAR component of the Super Science funding is intended to extend the provision of national-scale interoperation and collaboration infrastructure for research.

The total Commonwealth funding for the NeCTAR Project of \$47 million is staged over three years:

- \$23 million in 2009-10
- \$12 million in 2011-12
- \$12 million in 2012-13.

Funding is provided from the Education Investment Fund (EIF), under the *Nation-building Funds Act 2008* (Commonwealth), which has the authority to fund 'the creation and development of research infrastructure'.

Funding is provided through the Funding Agreement for the 'eResearch Collaboration Infrastructure Project for the Education Investment Fund', signed between the University of Melbourne and the Commonwealth as represented by DIISR on 10 June 2010. The NeCTAR Project will conclude on 31 December 2013.

The Commonwealth funding is intended to support the development, deployment and commissioning of facilities and infrastructure by the Project, including agreed project management costs. The University of Melbourne and its Sub-contractors must meet the associated operational costs of those facilities and infrastructure including the employment of appropriate staff to manage and sustain them.

It is expected that Proposals will offer contributions of investment at a similar level to EIF funds producing an expected total investment in NeCTAR infrastructure of around \$90M.

¹ http://www.budget.gov.au/2009-10/content/bp2/html/bp2_expense-20.htm

1.2 EIF Implementation Principles

The NeCTAR Project must endeavour to establish, operate and provide access to NeCTAR Project infrastructure in accordance with the EIF principles:

- **Principle 1**
EIF-funded projects should address national infrastructure priorities
- **Principle 2**
EIF-funded projects should demonstrate high benefits and effective use of resources
- **Principle 3**
EIF-funded projects should efficiently address infrastructure needs
- **Principle 4**
EIF-funded projects should demonstrate they achieve established standards in implementation and management.

The organisations participating in the NeCTAR Project, including the University of Melbourne as Lead Agent and other parties participating through Sub-contracts, must endeavour to establish, operate and/or provide access to the facilities in a manner which:

- takes into account the long-term strategic requirements of relevant research disciplines
- enhances national and international collaboration in research
- enhances research capability for relevant disciplines
- provides for merit-based access to the facilities in accordance with the norms and expectations of the research community
- has a strong emphasis on service provision to the research community, and
- has a strong emphasis on effective use of data and compute resources.

1.3 Relationship to other eResearch infrastructure initiatives

The NeCTAR Project is established in the context of a number of pre-existing or planned eResearch infrastructure developments which complement and are expected to interoperate with NeCTAR.

These infrastructure developments include planned and existing AeRIC components arising from NCRIS and Super Science such as the Research Data Storage Initiative (RDSI), National Research Network (NRN), Australian National Data Service (ANDS), National Computational Infrastructure (NCI), the Pawsey Centre Project and the Australian Access Federation (AAF).

NCI, AAF, iVEC (as host of the Pawsey Centre) and the Australian Research Collaboration Service (ARCS) have provided written responses to the NeCTAR Consultation Paper. Further input has been received from the eResearch Investments through the Consultation process, including the NeCTAR Townhall and face-to-face meetings.

NeCTAR is structured to ensure:

- that it can develop and install infrastructure for operation in enduring organisations, and
- its sustained operation for agreed periods by directly engaging relevant entities.

The NeCTAR Project will take account of the development of the RDSI Project in determining its infrastructure arrangements. The RDSI initiative will provide data storage infrastructure to enhance national data centre development and support retention and integration of nationally significant data assets into the national collaboration and data fabric.

It is important for the NeCTAR infrastructure to align with and leverage the emerging capabilities from the RDSI Project. NeCTAR will encourage co-location of Research Cloud infrastructure with RDSI infrastructure to support high bandwidth data throughput requirements of research applications and workflows deployed onto the NeCTAR and RDSI infrastructure.

NeCTAR will work with existing national initiatives and investments, such as the Australian Access Federation (AAF) and large-scale research activities, to maximise research outcomes through integration.

The NeCTAR Project is funded from the Education Investment Fund (EIF; see Section 1.1), which is specifically for the creation and development of infrastructure. EIF funds cannot be applied to the ongoing operation of existing infrastructure or services.

2 Project Overview

2.1 Vision

The NeCTAR infrastructure is built on the underlying capabilities provided through existing and new investments in research and eResearch infrastructure: data storage, data collections, high performance computing, networks and the national and institutional facilities which form the basis of research infrastructure in Australia. The NeCTAR eResearch Tools provide the researcher-oriented tools and environments which present these underlying capabilities through online, accessible and collaborative interfaces which have been built to meet identified researcher needs. The NeCTAR Virtual Laboratories integrate these capabilities into digitally-enabled “virtual laboratories” which draw on multiple facilities and capabilities across the country. These Virtual Laboratories will support and sustain increased research collaboration by enabling research workflows across institutional and discipline boundaries.

NeCTAR will also provision its own critical underlying infrastructure including a Research Cloud, which will for the first time provide an open national collaborative platform for deployment of research and eResearch applications. The NeCTAR National Server Program will provide a sustainable, reliable and robust platform for critical underlying eResearch services, such as authentication services and central data catalogues.

2.2 Scope

The NeCTAR Project will address the requirements for greater access to research resources and more efficient systems to encourage collaboration. The scope of the NeCTAR Project is limited to the creation and development of eResearch collaboration tools and resources infrastructure that address these requirements. Specific details of NeCTAR’s infrastructure development activities are contained in the description of the NeCTAR Project infrastructure at Section 4 and the implementation detail described at Sections 5 and 7.

eResearch infrastructure development not covered by these components is outside the scope of NeCTAR, but may fall under the responsibility of one of the other national eResearch infrastructure initiatives, with which NeCTAR will work closely.

The NeCTAR EIF funding can be applied to the creation and development of eResearch infrastructure. It cannot be applied to maintenance, training, support or outreach activities associated with this infrastructure. The NeCTAR Project will seek to ensure the provision of these additional services through the development of appropriate Sub-contracts that outline the co-investment models under which these activities will be delivered. The provision for training, support and outreach will be sought in addition to the requirement for each Sub-contractor to ensure that the infrastructure produced in the relevant Sub-project continues to operate for an agreed period determined on a case by case basis, but in all cases, extending to at least June 2014.

In consideration of potential Sub-projects, NeCTAR governance bodies will also consider the future sustainability of proposed development activities and the long-term benefits for the Australian publicly-funded research community.

2.3 Objectives

As a national eResearch infrastructure project, NeCTAR's objectives are to:

1. Enhance research collaboration through the development of eResearch infrastructure capable of having national impact and, through this, enhance national research outcomes.
2. Deploy eResearch infrastructure and services not otherwise available to publicly-funded researchers.
3. Extend the use of these eResearch capabilities to a wider cross-section of publicly-funded researchers more quickly than would otherwise occur.

In particular, NeCTAR seeks to enhance research collaboration and research outcomes by providing Information and Communication Technology (ICT) infrastructure that creates new information centric research capabilities and that significantly simplifies the combining of instruments, data, computing, and analysis applications and that enables the development of research workflows based on access to multiple resources. NeCTAR seeks to support the so-called "connected researcher" who at the desk-top or the bench-top has access to a full suite of digitally enabled data, analytic and modelling resources, specifically relevant to their research.

2.4 Outcomes

At the conclusion of the NeCTAR Project, it will have delivered for the benefit of publicly-funded Australian researchers:

- A set of eResearch Tools that support problem-oriented eResearch needs and further the achievement of improved research outcomes;
- Exemplar problem-oriented Virtual Laboratories that connect a range of resources of relevance to a specific research community; these resources might include sensor, instrument, compute, data and visualisation resources;
- A set of virtualised research applications that operate in a secure and shared Research Cloud environment, connected to major instruments, compute and data nodes; and
- National Servers infrastructure that provides the core functions to enable advanced information services, enhanced collaboration and the improved interoperability of research infrastructure.

Detailed benefits of each Sub-project will be identified during the analysis of Sub-projects submitted through Proposals plus further analysis of opportunities from integrating, enhancing, and streamlining these Sub-projects at a NeCTAR Project level.

A further key indicator of the NeCTAR Project's success will be its ability to generate practical rationale and arguments to support ongoing sustainability for investments in eResearch collaboration and interoperability. These arguments will be supported by the existence of key partnerships across the research community in implementing the NeCTAR Project and by demonstrated value to the research community.

2.5 Strategic Approach

Infrastructure to be developed under the NeCTAR Programs will leverage existing and emerging capabilities arising from NeCTAR and other national eResearch infrastructure projects. Specifically, NeCTAR Sub-projects should leverage:

- The NeCTAR Research Cloud for deployment and sharing of research applications
- The RDSI DaSh program for access to, and sharing of, research data;
- Authentication capabilities provided by the AAF project; and
- Data discovery and metadata capabilities provided by the ANDS project.

NeCTAR Virtual Laboratories: Bringing the Strands Together

The NeCTAR Virtual Laboratories gather together the strands of the various Programs of the NeCTAR Project to assist collaborating research communities around well described, community defined research problems. Virtual Laboratories empower research communities by providing capabilities to self-manage, share and connect existing and new distributed research resources and infrastructure.

NeCTAR Virtual Laboratories:

- Support cross-institutional and cross-disciplinary research workflows through the provision of integrated collaborative ICT infrastructure;
- Connect significant infrastructure capabilities to support discipline and problem oriented research workflows: e.g. remote laboratory access, computation, research data repositories, workflow tools and sensor networks;
- Provide an exemplar to research communities of the benefits of integrating significant research support capabilities into a rich online collaborative environment.

The NeCTAR Virtual Laboratories build upon capabilities from the other NeCTAR Programs:

- **Research Cloud:** a robust and open platform for deployment of Virtual Laboratory infrastructure to connect distributed research resources, and a cost-effective platform for the provision of computational resources to research communities.
- **eResearch Tools:** build and enhance research tools to better support collaboration, workflows and remote and collaborative access to facilities and infrastructure.
- **National Server Program:** securely and reliably hosting underlying core national eResearch services such as Authentication and Data Catalogues.

Each of the NeCTAR Programs delivers significant research infrastructure in their own right. The Virtual Laboratories provide exemplars and models to the sector for harnessing NeCTAR and other research infrastructure capabilities to improve research outcomes and enhance research productivity.

The NeCTAR Research Cloud: A sustainable platform for research applications

The NeCTAR Research Cloud is the key underpinning infrastructure of the NeCTAR Project. The Research Cloud leverages emerging and maturing technologies from the commercial sector for the cost-effective, scalable and flexible delivery of computing infrastructure. The

NeCTAR Research Cloud is a robust platform for deployment of research applications, including those arising from the NeCTAR eResearch Tools program.

The NeCTAR Research Cloud will also provide Cloud-based computational job submission service offerings for researchers. As such, the NeCTAR Research Cloud provides a computational infrastructure which is complementary to existing and future investments in High Performance Computing (HPC) infrastructure. Cloud computing provides a model for delivering computational resources for non-HPC research computation at low operational and capital cost. Non-HPC research computation includes many applications in high throughput computing, parameter sweep computation and computational workflows which readily decompose into large numbers of low CPU-count jobs. Once established, the NeCTAR Research Cloud federated model permits the provision of resources from additional nodes at a low additional operational cost.

Internationally, the research sector is seeing increasing deployment of Cloud platforms to provide research computing infrastructure, particularly in the life sciences. NeCTAR will actively engage with international partners to ensure best-practice and inter-operability with international Research Cloud infrastructures.

NeCTAR will establish a national research cloud infrastructure based on mature Cloud middleware.

The NeCTAR Research Cloud:

- Empowers research communities by providing an open, robust and scalable platform for researchers to deploy, share and manage their research applications;
- Provides a robust platform for deployment of NeCTAR eResearch Tools.
- Supports collaboration by providing a single national platform supporting cross-institutional and cross-disciplinary access to applications and facilities;
- Supports high data-throughput research applications through co-location of NeCTAR Cloud Nodes with RDSI Storage Nodes.
- Addresses sustainability of eResearch infrastructure by providing a platform in which deployed applications can be seamlessly migrated between service providers;
 - Based on de-facto standard APIs (eg. Amazon EC2 and S3);
- Provides opportunity for federation:
 - Outward with international research cloud infrastructures and
 - Inward with emerging institutional research cloud offerings;
- Provides a robust and open platform for deployment of Virtual Laboratory infrastructure.

NeCTAR eResearch Tools:

The NeCTAR eResearch Tools Program supports the creation of research software infrastructure for the Australian research community. The eResearch Tools program will fund the development of software-based infrastructure which addresses:

- Needs for eResearch Tools as identified by proposals from the research community;
- Requirements for specific capabilities identified by successful Virtual Laboratory proposals; and
- Migration of existing research application software to the Research Cloud.

The eResearch Tools Program enhances the Research Cloud Program by supporting the migration of existing research applications to the Research Cloud, improving access for researchers. Applications to be migrated may include existing HPC simulation and data analysis suites and hosted web-based applications and sites. Research Cloud Nodes are encouraged to include in their Proposals a request to fund the Research Cloud Application Migration activities.

The NeCTAR Virtual Laboratory Program benefits from the funding of eResearch Tools which are identified by the Virtual Laboratory proposals as addressing critical gaps in existing capabilities.

The NeCTAR eResearch Tools Program supports the creation of software-based infrastructure for the research community through the following:

- Building transformational new capabilities in computation and data analysis
- Supporting the needs for specific software tools identified by the Virtual Laboratory proposals to address gaps in existing capabilities
- Supporting the migration and deployment of research applications and software infrastructure on the NeCTAR Research Cloud
- Developing key common services, such as authorisation tools, that contribute to the overall functionality of the NeCTAR infrastructure

The NeCTAR eResearch Tools Program has a strong focus on extending and enhancing existing toolsets, according to identified need, to:

- Make them more collaborative,
- Improve access to underlying research facilities and infrastructure,
- Enhance support for research workflows, including cross-institutional and cross-disciplinary workflows, and
- Enable the connection of research data sets and repositories with research tools and workflows.

Priority will be given to eResearch Tool proposals which leverage NeCTAR infrastructure, especially the Research Cloud, and other national research infrastructure. NeCTAR will also fund the development of new tools to meet gaps in capability according to identified needs. Such proposals will need to demonstrate the need for the proposed tool and a track record in the successful development and operation of research tools.

While the NeCTAR Virtual Laboratories are built on the capabilities emerging from the other NeCTAR Programs, they also provide the deep engagement with identified research communities to inform the ongoing development of the Research Cloud and eResearch Tools programs.

NeCTAR National Servers Program: Sustaining the Foundations

The NeCTAR National Server Program (NSP) provides for the first time an identified reliable and robust platform for hosting the core eResearch services, and other eResearch services requiring high levels of reliability and availability.

Examples of such core eResearch services that could migrate to the NSP include

the authentication infrastructure created and operated by the Australian Access Federation (AAF); and the core services created by the Australian Research Collaboration Service (ARCS), i.e.: Data Fabric and Access Services; Video Conferencing Services (EVO and Access Grid); and Compute Grid, Cloud, and IdP Services.

Where core eResearch services are hosted on the NSP, the eResearch infrastructure to be created and operated under the NeCTAR Programs described above are encouraged to leverage those core eResearch services.

3 Project Management and Governance Overview

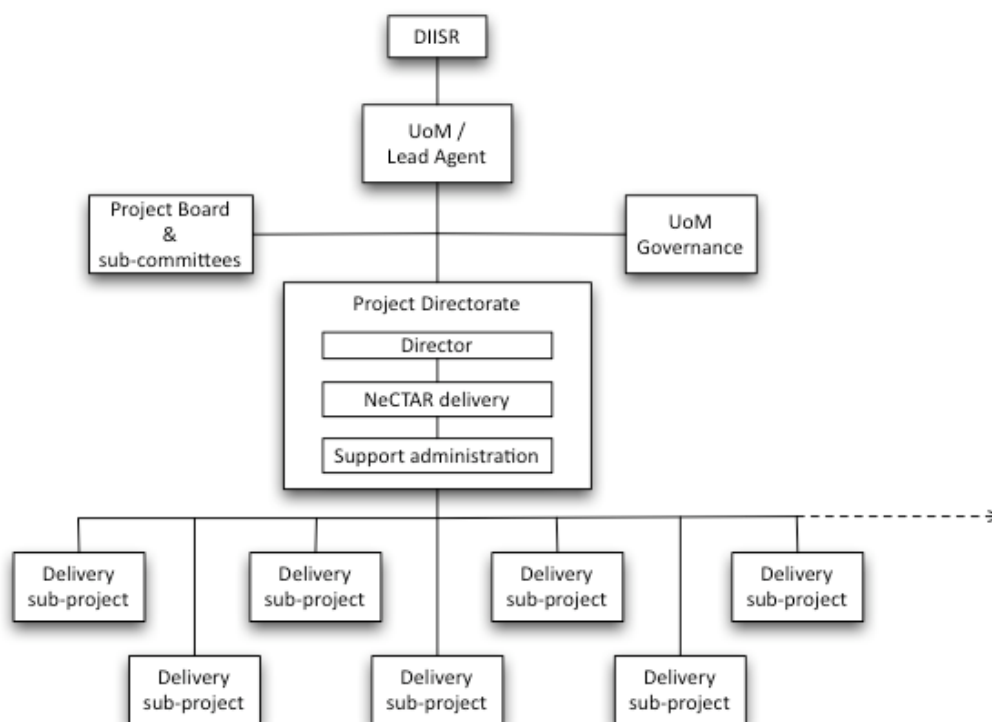
3.1 Management

The University of Melbourne is Lead Agent for the delivery of the NeCTAR Project and has overall responsibility for the management and implementation of the NeCTAR Project in accordance with the reporting and accountability requirements outlined in the Funding Agreement for the ‘eResearch Collaboration Infrastructure Project for the Education Investment Fund’, signed between the University of Melbourne and the Commonwealth as represented by DIISR on 10 June 2010.

The University of Melbourne has established the independent, sector-based NeCTAR Project Board and appointed a Project Director.

A schematic of the overall structure of the NeCTAR Project is given in Figure 3.1. A detailed description of the NeCTAR governance arrangements is provided in Appendix B; including the high-level roles and responsibilities of the Project Directorate and the Project Board. The Sub-Committees of the Project Board are listed in Appendix B and their roles are described further in Sections 4.3 and 5.3.

Figure 3.1: NeCTAR Project Structure



3.1.1 Project Directorate

The Project Directorate carries out the program management activities and coordinates the NeCTAR Programs. The Project Directorate can be broadly divided into the following divisions: Leadership and Governance through the activities of the Project Director; Control

& Delivery through the Program Management capabilities of the Directorate (NeCTAR Delivery); and Administrative Support.

3.1.2 Project Board

The NeCTAR Project Board is the independent body providing strategic guidance to The University of Melbourne and the NeCTAR Director with regards to the NeCTAR Project objectives, delivery and progress.

The Project Board is led by an Independent Chair, and includes the Deputy Vice-Chancellor (Research), The University of Melbourne or nominee, a senior representative from the CSIRO, a senior representative from another Australian research intensive University and at least five other members.

The NeCTAR Project Board as at June 2011 comprises the following members:

- Dr Graham Mitchell AO (Chair)
- Professor Andrew Cheetham, Pro Vice Chancellor (Research), University of Western Sydney
- Professor Max Lu, Deputy Vice Chancellor (Research), University of Queensland
- Professor Iain McCalman AO, Professorial Research Fellow, University of Sydney
- Professor Robyn Owens, Deputy Vice Chancellor (Research), University of Western Australia
- Dr Roger Proctor, eMII Director, Integrated Marine Observing System (IMOS)
- Mr Paul Sherlock, Director of Information Strategy & Technology Services, University of South Australia
- Professor Liz Sonenberg, Pro Vice Chancellor (Research Collaboration), University of Melbourne
- Professor John Taylor, Director, CSIRO eResearch & Computational and Simulation Sciences (CSIRO)

The Independent Chair of the NeCTAR Board, Dr Graham Mitchell, is also a member of the Australian eResearch Infrastructure Council (AeRIC) and in that capacity is called upon to provide advice to the Department on the Department's eResearch investments, including the NeCTAR Project. This provides further links between NeCTAR and other national eResearch infrastructure activities.

Professor Andrew Cheetham has been appointed as Deputy Chair of the NeCTAR Project Board to support the Board Chair.

4 NeCTAR Project infrastructure

4.1 Overview

The NeCTAR Project is structured to respond to both research problem-specific and national eResearch platform requirements. It is made up of the following four Programs:

Research problem-specific Programs:

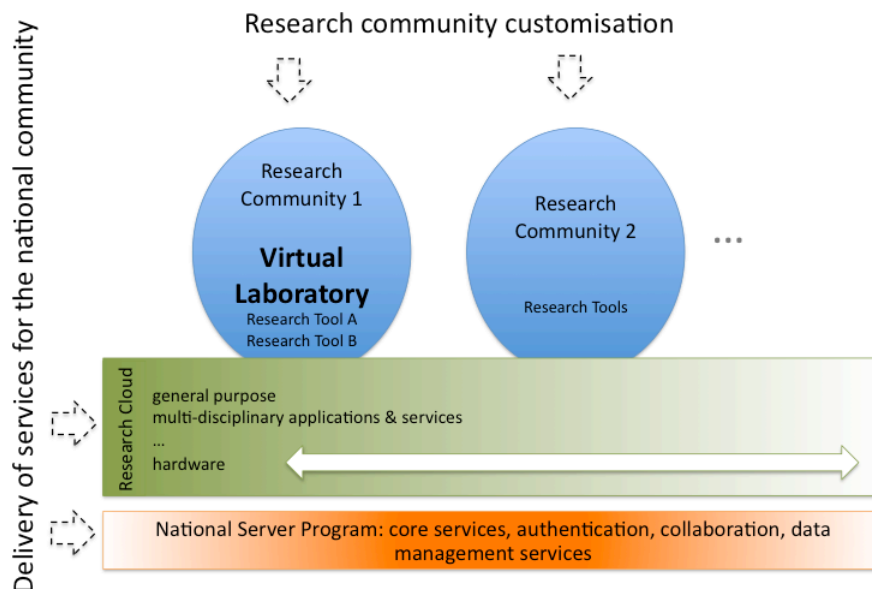
- eResearch Tools Program
- Virtual Laboratories Program

National eResearch platform Programs:

- Research Cloud Program
- National Servers Program.

The four Programs will have sufficient interconnections to provide coherence at the aggregate NeCTAR Project level, and to allow the infrastructure developed under each to evolve to meet changing research community needs or expectations. For example, a tool that originates in the eResearch Tools program may subsequently migrate to the Research Cloud or National Servers program if demonstrated to be of relevance to the wider research community, and operational support can be provided through co-investment.

Figure 4.1: Overview of the NeCTAR Programs



Descriptions of each activity are provided in this Section 4. Implementation arrangements for each activity are described at Section 5- NeCTAR Project Implementation.

4.2 Supporting problem-based needs

The eResearch Tools and Virtual Laboratories programs will develop solutions to address specific problems, as identified by the research communities.

Responses to NeCTAR requests for proposals under the Virtual Laboratory and eResearch Tool programs are expected to identify specific research needs to be addressed by the proposal. Proposals will be requested to nominate an identified research community to:

- support the research needs identified in the proposal;
- prioritise infrastructure requirements; and
- support on-going evaluation of the infrastructure development in addressing the identified research needs.

Given the objective of enhancing national research outcomes, we specifically define research communities as typically composed of researchers from multiple institutions, including possibly international institutions, and one or more disciplines, working on a common set of research problems, goals, tools and data.

NeCTAR Virtual Laboratories and eResearch Tools proposals are expected to leverage existing capabilities such as the RDSI DaSh program for access to research data; the AAF framework for authentication; and data discovery capabilities provided by the ANDS project.

Proposals are encouraged which represent a collaboration between research communities and identified eResearch capability partners.

NeCTAR defines as “eResearch capability partners” those organisations identified within the Sub-project proposals with responsibility to develop, build or operate the Sub-project infrastructure, according to the defined needs of an identified research community.

Proposals to NeCTAR will need to nominate:

- an identified developer and builder of the infrastructure;
- an identified operator of the proposed infrastructure; and
- an identified research community.

For many proposals it is expected that a single organisation or community may well undertake more than one of these roles.

Participants in proposals to NeCTAR will draw on the expert knowledge of existing tools (including international ones) already available to the community and any gaps that can be addressed through the NeCTAR Project. This includes the eResearch capability partners’ knowledge of existing eResearch tools, as well as the research community’s knowledge of domain or problem specific tools.

It is anticipated that Sub-projects developing eResearch Tools or Virtual Laboratories will need to work closely with their affiliated institutions, eResearch capability partners and designated operators to ensure the ongoing effectiveness of the infrastructure through

appropriate maintenance and support, and to ensure uptake of the resulting infrastructure in the relevant community.

Proposals are encouraged to adopt a staged delivery model for the Sub-project infrastructure; with early and staged opportunities to demonstrate and evaluate the provision of value to the research community. The research community identified in the proposal will be expected to support the evaluation of the delivered infrastructure throughout the staged deployment of the Sub-project.

A staged delivery model:

- supports ongoing engagement between the infrastructure builders and the research community;
- provides for the early delivery of value to the research community;
- fosters increased uptake of the infrastructure by the research community; and
- permits high performing Sub-projects to identify opportunities for the delivery of increased value to the research community.

4.2.1 Sub-Project Governance for Virtual Laboratory and eResearch Tools Programs

Proposals to NeCTAR under the eResearch Tools and Virtual Laboratory programs are required to propose appropriate governance arrangements for the successful delivery of the Sub-Project deliverables. This is expected to include an appropriately convened Sub-Project Steering Committee, including representation of the relevant participating institutions and stakeholders identified in the Proposal. Where there is substantial overlap or inter-dependency between Sub-Projects, NeCTAR would consider proposals for joint governance arrangements between the Sub-Projects. Sub-Project Steering Committees will be required to extend a standing invitation to the NeCTAR Director (or delegate) to attend meetings of the Sub-project Steering Committee as a non-voting observer.

Further guidance on NeCTAR Sub-Project governance requirements will be provided with the issuance of the NeCTAR Request For Proposals (RFPs).

4.2.2 eResearch Tools

The eResearch Tools (RT) program will develop and improve research tools to:

- enhance support for research collaboration;
- improve capabilities for remote access and real-time collaboration;
- improve the ability for researchers to connect research data sets and repositories with tools and research workflows; and
- improve and automate research processes and workflows.

The NeCTAR Project will allocate funding under the eResearch Tools Program in four specific areas:

- eResearch Tools selected from responses to the eResearch Tools Request For Proposals;

- eResearch Tools to meet identified needs arising from successful responses to the Virtual Laboratory Requests for Proposals; and
- Research Application Migration activities included in successful Research Cloud Node Proposals.
- Common utilities and services required to deliver the full NeCTAR infrastructure

The eResearch Tools program does not seek to duplicate existing tools. The program will seek to build upon existing tools, including those available internationally, to enhance their capabilities to support collaboration or to connect them through incorporation into a research workflow. Priority will be given to eResearch Tools proposals which leverage NeCTAR infrastructure, especially the Research Cloud, and other national research infrastructure. NeCTAR Virtual Laboratory proposals may include proposals for eResearch Tools to fill gaps in capability identified by the Virtual Laboratory proposal.

The process and principles for selection and prioritisation of responses received under the eResearch Tools Request for Proposals are addressed in Section 5.3. All development under the eResearch Tools program should seek to make use of existing national and international standards where possible.

Examples of tools that may be supported under the eResearch Tools program include the extension and development of tools to better support collaboration, including: real-time communication, remote access to instrumentation and interfaces and portals to software services or data. Workflow tools that streamline research and support the more efficient use of data and compute resources may also be developed or extended.

In addition, the Director may identify, and recommend to the NeCTAR Project Board for approval, key utilities that are required to improve the overall functionality of other NeCTAR activities. Such utilities may be agreed and commenced at any time, and are not constrained to the established Stage 1 and Stage 2 RFP cycles. The NeCTAR Director will consult with members of the Project Board and relevant sub-committees in initiating utilities which will then be managed in accordance with the processes applied to the eResearch Tools program.

4.2.3 Virtual Laboratories

The Virtual Laboratories program will deliver a set of integrated work environments that remotely connect researchers, applications and hardware, such as sensor networks, shared facilities and instruments.

The Virtual Laboratories program will integrate existing and new capabilities to create exemplar Sub-projects that demonstrate the enhanced capability that the application of eResearch tools and services can deliver for the research community. As exemplar Sub-projects the Virtual Laboratories will provide models for wider uptake of eResearch infrastructure capability to meet research sector needs.

The Virtual Laboratories will access and connect resources of precinct or national extent and create new research practices by integrating across relevant instruments, data and compute resources. Each Virtual Laboratory will target a well-described, significant research challenge and connect resources of precinct or national extent. They will link existing resources and

tools through workflows to streamline research activities, as well as provide a single point of access, to assist researchers in addressing the common research challenge.

The Virtual Laboratories program will be limited to funding integration activities for groups that are already at an advanced stage of eResearch development, and with a demonstrated user base for existing eResearch capability.

The process and principles for selection and prioritisation of Virtual Laboratory proposals are addressed in Section 5.3.

The Virtual Laboratories program is well placed to deliver early positive examples of eResearch development under the NeCTAR Project.

4.3 Supporting broad national needs

NeCTAR will support a broad program to establish a national eResearch platform through the Research Cloud and National Servers programs. The infrastructure developed under these programs will be delivered by enduring institutions or organisations with a demonstrated capability in this area (such organisations may include universities, selected state-based eResearch infrastructure providers, and government research organisations). They will undertake to deliver the activity for the broad benefit of the national research community.

The requirements for delivery of the Research Cloud and National Servers nodes will be fully defined by the NeCTAR Project to ensure the resulting infrastructure meets service level expectations. The service delivery requirements for the nodes will be provided with the issuance of the Requests For Proposals (RFPs) under the Research Cloud and National Server Programs.

Governance Arrangements for the Research Cloud and National Server Programs

NeCTAR will establish the following program-wide governance arrangements for the Research Cloud and National Server Programs:

- **A NeCTAR Platforms Steering Committee** to provide oversight and strategic guidance to the participants in the NeCTAR Research Cloud and National Server programs to achieve the NeCTAR Project objectives. The committee will be chaired by the NeCTAR Director (or delegate) and additionally comprise:
 - One senior representative of each participating node of the Research Cloud and National Server Programs and
 - Two invited representatives drawn from the community of research users of the Research Cloud and National Server Program.

The invited research representatives will be identified by the NeCTAR Director and approved, and subject to annual review, by the NeCTAR Project Board.

- **A NeCTAR Platforms Technical Advisory Group** to provide expert technical advice to the NeCTAR Directorate, the NeCTAR Platforms Steering Committee and the Program Nodes on matters of infrastructure architecture, implementation and

operation. The Technical Advisory Group is specifically tasked to identify opportunities for delivering increased value for the NeCTAR Project through emerging opportunities and technologies, while ensuring the delivery of a robust, scalable and stable service.

The members of the NeCTAR Platforms Technical Advisory Group will be nominated by the NeCTAR Director, in consultation with the NeCTAR Platforms Steering Committee, and approved by the NeCTAR Project Board.

The Terms of Reference for these committees will be developed by the NeCTAR Director in consultation with the NeCTAR Project Board and subject to approval by the NeCTAR Project Board.

4.3.1 Research Cloud

NeCTAR will build a Research Cloud, providing an environment for eResearch applications and services that are in common, national usage and will be comprised of a number of nodes operating within a prescribed Research Cloud Infrastructure Framework. The Cloud Infrastructure Framework will include an Infrastructure as a Service (IaaS) capability and support for hosting Platform as a Service (PaaS) offerings for research communities. The eResearch Tools program will support the migration of applications and services to the Research Cloud for common, national usage.

The Research Cloud will:

- be a federated network of virtual machines on designated hosts;
- support applications in common usage that have been 'migrated' to the Research Cloud for greater ease of access;
- support cloud-based service offerings for submission of cloud-appropriate computational workloads; including high throughput computing.
- operate with support services available during the host institution's standard business hours; and
- operate with entry, security and maintenance criteria that are intended to create a high degree of accessibility for Australian researchers.

The kinds of applications and services that could be deployed on the Research Cloud include:

- data analysis and access tools;
- visualisation tools;
- collaboration tools;
- computational batch job submission and workflow services
- security tools;
- application and service development platforms; and
- portals and interfaces to HPC and commercial cloud providers.

Institutions will be selected to host a Research Cloud node based on selection criteria that will be described in the Request for Proposals. There are expected to be up to six Research Cloud nodes.

The Research Cloud Sub-project selection processes are described in Section 5.3.

The nodes will be funded to deploy resources and may be co-located with RDSI Nodes if they meet the NeCTAR final selection criteria. A pre-condition of hosting a node will be that the node is operated and maintained within the prescribed NeCTAR Research Cloud Infrastructure framework.

4.3.1.1 Research Cloud Infrastructure framework

The Research Cloud Infrastructure Framework will provide a consistent interface to the range of applications and services running at the distributed nodes. It will be established to provide a common layer for deployment and management of applications hosted on the Research Cloud.

This will enable host institutions to run nodes by leveraging existing expertise and infrastructure and will retain flexibility in the delivery of the Research Cloud.

The Research Cloud Infrastructure Framework is based on an identified cloud management middleware defined through the consultation process described at Section 5.5.

Users and Developers of applications for the NeCTAR Research Cloud will be advised and strongly encouraged to leverage the de-facto standard APIs (Amazon Web Service APIs) offered for management and deployment of applications on the NeCTAR Research Cloud. This provides the greatest robustness against disruption due to emerging opportunities to deploy alternate cloud framework implementations and maximises sustainability for research applications and future opportunities for federated deployment on international research cloud infrastructures.

4.3.1.2 Research Cloud Lead Node

It is expected that up to six distributed nodes will operate together to form the Research Cloud. Of these nodes, the University of Melbourne cloud node will be the Research Cloud Lead Node which will create, deploy and operate the Research Cloud Infrastructure Framework, and monitor service delivery across all other nodes.

The Lead Node of the Research Cloud is charged with the responsibility to work collaboratively with all participating nodes of the NeCTAR Research Cloud to:

- Create, deploy and operate the defined Research Cloud Infrastructure Framework;
- Maintain and update the Research Cloud framework in consultation with all Research Cloud node hosts;
- Develop and publish procedures and policies for the deployment and operation of the Research Cloud Infrastructure Framework as agreed with the NeCTAR Platforms Steering Committee;
- Develop and publish architectural requirements for the underlying hardware deployments at the Nodes as agreed with the NeCTAR Platforms Steering Committee;
- Monitor and report on service delivery across the other distributed nodes to ensure that the Research Cloud infrastructure runs within the appropriate service levels;

- Act as a central point to triage Research Cloud allocation requests, fault reports, and so on;
- Provide and manage user and administration interfaces to the NeCTAR Research Cloud services;
- Receive advice and strategic direction from the NeCTAR Project Board through its subcommittees, including the NeCTAR Platforms Steering Committee under the Research Cloud governance arrangements described above, and act in accordance.

As described in Section 5.5, the University of Melbourne will be funded by NeCTAR to establish the first node of the Research Cloud and to operate as the Lead Node of the NeCTAR Research Cloud.

4.3.1.3 Research Cloud Nodes

The NeCTAR Research Cloud Nodes will be hosted by enduring institutions or organisations with a demonstrated track record in hosting and managing substantial ICT infrastructure and service delivery.

The Research Cloud Nodes are also charged with the responsibility to work collaboratively with all participating nodes of the Research Cloud to:

- Work with the Lead Node in developing procedures and policies for the deployment and operation of the Research Cloud Infrastructure Framework;
- Work with the Lead Node in developing architectural requirements for the underlying hardware deployments at the Nodes;
- Procure, deploy, maintain and operate the underlying compute and storage infrastructure according to the architectural requirements published by the Lead Node and agreed by the NeCTAR Platforms Steering Committee;
- Deploy and operate the designated Research Cloud Infrastructure Framework at the Node in accordance with the procedures and policies published by the Lead Node and agreed by the NeCTAR Platforms Steering Committee;
- Monitor and report on service delivery at the Node to ensure the infrastructure operates within the appropriate service levels;
- Respond to support requests generated from the Research Cloud central support service; and
- Receive advice and strategic direction from the NeCTAR Project Board through its subcommittees, including the NeCTAR Platforms Steering Committee under the Research Cloud governance arrangements described above, and act in accordance.

Additionally the Research Cloud Nodes may:

- Be funded through the Lead Node activity to participate in the development and deployment of the Research Cloud Infrastructure Framework; and
- Be funded to support the migration of research applications to the NeCTAR Research Cloud under the Research Cloud Application Migration Activities, as described in sections 2.5, 4.2.2 and 5.1

4.3.1.4 Research Cloud Allocation Committee

NeCTAR will establish a Research Cloud Allocation Committee to determine appropriate criteria for access to the Research Cloud infrastructure under a merit allocation scheme, and to evaluate applications for merit allocation of resources on the NeCTAR Research Cloud. The Research Cloud Allocation Committee will be convened in Q4 2011, in time to develop criteria and recommend allocation processes to the Project Board for the Full Access Phase of the Research Cloud (see Section 5.5). It is expected that the Committee will operate those processes, under the direction of the Project Board.

It is anticipated that merit allocation of resources will be one of several avenues for access to the Research Cloud infrastructure, including on-demand access by researchers up to a defined resource cap, merit allocation for computational resources and application hosting, and identified “partner shares” allocated to co-investing organisations and institutions.

4.3.2 National Servers

The National Servers Program (NSP) will consist of distributed nodes operating together to host core eResearch services. Core eResearch services are defined as those that support or underpin research activities of national relevance to researchers from multiple institutions and disciplines. It is also anticipated that services running on the NSP will be those coordinated at the institutional (or multi-institutional) level.

The NSP will deliver a higher availability and service level than that offered through the Research Cloud (refer to Table 4.1 below for a description of the differences). It will:

- provide appropriate 24/7 support to meet agreed service levels;
- be built with failover and/or redundancy in place; and
- be managed with strict entry, security and maintenance criteria.

Table 4.1: Difference between the characteristics of the National Server and Research Cloud programs.

National Servers	Research Cloud
Supports ‘core eResearch services’ upon which other services depend	Supports ‘discipline-centric services’ built on top of the core
Built for applications that need to run continuously for years	Built for applications that may run from minutes to months or over many years. Supporting “on-demand” resource provision and scaling for research application hosting.
Supported 24/7 with failover and/or redundancy in place	Built with 9-to-5 support for Australian researchers
Strict entry, security and maintenance criteria	Not so strict entry, security and maintenance criteria

At the highest service level, the NSP will provide a managed virtual machine (VM) service to ensure that VM-hosted operating systems are maintained regularly, ensuring security and stability.

Each NSP node will run the VM infrastructure within the host institution's pre-existing environment, including associated data centres, support structure and business processes. Potential NSP node hosts will need to demonstrate the ability to achieve this whilst providing a very high degree of interoperability across nodes.

As part of the Funding Agreement with DIISR, the University of Melbourne was contracted to deliver an early National Servers node built to the Basic Access Phase specifications described in the NSP Implementation Plan (this Plan was accepted by DIISR on 10 June 2010 as NeCTAR EIF Payment Milestone 1).

This Basic Access provision of the University of Melbourne node has been available for use since January 2011.

4.3.2.1 National Servers Lead Node

The University of Melbourne is named as the Lead Node for the National Servers Program and will be responsible for:

- monitoring and reporting on service delivery across the other distributed nodes to ensure that the National Servers infrastructure runs within the appropriate service levels; and
- acting as a central point to triage National Servers allocation requests, fault reports, and so on.

The University of Melbourne National Servers node was established early under the contracted Funding Agreement with DIISR and therefore operates as the Lead Node of the National Servers Program.

The University of Melbourne will retain Lead Node status for the life of the NeCTAR Project, consistent with the University's role as Lead Agent responsible for the NeCTAR outcomes.

It is considered that the technical and service quality of the NSP infrastructure is a critical underlying element of NeCTAR's overall success and that the University should therefore retain the role of Lead Node to maintain direct control over the timeliness, technical quality, and service delivery standards associated with the infrastructure.

Further detail is provided in the NeCTAR National Servers Program Implementation Plan which is available from the NeCTAR website: www.nectar.org.au.

4.3.2.2 NSP Allocation Committee

An NSP Allocation Committee has been established to determine the criteria that should be applied for access to the NSP infrastructure, and to recommend services that should be admitted for support under the infrastructure to the NeCTAR Project Board.

The Committee will operate according to the Board-approved Terms of Reference and will review services admitted to the NSP infrastructure on a regular basis, taking into consideration:

- the continuing demand for the service;
- the reliability and usage statistics for each service; and

- the level of the service-owner response to application issues and user-queries relating to that service.

4.4 NeCTAR Project deliverables

The four Programs of the NeCTAR Project described above will produce the tangible deliverables outlined in the Product Breakdown Structure shown in Figure 4.2 below. The accompanying Product Descriptions in Table 4.2 provide more detail about these deliverables.

Figure 4.2: NeCTAR Product Breakdown Structure

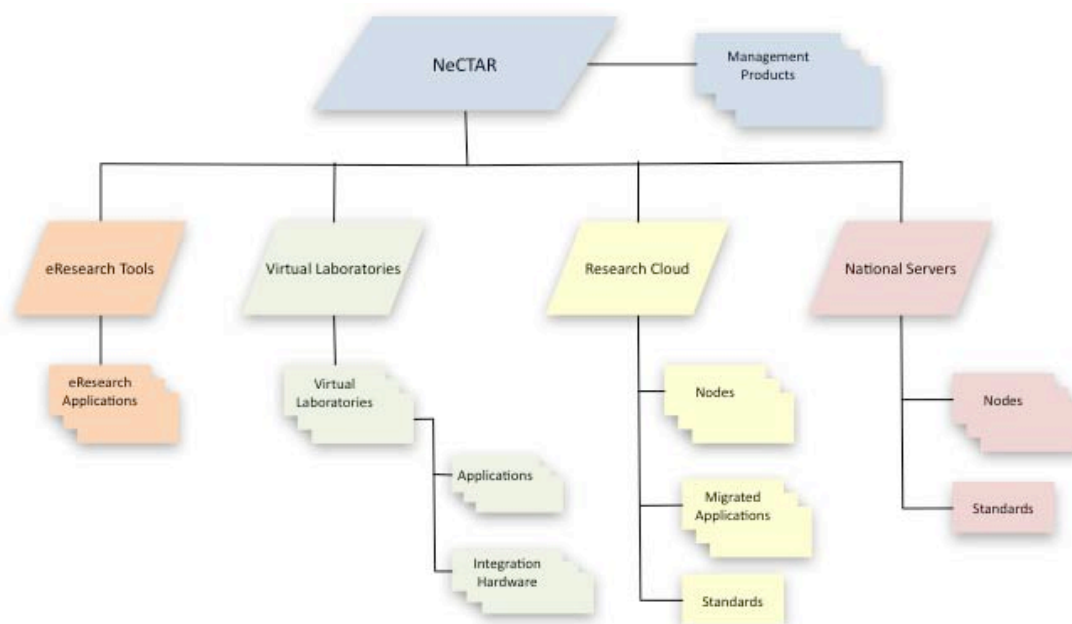


Table 4.2: NeCTAR Product Descriptions

NeCTAR	
Management Products	Documents specified under the NeCTAR EIF Funding Agreement: <ul style="list-style-type: none"> • Final Project Plan • Annual Reports • Annual Business Plan • EIF Milestone Reports • Final Project Report
Virtual Laboratories	
Virtual Laboratory	An integrated environment that remotely connects researchers, applications and hardware.
Applications	Applications integrated into each Virtual Laboratory may include: <ul style="list-style-type: none"> • workflow tools (applications built to facilitate the workflow integration) • eResearch applications (existing or built) to address the research problem specific to the Virtual Laboratory
Integration hardware	Purchased infrastructure such as network hardware to facilitate the integration of various components of the Virtual Laboratory.
eResearch Tools	
eResearch	Research problem-specific applications that:

applications	<ul style="list-style-type: none"> • enable the improved access to data • support research collaboration • automate research processes • aid in the management of workflow capabilities. <p>It also includes the:</p> <ul style="list-style-type: none"> • migration of existing applications into the Research Cloud through additional development, or • development from scratch of applications designed specifically for the Research Cloud.
Research Cloud	
Nodes	Nodes consisting of hardware (CPU, storage and network) and software (Cloud Management, authentication and authorisation tools, and Virtual Machine hypervisors). Hardware and software may be a combination of existing (within the host institution) or purchased.
Standards	Technical and service level standards that govern the operation of the Research Cloud across the distributed nodes. Includes specification of the Cloud Management software to be used.
National Servers	
Nodes	Three nodes consisting of hardware (CPU, storage and network) and software (authentication and authorisation tools, and Virtual Machine hypervisors). Hardware and software may be a combination of existing (within the host institution) or purchased.
Standards	Technical and service level standards that govern the operation of the National Servers across the three distributed nodes.

5 NeCTAR Project Implementation

5.1 Sub-projects and NeCTAR Staging Model

The NeCTAR infrastructure will be built through Sub-projects, which will be delivered by institutions, organisations, or research groups drawn from across the research community. Sub-projects will be formed under each of the four NeCTAR Programs.

The Sub-projects will be enacted through Sub-contracts signed between the University of Melbourne (as Lead Agent for the NeCTAR Project) and the institution, organisation, or research group that undertakes to deliver the Sub-project. Where the University of Melbourne undertakes the delivery of a Sub-project, the Sub-project will be enacted through a Memorandum of Understanding. A detailed discussion of the Sub-contracting relationship is at Section 5.2.

The expected form and number of Sub-projects to be supported under the NeCTAR Programs is described below and summarised in Table 5.1.

eResearch Tool Sub-projects will be evaluated and allocated following a Request for Proposals in one stage. It is expected that proposals will come from collaborations between eResearch capability partners (see Section 4.2) and identified research communities, but individual groups may also apply. Each Sub-project is expected to take between one and two years to develop and implement, and cost between \$300,000 and \$1 million. It is anticipated that between 8 and 15 eResearch Tool Sub-projects will be funded through the eResearch Tools Request for Proposals.

It is expected that a further 5 to 10 eResearch Tools will be evaluated and allocated through successful Virtual Laboratory Proposals which include proposals for specific eResearch Tools required to address identified gaps in existing capability. It is also expected that the NeCTAR eResearch Tools Program will fund 6 to 8 Research Cloud Application Migration Activities, including proposals for Research Cloud Application Migration included in successful Research Cloud Node Proposals.

Virtual Laboratory Sub-projects will be evaluated and allocated following a request for proposal, over two stages. It is expected that proposals will come from collaborations between eResearch capability partners and identified research communities, but individual groups may also apply. Each Sub-project is expected to take between one and two years to develop and implement, and cost between \$1 million and \$2 million. It is anticipated that between eight and twelve Virtual Laboratory Sub-projects will be funded. The NeCTAR Project will identify up to three Early Activity Virtual Laboratory proposals to be funded under an accelerated approval process as described in Section 5.4.

Research Cloud nodes will be evaluated and allocated following a Request for Proposals over two stages. It is expected that nodes will be hosted by institutions or enduring organisations. Each node is expected to take one year to implement, and cost \$1.5 million. It is anticipated that there will be up to six Research Cloud nodes. Research Cloud Node Proposals are

encouraged to include a proposal for funding the migration of existing research applications to the Research Cloud.

Two additional National Server Program nodes will be evaluated and allocated following a Request for Proposals, in one stage. It is expected that nodes will be hosted by institutions or enduring organisations. Each node is expected to take one year to implement, and cost \$1 million. It is anticipated that there will be three National Server nodes in total.

Details about the expected level, nature, and source of the co-investment against individual Sub-projects are provided at Section 6.2.

The evaluation process is described at Section 5.3

Table 5.1: Summary information: NeCTAR Sub-projects

NeCTAR Program	Sub-project Allocation mechanism	Sub-project Allocation stage(s) ¹	Expected Sub-project applicants	Expected Sub-project duration	Expected NeCTAR EIF contribution per Sub-project	Expected total number of Sub-projects
eResearch Tools	RFP	1	eResearch Collaborations ²	1 to 2 years	\$300,000 to \$1M	8 to 15
	From Virtual Laboratory Proposals	1,2	eResearch Collaborations ²	1 to 2 years	\$300,000 to \$1M	5 to 10
	From Research Cloud Node Proposals	1,2	Research Cloud Nodes	1 to 2 years	\$300,000 to \$700,000	6 to 8
Virtual Laboratories	RFP	1, 2	eResearch Collaborations ²	1 to 2 years	\$1M to \$2M	8 to 12
Research Cloud nodes	RFP or EOI	1, 2	Institutions / organisations	1 year	\$1.5M	6
National Servers nodes	RFP or EOI	1	Institutions / organisations	1 year	\$1M	3

¹ See Section 5.1.1 for a description of the staging model.

² Expected applicants include collaborations between eResearch Capability partners and identified research communities (See Section 4.2).

5.1.1 NeCTAR staging model

The delivery of the four Programs will be staged over the period of the NeCTAR Project. The NeCTAR EIF funds will be released in stages to allow for communities to engage at several points in the NeCTAR Project, depending on their readiness. This will also allow NeCTAR to best respond to changing research needs and evolving technologies, and to respond appropriately to the outcomes of the NeCTAR Review, scheduled for early 2012, which will inform the first NeCTAR Annual Business Plan. The terms of reference of the NeCTAR Review will be agreed by the Project Board.

The proposed stages and corresponding amounts are indicative only, and will be subject to approval by the NeCTAR Project Board, taking advice from the Expert Panels, as part of the Annual Business Planning process.

Table 5.2: NeCTAR staging model

Stage	Timing	Activities	Amounts (NeCTAR EIF funds) ¹
NeCTAR Early Activities	Q3 2011	<i>Virtual Laboratories</i>	
		<ul style="list-style-type: none"> Three Early Activity Virtual Laboratories created (Section 5.4) 	\$2.0M
		<i>Research Cloud</i>	
		<ul style="list-style-type: none"> Research Cloud Phase 1 Node created Research Cloud Phase 1 Lead Node Activity 	\$1.5M \$0.5M
TOTAL			\$4.0M
Stage 1	RFP issued Q3 2011 Sub-project funding from Q1 2012	<i>eResearch Tools</i>	
		<ul style="list-style-type: none"> Request for proposals for eResearch Tools From Virtual Laboratory Proposals Research Cloud Application Migration Proposals 	\$7.0M \$2.0M \$3.3M
		<i>Virtual Laboratories</i>	
		<ul style="list-style-type: none"> Request for Proposals for Virtual Laboratories 	\$8.0M
		<i>Research Cloud</i>	
		<ul style="list-style-type: none"> Open Request for Proposals for delivery of Research Cloud nodes Research Cloud Full Access Phase Lead Node 	\$4.5M \$0.5M
		<i>National Servers</i>	
		<ul style="list-style-type: none"> Open Request for Proposals for hosting two additional nodes of the National Servers Program 	\$2.0M
TOTAL			\$27.3M
Stage 2	RFP issued Q2 2012 following the NeCTAR Review Subproject funding from Q3 2012	<i>eResearch Tools</i>	
		<ul style="list-style-type: none"> Through Virtual Laboratory Proposals Research Cloud Node Application Migration Proposals 	\$1.0M \$1.0M
		<i>Virtual Laboratories</i>	
		<ul style="list-style-type: none"> Request for proposals for Virtual Laboratories 	\$5.0M
		<i>Research Cloud</i>	
<ul style="list-style-type: none"> Open call for Expressions of Interest for provision of Research Cloud nodes 	\$3.0M		
TOTAL			\$10M

¹ Remaining NeCTAR EIF Project Funds allocated as per Table 6.1: Project Directorate (\$4.7M); construction of preliminary Lead Node of National Servers Program (\$1M; the University of Melbourne as contracted under Funding Agreement).

5.2 Sub-contracts

The NeCTAR infrastructure will be delivered through the formation of a series of Sub-projects. These Sub-projects will be enacted through Sub-contracts signed between the University of Melbourne (as Lead Agent for NeCTAR) and the institution or organisation that undertakes to deliver the Sub-project.

5.2.1 Sub-contract delivery arrangements

The subcontractor must be a legal entity and is referred to in this document as the Sub-contract Lead.

It is expected that some Sub-projects (eResearch Tool and Virtual Laboratory Sub-projects) will be delivered by a collaboration of parties. Where this is the case, the University of Melbourne will enter into a sub-contract with a single legal entity, the Sub-contract Lead, which is designated to represent the collaboration. Sub-project proposals will be required to nominate the Sub-contract Lead.

Other Sub-projects (eg Research Cloud and National Servers Sub-projects) will be delivered by single institutions or organisations which will enter into contractual arrangements with the University of Melbourne.

In all cases, the Sub-contract Lead will:

- sign the Sub-contract with the University of Melbourne;
- receive the associated funding for distribution to other Sub-project participants as appropriate;
- be accountable to the University of Melbourne for progress against agreed milestones and delivery of the requirements of the Sub-contract;
- provide the University of Melbourne with a detailed Sub-project plan to be agreed to as part of the Sub-contract negotiation;
- provide the project management resources necessary for the successful delivery of the requirements of the Sub-contract;
- be responsible for ensuring that the delivery and payment milestones described in the Sub-project plan are met;
- execute necessary agreements with collaboration partners (if applicable); and
- represent the collaboration in contractual arrangements with the University of Melbourne (if applicable).

Sub-contracts will include phased milestones that reflect the activities and deliverables of the Sub-project plan. NeCTAR payments to the Sub-contract Lead will be paid on delivery of these phased milestones.

The Sub-contracts will also include a set of performance indicators for each Sub-project against which the success of the Sub-projects will be formally evaluated.

5.2.2 The University of Melbourne delivery arrangements

The Sub-contracts signed between the University of Melbourne (as NeCTAR Lead Agent) and the institution, organisation, or research group that undertakes to deliver the NeCTAR Sub-

projects is the mechanism through which the project control arrangements will be specified. The control arrangements will include Sub-project deliverables, timelines, milestone payments, and mechanisms for dispute resolution.

As the University of Melbourne is also eligible for the delivery of NeCTAR projects but is unable to form a Sub-contract with itself, a separate legal instrument, described below, has been established to manage, monitor and control this aspect of the NeCTAR infrastructure delivery.

The University of Melbourne's standard project management approach, which utilises PRINCE2 methodology, will be employed for the delivery of all NeCTAR-funded UoM Sub-projects. Detailed information about this approach is available from www.its.unimelb.edu.au/projects.

This process will result in the development of appropriate project management documentation, including a Project Brief, Business Case, and Project Management Plan. Collectively, these documents will define the scope of the Sub-project, acceptance criteria, and a detailed implementation plan.

A separate UoM accounting cost centre will be established for each NeCTAR-funded UoM Sub-project to enable the separate tracking and reporting of Sub-project budgets.

The University of Melbourne will bid for Sub-projects through the competitive allocation mechanism outlined at Section 5.3.

The only exceptions to this are the Lead Nodes of the National Servers Program and the Research Cloud. The University of Melbourne was contracted to deliver the Lead Node of the National Servers Program under the NeCTAR EIF Funding Agreement signed with the Commonwealth. The University of Melbourne is also identified in this Final Project Plan, with the agreement of DIISR, as responsible for establishment of the first Node of the NeCTAR Research Cloud, including the Lead Node responsibilities for the Research Cloud.

5.2.3 Co-investment

Success of the NeCTAR Project will depend on sufficient co-investment from the research community in order to ensure maintenance and ongoing operation of the developed infrastructure, and to ensure engagement and support of the end users. In all cases, there is a requirement for Sub-contractors to ensure that the NeCTAR infrastructure developed through the Sub-contract continues to operate until at least 30 June 2014, or for an agreed period beyond this.

The NeCTAR EIF funding can be used to fund capital development and initial installation of infrastructure but not operational costs. Successful Sub-project proposals or expressions of interest must therefore demonstrate competitive co-investment models.

It is anticipated that Sub-contractors will deliver co-investment to the NeCTAR investment in the form of in-kind or financial contributions to the Sub-project (see Table 6.1). Accordingly, NeCTAR is seeking co-investment at least equivalent to the NeCTAR investment in Sub-

projects. In situations where an organisation is allocated more than one Sub-project co-investment commitments may be aggregated across these Sub-projects.

Proposed co-investment could include:

- cash contributions;
- operational support, including funding of operational costs;
- ongoing maintenance;
- user technical support;
- engagement and outreach; and
- training.

Although the co-investment can be aggregated at the level of the Sub-contract, the source of the co-investment may be any party named as a participating organisation in the Sub-contract. This would allow the Sub-contract Lead to share the co-investment responsibility with its partners. It would also enable research groups to contribute their expertise as co-investment where appropriate, while participant institutions may cover other aspects, such as ongoing maintenance of physical infrastructure.

The source and nature of the expected co-investment varies across the NeCTAR Sub-projects.

For the Virtual Laboratories, eResearch Tools and the migration of applications to the Research Cloud, co-investment against the NeCTAR funding must be adequate to fully fund the operation, maintenance and training needs of the built infrastructure.

As illustrated in Table 6.1, the co-investment sought for delivery of these elements is at the ratio of at least 1:1. While cash contributions are encouraged (and, for the Virtual Laboratories, may come via a State Government investment), this co-investment is expected to include commitments from the operator of the infrastructure in order to cover:

- operational support;
- ongoing maintenance;
- user technical support;
- engagement and outreach; and
- training.

The Sub-contractors selected to deliver the nodes of the Research Cloud and National Servers programs will be enduring institutions or organisations with a demonstrated capability in this area.

These institutions or organisations will be expected to contribute co-investment consisting of a mixture of cash (which may also come via a State Government investment) and in-kind contributions to cover:

- ongoing operational costs, including utilities charges;
- ongoing maintenance; and
- user technical support, through a help-desk or user training.

As illustrated in Table 6.1, the co-investment sought for delivery of the Research Cloud nodes is at the ratio of at least 1:1, while the co-investment sought for the delivery of the National Servers nodes is at the ratio of at least 1:1.3. The co-investment required for the National Servers nodes is greater due to the higher service levels associated with this infrastructure and the costs of running the managed Virtual Machines.

5.2.4 Access and pricing

In general, the systems and services supported by the investments in the NeCTAR infrastructure will be part-funded by the Commonwealth and part-funded by other participants.

The Commonwealth intends that its funding shall be provided as a contribution to Sub-projects to be expended on appropriate items within a total Sub-project budget.

It is an expectation of the Commonwealth that the operators of the resulting Sub-project infrastructure shall make it available to research activities undertaken by publicly funded researchers, wherever possible and appropriate. Exceptions to this may include restrictions on access to tools or services arising from data privacy requirements resulting from research ethics agreements or requirements that arise under the Australian Code for the Responsible Conduct of Research, and these will be outlined in Sub-project proposals. In such cases, access to data or services may be restricted to identified researchers or research communities according to ethical or privacy requirements. These exceptions would be considered by the relevant Expert Panel at the time the proposal is submitted for evaluation.

The access and pricing policies developed by NeCTAR with input from the eResearch Platforms Expert Panel will be developed from the EIF Implementation Principles and the NeCTAR Objectives and may include a policy that allows for the recovery of operational costs or all costs, where the Project Board determines this is appropriate. They may also provide for organisations to purchase a portion of the Research Cloud or National Server capability for their priority use at full cost recovery.

Cost recovery for Research Cloud or National Server capability will be negotiated at the time that the Sub-contract for delivery is developed. The operational costs associated with the provision of the Research Cloud nodes and the hosting of the National Servers nodes will require a consistent pricing regime. Typically, early operational costs would be part of the co-investment with provision made in later years for cost recovery to cover service operation. Further guidance on cost recovery will be released to the sector in a timely manner.

Access and pricing models, such as institutional subscription, will be considered, subject to approval by the Project Board.

5.2.5 Intellectual property

The Commonwealth intends that the University of Melbourne and its Sub-contractors shall enable access to and dissemination of the intellectual property arising from the NeCTAR Project for the purpose of the NeCTAR Project.

The intellectual property created in each Sub-project is expected to remain with the Sub-project participants, unless prohibited by the terms of software or other similar licence or otherwise by background intellectual property arrangements. The treatment of intellectual property in each Sub-project shall be defined in the respective Sub-project contract taking into account the requirements of that Sub-project's participants.

The general expectation is that Sub-contractors will enable broad access and dissemination of the infrastructure they create, by use of Creative Commons or other open licence regimes.

As a principle, the University of Melbourne will use its best endeavours to maximise the extent to which intellectual property generated in the NeCTAR Project is appropriately accessible through the use of open content licence regimes such as Creative Commons.

5.2.6 Performance Evaluation

NeCTAR Sub-projects will be required to report regularly on progress against agreed Performance Indicators. The Performance Indicators may vary between Sub-projects according to Sub-project priorities and implementation strategies. The NeCTAR Directorate will nominate a range of Performance Indicators common across Sub-projects to support overall NeCTAR Project and Program performance evaluation. These common Performance Indicators will be consistent with the NeCTAR Project Performance Indicators and performance evaluation processes described in Section 8.3.

Responses to the Request for Proposals will be required to nominate additional Performance Indicators for the Sub-project for agreement with NeCTAR.

Additional detail on the Performance Indicators and reporting requirements will be provided with the Request For Proposals in each of the NeCTAR Programs.

5.3 Sub-project evaluation and selection

Two Expert Panels—the Research Capability and the eResearch Platforms Expert Panels—will be established as sub-committees of the NeCTAR Project Board to provide expert advice to the Board on:

- technical strategy;
- the merit and priority allocation criteria that should be applied to the allocation of Sub-projects and access to the resulting infrastructure; and
- the evaluation and selection of Sub-projects for funding under the NeCTAR Project.

The Research Capability Expert Panel will ensure that the NeCTAR Project delivers infrastructure to meet researchers needs and the eResearch Platforms Expert Panel will provide domain based ICT expertise.

It is anticipated that there will be sufficient overlap of membership between the two Expert Panels to ensure coherence of strategy, and to enable the deliberations of the Research Capability Expert Panel to receive appropriate advice with regards to the practices and operating realities of eResearch systems.

The Project Board will approve the final membership of the Expert Panels and review appointments annually.

5.3.1 Research Capability Expert Panel

This Panel will be formed to:

- recommend criteria to the NeCTAR Project Board for the prioritisation of NeCTAR investments in infrastructure that responds to specific research problem-based needs (that is, infrastructure developed under the eResearch Tools and Virtual Laboratories programs); and
- evaluate proposals received through the Requests For Proposals issued under the eResearch Tools and Virtual Laboratory Programs; and recommend preferred proposals to the Board for approval.

This Panel will be composed of national research capability experts with broad discipline representation from across the national research community. Members will have expertise in the development and operation of programs to deliver quality national research outcomes, as well as an understanding of the role eResearch can play in the delivery of improved research outcomes.

There will be a call for nominations for membership of the Research Capability Expert Panel. The NeCTAR Directorate will make recommendation to the Project Board for their approval. It is expected that the membership will provide broad representation of research, particularly the Super Science and NCRIS Capability areas.

The final criteria for evaluation of proposals will be made available to the sector along with the issuance of the NeCTAR Request for Proposals (RFPs). These criteria for the assessment of proposals will be developed with due regard to the EIF Implementation Principles and the NeCTAR Objectives, and will take into account the following broad factors:

- the extent to which an eResearch Tools or Virtual Laboratories proposal will deliver a transformative impact for an identified Research Community;
- the proposed co-investment (noting that co-investment can be aggregated at the Sub-contract level);
- the strategic principles for the eResearch Tool and Virtual Laboratory Programs described in Section 2.5 Strategic Approach;
- the demonstrated track record of the proposal partners in the development and operation of eResearch infrastructure; and
- the extent to which the proposal leverages or builds upon existing research and eResearch infrastructure, including:
 - the NeCTAR Research Cloud and National Server Programs;
 - NCRIS and Super Science investments in networking, supercomputing, data management, and storage and collaboration infrastructure;
 - common authentication and authorisation infrastructures such as that operated by the Australian Access Federation (AAF);
 - institutional research infrastructure and capabilities; and
 - other significant research support capabilities.

The evaluation criteria will also take into account the following priority and merit principles identified in the responses to the NeCTAR Consultation Paper:

- alignment with national research priorities;
- the development of infrastructure that can be re-used across disciplines;
- the development of infrastructure that utilises existing developments;
- the development of infrastructure in response to a defined need not met through existing systems;
- investment in areas of proven capability and community readiness and willingness to engage;
- investment in standards-based and open source development;
- investment in proposals with a demonstrated model for future sustainability of the infrastructure; and
- investment in Virtual Laboratories that bring together existing research infrastructure investments.

5.3.2 eResearch Platforms Expert Panel

This Panel will be formed to:

- make recommendations to the Board regarding the structure and preferred hosts of the Research Cloud and National Servers programs;
- evaluate proposals received and recommend preferred Sub-projects to the Board for funding;
- advise the Board regarding the criteria and policies that should guide the allocation of resources across disciplines or to user groups; and
- monitor proposals closely in order to avoid duplication of funded infrastructure development.

There will be a call for nominations for membership of the eResearch Platforms Expert Panel. The NeCTAR Directorate will make recommendation to the Project Board for their approval. It is expected that membership will include national eResearch experts with broad representation from across the eResearch community. Members of the panel will have an expert understanding of the role of technology in research and current knowledge of international best practice. They will be able to identify local expertise as well as the gaps in existing infrastructure that the NeCTAR investments should be targeted to fill.

In evaluating proposals, the Panel will take into account the following factors (in no particular order):

- the capability of the proposed Sub-contractor to adhere to the common framework for interoperability as established by the Research Cloud Working Group;
- co-location of a proposed node with high performance computing and/or data storage capability;
- the proposed co-investment (noting that co-investment can be aggregated at the Sub-contract level);

- the extent to which the proposed development benefits the national research community;
- the extent to which the proposed development leverages or builds upon existing Super Science investments in networking, supercomputing, data management, and storage and collaboration infrastructure, as well as other significant research support capabilities.

5.4 NeCTAR Early Activity Virtual Laboratories

NeCTAR Early Activities are defined as NeCTAR Project delivery activities that are funded under an accelerated process for approval by the NeCTAR Project Board and subject to agreement with DIISR.

NeCTAR will establish up to three early Virtual Laboratories under the NeCTAR Early Activities, enabling NeCTAR to deliver early positive outcomes for the research community. Overall funding for the NeCTAR Early Activities is capped at \$2M from the overall NeCTAR Project budget. These Virtual Laboratories will initially be allocated up to \$700k, with the opportunity to refresh this funding through Rounds 1 or 2 of the Virtual Laboratory Request for Proposals (RFP) process.

The Early Activity Virtual Laboratories will create exemplar Sub-projects that demonstrate the enhanced capability that the application of eResearch tools and services can deliver for the research community.

Each Virtual Laboratory will target a well-described, significant research challenge and connect resources of precinct or national extent.

The Virtual Laboratories program in its entirety will be limited to funding integration activities for groups that are already at an advanced stage of eResearch development, and with a demonstrated user base for existing eResearch capability. The funding available under the Virtual Laboratories program (see Section 6) is intended to assist these groups to undertake development work aimed at integrating existing capabilities in a short period of time in order to add value and deliver enhanced collaborative research outcomes.

On this basis, it is considered that the Virtual Laboratories program is well placed to deliver early positive examples of eResearch development under the NeCTAR Project.

The criteria for selecting the NeCTAR Early Activity Virtual Laboratories are as follows:

1. The recipient research community is ready and willing to respond quickly.
2. The proposed Virtual Laboratory aligns with an existing NCRIS or Super Science Capability.
3. There is a significant anticipated impact for the recipient researcher community.
4. The recipient research community is national in scope.
5. There is a demonstrated high level of commitment and identified co-investment from the research community.
6. An operator has been identified that will provide on-going support and sustainability of the Virtual Laboratory.

7. The proposed Virtual Laboratory will utilise NeCTAR and other national infrastructure.

With DIISR's agreement, the proposed process for recommending the NeCTAR Early Activity Virtual Laboratory Sub-projects to the Board will be as follows:

- the NeCTAR Directorate will carry out consultation with potential recipient communities;
- the NeCTAR Directorate will form a recommendation that will come to the Board; and
- this recommendation will be accompanied by a full report against the selection criteria, as well as a proposal outlining the development activities to be undertaken in each Sub-project.

Following approval by the Board, successful Virtual Laboratories will be required to develop a full Project Plan, outlining the implementation detail, for agreement with the NeCTAR Directorate.

Subject to agreement with DIISR, no more than \$2M of the total funding envelope nominated for NeCTAR Early Activities will be released for the development of the NeCTAR Early Activity Virtual Laboratories, with the funding available for each Laboratory to exceed no more than \$700k.

The NeCTAR Early Activity Virtual Laboratories will have an opportunity to apply for further development funding through the Request for Proposals in Stage 1 and Stage 2.

5.5 NeCTAR Research Cloud Implementation

The early establishment of an initial NSP and Research Cloud service provides for the timely establishment of the underlying infrastructure required for the Research Tools and Virtual Laboratory programs, as described in Section 2.5 and illustrated in Figure 4.1. NeCTAR will fund the establishment of the first node of the Research Cloud at the University of Melbourne. Additional nodes of the Research Cloud will be selected through an open Request For Proposals process. The University of Melbourne is also identified to operate as the Lead Node of the Research Cloud with the responsibilities described in Section 4.3.1.2.

It is consistent with the University of Melbourne's role as Lead Agent responsible for the NeCTAR outcomes to assume the responsibilities as Initial Node of the Research Cloud. This will enable it to maintain direct control over the timeliness, technical quality, and service delivery standards associated with this crucial first round of underlying NeCTAR infrastructure development.

The University of Melbourne has provided an agreed Implementation Plan to the NeCTAR Directorate, specifying implementation details, including budget, deliverables and timeline. This includes a statement of the co-investment commitment to cover maintenance and operation of the resulting infrastructure.

NeCTAR has selected the OpenStack Cloud Computing Framework (<http://openstack.org>) as the cloud middleware for operating the NeCTAR Research Cloud (see Section 5.5.4 below).

The OpenStack community has attracted substantial support from leading commercial and research sector cloud computing organisations. OpenStack was initially formed of a partnership between NASA and RackSpace (a major industry provider of cloud storage solutions). NeCTAR and the University of Melbourne (as Lead Node) will engage with the OpenStack consortium and community to:

- Ensure best-practice deployments of cloud computing infrastructure
- Maximise opportunity for interoperation with international OpenStack-based research cloud initiatives
- Ensure the needs of the Australian research sector are accommodated in the OpenStack development roadmap and planning

5.5.1 Implementation Strategy

The NeCTAR Research Cloud seeks to maximise value to the research sector by adopting strategies and practices from the commercial cloud computing industry for cost effective deployment of computing infrastructure; including:

- Leveraging commodity-class hardware deployments to maximise the achieved value of capital investments;
- Achieving reliability and robustness of service through redundancy and planned recovery from failure;
- Reducing operational costs through centralised monitoring, configuration and deployment;
- Implementing de-facto industry standards-based APIs for the deployment of services and applications on the NeCTAR Research Cloud

Additionally, NeCTAR will engage with major international research cloud initiatives to adopt best practice in deployment of cloud infrastructure to meet the specific needs of the research community.

It is expected that the majority component of the computational resources deployed at the nodes of the Research Cloud will offer value-for-money consistent with commodity-class computing infrastructure typically deployed in commercial cloud offerings. Research Cloud Node proposals are nonetheless welcome to identify a portion of their offerings to include hardware and software configurations which meet specific needs of identified research activities. Specialised configurations would be made available to the Research Community under the cloud computing APIs through availability zones within a Node's overall cloud offering. Examples of specialised configurations which could be offered include GPU-enabled zones, large memory zones, high-security zones, zones architected to support High Throughput Computing and zones offering access to restricted-licence software.

The NeCTAR Research Cloud will be deployed in two phases:

NeCTAR Research Cloud Phase 1:

- Operating from August 2011 to February 2012
- Comprising a single node at the University of Melbourne

- Allocation of resources available by application to the University of Melbourne and approval by the NeCTAR Director.

NeCTAR Research Cloud Full Access Phase:

- Operating from February 2012
- Comprising up to 5 additional nodes (selected from an RFP process)
- Operating under the governance of the NeCTAR Platforms Steering Committee
- Allocation of resources available via:
 - On-demand allocation requests up to a specified resource cap
 - Merit Allocation (see Section 4.3.1.4)
 - Identified “Partner Shares” at specific nodes

5.5.2 NeCTAR Research Cloud Phase 1

The University of Melbourne will deliver the first node of the NeCTAR Research Cloud according to the following implementation schedule:

- August 2011: Go-Live – Production Node
 - Limited service offerings and simple monitoring in place
 - Initial hardware deployment
- October 2011: Expanded hardware deployment
- February 2012: Full service operations phase
 - Including operation across redundant data centres

Further detail is available in the University of Melbourne’s “NeCTAR Research Cloud Node Implementation Plan” available from the NeCTAR website: <http://nectar.org.au>.

Additionally, the University of Melbourne is also named as Lead Node of the Research Cloud. In this capacity the University of Melbourne will be funded to establish and deploy infrastructure and service offerings to support the Full Access Phase of the Research Cloud; including policies, service descriptions, implementation procedures and documentation. Further detail is provided in the University of Melbourne’s “NeCTAR Research Cloud Lead Node Implementation Plan – Initial Phase” available from the NeCTAR website. The Implementation Plan covers operation during Phase 1. A separate Implementation Plan for the Full Access Phase will be prepared for approval by the NeCTAR Project Board before February 2012.

During Phase 1 of the NeCTAR Research Cloud, access to resource allocations will be through application to the University of Melbourne and approval by the NeCTAR Directorate. Priority will be given to applications which align with national research priorities, including NCRIS and EIF priority areas, and which provide value to NeCTAR as exemplars of research utilisation of cloud computing infrastructure. Whilst a production-level service will be offered in Phase 1, there may be a limited feature set available to users during this phase.

It is expected that Early Activity Virtual Laboratory Sub-projects will be granted early access to the Research Cloud infrastructure as a platform for implementation and deployment of their associated services and applications.

NeCTAR will conduct an architectural and operational review of the Research Cloud Phase 1 implementation in November 2011 in order to reassess the design architecture and implementation before commencement of the Full Access Phase.

5.5.3 NeCTAR Research Cloud Full Access Phase

In the Full Access Phase, the NeCTAR Research Cloud Program will operate under the governance arrangements described in Section 4.3. The NeCTAR Platforms Steering Committee and the NeCTAR Platforms Technical Advisory Group will be convened in late 2011, after the successful Stage 1 RFP Node proposals have been announced.

A suite of Resource Allocation Models will be finalised through agreement with the NeCTAR Research Cloud Steering Committee, taking into account responses from the research sector through the NeCTAR consultation process and the EIF principles. The final Resource Allocation Models will be submitted for approval by the NeCTAR Project Board before February 2012. The Resource Allocation Models are expected to include:

- On-demand allocation for publicly funded research purposes up to a defined resource quantum (subject to available capacity)
- Merit allocation through the NeCTAR Research Cloud Allocation Committee
- Defined “Partner Shares” at specific nodes of the Research Cloud

The University of Melbourne will continue as Lead Node throughout the Full Access Phase of the NeCTAR Research Cloud. During the Full Access Phase it is expected that some of the responsibilities of the Lead Node may be fulfilled through effort contributed by other participating Research Cloud nodes. The University of Melbourne will work with the other nodes of the Research Cloud through the NeCTAR Platforms Steering Committee to prepare a Full Access Phase Lead Node Implementation Plan for agreement with NeCTAR and approval by the NeCTAR Project Board. This plan may include a proposal for distribution of funds to participating nodes in support of the Lead Node activity.

5.5.4 Research Cloud Infrastructure framework

The Research Cloud Infrastructure Framework (Section 4.3) will provide a consistent interface to the range of applications and services running at the distributed nodes. It will be established to provide a common layer for deployment and management of applications hosted on the Research Cloud.

Users and Developers of applications for the NeCTAR Research Cloud will be advised and strongly encouraged to leverage the de-facto standard APIs (Amazon Web Service APIs) for management and deployment of applications on the NeCTAR Research Cloud. This provides the greatest robustness against disruption due to emerging opportunities to deploy alternate cloud framework implementations and maximises sustainability for research applications and future opportunities for federated deployment on international research cloud infrastructures

The Research Cloud Infrastructure Framework is based on an identified cloud management middleware and has been defined by the NeCTAR Director, taking appropriate advice from the eResearch community through the following process.

Research Cloud Technical Workshop

- A Research Cloud Technical Workshop was held in March 2011 to explore possible frameworks for and the technical design of the Research Cloud.
- Representatives of several international research cloud infrastructure projects and communities were invited to attend the Workshop and discuss exemplar frameworks, as well as policies that facilitate cloud service provision.
- Representatives from potential research cloud node hosts were invited to attend the Workshop.

Research Cloud Working Group

- With approval of the NeCTAR Project Board, the NeCTAR Director established a Research Cloud Working Group to advise NeCTAR with regards to the development of the Research Cloud Infrastructure Framework.
- The scope and composition of the Research Cloud Working Group is as described in the Terms of Reference. The criteria the Research Cloud Working Group used to inform its advice are included in the Terms of Reference.
- The members of the Research Cloud Working Group attended the workshop and participated in and were informed by the presentations and discussion forums of the Research Cloud Technical Workshop.
- The members of the Research Cloud Working Group convened after the workshop to prepare its recommendations to NeCTAR.

The members of the Research Cloud Working Group are all technical experts in cloud technology or the provisioning of virtualised research computing infrastructure.

The detailed recommendations of the NeCTAR Research Cloud Technical Working Group will be published separately by the NeCTAR Directorate.

The proposed Research Cloud Infrastructure Framework is required to support appropriate authentication mechanisms, such as the authentication infrastructure established and operated by the Australian Access Federation (AAF). NeCTAR will fund the extension, where necessary, of the identified Cloud Middleware to support these identified authentication mechanisms.

5.5.3.1 Recommendations of the Research Cloud Technical Working Group

The Research Cloud Technical Working Group have made the following recommendations to NeCTAR:

- That OpenStack (<http://openstack.org>) is the preferred middleware for the NeCTAR Research Cloud implementation, due to:
 - Perceived maturity and scalability of the storage component, based on the SWIFT cloud storage infrastructure. SWIFT has been open-sourced and contributed to the OpenStack project by RackSpace; a leading commercial provider of enterprise cloud storage infrastructure.

- Significant participation by international research and corporate organisations deploying large research cloud infrastructures:
 - Eg. OpenStack has been initially founded by a partnership between NASA and RackSpace.
- Attractive governance model for community and industry partners with a commitment to Open Source middleware development
- Compliance to de-facto industry standard APIs (Amazon AWS: EC2, S3, EBS)
- Well documented and published development roadmap
- That alternative open-source cloud middleware products, Eucalyptus and OpenNebula, are also viable selections for the NECTAR Research Cloud.

Additionally, the Research Cloud Technical Working Group has endorsed the initial NeCTAR Research Cloud deployment strategy such that:

- NeCTAR build a Research Cloud Phase 1 production deployment based on OpenStack at a single initial node of the Research Cloud (University of Melbourne).
- NeCTAR share experience through open collaboration with interested partners in research cloud deployments, including potential future nodes of the NeCTAR Research Cloud.
- NeCTAR conduct a review of the NeCTAR Research Cloud Phase 1 in Q4 2011 to re-assess the implementation architecture based on operational experience, before funding and commissioning of additional nodes of the NeCTAR Research Cloud through the Stage 1 Request for Proposals.

6 Budget and Financial Information

6.1 Value Proposition

The NeCTAR Project is focused on adding and delivering Value against the investment of the Commonwealth Government. It will not operate in isolation, but is required to leverage existing infrastructure components and to attract co-investment from the eResearch community. Active engagement with this community and meeting their requirements is vital to the success of NeCTAR.

The NeCTAR Value Proposition will progress and be refined over time in several specific steps leading to the first business model and Annual Business Plan which is scheduled in the Funding Agreement as due 31 March 2012.

The NeCTAR Requests for Proposals (RFP) are expected to result in about 60 – 90 Proposals to NeCTAR which will include the following financial information:

- What levels of co-investment will be attracted for development and ongoing sustainable operations;
- What is the model for operations and support, and what level of cost-recovery is needed for sustainability;
- What Value (measures of this) are expected to be delivered;

The second and final Annual Business Plan is due on 31 March 2013. At this time, most Sub-projects will be underway, and the business model will be more refined and will be used to reforecast the Annual Business Plan.

6.2 NeCTAR Project budget allocations and expected co-investment

The distribution of the EIF Project funds and expected levels of co-investment for each of NeCTAR's four Programs is outlined in Table 6.1. Note that it is a requirement of all NeCTAR Sub-contracts that Sub-contractors will undertake to operate and maintain the resulting infrastructure (through co-investment) until at least June 2014.

Up to a total of 10% of EIF Project funds may be applied to project administration and delivery over the life of the NeCTAR Project, subject to confirmation of detailed requirements provided in this Plan.

The NeCTAR Project Board may, at its discretion, approve a variation of the budget allocations across the four NeCTAR Programs in the Annual Business Plans, for recommendation to DIISR, after taking appropriate advice from the Expert Panels.

The staged approach to delivery of the Programs will allow the Expert Panels to assess the distribution of funds as part of the NeCTAR Review in early 2012, and recommend variations to the Project Board as needed.

Table 6.1: Anticipated Budget allocations and expected co-investment

Item	EIF \$M	Co-investment expectations		
		Amount	Source	Nature
Project Directorate <ul style="list-style-type: none"> • Leadership • Coordination • Administration 	\$4.7M ¹	\$1.2M	University of Melbourne	Cash and in-kind
TOTAL	\$4.7M	\$1.2M		
Research problem-specific programs				
eResearch Tools	\$14.3M	> \$14.3M	Service Operators	In-kind
Virtual Laboratories	\$15M	> \$15M	Service Operators State gov'mnts	In-kind Cash
TOTAL	\$29.3M	> \$29.3M		
National eResearch platform programs				
Research Cloud	\$10M	>\$9M		
Framework ²	\$1M	\$0M		
Nodes ³	\$9M	>\$9M	Institutions & organisations State gov'mnts	Cash and in-kind
National Servers ³	\$3M	\$4M	Institutions & organisations State gov'mnts	Cash and in-kind
TOTAL	\$13M	>\$13M		
GRAND TOTAL	\$47M⁴	\$43.5M		

¹ Expenditure of EIF Project funds for the Project Directorate is capped at this amount. These funds cover technical and Project leadership, consolidation and coordination of the programs of Sub-projects plus support administration. The current forecast is \$4.0M (see Appendix B). This will be reviewed when the Directorate team is in place. Any difference from the cap will be deployed into the programs of work.

² Includes provision for licence fees and commissioning.

³ Aggregate figures covering investment over more than one node.

⁴ NeCTAR funds will be held in an interest bearing account and the interest earned will be reserved as contingency for expenditure on NeCTAR Project activities as approved by the Project Board. The use of interest earned will be reported through the Annual Business Plans and Annual Report budget.

The breakdown of expenditure for each NeCTAR Program, in addition to the Project Directorate, for each financial year of the NeCTAR Project is shown below (rounded to one decimal place). The figures are forecast only, based on the estimated Sub-project costs in Table 5.1. The final timing of expenditure will depend on when Sub-contracts are signed.

Table 6.2: Forecast budget allocations by year (\$M)

Item	2010-2011	2011-2012	2012-2013	2013-2014	TOTAL EIF \$M
Project Directorate	0.9	1.4	1.4	1.0	4.7
TOTAL	0.9	1.4	1.4	1.0	4.7
Research problem-specific programs					
eResearch Tools	0.0	6.2	7.6	0.5	14.3
Virtual Laboratories	0.0	6.0	7.8	1.2	15.0
TOTAL	0.0	12.2	15.4	1.7	29.3
National eResearch platform programs					
Research Cloud	0.0	4.5	4.8	0.7	10.0
Framework	0.0	0.5	0.5	0.0	1.0
Nodes	0.0	4.0	4.3	0.7	9.0
National Servers	0.5	1.5	1.0	0.0	3.0
TOTAL	0.5	6.0	5.8	0.7	13.0
GRAND TOTAL	1.4	19.6	22.6	*3.4	47.0

*These funds are to be expended by 31 December 2013

6.3 NeCTAR Initiated Activities

While the majority of NeCTAR EIF funds will be expended across the four NeCTAR Programs through the Request for Proposals process, specific provision is provided for the NeCTAR Director to initiate funded activities under the NeCTAR Programs. In order to do this, the NeCTAR Director may direct funds from existing Program allocations to create infrastructure under that Program, in order to realise additional value from emerging opportunities that are not identified through the proposal processes. These activities will be initiated on an exceptions basis to address opportunities that clearly could not be identified or addressed through NeCTAR's open RFP processes, but is clearly beneficial and relevant under one of the Programs.

NeCTAR initiated activities will be proposed by the NeCTAR Director, in consultation with the relevant sub-committees of the Project Board, and approved by the NeCTAR Project Board. The allocation of funding for NeCTAR Initiated Activities will be based on guiding or allocation principles to be agreed with the Project Board before December 31 2011 and are expected to include:

- Funding on any one activity to be capped at \$500,000;
- Eligibility for funded parties to be consistent with established criteria under the relevant NeCTAR Programs;
- Exceptional nature of the initiative which precludes consideration under the open RFP processes;
- Strategic impact of the initiative, benefit and relevance under the NeCTAR Programs;
- Consistency with the NeCTAR objectives and the EIF funding rules; and
- Planning and implementation timeframes being consistent with the normal NeCTAR contractual obligations.

NeCTAR Initiated Activities may be agreed and commenced at any time after these principles are agreed with the Project Board, and are not constrained to the established Stage 1 and Stage 2 RFP cycles. The activities may be implemented through a tender process, or as a Variation to an existing Sub-contract to incorporate the additional scope of the proposed infrastructure. The Director will report initiation and progress on these activities to the Project Board.

Throughout the lifetime of the NeCTAR Project, the EIF funds expended under the NeCTAR Initiated Activities will be capped at a total expenditure of \$1M across the four NeCTAR Programs.

6.4 EIF Milestone Payments

A summary of EIF contributions to the NeCTAR Project (GST exclusive) is below.

Table 6.3: EIF contributions by year

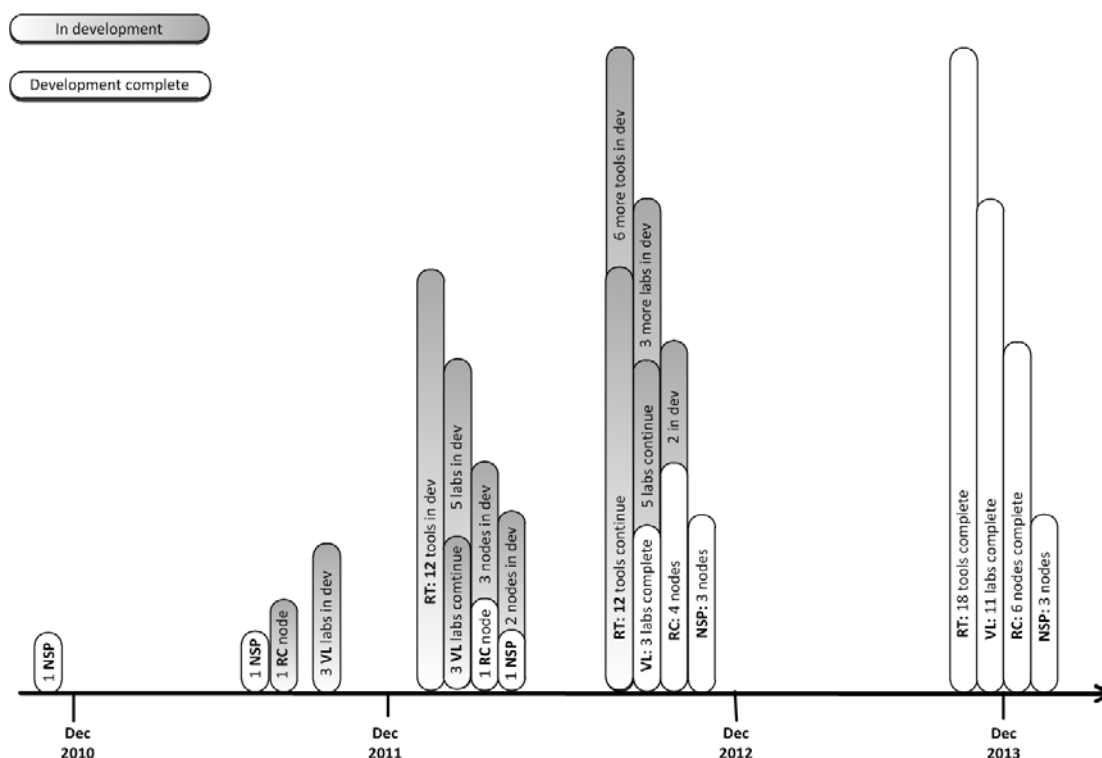
Financial year	Date	Amount	Milestone
2009/10	10 June 2010	\$23M	On provision of a satisfactory National Servers Program Implementation Plan as determined by the DIISR Program Delegate in his/her sole opinion (Note: This has been accepted.)
2010/11	N/A	Nil	N/A
2011/12	30 January 2012	\$12M	On advice to DIISR of the satisfactory commissioning of the Research Cloud Phase 1 service, as determined by the Program Delegate in his/her sole opinion.
2012/13	30 July 2012	\$12M	On advice to DIISR of names of Stage 2 subcontractors and proposed sub projects and that 80% of Stage 1 subcontracts in the Research Tools and Virtual Laboratory Programs have been satisfactorily executed, as determined by the Program Delegate in his/her sole opinion.
TOTAL		\$47M	

7 Key NeCTAR Project implementation details

7.1 NeCTAR Project Milestones

With the implementation of the NeCTAR Project through a staged approach the outputs will increase in number throughout the life of the NeCTAR Project. The figure and table below show the forecast accumulation of outputs from the four Programs. In the figure and table below the number of Sub-projects for each Program is an approximation only based on the estimated Sub-project costs in Table 5.1; the final numbers will depend on the size and number of Proposals that are funded.

Figure 7.1: NeCTAR Program output development and completion timeline



The NeCTAR Project implementation milestones over the life of the NeCTAR Project are shown in Table 7.1. Detailed implementation milestones are provided for the 2011-2012 implementation period. These implementation milestones will be updated with additional detail through the NeCTAR Annual Business Plans.

Table 7.1: NeCTAR Project Implementation Milestones (July 2011-March 2014)

Implementation Milestone	Due Date
Appointment of final Directorate project staff	31 July 2011
Issuance of RFP for Stage 1 Proposals (all programs), including selection criteria and template sub-contract	15 September 2011
Early Activity Virtual Laboratories submitted to DIISR for approval	31 September 2011
Establishment of Selection Committees (Expert Panels)	30 October 2011
NeCTAR Research Cloud Phase 1 Go-Live	30 September 2011
First Annual Report submitted to DIISR for approval	30 September 2011
Selected Stage 1 contractors advised to DIISR for approval	30 November 2011
Appointment of Deputy Director(s)	15 December 2011
Research Cloud Phase 1 Review completed	15 December 2011
EIF Milestone Report 6	31 December 2011
Establishment of NeCTAR Platforms Steering Committee	30 January 2012
Payment Milestone Report 2	30 January 2012
Establishment of NeCTAR Platforms Technical Advisory Group	31 February 2012
Stage 1 Research Cloud and NSP Nodes commence implementation	31 February 2012
Stage 1 eResearch Tools and Virtual Laboratories commence implementation	31 February 2012
Research Cloud Full-Access Phase commences	31 February 2012
NeCTAR Stage 1 Review complete	31 March 2012
Commissioning of Stage 1 Research Cloud and NSP Nodes	31 March 2012
First Annual Business Plan submitted for approval	31 March 2012
Issuance of RFP for Stage 2 Proposals for VL, NSP and RC	30 April 2012
EIF Milestone Report 8	30 June 2012
Payment Milestone Report 3	30 July 2012
Selected Stage 2 contractors advised to DIISR for approval	30 July 2012
Second Annual Report submitted for approval	30 September 2012
Stage 2 Research Cloud and NSP Nodes commence implementation	31 September 2012
Stage 2 eResearch Tools and Virtual Laboratories commence implementation	31 September 2012
Commissioning of Stage 2 Research Cloud Nodes and (if relevant) NSP Nodes	30 November 2012
EIF Milestone Report 10	31 December 2012
Second Annual Business Plan submitted for approval	31 March 2013
EIF Milestone Report 12	30 June 2013
EIF Milestone Report 13	30 September 2013
Third Annual Report submitted to DIISR for approval	30 September 2013
Project Evaluation complete	30 December 2013
Final Report submitted to DIISR for approval	31 March 2014

8 NeCTAR Project Delivery Approach

8.1 Detailed Program Management Planning

An internal project schedule will be developed to track and manage NeCTAR Directorate planning activities along with key external commitments.

- Critical project-level resources and dependencies will be identified:
- A Consolidated Sub-Project Plan will be created along with underlying tools and interfaces.
- A Request For Proposals (RFP) will be developed and will include more detail on selection criteria and other items covered in this document at a high level only
- A Program Manual will be prepared to provide guidance to current and future team members on processes and standards and related matters.
- Workshops of Risk identification and Assessment will be performed, drawing upon the collective expertise of Directorate members. Risks will be stored in a Risk Register and reviewed at regular meetings and ad hoc as needed.
- An Issue Register and Change Register will be created.
- An Asset Register will be maintained to record assets created by the NeCTAR Directorate and the Sub-projects as required under the Funding Agreement.

An RFP will be developed and used as the tool for soliciting Proposals under the NeCTAR Programs. This approach has the following benefits:

- Standardised responses to certain items will help in rapid and demonstrably equitable assessment of the Proposals;
- A standardised structure will facilitate negotiating, agreeing and approving a large number of Sub-projects in a short timeframe; and
- **The above points will maximise the available time to Providers for actual delivery.**

The Consolidated Sub-Project Plan will be prepared after final agreement on the Stage 1 Sub-projects. The Consolidated Sub-project Plan will be based on the Sub-project plans of proposals funded through the RFP process, and will include explicit dependencies between Sub-projects and a consolidated quarterly forecast of expenditure of EIF funds against the funded NeCTAR Sub-projects.

The Consolidated Sub-Project Plan will be updated by the Directorate to accommodate the Stage 2 proposals and significant impacts arising through the NeCTAR Project Change Management processes.

8.2 Risk and Issue Management

NeCTAR Project risk is managed as part of the program management framework. NeCTAR risk management follows the University of Melbourne's risk management guidelines, which are based on the Australian Standard, AS 4360:2004.

8.2.1 Risk Assessment and Planning

The key risks to the NeCTAR Project's outcomes and the risk management strategies to be employed, can be grouped into three major categories:

- project management;
- financial, including sustainability; and
- suitability for purpose, including technical.

At several times during the lifecycle of the NeCTAR Project, the Directorate will conduct risk management workshops to identify key risks and assess their impact. These will be: after the commencement of the team as part of kickoff activities; during Stage 1 initiation; and during Stage 2 initiation. These workshops will be used to create and then update a Risk Register.

The Directorate will determine actions for risk management and include these in the Risk Register.

Significant or changing risks will be raised and discussed in Directorate meetings. NeCTAR Project reports will include the top risks and their status.

8.2.2 Selective Risk reporting and inclusion from Sub-projects

Risk Management will be required from each Sub-project, which will maintain a Risk Register. Reports from Sub-projects will report the top risks each reporting period and highlight any significant changes. This will demonstrate active risk management.

Sub-projects are expected and required to manage their own risks which affect only the Sub-project.

Significant risks which could affect the NeCTAR Project level or could adversely impact other Sub-projects will be brought to the attention of the NeCTAR Project during periodic reporting or on an exception basis if urgency is required.

8.2.3 Risk Management and Escalation

High-level NeCTAR Project risks, as well as mitigation actions, will be reported regularly to the Project Board, and detailed in the Annual Business Plan and Milestone Reports to DIISR.

The Board will approve mitigation and resolution actions for escalated risks and Issues which have potential major impact upon multiple strategic objectives of the NeCTAR Project, or affect delivery under the Funding Agreement.

8.3 NeCTAR Project Evaluation

The evaluation of the NeCTAR Project will be measured against the stated NeCTAR Project Objectives. Quantified metrics will be developed after the Sub-project selection process.

A formal NeCTAR Project evaluation will take place at the end of the NeCTAR Project utilising data collected over the life of the NeCTAR Project from a range of sources, including Sub-contractors, key stakeholders, and information held by the NeCTAR Directorate. Evaluation will consider how final outcomes compare with the initial state, insomuch as this can be determined without initial baseline measurements.

Sub-contractors (Providers) will be contractually required to collect and report to the NeCTAR Directorate on the range of variables identified as Performance Indicators. The NeCTAR Directorate will also engage an independent evaluator to undertake qualitative assessment with key stakeholders.

Indicative NeCTAR Performance Indicators to be used in the final NeCTAR Project evaluation are described at Appendix D. Further detail on performance indicators to be adopted by NeCTAR will be provided In the First NeCTAR Annual Business Report.

9 Glossary and Acronym List

AAF	Australian Access Federation*
Acceptance Criteria	Agreed criteria for determining if a deliverable from a Project is suitable for use. They will be specific and measureable and comprehensive. The Provider will nominate suitable acceptance criteria for each deliverable as part of the Proposal. These will be reviewed during Proposal evaluation and accepted on Sub-contract signing.
ANDS	Australian National Data Service*
ARCS	Australian Research Collaboration Service
Benefit	A benefit describes “why” something is done and is generally a quantified positive outcome.
CAUDIT	Council of Australian University Directors of IT
CAUL	Council of Australian University Librarians
Consolidated Program Plan	An overall schedule which shows all Sub-projects at a high-level, typically standardised phase plus key milestones. Critical interdependencies and critical resources will also be added.
DIISR	Department of Innovation, Industry, Science and Research
Education Investment Fund (EIF)	The source of Commonwealth Government funds for NeCTAR as described in the Funding Agreement.
EOI	Expression of Interest
eResearch capability partner	Those identified organisations within a NeCTAR Sub-project with responsibility to develop and build, or to operate, the infrastructure created by the Sub-project.
eResearch Collaboration	A collaboration of an identified research community and one or more eResearch capability partners to define, develop, build and operate infrastructure under the NeCTAR Sub-projects.
Funding Agreement	The primary instrument describing the contractual relationship between the Commonwealth Government (represented by DIISR) and the UoM as Lead Agent.
ICI	Interoperation and Collaboration Infrastructure*
IMOS	Integrated Marine Observing System*
Issue	An event which has adverse consequences and needs resolution. Often, but not always, arises when identified Risks are triggered.
Lead Agent	The entity responsible for delivering contract where there are multiple parties involved.
Memorandum of Understanding (MoU)	An agreement within the University of Melbourne to deliver a Sub-project in the same manner as a Sub-contract. Required because a legal entity cannot write a contract with itself.
NCRIS	National Collaborative Research Infrastructure Strategy
NeCTAR	National eResearch Collaboration Tools and Resources*
NeCTAR Lead Agent	The University of Melbourne is Lead Agent for the delivery of the NeCTAR Project and has overall responsibility for the management and implementation of the NeCTAR Project in accordance with the reporting and accountability requirements outlined in the Funding Agreement signed between the University of Melbourne and the Commonwealth on 10 June 2010.
NeCTAR Project	The NeCTAR Project is structured to deliver national eResearch infrastructure through four identified Programs. Each NeCTAR

	Program is made up of Sub-projects.
NRN	National Research Networks*
NSP	National Servers Program
PfC	Platforms for Collaboration*
Opportunity	Potential for Value
Outcome	Generally describes an operational state after a project or program.
Output	Generally describes a feature or deliverable that is new.
PHRN	Population Health Research Network*
Portfolio	A collection of programs and projects managed because of a common relationship such as for a particular client or under a particular strategy. Places little emphasis on the relationships and interdependencies between the projects and programs. The highest level of project management as a discipline.
Programs	The NeCTAR Project is broken down into four Programs of work: eResearch Tools; Virtual Laboratories; Research Cloud; and National Servers Program.
Proposal	A response from a Provider to the Request For Proposal or other means of generating work.
Provider	An organization (legal entity) which delivers a Project, with its associated deliverables, under NeCTAR through a Sub-contract.
RC	Research Cloud
RDSI	Research Data Storage Infrastructure
Request For Change (RFC)	A request by either party in the Funding Agreement or a Subcontract to Change the agreed terms, conditions or scope of the contracted works.
Request For Proposal (RFP)	An invitation to submit a proposal for funding through the NeCTAR Programs.
RT	eResearch Tools
Senior Responsible Officer (SRO)	The Executive in the Lead Agent responsible for the performance of the Lead Agent under the Funding Agreement. In NeCTAR, this is the Chief Information Officer (CIO) of the UoM.
Sub-contract	Sitting below the Funding Agreement between DIISR and the University of Melbourne, a Sub-contract is a back-to-back agreement between the University of Melbourne as Lead Agent and a Provider to deliver one or more Sub-projects. In this document, it generally includes the term Memorandum of Understanding.
Sub-project	Sub-projects are formed to deliver specific eResearch infrastructure under the NeCTAR Programs. Each Sub-project is delivered through a Sub-contract or Memorandum of Understanding.
UoM	The University of Melbourne
Value	Additional revenue or other Benefits. These may be direct or indirect and tangible and intangible. Value can also be obtained by reducing adverse consequences.
Value Proposition	How the Value of an Outcome compares to the expense and effort of delivering it.
VL	Virtual Laboratories
VM	Virtual Machine

Weighted Milestone	A key point in a project (milestone) identifiable by the unambiguous attainment of deliverables to defined Acceptance Criteria. The project budget is distributed proportionally (weighted) against each milestone to reflect the capital part and baseline effort part at a fine enough resolution to identify performance problems early and allow corrective actions and assistance.
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* These projects or capabilities are funded under the NCRIS program or Super Science Initiative, or through other assistance from DIISR.

Appendix A NeCTAR Consultation Process

The sector has welcomed the opportunity to shape the NeCTAR Project through an ongoing consultation process. This Final Project Plan has been informed by responses to a consultation process consisting of the release of a Consultation Paper in October 2010 and townhall meetings held in November and December 2010 in Melbourne, Brisbane, Sydney, Hobart, Adelaide, Perth and Canberra. The NeCTAR Consultation Plan and related documents are available for download from www.nectar.org.au.

The consultation process was designed to enable NeCTAR to engage broadly with research communities and research institutions in order to seek feedback on the following aspects:

- the four NeCTAR Project Programs
- the implementation of these Programs
- the budget distribution between the Programs and Sub-projects
- the roles of various sector participants
- the level of co-investment needed to supplement Super Science investment in each of the Programs and Sub-projects, and
- the Sub-project selection and resource allocation processes; and
- the service and functional requirements of the end user community.

Stakeholder groups that the NeCTAR Project has explicitly sought to engage with include:

- university stakeholders, including IT departments, research administration divisions, research groups, and researchers
- major collaborative research groups and projects, including Centres of Excellence and Cooperative Research Centres
- State and Federal Government research organisations and agencies
- State-based eResearch organisations
- NCRIS capabilities
- Super Science initiatives
- collectives such as CAUDIT, CAUL, and the academies.

Sixty-nine written responses were received in response to the NeCTAR Consultation Paper released in October 2010. These responses reflected a high level of sector interest in the NeCTAR Project. Major research groups and disciplines were represented in responses, as were key eResearch organisations, universities, and special interest groups. A full list of responses not marked 'confidential' is at Table A.1 below, and the responses themselves are available in full from the NeCTAR website.

The written responses received were systematically analysed by the NeCTAR Directorate in November 2010. Particular attention was given to any guidance they offered to the Project in terms of:

- the principles that should be used to set the priorities for the infrastructure development;

- the process for actively identifying and approving proposed activities under the various NeCTAR Programs; and
- the process for determining resource allocation to approved activities.

Sector views on the amount and nature of the co-investment required to supplement the Super Science investment in each of the NeCTAR Programs was particularly sought. Feedback provided on this point has been incorporated into Section 5.2.3.

Summary of the Consultation Responses

The number of submitted responses to the NeCTAR Consultation Paper and the response to the NeCTAR Townhall meetings indicate substantial interest in the Project from the sector. The responses supported the robust, sector-led and transparent governance arrangements for the NeCTAR Project. The responses have also supported a balanced program addressing cross-sectoral infrastructure needs as well as the problem-based needs of specific research communities. The community has also expressed a desire for coordination between NeCTAR and the various other Super Science investments and major eResearch initiatives.

Many of the received responses from the consultation provide guidance to the Project on the specific needs of particular research communities and disciplines, and the manner in which they would wish to engage with the NeCTAR Project. These responses have informed the preparation of this Final Project Plan, with its emphasis on engagement with identified research communities (see Section 4.2).

Despite the diversity and breadth of responses a number of overarching themes have emerged from the many submitted responses and questions raised at the Townhall and face-to-face meetings. In particular the responses reflect interest in the following broad themes:

Governance and Sustainability:

- the definition of eResearch needs should be largely researcher-driven
- independent and transparent governance processes are important
- decision-making processes and criteria should be clearly articulated
- the sector is concerned about the sustainability of the infrastructure after the NeCTAR Project end-date

Investment Priorities:

- there is a need to balance the creation of infrastructure that responds to universal needs vs research problem-specific needs
- NeCTAR should avoid duplicating existing offerings
- NeCTAR should leverage institutional investments

Implementation:

- there is a need to ensure coherence of outcomes at the NeCTAR Project level
- there is a need to focus on NeCTAR service delivery

- usability, accessibility and endurance of the resulting infrastructure is a priority
- maintenance, outreach and training are especially important.

Incorporating sector responses into the Final Project Plan

The sector has expressed significant interest in the Governance arrangements of the NeCTAR Project and welcomed sector-led independent and transparent governance arrangements for the Project. The sector's desire for such robust governance arrangements has been implemented through establishment of the sector-based NeCTAR Project Board and through the clearly defined allocation and decision-making processes described in this Final Project Plan (see Sections 5.1 and 5.3).

The following issues arising from the consultation responses have been specifically addressed in this Final Project Plan:

- the four Programs have been refined to respond to the two streams of research community needs—problem-based needs, and broad national needs (Section 4);
- the process and principles for allocating the NeCTAR funds to Sub-projects, including the concept of the Expert Panels and evaluation criteria (see Sections 5.1, 5.3)
- the co-investment principles, size and nature, including identification of co-investment as the mechanism through which user engagement, maintenance and support can be funded (see Sections 5.2.3 and 6.0)
- the staged approach to infrastructure delivery, including the need for NeCTAR to deliver early positive outcomes, and to allow for emerging needs to be accommodated later in the timeline (Section 5.1)

Further Consultation

Sector comment on a draft of the Final Project Plan will be sought through written response after approval to release the document. Following receipt and analysis of the responses received, the draft will be amended and updated as appropriate for review and approval by the independent NeCTAR Project Board and agreement by DIISR.

Table A.1: Non-Confidential Responses to the NeCTAR Consultation Paper

A	- Australian Academy of the Humanities	J	- James Cook University
	- Australian Access Federation (AAF)		- Jianfeng Li
	- AARNet	L	- La Trobe University
	- ACM Administrative Centre		- Laser Interferometer Gravitational Wave Observatory (LIGO) Australia
	- Australian Data Archive	M	- Macquarie University
	- Australian Institute of Marine Science (AIMS)		- Monash University
	- Australian Microscopy and Microanalysis Research Facility (AMMRF)	N	- National Computational Initiative (NCI)
	- Australian Mathematical Sciences Institute (AMSI)		- Neil Thelander
	- Andy Pitman	P	- National Health and Medical Research Council (NHMRC)
	- Australian Nuclear Science and Technology Organisation (ANSTO)		- Peter Blain
	- Anthony Fok		- Population Health Research Network
	- Australian Research Collaboration Service (ARCS)		- Population Health Research Network (NSW & ACT)
	- Ascelin Gordon		- Plant Accelerator
	- Astronomy Australia		- Phenomics Ontology Driven Data (PODD) Project
	- Atlas of Living Australia	Q	- QCIF
	- AuScope		- Queensland University of Technology
	- Australian Animal Health Laboratory	R	- RMIT University eResearch Office
	B - Bill Langford		- Scott Brown
	- Bureau of Meteorology	S	- Semantic Identity
	C - Council of Australian University Directors of IT (CAUDIT)		T - Trevor Powell
- Council of Australian University Librarians (CAUL)	U	- University of Melbourne and Parkville Precinct	
- Centre for Comparative Genomics		- University of Newcastle	
- Central Queensland University		- University of NSW	
- Centre of Excellence for Particle Physics at the Terascale		- University of Queensland	
- CSIRO		- University of Queensland eResearch Lab	
- Curtin University		- University of Sydney	
E - eResearch SA		- University of Tasmania	
G - Geoscience Australia		- University of Western Sydney	
- Gerard Gibbs		- University of Wollongong	
- Griffith University		V	- Victorian eResearch Strategic Initiative (VeRSI)
I - Integrated Marine Observing System (IMOS)	- Victorian Partnership for Advanced Computing (VPAC)		
- Intersect			
- Issam Ibrahim			
- iVEC			

Appendix B NeCTAR Project Governance and Management

B.1 NeCTAR Project Board, Project Directorate, and Governance

B.1.1 Project Board

The NeCTAR Project Board is the independent body providing strategic guidance to The University of Melbourne and the NeCTAR Director with regards to the NeCTAR Project objectives, delivery and progress.

The Project Board Terms of Reference define the membership of the Board and the scope of its operations. The Project Board Operating Procedures define the manner in which the Board will undertake its activities.

The Project Board is led by an Independent Chair, and includes the Deputy Vice-Chancellor (Research), The University of Melbourne or nominee, a senior representative from the CSIRO (to be appointed), a senior representative from another Australian research intensive University and at least five other members.

The NeCTAR Director attends Project Board meetings in an ex-officio capacity and does not vote.

The Independent Chair of the NeCTAR Board, Dr Graham Mitchell, is also a member of the Australian eResearch Infrastructure Council (AeRIC) and in that capacity is called upon to provide advice to the Department on the Department's eResearch investments, including the NeCTAR Project. This provides further links between NeCTAR and other national eResearch infrastructure activities.

The Board:

- provides strategic guidance to the University of Melbourne and to the NeCTAR Director;
- monitors the overall strategic direction of the NeCTAR Project and ensures the NeCTAR Project is focussed on the development of infrastructure capable of having a national impact;
- receives and approves Annual Reports and the Final Report on NeCTAR Project performance;
- approves the Final Project Plan and Annual Business Plans, which include implementation milestones and budget allocations;
- endorses merit and priority allocation processes adopted by the NeCTAR Project;
- endorses the appointment process and the appointment of the NeCTAR Director, noting that the nominated candidate must be found acceptable by the University of Melbourne;
- advises and assists the University of Melbourne in the management of project risk; and
- provides other advice and input as required.

Project Board members have been appointed for their outstanding abilities to guide the NeCTAR Project. They are senior people able to take a broad, national, collaborative

perspective and include persons with previous experience which collectively covers the following areas:

- corporate governance;
- financial/business management;
- research and development activities;
- information and communications technologies;
- international and national activities in developing and delivering eResearch infrastructure and services; and
- data-intensive research.

The appointment of the Project Board Chair and Project Board members are for the period of the NeCTAR Project.

B.1.2 NeCTAR Project Board Sub-committees

Sub-committees of the Project Board will be established to:

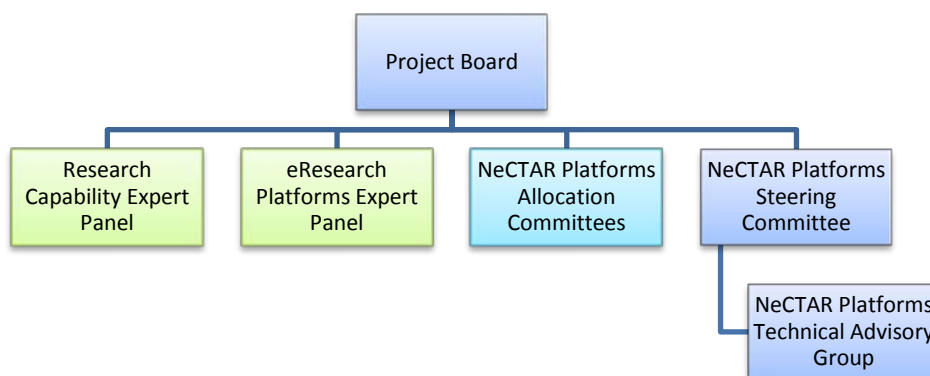
- develop and operate priority and merit allocation systems in order to recommend Sub-projects to the Project Board;
- determine appropriate access mechanisms and resource allocation principles; and
- provide strategic and technical advice.

Such committees will have suitable membership drawn from the research community and allocate resources using principles and processes consistent with the expectations of the community.

Sub-committees will operate according to their own Terms of Reference and Operating Procedures, which will be developed in discussion with the Project Directorate and Project Board, and submitted to the Project Board for approval. The NeCTAR Directorate will provide support for the sub-committees.

Sub-committees of the Project Board that will be established are shown in Figure B.1.

Figure B.1: NeCTAR Project Board Sub-committees



The sub-committees to be established are:

- The Research Capability Expert Panel and the eResearch Platforms Expert Panel

- To evaluate Proposals submitted in response to the NeCTAR Requests For Proposals and recommend proposals for approval to the NeCTAR Project Board (Section 5.3.2)
- The NSP Allocation Committee and the Research Cloud Allocation Committee
 - To review and approve requests for allocation of resources on the National Server Program and Research Cloud (Section 4.3.1.4 and 4.3.2.2)
- The NeCTAR Platforms Steering Committee
 - To provide oversight and strategic guidance to the participants in the NeCTAR Research Cloud and National Server programs to achieve the NeCTAR Project objectives (Section 4.3).
 - A NeCTAR Platforms Technical Advisory Group will also be established under the NeCTAR Platforms Steering Committee (Section 4.3).

The establishment of additional sub-committees at a future point in time is at the discretion of the Project Board.

B.1.3 NeCTAR Project Director

The NeCTAR Project Director coordinates the strategic vision of the Board, instructions and approvals from DIISR and the University of Melbourne while collaboratively working with sub-contracted parties to deliver eResearch infrastructure in a consistent, high-value, realistic and attainable manner.

The Project Director:

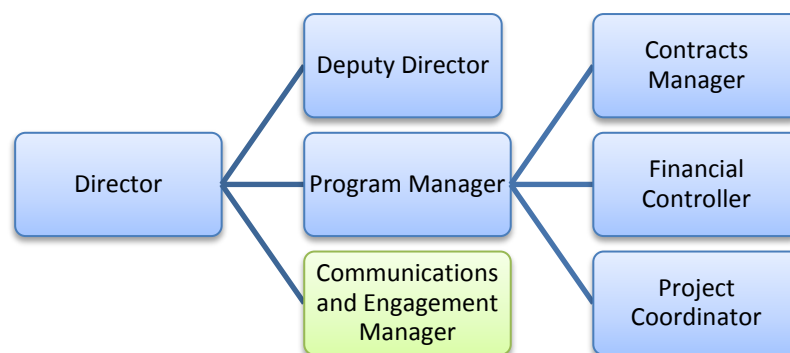
- supports the Project Board in its role;
- undertakes activities as required for the proper performance of the NeCTAR Project;
- receives advice from the Project Board with regard to the overall strategic directions of the NeCTAR Project and the management and performance of the NeCTAR infrastructure in accordance with the Funding Agreement and the longer-term national strategic goals that inform the NeCTAR objectives;
- develops, proposes and oversees activities that implement the objectives of the NeCTAR Project;
- liaises with DIISR on a regular basis in relation to the status of the NeCTAR Project and seeks approval from DIISR as needed, based on recommendations of the Board;
- leads the Project Directorate and manages other staff as may be appointed for the purposes of the NeCTAR Project by the University of Melbourne; and
- provides strategic direction to the NeCTAR Project across the four NeCTAR Programs through strategic liaison with stakeholders, co-investors and participants in NeCTAR to deliver infrastructure that is functional and viable over the long term to meet the needs of the national research community
- Attends the NeCTAR Board meetings as an Ex-Officio member
- Chairs the Board Expert Panel (Allocation and Merit) sub-committees
- Represents the NeCTAR project at external events
- Ensures appropriate communication across all stakeholders and relevant parties, nationally and abroad, to facilitate the best outcome for the project.

B.2 The NeCTAR Project Directorate

The Project Directorate, under the leadership of the Project Director, provides technical and architectural design and alignment, while managing and co-ordinating the efficient and effective delivery of the Sub-projects. The Directorate also has a key communications role, initially during the design and building of the services and later to encourage and reinforce uptake by users of the delivered services.

The structure of the Project Directorate is shown in Figure B.2 below, and the high-level roles and responsibilities are described in the following sections. The positions described are to be budgeted from EIF funds, with the exception of the Communications and Engagement Manager which is funded through co-investment from the University of Melbourne (see Section B.2.7 below).

Figure B.2: NeCTAR Project Directorate Structure



The Communications and Engagement Manager role will be funded through co-investment from the University of Melbourne with the remaining roles funded through EIF funds.

B.2.1 NeCTAR Deputy-Director

The Deputy-Director will be responsible for the coordination of one or more specific NeCTAR Programs, working under the Director and in close co-operation to maintain a shared vision.

The Deputy-Director will be responsible for providing expert eResearch input and advice to the NeCTAR Project, its governance bodies, and its key stakeholders with respect to the development and ongoing delivery of a cohesive strategy for the Project. The Deputy-Director maintains strong relationships with stakeholders of the NeCTAR Programs, including members of the national research community.

Key Responsibilities include:

- Represent the NeCTAR Directorate on selected sub-project and program steering committees, develop and leverage formal and informal networks with key stakeholders across the national research and eResearch communities in order to facilitate the collaborative delivery of the NeCTAR infrastructure and achievement of NeCTAR Project goals
- Collaboratively develop a cohesive strategy for the NeCTAR Project and provide input and advice to the NeCTAR governance bodies

The Deputy Director role may be implemented as a single full-time appointment or as two half-time appointments, subject to NeCTAR objectives and the suitability and availability of candidates. It is expected that the Deputy Director role(s) may be filled through appointment or secondment at institutions other than the University of Melbourne.

B.2.2 Program Manager

The Program Manager reports to, and will work closely with, the NeCTAR Project Director and manage the full suite of business, program & portfolio management, and administrative operations of the NeCTAR Project.

Key Responsibilities include:

- Manage the NeCTAR Project Budget, forecasting and reporting requirements in conjunction with the University financial services
- Lead, manage and deliver the NeCTAR business and administrative work streams
- Work with key stakeholders at the University of Melbourne to coordinate the business and administrative requirements of the NeCTAR Project, and to address any gaps

B.2.3 Communications and Engagement Manager

The Communications and Engagement Manager is responsible for development and implementation of the NeCTAR communications strategy as well as stakeholder management and engagement. The role reports to the NeCTAR Director.

Key Responsibilities include:

- Develop and implement the Stakeholder and Communications Strategy and the Communications Plan for the Project to achieve awareness, acceptance and adoption by the sector of the developed NeCTAR infrastructure.
- Coordinate the development and implementation of targeted communication strategies and plans to support strategic information flow.
- Develop and manage Project communication channels such as the Project website, newsletters etc

The Communications and Engagement Manager is funded through co-investment from the University of Melbourne.

B.2.4 Financial Controller

The Financial Controller is responsible for assisting the Program Manager in managing and controlling budget, forecasts, expense allocation and cash flow. This includes planning disbursements to the sub-projects against a cash flow plan, and monitoring and reviewing the financial performance and compliance of each sub-project working closely with the Project Coordinator. The Financial Controller will also perform Office Manager/Administrator responsibilities. The role reports to the Program Manager.

Key Responsibilities include:

- Financial Management

- Monitor and manage the NeCTAR Project budget and assist in preparing budgetary forecasts
- Analyse financial aspects, including funding compliance and cash-flow models of sub-project Proposals during the selection process
- Maintain an Asset Register to record assets created by the NeCTAR Directorate and the sub-projects (as required by the Funding Agreement);
- Assist in the preparation of the Annual Business Plans
- Office Management and Administration
 - Act as Configuration Controller for documentation created or received by the NeCTAR Directorate

B.2.5 Contracts Manager

The Contracts Manager will coordinate the sub-project selection process, work closely with and provide advice to the NeCTAR governance bodies during the evaluation of proposals and tenders, negotiate contracts, and manage the contracts lifecycle, including sub-contract milestone monitoring. The role reports to the NeCTAR Program Manager.

Key Responsibilities include:

- Manage the sub-contract negotiation and any agreed special conditions
- Develop contracts and Request For Proposal (RFP) and related documents, working with the Program Manager and Project Director
- Manage contract and sub-contract Changes (variations) and the associated processes and negotiations as part of the NeCTAR Change Management process.

B.2.6 Project Coordinator

The Project Coordinator is responsible for monitoring and supporting the delivery of the sub-projects as a consolidated program and portfolio, as well as monitoring the progress of the NeCTAR Directorate activities and schedule. This includes managing and escalating risks and issues, managing critical resources and interdependencies, and measuring and reporting performance metrics from sub-project level through to portfolio level. The role reports to the NeCTAR Program Manager.

Key Responsibilities include:

- Executive support for governance bodies
- Executive Assistance to the Project Director and Program Manager.
- Address sub-project changes through the NeCTAR Change Management process.
- Ensure timely status reporting from the sub-projects to the NeCTAR Directorate
- Consolidate and analyse sub-project status information for the use of the NeCTAR Directorate, NeCTAR Board and DIISR.
- Prepare portfolio reports (including dashboards) at time of sub-project selection and tracking performance through delivery.

B.2.7 NeCTAR Directorate Budget

The DIISR-funded contribution to the Project Directorate, including administration, is limited under the Funding Agreement to 10% of the NeCTAR budget, or \$4.7M. The estimates below

are based on the organisational structure described here and the governance model and associated description of the roles and responsibilities. The forecast expenditure against this Directorate model is \$4.0M. This forecast covers all envisaged operations against the Directorate model and the current Final Project Plan as it stands.

No realistic situation is envisaged where the Directorate budget will exceed the \$4.7M cap. However, it is recommended that it be retained as Management Reserve until there is sufficient confidence to allocate it to Sub-projects and possible scope expansions (under Change Management) to demonstrably increase value to the NeCTAR deliverables and services.

The forecast expenditure of EIF funds is mapped across Financial years in the table below.

2010-2011 FY	2011-2012 FY	2012-2013 FY	2013-2014 FY	TOTAL
0.9M	1.1M	1.1M	0.9M	4.0M

Co-investment by the University of Melbourne against the NeCTAR Directorate Budget occurs in three main categories: (i) Direct Co-investment, (ii) provision of various services and support while absorbing these fees, and (iii) additional items. The bulk of the Direct Co-investment funds the activities of the Communications and Engagement Manager – a role seen as vital to the successful engagement and buy-in of the research community followed by outreach and uptake of NeCTAR services and deliverables.

The total forecast of the co-investment from the University and in-kind contribution for the Directorate across the three categories is \$1.0M over its life until March 2014.

B.3 The University of Melbourne

The University of Melbourne, as Lead Agent for the NeCTAR Project, is responsible for the management and implementation of the NeCTAR Project. The role of the University of Melbourne in relation to the NeCTAR Project encompasses the following aspects:

- Lead Agent and signatory to the funding agreement with the Commonwealth;
- direct recipient of EIF Funds; and
- responsible for overall management of the NeCTAR Project.

The University of Melbourne will:

- manage distribution of EIF funds, including through Sub-contracting arrangements;
- meet Commonwealth reporting and accountability requirements;
- provide a high level of responsiveness to DIISR in relation to the implementation of the NeCTAR Project;
- establish the Project Board with DIISR's prior written agreement and establish Terms of Reference and Operating Procedures for the Board to be agreed with DIISR;
- appoint the NeCTAR Director with DIISR's prior written agreement and support staff as agreed by the Project Board;
- support the NeCTAR Director;
- ensure the governance and management functions are diligent and effective
- engage and work with stakeholders in a transparent manner; and

- comply with the requirements of the Funding Agreement and use its best endeavours to carry out its role, to a high standard, with all due care, skill and judgment and in a manner that promotes the NeCTAR Project objectives.

The NeCTAR Project is managed through the following arrangements:

- the University of Melbourne has established a Project Board;
- the University of Melbourne has appointed a Project Director;
- except where directed in the NeCTAR EIF Funding Agreement, all activities of the NeCTAR Project will be appropriately authorised by the Project Board in accordance with its Terms of Reference; and
all activities of the NeCTAR Project will be implemented either by a Sub-contract with the University of Melbourne for a Sub-project delivered by another Provider or by a Memorandum of Understanding for a Sub-project delivered by the University of Melbourne (as the UoM cannot subcontract itself).

B.4 NeCTAR Project Directorate Processes

The NeCTAR Project Directorate has established processes based on the project management methodologies as practiced at the University of Melbourne, particularly in the areas of program management and portfolio management. The extensions and adaptations have drawn upon proven methodologies from both the Project Management Institute and the Office of Government Commerce.

Portfolio Management methodologies will ensure that the funded subprojects form a balanced portfolio which is aligned to the EIF Principles and the NeCTAR Project Objectives.

Program Management methodologies will ensure that the critical resources and interdependencies across the Sub-projects are monitored and managed. Overall planned value against the objectives and targets will be monitored through the delivery lifecycle of the Sub-projects at milestones with associated deliverables and services. The achieved value will be reported regularly, and later certified for compliance by the Sub-contractor's executive management.

The methodology adopted by the NeCTAR Project is documented in an internal Program Manual, which includes processes, tools, templates and logs. This manual assists new staff members to adapt to the NeCTAR Project quickly, and also acts as a key document to record the results of discussions and deliberations about how to best deliver NeCTAR efficiently and effectively. It is a dynamic document under change control to reflect changing policies or circumstances.

Particular emphasis is placed upon: risk management; issue management; and change management. Each of these management and control areas results in closely monitored logs where mitigations, resolutions and key decisions are recorded, tracked and escalated as necessary. Governance processes are also documented.

B.5 Project management of Sub-project delivery

Sub-project proposals and sub-contracts include a list of milestones. These milestones have associated deliverables and services. Value associated with each milestone is identified for both EIF funding and co-investment contributions. Also as part of the proposal and subsequent documents, acceptance criteria for the deliverables will be nominated by the Sub-contractors and included in their test plan. The NeCTAR Directorate will assess these criteria as reasonable during selection and will review test results and other deliverables against the criteria during execution.

A Consolidated NeCTAR Project Schedule will be prepared which covers all Sub-projects and their milestones. Critical resources and interdependencies will be added where identified, and considered carefully during Change Management.

Key Issues and Risks will be monitored to verify active management by the Sub-project, and will be escalated up to the NeCTAR Risk and Issue Logs if they affect the higher level NeCTAR Project or other Sub-projects.

It is inevitable that the evolving technology underpinning NeCTAR and its services, plus additional initiatives will lead to changes to scope, and possibly to schedule and budget as well. Change Management will be applied to assess the full impacts of Changes and to reinforce clear expectations of timely delivery of agreed scope to agreed budget. Changes will be viewed as normal positive occurrences in NeCTAR and promptly managed; this will help maximise opportunities arising from new developments. Change Management may also be used to leverage further opportunities within high performing projects.

Appendix C Publicly-funded eResearch Infrastructure Development

The Australian Government's Super Science initiative² to fund Data Storage and Collaboration Infrastructure was initially funded under the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS) Platforms for Collaboration (PfC) Investment Plan; with funding directed through the NCRIS PfC Interoperation and Collaboration Infrastructure component (PfC ICI). This component included funding for the Australian Research Collaboration Service (ARCS), established in 2007, and for which the NCRIS funding concludes at 30 June 2011.

The overall objectives of the NeCTAR Project are therefore informed by the eResearch infrastructure development strategies formed under NCRIS.

In 2007, the goal of the ICI component was described in the PfC Investment Plan³ as being to operate an extended 'Australian National Grid', working towards an envisaged state where: "problem-oriented" virtual infrastructures are routinely constructed from sensor, instrument, compute, data and visualisation resources.'

This description of 'virtual infrastructure' encompassed:

- on-demand, ubiquitous access to remote computers, digital repositories, scientific instruments and sensor networks
- virtual environments and online collaborative interaction
- seamless resource sharing
- cooperative working, and
- coordinated problem-solving within dynamic virtual organisations.

In 2008, this vision was recast in the Strategic Roadmap for Australian Research Infrastructure⁴ as: 'empowering researchers to work with each other and more easily share and access resources including global resources, and to more easily take advantage of web and video collaboration possibilities.'

The Roadmap also envisaged that in addition to general eResearch infrastructure, discipline- or project-specific tools and services would also be needed to accelerate these integrative developments.

Problem- or purpose-focused infrastructure would deploy tools, middleware and hardware to allow:

- the easy capture, pre-processing and visualisation of data from shared facilities and instruments, eg telescopes, synchrotrons, microscopes and laboratory information management systems, and

² http://www.budget.gov.au/2009-10/content/bp2/html/bp2_expense-20.htm

³ <http://ncris.innovation.gov.au/Documents/PfCInvPlansum.pdf>

⁴ http://ncris.innovation.gov.au/Documents/2008_Roadmap.pdf

- remote access to sensor networks or the easy integration of outputs from observational platforms.

The NeCTAR Project objectives build upon this evolution in strategy for the development of interoperative and collaborative infrastructure.

Appendix D High-Level NeCTAR Performance Indicators

This will be progressively developed over the life of the Project at key times.

1. In the Request For Proposal
2. During the Sub-project selection process

	Objective	Performance Indicator	Point of capture	Data type
1	Enhance research collaboration through the development of eResearch infrastructure capable of having national impact and, through this, enhance national research outcomes.	Number of collaborative agreements/relationships established for the construction and management of NeCTAR infrastructure	Sub-contract	Quantitative
		Number of collaborations between Australian and/or international researchers that are supported by the NeCTAR infrastructure	Sub-contract	Quantitative
		Degree of research community satisfaction that creation of the NeCTAR infrastructure has impacted positively on its ability to produce quality research outcomes	Independent evaluation	Quantitative & Qualitative
2	Deploy eResearch infrastructure and services not otherwise available to publicly-funded researchers.	Value of NeCTAR infrastructure by location	Sub-contract	Quantitative
		Percentage utilisation of NeCTAR services capacity, where applicable	Sub-contract	Quantitative
		Degree of research community satisfaction that identified gaps in national eResearch infrastructure capability were appropriately addressed	Independent evaluation	Qualitative
3	Extend the use of these eResearch capabilities to a wider cross-section of publicly-funded researchers more quickly than would otherwise occur.	Number of research problem-focused tools developed per discipline	NeCTAR	Quantitative
		Number, type and location of applicants for NeCTAR services and tools (where applicable)	Sub-contract	Quantitative
		Number, type and location of users of NeCTAR services and tools	Sub-contract	Quantitative