

AUSTRALIAN e-RESEARCH INFRASTRUCTURE COUNCIL (AeRIC)

AeRIC MEETING – 5 AUGUST 2008

AGENDA ITEM 4: Pfc Communications Strategy

Purpose

To seek AeRIC's endorsement of the Pfc Communications Strategy to ensure consistency across communications activities relating to current and future eResearch Infrastructure investments and activities.

Introduction

This document is an overarching Communications Strategy for the Platforms for Collaboration (Pfc) Capability funded under the National Collaborative Research Infrastructure Strategy (NCRIS) Program in the Department of Innovation, Industry, Science and Research (DIISR).

It seeks to ensure consistency across communications activities related to current and future eResearch Infrastructure investments and activities and to articulate some common objectives.

Its overarching goal is to strengthen communication activities in order to enhance service delivery, strengthen perceptions of value and also to consolidate and build on the support currently available to the concept of national eResearch Infrastructure.

Background

NCRIS is a funding programme that was announced by the Australian Government in 2004 as part of Backing Australia's Ability – Building our Future through Science and Innovation.

Through NCRIS, the Government is providing \$542 million over 2005-2011 to provide researchers with major research facilities, supporting infrastructure and networks necessary for world-class research. It follows the major programme of investments provided under the Systemic Infrastructure Initiative and the Major National Research Facilities Programme of the former Department of Education, Science and Training (DEST).

The NCRIS program is funding research capability areas that were identified in the 2006 NCRIS Roadmap following extensive consultation with the research community.

NCRIS funds will not be used to fund research programs, projects or activities but will be used for the:

- operation and development of existing facilities;
 - enhancement of existing facilities;
 - establishment, operation and development of new facilities; and
 - gaining access to offshore facilities.

The investments and arrangements established by the Pfc capability are attached in Appendix I.

NCRIS has noted that the Pfc capability will require a managed approach to its communication as it is intended to support e-research infrastructure in universities and other research institutions, including through the continued support of high quality information and communications technology.

Pfc is intended to have application across the whole of the NCRIS program, as well as to the wider research community.

Environment

The Pfc investments are operating in an environment where recognition is available of their critical importance and that further and higher levels of investment will be required.

It will therefore be necessary to communicate PfC specific as well as more general eResearch Infrastructure related messages across many research communities and organisations as well as service providers and technical specialists.

It will also be important to consider a range of initiatives now managed by the Commonwealth Innovation and Education portfolios. These include pre-existing SII investments, the Australian Research Council's Linkage Infrastructure and Equipment Fund (LIEF), NCRIS, the Higher Education Endowment Fund, a further NCRIS or NCRIS like initiative and the Education Investment Fund.

Communications Strategy

Aims

1. Engender a positive, cooperative environment for the continuing development and investment in eResearch Infrastructure through the strategic exchange of information with, and between, key committees, external agencies and major stakeholders and through the communication to internal DIISR stakeholders of the importance and the impact of PfC.
2. Increase the impact and benefit of the PfC investments; by raising awareness amongst the research community and the wider community, of the facilities and opportunities they create.
3. Enhance service delivery and responsiveness to key user groups, particularly existing and potential NCRIS capabilities, as identified in the revised NCRIS Roadmap.
4. Enhance the user experience and improve service delivery in each component by encouraging interaction with and learning from each other, and other NCRIS activities.

Communications Objectives

1. To ensure consistent messages are delivered to the research community by all stakeholders involved in the PfC investments;
2. To develop and maintain positive relationships between the clients and operators of the PfC capability and Research Infrastructure Branch;
3. To inform, in a timely manner, key stakeholders and other interested parties of significant developments within PfC;
4. To facilitate a flow of information, experience and best practice between the PfC components and the ICT activities of all NCRIS capabilities;
5. To support the integration of PfC capabilities into the day to day research support activities of NCRIS capabilities;
6. To promote Australian eResearch activities and outcomes in international fora and in turn, to encourage our adoption of best practice where sourced
7. To assist NCRIS to promote a sustained cultural shift in attitudes to research infrastructure investment that is increasingly national, strategic and collaborative.

Target Audiences

Owners of the investment

- NCRIS, DIISR, Minister Carr

Beneficiaries of PfC

- Australian researchers
- NCRIS capabilities and associated communities

Stakeholders in eResearch Infrastructure

- DVCs, CIOs, and other senior officers of universities and major research institutions
- Funding providers including NCRIS, ARC, NHMRC, DIISR, DEEWR, state governments
- IT Directors of research intensive organisations (CAUDIT)
- Data and information managers (OSDM, CAUL...)
- State Governments

Participants and collaborators in eResearch service delivery

- National eResearch service providers (AAF, AARNet, ANDS, ARCS, NCI)
- Regional eResearch service providers (MARCS, VeRSI, ...)
- Relevant research groups investments MELCOE, OAK-Law...
- Institutional eResearch service/resource managers

Key Messages

The Key message should be able to be extracted from the content of the NCRIS 2008 Roadmap (cite when published), which is at Attachment C.

The following may be used, depending on the specific audience and purpose of the communication.

- PfC is open for business.
- ARCS for collaboration needs, ANDS for data sharing challenges, NCI for advanced modelling, AARNet for connectivity (especially internationally), and the AAF to simplify access control
- The use of advanced ICT is now essential and pervasive across and between disciplines so that eResearch Infrastructure is a critical enabling capability.
- The change being wrought in the research sector through ICT capabilities are inevitable and need to be embraced rather than resisted.
- National level investment is needed in Advanced Networking, Capability HPC, retention of National Data Assets and provision of common Access Controls to ensure the existence and continuation of foundation building blocks
- The gains come from building collaboration spaces around people, tools and data, and that is the mission of ARCS and ANDS
- These investments are most valuable when deeply integrated into the research practice of research communities. PfC investments will contribute to sustained skills and services developed as part of research teams and other research infrastructure activities.

Communications Tools and Channels

This section will outline the tools and channels that are expected to assist with the communication of key messages to each target audience.

The section will be fleshed out following agreement around the target audiences and probable key messages.

Attachment A

PLATFORMS FOR COLLABORATION (PfC)

<extracted from a previous report – will need to be kept up to date>

Background

The NCRIS Roadmap identified 16 Priority Capability Areas for investment in research infrastructure.

The Platforms for Collaboration (PfC) Capability has been funded to support the development of underpinning technological platforms that enable the research community to efficiently collect, share, analyse, store and retrieve information.

These platforms support all other NCRIS capability areas as well as providing research infrastructure across a range of research disciplines including the Humanities, Arts and Social Sciences, which were not otherwise provided for in the NCRIS program.

The investment of \$82 million in PfC reflects the central role that information and communication technologies (ICT) play in enabling collaborative and strategic approaches to research. This is particularly true for the NCRIS approach of addressing critical research challenges that often go beyond boundaries of disciplines, individual interests or jurisdictions.

PfC promotes the effective use of research infrastructure by supporting the ability to coordinate separate and sometimes limited resources for use by researchers across the country regardless of their location or institutional affiliation.

Investments within NCRIS PfC have specifically focused on three components:

1. wider access to national high end computational facilities (high performance computing infrastructure);
2. an interoperation and collaboration infrastructure focussing on national collaborative tools and services; and
3. national data management infrastructure to improve the management, sharing, open access and use of research data.

The Australian eResearch Infrastructure Council (AeRIC)

AeRIC has been established as the governance and coordination body within the PfC capability. The Council first met in July 2007. It will meet next on 22 February 2008 to consider its approach to providing input to the NCRIS Roadmap Review and National Innovation System Review, developments within the National Computational Infrastructure (NCI) component and progress in implementation, and updates on Australian Access Federation (AAF) and National eResearch Architecture Taskforce (NeAT).

National Computational Infrastructure (NCI)

The NCI component provides researchers with access to national peak computing facilities and high performance computing tools. An agreement to deliver NCI has been signed with the ANU for \$26 million.

Negotiations are underway with organisations such as CSIRO, Geoscience Australia and the Bureau of Meteorology to gauge their demand for computing resources as well as to develop a broader partnership and increase co-investment in national computing capabilities..

- The Chair of the NCI Steering Committee is Professor Mark Wainwright
- The NCI Executive Director is Professor Lindsay Botten.
- The Chair of the NCI Merit Allocation Committee is Dr Brian Yates

Interoperation and Collaboration Infrastructure (ICI)/ Australian Research Collaboration Service (ARCS)

The ICI is being implemented through a Funding Agreement between the Department of Education, Science and Training (DEST) (now the Department of Innovation, Industry, Science and Resources – DIISR) and the Victorian Partnership for Advanced Computing (VPAC). VPAC distributes funds to a partnership of service providers across Australia to create a seamless network of compute and data support systems and nationally consistent eResearch services. Distribution of the funds will occur through a Joint Venture Agreement which was agreed between the project participants and approved by DEST in November 2007. The Joint Venture defines the operating principles and governance arrangements for the collaboration and also enables the participants to provide services in addition to the ICI services funded by NCRIS. This Joint Venture is known as the Australian Research Collaboration Service (ARCS). Professor Anthony Williams was appointed as ARCS Executive Director in December 2007.

An Implementation Plan was approved by DEST in November 2007 and details the business plan through to June 2008. A cycle of annual business plans and progress reports will commence from 2008.

Australian National Data Service (ANDS)

The ANDS component of the PfC capability aims to ensure researchers are able to identify, locate, access and analyse any available research data. In particular, ANDS will provide a systemic approach to research data to transform the disparate collections of research data around Australia into a cohesive corpus of research resources.

A Technical Working Group was established by a broader ANDS reference group in early 2007 and submitted its conceptual design for ANDS in the form of a report, Towards the Australian Data Commons, in October 2007 (available online at: <http://www.pfc.org.au/twiki/pub/Main/Data/TowardstheAustralianDataCommons.pdf>). This report formed the basis of deliverables required of ANDS and enabled the characteristics of its operation to be well defined and broadly agreed.

A contract has been signed with Monash University to conduct an ANDS Establishment Project through to the end of 2008. Under this agreement, Monash will work with the Australian National University (ANU), CSIRO and potentially a range of other parties to develop the necessary elements to move to full ANDS implementation from 1 July 2008.

National eResearch Architecture Taskforce (NeAT)

NeAT has been established to provide guidance on the evolution of the national eResearch infrastructure and to identify and scope activities that broaden the appeal of eResearch services. AeRIC approved its operational framework and membership in August 2007.

NeAT is chaired by the Executive Director of AeRIC, Dr Rhys Francis, and will recommend projects for investment within the ANDS and ARCS business plans. First-round NeAT project proposals are currently being defined and will be incorporated into the ANDS and ARCS Business Plans from 2008/09. NeAT is meeting on 21 February 2008 to review and consolidate comments to AeRIC on these project proposals.

Australian Access Federation (AAF)

The AAF project is an initiative funded by the Australian Government to provide a shared infrastructure for all users working in multiple environments/ institutions to have seamless and secured access to resources online. The AAF is a foundation element of PfC. Once established, the AAF will provide a national authentication and authorisation framework for the higher education and research

community, and will hence play a critical role ensuring the accessibility of NCRIS infrastructure and research data.

The AAF project team is comprised of staff from the University of Queensland, Macquarie University and AusCERT. Work is underway on governance, technical and legal issues, and a communications strategy to engage prospective members of the Federation, such as universities, research agencies and service providers. It is expected that implementation will commence in 2008.

The Board of Universities Australia (UA) has agreed to host the AAF. Further work is being undertaken on the operational structure that would exist below UA.

Australian Research and Education Network (AREN)

The Australian Research and Education Network (AREN), funded by the Australian Government to the value of \$88 million from 2003 to 2006 through the Systemic Infrastructure Initiative, is one of the most advanced international optic fibre research and education networks in the world. The network connects universities and research institutes in all capital cities and many regional centres, as well as isolated research facilities such as radio telescopes. It also connects the east coast of Australia to multiple points of presence on the west coast of the USA and the west coast of Australia to Singapore, Frankfurt and on to European networks.

The potential exists for the AREN to grow to meet the needs of new NCRIS users of the network, such as researchers in Government organisations. Defining these requirements and setting the standards for access to the network is a priority for PfC as it goes forward. At its August 2007 meeting, AeRIC agreed the establishment of an Expert Advisory Group on AREN to consider and frame recommendations on these matters.

eResearch Australasia 2008

An eResearch Australasia Conference will be held each year as a showcase of the Pfc activities.

The 2008 conference will be held between 29 September to 1 October 2008 in Melbourne with workshops following on 2 and 3 October 2008. The forum will build on the highly successful eResearch Australia conference held in 2007, funded in part by the Australian Government. The Government is again sponsoring the conference with the aim of establishing the eResearch Australasia Series as a regular annual event. The funding will enable the conference to be held annually between 2008 and 2010 when it is expected to become self funding.

The conference will feature speakers and demonstrations from the Australian and international eResearch community and will provide:

- A catalyst for innovation and collaboration, by bringing together the architects, builders, users, and managers of eResearch infrastructures and services;
- A forum to support the development, enhancement, and harmonization of national, regional, and discipline-specific eResearch infrastructures and services; and
- A showcase for innovative science and research enabled through these technologies and services.

Attachment B

Participant organisations in Platforms for Collaboration

The Australian eResearch Infrastructure Council (AeRIC)

Current Members of AeRIC:

- Professor Tom Cochrane (Chair) Deputy Vice-Chancellor, Information and Learning Support, Queensland University of Technology
- Professor Iain Wallace, Emeritus Professor, Swinburne University and Chair, Board of Victorian Partnership For Advanced Computing (VPAC)
- Professor Robin Stanton, Pro Vice-Chancellor, Australian National University (ANU)
- Mr Alan McMeekin, Executive Director, Information Technology Services, Monash University and Chair, Council of Australian University Directors of Information Technology (CAUDIT)
- Ms Cathrine Harboe-Ree, University Librarian, Monash University and Deputy President, Council of Australian University Librarians
- Mr Chris Hancock, Chief Executive Officer, Australia's Academic and Research Network (AARNet Pty Ltd)
- Dr Rob Woodcock, Research Group Leader, CSIRO Exploration and Mining
- Ms Anne-Marie Lansdown, General Manager, Research Infrastructure, DIISR
- Dr Rhys Francis, Executive Director, AeRIC

Interoperation and Collaboration Infrastructure (ICI)/ Australian Research Collaboration Service (ARCS)

ARCS is a collaborative agreement between these parties to deliver long-term eResearch support services for the Australian research community with a particular focus on interoperability and collaboration infrastructure, tools, services and support.

- ac3 - Australian Centre for Advanced Computing and Communications
 - ANU - Australian National University
 - CSIRO - Commonwealth Scientific and Industrial Research Organisation
 - iVEC – ‘The hub of advanced computing in Western Australia’
 - eRSA (formerly SAPAC) - eResearch SA
 - TPAC - Tasmanian Partnership for Advanced Computing
 - VPAC - Victorian Partnership for Advanced Computing
 - QCIF - Queensland CyberInfrastructure Foundation

The newly established NSW eResearch entity, INTERSECT, is expected to replace Ac3 in the near future.

Australian National Data Service (ANDS)

Monash University has signed a contract with DIISR for the ANDS Establishment Project. Monash is required to collaborate with – as a minimum – ANU and CSIRO to deliver ANDS.

National Computational Infrastructure (NCI)

The contract to deliver the NCI is between DEST and ANU, based on ANU’s past experience at the centre of the Australian Partnership for Advanced Computing (APAC) and the facilities currently provided by the ANU Supercomputing Facility.

The NCI Steering Committee was established in late 2007 and includes representatives of ANU, CSIRO, Bureau of Meteorology, Geoscience Australia and the Group of Eight Universities, as prospective partners in NCI.

The NCI Steering Committee is chaired by Professor Mark Wainwright and includes representatives of both current and prospective partners in NCI.

National eResearch Architecture Taskforce (NeAT)

The National eResearch Architecture Taskforce (NeAT) has been established to provide guidance on the evolution of the national eResearch infrastructure and to identify and scope activities that broaden the appeal of eResearch services.

Current NeAT members are:

- | | | |
|--------------------|-----------------|-------------------------------------|
| ▪ Rhys Francis | Victoria | Chair |
| ▪ Robert Woodcock | WA | AeRIC representative |
| ▪ David Abramson | Victoria | middleware |
| ▪ Ian Atkinson | Queensland | middleware |
| ▪ Nathan Bindoff | Tasmania | marine |
| ▪ Markus Buchhorn | ACT | data management |
| ▪ Adrian Burton | ACT | repositories |
| ▪ Paul Coddington | South Australia | middleware |
| ▪ James Dalziel | NSW | AAF |
| ▪ Paul Davis | Victoria | networks and technology application |
| ▪ Lindsay Hood | ACT | grid and Bio-tech |
| ▪ Jane Hunter | Queensland | semantics |
| ▪ Marco La Rosa | Victoria | HEP/EGEE |
| ▪ Stave Maddocks | WA | networks |
| ▪ John McGee | ACT | networks |
| ▪ Deborah Mitchell | ACT | social sciences |
| ▪ Andrew Treloar | Victoria | data management |
| ▪ Lesley Wyborn | ACT | geosciences |

Australian Access Federation (AAF)

The Australian Access Federation (AAF) project is an initiative funded by the Australian Government to provide a shared infrastructure for all users working in multiple environments/ institutions to have seamless and secured access to resources online.

The AAF is a foundation element of PfC. Once established, the AAF will provide a national authentication and authorisation framework for the higher education and research community, and will hence play a critical role ensuring the accessibility of NCRIS infrastructure and research data. The AAF project team is comprised of University of Queensland, Macquarie University and AusCERT staff. Website at <http://www.aaf.edu.au/>.

Australian Research and Education Network (AREN)

The Australian Research and Education Network (AREN), funded by the Australian Government to the value of \$88 million from 2003 to 2006 through the Systemic Infrastructure Initiative, is one of the most advanced international optic fibre research and education networks in the world.

AREN is a foundation element of PfC. The key company involved in delivering network connectivity to universities is AARNet Pty Ltd. In addition to AARNet Pty Ltd, the AREN is delivered in part by VERNet in Victoria and SABRENet in South Australia.

Attachment C

<extracted from draft as at July 30, will need to be replaced by final NCRIS approved text>

eResearch Infrastructure

Regardless of research discipline, there is growing recognition that new ways to conduct research have emerged and are being validated. Adding to traditional forms of research that rely on experiment, theory and the testing of hypotheses using data, it is now evident that researchers collect increasingly larger sets of data as a primary form of research. Having collected this data, researchers are using modelling tools to assist them in deriving patterns, perceptions and trends that can form the basis to establishing and confirming hypotheses. Information and communications technology (ICT) is the cornerstone to such new approaches, providing the means not only for increasingly powerful computer-enabled simulation and modelling, but also the very means to manage and integrate the increasing volume and complexity of datasets and collections. Hence, ICT is not only a means to administrate and manage research but also to drive and innovate the ways in which research is conducted.

Contextual framework

Much of the research carried out around the globe is now conducted with the assistance of Information and Communications Technology (ICT) tools and services. Researchers can now reach out to each other from opposite ends of the country, even the globe, sharing data, ideas and instruments or equipment. Entirely new fields of research are emerging and researchers can now collect, move and manipulate large amounts of data, enabling new and much more complex problems to be addressed. The technologies themselves create new avenues through which research can be achieved; research which would be infeasible using any other means. These new and collaborative approaches to research, within disciplines and across distinct but complementary disciplines and supported by advanced information technology, constitute eResearch.

The use of advanced ICT is now essential and pervasive across and between disciplines leading directly to the view that eResearch Infrastructure is a critical enabling capability, alongside expertise, skills, governance, management, and cross-capability interfaces.

Defining ICT as an enabling capability responds to a widespread and robust debate on how ICT can support Australian research and empower national and international research collaborations. The debate is partly an outcome of the investments into the NCRIS Platforms for Collaboration (PfC) capability, through which NCRIS provides ICT support for research.

Description

As research is being redefined by the use of ICT, it is vital that Australian researchers and research institutions have access to the infrastructure they need to participate in this transformation. The NCRIS Platforms for Collaboration (PfC) capability created a basis for this support by focussing on collaboration tools; a national approach to data services; high performance computing; high performance networks; and access and authentication frameworks.

However, the scale of demand for ICT infrastructure for research, and the breadth and magnitude of the task to address eResearch, have significantly increased since the 2006 Roadmap was developed. As reliance on shared access to and use of data has risen, and as researchers have become accustomed to using advanced ICT to support their research, expectations in terms of the supporting infrastructure and accompanying expertise have grown. Research communities are being challenged by this increasing dependence on ICT and the new ability it brings to work in multi-disciplinary groups. A particular example of how this reliance has grown is the greater appreciation for the role of research networks (such as the Australian Biosecurity Intelligence Network) in enabling research.

This growth translates into greater need but also different needs. It is not simply that more researchers need to keep, organise, manage and analyse data better and on a larger scale, or more often use models as a basis of their research, or more frequently seek better means to collaborate around shared data and

associated tools. These needs in themselves are significant and affect the scope of the investment in eResearch. It is also that, as opportunities and different ways of using ICT emerge, and as researchers appreciate the potential of eResearch, new or more clearly defined needs reach a critical level. For instance, remote access to shared and unique collections and resources, including for regional or smaller institutional researchers or researchers in the field, is now critical.

Therefore, an expansion in eResearch support in three ways is proposed:

- infrastructure that forms the 'backbone' to eResearch, including high performance communications networks, high performance computing facilities, data storage, and resource access and authentication systems. The impact on researchers is not only that they can work with people at the far ends of the earth as easily as the person down the corridor or in the same room, but also that they can in the widest sense of the word visualise data and models of data in ways that add new perspectives and value to their research. The ability to store and secure research such that its value and origin is respected and recognised is a critical benefit of the 'backbone' infrastructure;
- infrastructure that helps effect the transition from research to eResearch, including data federation tools, collaboration and sharing tools, such that researchers are able to work more effectively and easily with each other and in ways they had not previously imagined. A researcher will be able to participate in real-time in complex research endeavours that amass the collective knowledge and most recent analysis of peers in other institutions or locations; and manipulate equipment or datasets or virtual representations of these on-site or from a distance – often in ways that would not otherwise be possible, such as with delicate documents or specimens; and
- improved governance and expertise building to ensure that personnel with the necessary skills and experience are available to drive and deliver these services and tools. As the increasing importance of ICT is recognised and as researchers become more accustomed to eResearch support, leadership in promoting, guiding, funding and using ICT will be necessary to enable a committed and effective approach. Increasing the awareness and understanding of researchers of the potential impacts of these tools on their work will be essential if researchers are to systematically reap the benefits of investments in this area..

Strategic Impact

Today's research challenges are complex and global, including problems such as climate change, sustaining ecologies and the environment, predicting and living with extreme geological activity, managing disaster reduction and security, improving the health of our population and containing infectious disease. Such problems demand profound understanding of complex systems that cannot be achieved by isolated efforts or by real world experimental means.

The impact of eResearch is often most keenly apparent when a problem falls into this category of complexity or breadth and cannot be handled by a single institution, discipline or jurisdiction. Hence, researchers dealing with complex issues of health, biosecurity, terrestrial ecosystems and others benefit strongly from the use of ICT to bring together otherwise isolated or individual expertise, knowledge and analysis to bear on the problem.

On a different level, access to an up-to-date research network that connects researchers in real-time can bring significant benefit to addressing matters of high priority or immediate need (such as water management or disaster preparedness). High performance computing (HPC) resources that enable virtual experiments are sometimes the only way theory can be developed and tested. Finally, ICT can enable researchers' use of resources that present physical challenges in accessing them because they are otherwise too expensive, large, distant or fragile to be readily available. This latter impact includes for example researchers' access to the Australian Synchrotron or digitised archaeological collections.

Hence the goal of this capability is two-fold: to enable researchers to accomplish studies of national significance which are beyond the scope of individuals and organisations; and to build a national foundation eResearch capability that provides an innovative, sustainable approach to ICT enhanced research. This aligns with both the UK e-science program and the US cyber-infrastructure initiative which have shown that an effective transition is best effected at the national level.

Challenges and assumptions

Work underway on the Australian Research Collaboration Service (ARCS) and the Australian National Data Service (ANDS) will form a critical basis for addressing the future infrastructure and practices needed to collaborate well and, in particular, to share, reuse and curate data. Similarly, work on the Australian Access Federation (AAF) in establishing trust between organisations and between researchers, investment in high performance computing and high performance networks will be built on in further developing the eResearch 'backbone'.

Transitioning from research to eResearch is challenging to researchers and research organisations. Research is traditionally competitive and researchers have limited capacity to share, in the sense that their funders, institutions and disciplines may have structures or mechanisms in place that impede the levels of collaboration that can best advance research. Institutions are also challenged to provide the level of general and discipline-specific ICT support to meet research needs. As an example, network performance can be throttled by institutional firewalls and enterprise networks, so that while high bandwidth pipes exist to the front gate, the myriad garden hoses with taps, filters and sometimes meters once past that gate compromise usability and connectivity from a research and collaboration perspective.

Another challenge in developing eResearch Infrastructure is to ensure it can engage other investments and capabilities in a way that meets needs and brings about highly developed solutions. The success of eResearch depends on the sustainability of resources available to identify and provide for the ICT requirements of researchers in those capabilities. Hence, an underlying assumption in developing a strategy for eResearch is that a long-term commitment will be made to the initiatives.

In addition, the increasing dependence on ICT expertise is presenting a particular challenge of its own – how to source the skills into the research sector and how to retain them. The pervasiveness of ICT adds a unique dimension to the issue of who can best support its use.

While some researchers advance readily into an ICT-enabled world, it is important to bring other researchers as well. Action is needed to ensure that researchers, and the institutions that support them, better appreciate the benefits and imperatives of enabling research using ICT.

Requirements

Infrastructure

Enabling Components provide the infrastructure landscape that is essential and pervasive: high performance communications networks, a range of high performance computing facilities, data storage, and resource access and authentication systems.

- **Access Management:** to allow organisations to reliably and easily grant access to resources given a researcher's identity, and limit access or use of resources to those for which a researcher has been given permission. This component will build on the work of the Australian Access Federation (AAF), which is developing and deploying the core components of such an infrastructure to facilitate collaborations locally, nationally and internationally. The AAF provides a Public Key Infrastructure for strong authentication and access to systems; and a web based authentication and authorisation infrastructure called Shibboleth. The AAF infrastructure can be federated across institutions and trusted by international collaborators.

Further investment is required to develop and operate co-ordinated access and authorisation solutions for all research resources and capabilities. The access management solutions must also inter-operate with government authorisation systems.

- **Data Storage:** to provide research with data storage facilities (the hardware component) and data management plans (the principles for storage and long term preservation).

Building on the Australian Research Collaboration Service (ARCS), a national data grid is needed to provide for long-term preservation of data. This national data grid would provide seamless unstructured storage as well as collaborative storage spaces, particularly focussing on but not

limited to active research projects and research collaborations. A dedicated high performance network would link the nodes in the grid, allowing researchers to move data rapidly from instrumentation to computing resources and to institutional storage.

This investment would extend to research organisations for the development of institutional nodes of the storage grid, on the condition that the storage is used for research data; the institutes co-invest in the infrastructure; each institute agrees a data management plan; and each institute ensures its researchers use and abide by the data management plan.

- High Performance Computing (HPC): to meet the needs of advanced “in-silico” science and the modelling and data analysis needs of complex system sciences. This component will build on the existing investment in the National Computing Infrastructure (NCI) that provides a peak computing facility accessible on a merit and priority basis and expert support for researchers who use it.

Further significant computing needs exist as do new forms of computing aggregations so that the demand for HPC services is expected to grow for the foreseeable future.

Continuing federal investments and research co-investment are required to provide the mix of facilities that can meet these growing computing needs. Three forms of support are envisaged:

- the development of specialised services, each contributing to a globally significant computing resource, that support priority research areas and which bring together the necessary research and HPC skills with problem specific data and modelling capabilities;
 - a national HPC resource or peak facility that can be made available to all researchers through an open merit allocation scheme; and
 - special purpose facilities that provide tailored data analysis, real-time processing or visualisation services.
- High Capacity Communication Networks: to enable effective research and research collaboration by connecting research organisations and researchers. Future development will build on the investment in the Australian Research and Education Network (AREN), managed by AARNet Pty Ltd, that provides a high-speed core network between capital cities, interconnecting Australian universities, some research institutions, and regional and international research networks.

Future strategic development of the AREN should focus on:

- The continued development in reach and capacity of the underlying national backbone
- Provision of ad-hoc dedicated circuits configured on demand to support advanced experiments, computing grids and machine-to-machine interactions;
- Extension of the AREN to government researchers and for research access to resources that governments hold and agree to share for research use;
- Enhanced network capacity to international research organisations;
- An enhancement strategy to improve network performance ahead of, rather than in response to, needs. This would be aided by a national co-ordination and investment management process that is independent of specific providers but takes account of research sector, State and Territory government and overall provider interests; and
- A strategic design activity to scope and align investments in backbone, regional and institutional network capabilities and to more fully develop the demand for advanced research network services in preparation for significant additional investment.

Transition Components provide the support and infrastructure to bring about an effective transition from research to eResearch with a focus on data federation, seamless collaboration and effective sharing of resources. They include:

- Shared Spaces: collaboration spaces that are managed in their own right and span the enterprise spaces provided by individual research organisations. These spaces will empower researchers to

work with each other and more easily share and access global resources, including through web collaboration and video collaboration tools. They will enable researchers to access, annotate and analyse large-scale, distributed data sets that conform to world standard data formats and international discipline-based standard metadata schemas; as well as ingest, manage, annotate, analyse, share and publish their own data.

In addition, shared spaces will enable researchers to use simple, customized user interfaces to perform large-scale simulation, modelling and analysis on high-end computing facilities; perform complex workflows that automate tasks currently done manually; and remotely manage and operate facilities, instruments and sensor networks.

A mixture of case specific and general eResearch infrastructure tools and services will be needed to accelerate these integrative developments.

- Shared Data: the national capacity to re-use and re-purpose data gathered for research and to make data that might be gathered for other purposes available for research. Based on the concept of an Australian Research Data Commons , ongoing investment and a very significant increase in resource is needed in:
 - Identification, registration and searching services;
 - Capability building at research institutions so as to appropriately gather, retain or preserve, curate and migrate data for re-use;
 - Policy development to agree and where possible simplify the arrangements around data, so that re-use and data integration are socially, legally and technically feasible; and
 - A case by case approach to assist research communities and data managers integrate their activities and hence their data into the Data Commons.

An additional challenge and task in building the data commons is to integrate data-sets from all investments in research and research infrastructure. This will include harmonising other investments in data gathering, data generation from instruments and a variety of imaging and sensing deployments; as well as digitisation of existing collections.

- Shared Infrastructure: the deployed tools, middleware and hardware that allow for the rapid integration and sharing of infrastructure. Examples include systems that allow the easy capture, pre-processing and visualisation of data from shared instrumentation (e.g. telescopes, synchrotrons, microscopes, laboratory information management systems), and remote access to sensor networks or the easy integration of outputs from ecological observational platforms.

A key characteristic of eResearch infrastructure and its deployment and use will be a rapid co-evolution of the NCRIS capabilities and their services. Significant barriers to evolution related to expertise, design, installation, and technological change management, especially as these are related to ICT and eResearch practice, will need to be overcome. The National eResearch Architecture Taskforce should operate on a broader scale to support more intensive integrative projects. Such 'bridge building' will require the addition of investment on a discretionary basis for the development and deployment of shared infrastructure.

A Coordination Component is needed to further the development of eResearch infrastructure and assist the ICT enabled evolution of research practice.

- Governance: the scale of activity needs stronger corporate governance, with clearer legal status, especially if the application of longer term funding is to be managed.

An appropriate governance role could include:

- The ability to influence or direct funding to the development of next generation activities, to overcome the resource hurdle that currently inhibits the creation of 'new' services at the intersection of eResearch and other Capabilities;
- A mandate to assess and influence the business plans of the infrastructure components within this capability;

- An ability to provide advice on the ICT infrastructure within other capabilities; and
- An ability to leverage institutional and eResearch centre activity in a coordinated manner.

Stronger governance would also manage integration and change more effectively and allow stronger reliance on the eResearch services provided. A new governing board related to the extended role would subsume the role of the Australian eResearch Infrastructure Council (AeRIC), which has been advising on the set up of the PfC investments.

- Leadership: to promote awareness of and achieve the research gains possible from advanced ICT, the coordinating component would also:
 - Build bridges between research infrastructure and research investments, assist government and academic research activities inter-relate, and reduce policy impediments to collaboration;
 - Have the ability to speak for eResearch as a whole, to undertake strategic planning, to package eResearch support to meet significant national research needs and major national and international research collaborations; and
 - Provide the ‘national voice’ that could project Australian eResearch interests on the institutional, regional, national and international scenes; and, in particular, represent research interests in gaining maximum access to data and physical collections funded outside the research sector.
- Skills development: eResearch skills, while not addressed directly above, warrant discussion in light of the consideration of expertise as an enabling infrastructure in this Roadmap. Valuing and keeping ICT staff and their expertise require career structures and rewards similar to the opportunities such skills enjoy elsewhere.

The coordinating component through its national voice and ability to support strategic investment decisions can assist sector activities specifically targeting skills development.

To fully realise the benefits of eResearch, national investments must extend and complement ICT and eResearch support in institutions and by state and territory governments; and allow for the evolution and migration of services over time.

There is also a need to ensure that capabilities describe their eResearch support requirements adequately and that investment plans fund access to eResearch expertise, rather than destructively appointing and competing for rare resources.

There is recognition that advances in eResearch will depend vitally on advances in research into ICT. As these advances occur specific to capabilities and require corresponding advances in research infrastructure, a coordinated approach to leverage these advances across the capabilities may also be required.