Submission
2016 National Research Infrastructure Roadmap
Capability Issues Paper

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Questions

Question 1:   Are there other capability areas that should be considered?

N/A

Question 2:   Are these governance characteristics appropriate and are there other factors that should be considered for optimal governance for national research infrastructure.

Additional factors need to be considered for optimal governance of national research infrastructure, these include frameworks:

- To ensure 'whole-of-system' coherence;
- That include contractual requirements for investments to utilise the underpinning capabilities and not duplicate resources;
- To ensure Australia's capabilities align with and leverage global initiatives already underway;
- To manage new investments mid-cycle as things evolve and new technologies, research disciplines and capabilities emerge. Governance processes should ensure some funding is directed to new capabilities and not just maintaining and operating existing infrastructure;
- That define flexibility around capital investment vs operational investment;
- That enable a predictable income stream for incremental innovation and evolution of research infrastructure;
- For project management of investments and scarce resources to ensure appropriate allocation schemes, accountability of expenditure and whole of research system benefit; and
- For standards and accreditation to ensure best practice and alignment with national and global needs; and
- That define and monitor key performance indicators and targets for collaboration and interoperability between capabilities in order to maximise investment and reduce duplication.

Question 3:   Should national research infrastructure investment assist with access to international facilities?

Yes, it is vital that Australian researchers are able to easily collaborate and work with their international partners. Australia should be an active participant in the global community to enable this access to occur. From an access and authentication perspective an ongoing annual investment in the underpinning research infrastructure is required to enable and maintain this access. Internationalisation will ensure that Australia's research system is world-class, opening up many opportunities into the future.

Connecting Australia's National Authentication Service Globally:

The underpinning access and authentication research infrastructure requires a significant multi-year investment program of work followed by an ongoing annual investment to maintain. Such and investment will allow Australian researchers to collaborate and innovate with their international counterparts. This would see Australia's national access and authentication service/capability (provided by the Australian Access Federation, AAF) fully connect with the global access and authentication federation initiative in operation today.

Internationalisation of Australia's national authentication framework, will allow researchers to access a multitude of global research services through one simple login solution. Currently services such as those provided by CERN (the European Organisation for Nuclear Research, physicists and engineers), LIGO (the Laser Interferometer Gravitational-Wave Observatory) and CLARIN (Common Language Resource and Technology Infrastructure) can be accessed globally through this initiative. It would also enable Australian datasets and tools to be easily shared with international researchers so they can leverage existing research and collaborate with researchers based in Australia. This important underpinning infrastructure can enable international research connectivity and collaboration that would also support future international infrastructure investments. While the early stages of this connectivity are underway, investment into the national implementation is required to accelerate Australia's connectivity on a global scale.

Question 4:   What are the conditions or scenarios where access to international facilities should be prioritised over developing national facilities?

For the access and authentication underpinning capability, national and international should be considered together. National underpinning infrastructure investments must enable international access and authentication simultaneously. For the broader group of facilities the following conditions should be considered:

- Governance frameworks to ensure that capabilities and services that already exist elsewhere in the world are either connected to the global initiative or not replicated;
- Investing in capabilities where there is an opportunity for Australia to become a leader;
- Investing in areas that are somewhat unique to Australia or where Australia offers a different perspective;
- Data sovereignty requirements and laws locally and internationally, eg. data sets may have embargos that prevent international access;
- The relevance of the international service to the local research service requirement; and

- Priorities of global research initiatives in line with Australia's national priorities.

Question 5:   Should research workforce skills be considered a research infrastructure issue?

Yes most definitely.

- The workforce skills for the research infrastructure providers need to be considered. This workforce is:
    o   multi-skilled and highly specialised;
    o   difficult to recruit and retain;
- In the context of access and authentication, it is simply not possible, nor feasible to have every research capability in the research system skilled in this area of expertise. The capabilities in the research system should be provided training which enables them to partner with the underpinning capabilities through preferred supplier arrangements. For examples research capabilities will often develop their own access and authentication service which is not sustainable, secure or interoperable on a national or global level. However professional support needs to be made available to educate and align capabilities with the service provided by underpinning capabilities such as the Australian Access Federation; and
- Awareness of established capabilities is a related problem. Research organisations continue to channel resources into custom solutions simply because they are unaware / don't have the skills to use the underlying capabilities and do not understand that in many cases they can be easily integrated or used to address many of the common challenges.

Question 6:   How can national research infrastructure assist in training and skills development?

It is important that national research infrastructure providers partner in delivering skills development. This also includes partnerships between the NCRIS capabilities, institutions and industry.

- A pool of skilled information technology professionals need to be fostered in the areas of:
    o   project management;
    o   management and leadership;
    o   engaging with researchers (collaboration, communication);
    o   technical specialist capabilities;
    o   software carpentry;
    o   data technologists;
    o   use of and integration of research infrastructure into research workflows and process;
- Investment in programs for the development of long term career opportunities in operating and innovating research infrastructure is critical for the future; and
- Creators of research tools quickly discover interactive, workshop style training is unsustainable. Establishing a common toolset for delivery of online learning would help to address these challenges for the NCRIS capabilities and underlying infrastructure providers alike.

Question 7:   What responsibility should research institutions have in supporting the development of infrastructure ready researchers and technical specialists?

Research institutions are responsible for providing the policy, technology infrastructure and tools for developing infrastructure ready researchers and technical specialists.

It is therefore important that research institutions take an active approach in the:

- Adoption, use and training of infrastructure ready researchers and technical specialists;
- Integrating research tools and technologies and underpinning capabilities into the research system; and
- Developing of policy to favour the use of shared infrastructure and enabling capabilities where possible and practical.

Question 8:   What principles should be applied for access to national research infrastructure, and are there situations when these should not apply?

- Research infrastructure access principles are diverse, complex and constantly evolving. As data sets grow, researchers demand more sophisticated and nuanced ways to manage access to data.

    For example, Atlas of Living Australia and BioPlatforms Australia have 'open-data' where anyone can use the data, however the contribution to the data is 'closed-data'. The Australian Urban Research Infrastructure Network's (AURIN) data often has embargos on the access to the data for particular periods of time before it becomes available and in some cases users have to pay to access it. There is often a need to segregate access to data between research and industry usage. Other industries are ok with sharing data with researchers but not government. The access problem gets more complex when you cross international boundaries. In summary, all capabilities have complex accessibility principles applied to the access of their service.

- Access to research infrastructure capabilities needs a consistent national approach which will provide a seamless access mechanism for researchers. A centralised and consistent approach will also make it easier to connect Australia's research internationally. It does not preclude the ability to extend the consistent approach to meet bespoke arrangements to tailor access requirements for specialist capabilities.

    Significant ongoing investment is needed to identify and codify access principles. To date the national access and authentication service provided by the Australian Access Federation is unable to meet every use case due to the complex access requirements of the research system. Significant investment is required into the future to meet the evolving demands of national research infrastructure as they arise.

- The underpinning capabilities play a vital role in enabling access to national research infrastructure. Capabilities must adopt and use the underpinning infrastructure to ensure standardisation and remove duplication. In particular:

    The AAF is a crucial requirement for the national research system, as it is the only provider of its kind in Australia and part of the global community which openly collaborates to evolve access and identity management for research. Considering this, the AAF should be a key requirement for all research capabilities moving forward. Investment in evolving the AAF services to meet these needs is required into the future.

Question 9: What should the criteria and funding arrangements for defunding or decommissioning look like?

No comment.

Question 10: What financing models should the Government consider to support investment in national research infrastructure?

Models include:

- Seed funding programs;
- Co-investment;
- Partial investment;
- Full investment;
- Private sector investment; and
- Investments that could evolve into self-sustained models, supplemented with incremental project or innovation investment periodically.

Incremental investment in innovation is vital to ensure the current capabilities evolve and continue to address gaps in the market and new requirements as they arise.

It is vital that the model(s) used focuses on sustainability of the investment into the future. While seed-funding may establish a service/capability initially, consideration is required as to how the service will continue operate and innovate once the initial funding expires. It is also important to note that many of the capabilities exist as the market is unable to meet the advanced requirements of the research system and hence multi-year investment from Government is critical to sustain the service for the long term.

Question 11: When should capabilities be expected to address standard and accreditation requirements?

Investment in standards and accreditation needs to from part of the future roadmap. Standards and accreditation also needs to be embodied into future governance structures and in some cases a requirement for investment.

- At a minimum, capabilities should be required to aspire to standards and accreditation from a technical and process level (e.g. project management, through to meeting ISO/AS standards). The degree would be determined based on the:
    - the size and reach and investment of/for the capability
    - the requirement by the research community for the capability to meet standards and accreditation
    - the cost vs benefit of becoming/meeting a standard or accreditation
    - any legal requirements to meet a standard or accreditation; and
- having a floor of standards / accreditation should be a strong objective.

Question 12: Are there international or global models that represent best practice for national research infrastructure that could be considered?

In the context of Access and Authentication the following area needs to be considered:

1. *Enabling Australian eResearch capabilities to connect globally via the Australian Access Federation*

    Connecting the Australian Access Federation (AAF) to the rest of the world is the next step for Australia's national authentication service for research and education. Implementation will be a multi-year journey. It will:

    - connect Australian researchers with their counterparts across the globe; and
    - create the mechanism for international collaboration partners to access Australia's NCRIS capabilities (via participating federations).

    This is being achieved through a global initiative called eduGAIN (see edugain.org) of which Australia is now a part of (an initiative which began as a project as a major collaboration between European Union and European National Research and Education infrastructure providers). eduGAIN provides the infrastructure that interconnects authentication federations around the world, allowing researchers to access content, services and resources for the global research and education community.

2. *Standardising on linking researchers to their research outputs - ORCID (Open Researcher Contributor ID):*
    - ORCID is a separate service to the national authentication service provided by the AAF. Specifically, ORCID provides a global persistent identifier that distinguishes a researcher from every other researcher and, through integration in key research workflows such as manuscript and grant submission, supports automated linkages between a researcher and their professional activities ensuring that their work is recognised. The use of ORCID is

being adopted globally and as of September 2016 approximately 2.5million researchers have been provided with an ORCID identifier.

- Australia (through the AAF) in line with other countries around the world has been operating a national ORCID consortium[1] (since January 2016). The consortium's specific role is to provide ORCID licences and technical support to research institutions and funding bodies wanting to provide an ORCID identifier to their researchers and incorporate ORCID into their research systems. Significant investment is required in Australia to deploy ORCID on a national level, this includes but is not limited to:
    - o undertaking technical integration of ORCID into research management systems, grant management systems and research tools;
    - o undertaking technical integration of institution's access and authentication systems to populate and consume the researcher's ORCID identifier;
    - o developing models of best practice in the use of ORCID;
    - o training and support for researchers in the use of their ORCID identifier;
- There is a significant need for ongoing investment for the AAF and the sector to continue to embark, maintain and support this important multi-year program of work. In particular, to imbed ORCID into systems and processes and provide support for the uptake and use of ORCID in the research system.

Question 13: In considering whole of life investment including decommissioning or defunding for national research infrastructure are there examples domestic or international that should be examined?

No comment.

Question 14: Are there alternative financing options, including international models that the Government could consider to support investment in national research infrastructure?

'user-pays' models for infrastructure usage may put artificial barriers for adoption if the individual researcher is expected to pay, thus inhibiting the growth and uptake of the service.

Shared services / member based / consortium models for service operations might be considered. These models could become self-sustained, requiring incremental national investment to meet the evolution of innovation and gaps in the market.

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[1] As of September 2016, 40 organisations are members of the Australian ORCID Consortium, this includes the NHMRC, ARC, 36 Universities, CSIRO and the Heart Research Institute. For more information see: www.aaf.edu.au/orcid.

Health and Medical Sciences

Question 15: Are the identified emerging directions and research infrastructure capabilities for Health and Medical Sciences right? Are there any missing or additional needed?

No comment.

Question 16: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

As outlined in the response to Question 12, significant investment is required in the underpinning access and authentication areas to support Health and Medical Science collaborations:

- Internationalisation of the national authentication framework to enable Australian Health and Medical science research to be accessed globally; and
- The deployment of ORCID on a national level to support this capability area.

Question 17: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Health and Medical Sciences capability area?

- The underpinning capabilities (network, access and authentication) are critical to future planning and development of infrastructure for Health and Medical sciences;
- This group needs to be better serviced by the Australian Access Federation due to their diverse, complex and evolving requirements which are beyond the service that the national authentication service currently provides. Further investment is required in the following areas:
    - o Authorisation tools and technologies to assist the research capability manage access rights to their user communities and domains. In particular the development of enhanced authorisation processes to enable fine-grained access to data for sensitive data sets provided by this domain;
    - o An incremental innovation framework for investment is required to meet the bespoke, complex and evolving needs of the capability as they emerge;
    - o Non-web solutions to connect researchers to any non-web research tools, capabilities and services (HPC, cloud, compute and the research data system) that they may use;
    - o Internationalisation of the national access and authentication service to enable researchers to connect with their colleagues globally;
    - o Expansion of the national access and authentication service to enable access to collaboration partners in industry, government and other market segments not supported by the service in 2016. Government access and collaboration is particularly important in the area of Health and Medical Science;
    - o Evolution of the national access and authentication framework to support new and emerging protocols ;
    - o National rollout and integration of standards that identify researchers with their research outputs such as ORCID.

Environment and Natural Resource Management

Question 18: Are the identified emerging directions and research infrastructure capabilities for Environment and Natural Resource Management right? Are there any missing or additional needed?

No comment.

Question 19: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

As outlined in the response to Question 12, significant investment is required in the underpinning access and authentication areas to support Environment and Natural Resource Management collaborations:

- Internationalisation of the national authentication framework to enable Australian Environment and Natural Resource Management research to be accessed globally; and
- The deployment of ORCID on a national level to support this capability area.

Question 20: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Environment and Natural Resource Management capability area?

- The underpinning capabilities (network, access and authentication) are critical to future planning and development of infrastructure for Environment and Natural Resource Management;
- This group needs to be better serviced by the Australian Access Federation due to their diverse, complex and evolving requirements which are beyond the service that the national authentication framework currently provides. Further investment is required in the following areas:
    - Authorisation tools and technologies to assist the research capability manage access rights to their user communities and domains;
    - An incremental innovation framework for investment is required to meet the bespoke, complex and evolving needs of the capability as they emerg;e
    - Non-web solutions to connect researchers to any non-web research tools, capabilities and services (HPC, cloud, compute, tools and equipment such as sensors in the field and the research data system) that they may use;
    - Internationalisation of the national access and authentication service to enable researchers to connect with their colleagues globally;
    - Expansion of the national access and authentication service to enable access to collaboration partners in industry, government and other market segments not supported by the service in 2016;
    - Evolution of the national access and authentication framework to support new and emerging protocols into the future;
    - National rollout and integration of standards that identify researchers with their research outputs such as ORCID.

Advanced Physics, Chemistry, Mathematics and Materials

Question 21: Are the identified emerging directions and research infrastructure capabilities for Advanced Physics, Chemistry, Mathematics and Materials right? Are there any missing or additional needed?

No comment.

Question 22: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

As outlined in the response to Question 12, significant investment is required in the underpinning access and authentication areas to support advanced physics, chemistry, mathematics and materials:

- Internationalisation of the national authentication service to enable Australian advanced physics, chemistry, mathematics and materials research to be accessed globally; and
- The deployment of ORCID on a national level to support this capability area.

Question 23: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Advanced Physics, Chemistry, Mathematics and Materials capability area?

- The underpinning capabilities (network, access and authentication) are critical to future planning and development of advanced physics, chemistry, mathematics and materials.
- This group needs to be better serviced by the Australian Access Federation due to their diverse, complex and evolving requirements which are beyond the service that the national authentication framework currently provides. Further investment is required in the following areas:
  - Authorisation tools and technologies to assist the research capability manage access rights to their user communities and domains;
  - An incremental innovation framework for investment is required to meet the bespoke, complex and evolving needs of the capability as they emerge;
  - Non-web solutions to connect researchers to any non-web research tools, capabilities and services (HPC, cloud, compute and the research data system) that they may use;
  - Internationalisation of the national access and authentication service to enable researchers to connect with their colleagues globally. Eg. As part of connecting the Australian Access federation internationally a proof of concept has demonstrated the potential value of this service by connecting the Laser Interferometer Gravitational-Wave Observatory (LIGO) to the federation.
  - Expansion of the national access and authentication service to enable access to collaboration partners in industry, government and other market segments not supported by the service in 2016;
  - Evolution of the national access and authentication framework to support new and emerging protocols into the future;
  - National rollout and integration of standards that identify researchers with their research outputs such as ORCID.

Understanding Cultures and Communities

Question 24: Are the identified emerging directions and research infrastructure capabilities for Understanding Cultures and Communities right? Are there any missing or additional needed?

No comment.

Question 25: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

As outlined in the response to Question 12, significant investment is required in the underpinning access and authentication areas to support understanding cultures and communities:

- Internationalisation of the national authentication framework to enable Australian understanding cultures and communities research to be accessed globally; and
- The deployment of ORCID on a national level to support this capability area.

Question 26: Is there anything else that needs to be included or considered in the 2016 Roadmap for the Understanding Cultures and Communities capability area?

- The underpinning capabilities (access and authentication and network) are critical to future planning and development of understanding cultures and communities.
- This group needs to be better serviced by the Australian Access Federation due to their diverse, complex and evolving requirements which are beyond the service that the national access and authentication service currently provides. Further investment is required in the following areas:
    - Authorisation tools and technologies to assist the research capability manage access rights to their user communities and domains;
    - An incremental innovation framework for investment is required to meet the bespoke, complex and evolving needs of the capability as they emerge;
    - Non-web solutions to connect researchers to any non-web research tools, capabilities and services (HPC, cloud, compute and the research data system) that they may use;
    - Internationalisation of the national access and authentication service to enable researchers to connect with their colleagues globally;
    - Expansion of the national access and authentication service to enable access to collaboration partners in industry, government and other market segments not supported by the service in 2016;
    - Evolution of the national access and authentication framework to support new and emerging protocols into the future;
    - National rollout and integration of standards that identify researchers with their research outputs such as ORCID.

National Security

Question 27: Are the identified emerging directions and research infrastructure capabilities for National Security right? Are there any missing or additional needed?

No comment.

Question 28: Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

No comment.

Question 29: Is there anything else that needs to be included or considered in the 2016 Roadmap for the National Security capability area?

- Significant investment is required in the underpinning access and authentication areas to support National Security to:
    - be able to provide an underpinning capability that meets their higher levels of identity assurance for access and authentication to national security research systems. In some cases higher levels of identity assurance are required to ensure that the researcher is who they say they are. This includes:
        - developing and implementing advanced security frameworks for access and authentication;
        - working closely with international working groups in defining standards for advanced access and authentication (e.g. levels of assurance);
        - developing technology solutions not available in the market to meet the advanced requirements;
        - developing an Australian 'thought leadership' capability for meeting enhanced requirements for access and authentication.

Underpinning Research Infrastructure

Question 30:   Are the identified emerging directions and research infrastructure capabilities for Underpinning Research Infrastructure right? Are there any missing or additional needed?

Yes, noting that, Access and Authentication is a key underpinning service that is also a requirement for all capabilities including other underpinning infrastructures such as HPC, digitisation, etc.

Question 31:   Are there any international research infrastructure collaborations or emerging projects that Australia should engage in over the next ten years and beyond?

Table 1 below outlines the international research infrastructure collaborations and emerging projects in relation to access and authentication that Australia must engage with over the next decade.

Emerging international research infrastructure collaborations / emerging projects	Problem to be solved	Outcome	Specific capability/areas that need to be serviced
Internationalisation of the national access and authentication service via the global interconnected federation initiative (eduGAIN – see: edugain.org)	Currently the Australian Access Federation technology stack and policy only provides access for Australian researchers to Australian research infrastructure. Investment is required to connect access and authentication globally	Connecting global research infrastructure to Australian researchers Connecting global researchers to Australia's research infrastructure	All capability areas
Non-web access and authentication to HPC compute facilities, tools and equipment such as sensors out in the field and authentication between IT resources (machine to machine)	The national authentication framework (AAF) technologies only provide a solution for web-based services. Many research applications and tools are not-web based. investment is required to develop and implement technologies for direct systems access (High performance compute facilities and access to command line tools on VMs, field sensors and equipment) The need for IT resources to authenticate between each other is an emerging need eg. Data storage to authenticate against compute facilities.	National access and authentication solutions for non-web applications. Potential solutions for machine to machine authentication to allow access to researchers seamlessly across the research data system and capabilities (not currently achievable with the current access and authentication service).	HPC has a strong requirement for this capability The research data system (data for research and discoverability) has a strong requirement for this capability Capabilities that provide tools to researchers that are not accessed by a web browser have this requirement Data storage and compute has this requirement
Rapidly advancing protocols and new standards for access and authentication are being developed and adopted internationally (e.g. OpenID Connect[2])	New access and authentication technologies are being standardised and developed internationally (beyond the current Security Assertion Mark-up Language (SAML) technology standards used by access and authentication federations). Multi-year Investment is required to incorporated these new technologies into AAF's	A broader range of access and authentication solutions for research tools and capabilities, e.g. the ability for research infrastructure to leverage existing social network identity data (e.g. Google and Facebook identities).	Today, a number of the capabilities have this requirement (eg. NeCTAR Virtual Laboratories, such as the Characterization Virtual Laboratory (CVL), The Atlas of Living Australia, BioPlatforms Australia, Population Health Research Network and AURIN have strong use cases that would benefit from the emerging standards)

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[2] http://openid.net/connect/

Emerging international research infrastructure collaborations / emerging projects	Problem to be solved	Outcome	Specific capability/areas that need to be serviced
	authentication solutions.	It would also be a mechanism to provide authenticated access to the public to address access to open-data.	The research data system Commercial providers of tools, compute, storage and cloud for research
International thought leadership on access and authentication	Alignment of international technologies and policies Influencing emerging authentication standards to address the challenges of the Australian research community.	Economies of scale to maximise innovation investment for national authentication frameworks globally	All capability areas Industry
Global adoption and integration of the ORCID[3] identifier	ORCID the international identifier for researchers is gaining global momentum. Investment is required to integrate Australia's research tools and services to use this identifier.	Every researcher in Australia will have a global unique identifier. Research systems will be able to link a researcher's outputs to this identifier.	All researchers Research organisations, Funding agencies, and industry A number of research capabilities want to incorporate the ORCID identifier into their systems Research data systems and tools including grant management systems and publications

Table 1: *International research infrastructure collaborations and emerging projects in relation to access and authentication*

Question 32:   Is there anything else that needs to be included or considered in the 2016 Roadmap for the Underpinning Research Infrastructure capability area?

Today the national access and authentication service provided by the Australian Access federation is an integral part of the Australian research infrastructure landscape.

The service delivered by the AAF is reliable, scalable and built on solid foundations. It is highly regarded in the user community and forms an integral part of the operations of the services provided by many of the NCRIS capabilities in operation today e.g. ANDS, NeCTAR, RDS, AARNet and AURIN to name a few. The services that AAF deliver are also important to the operations of all Australian Universities, research organisations (eg. CSIRO) and many research support originations in providing cost effective, reliable and secure access to their researchers.

While the AAF has been successful in establishing a service where its operations are sustainable through a subscription model levied to those participating organisations, significant investment in innovation is required into the future to meet the evolving needs of the research system.

As highlighted throughout the response, the access and authentication requirements of the research system are diverse, complex and evolving as new capabilities and technologies emerge. The response has also highlighted that there are many new and emerging access and authentication technologies which require multi-year investment to enable for Australia's national authentication framework. The following summaries the areas of **key innovation investment that are vital over the next 10 years:**

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[3] Orcid.org

- **Internationalisation of the national authentication service** to connect with research and education authentication frameworks globally;
- **Evolution of the national authentication framework to support vital new and emerging access and authentication protocols** today and into the future;
- **Authorisation tools and technologies** to assist research capabilities manage access rights to their user communities and domains;
- **Non-web solutions to connect non-web services** (HPC, cloud, compute, field sensors and the research data system) to the authentication framework;
- **An incremental innovation framework for investment** is required to meet the bespoke, complex and evolving needs of the capabilities and research system as they emerge;
- **Standardised approaches and components** for access and authentication to enable researchers to connect to the research system quickly and securely;
- **National rollout and integration of international standards/services** that identify researchers with their research outputs such as ORCID; and
- **Development and implementation of higher levels of identity assurance, access and authentication services** for those research capabilities requiring it. This includes programs of work to up-lift the current access and authentication service to support higher levels of researcher identity assurance.

It is important to note the pervasive nature of the underpinning capabilities, and that a number of these key infrastructure capabilities are bespoke and essential for enabling the research system, in-particular HPC, Network and Access and Authentication. These underpinning infrastructure capabilities exist as the market is unable to meet the advanced requirements of the research system. Subsequently this highlights the importance to support these capabilities to evolve and meet the ever changing needs of Australian research. Many of these capabilities already collaborate in an open and accessible global community which will continue to support innovation and evolution of these products and services.

Data for Research and Discoverability

Question 33   Are the identified emerging directions and research infrastructure capabilities for Data for Research and Discoverability right? Are there any missing or additional needed?

Ensuring that data controls for access and authentication are considered as a crucial connector for international research collaboration will be an imperative requirement moving forward.

Question 34: Are there any international research infrastructure collaborations or emerging
            projects that Australia should engage in over the next ten years and beyond?

Significant investment is required in the underpinning access and authentication areas to support data for research and discoverability.

These are the same requirements identified in the response to Question 12, Question 31 and Question 32.

Question 35: Is there anything else that needs to be included or considered in the 2016 Roadmap
            for the Data for Research and Discoverability capability area?

It is important that data is viewed in a holistic way in regards the complete life cycle from its creation, storage, catalogue, access through to its final decommissioning. In particular it is imperative that the future considers the needs of the underpinning capabilities to support the requirements of research and data discoverability. It is also important that in order to maximise investment this capability area it is mandated that they use the underpinning capabilities as part of any investment agreement(s).

It is also important to acknowledge the work of the RDSI, RDS, NeCTAR and ANDS projects in establishing the important infrastructure operating today for data and research discoverability. Coordinated investments in these areas are required into the future.

Other comments

If you believe that there are issues not addressed in this Issues Paper or the associated questions, please provide your comments under this heading noting the overall 20 page limit of submissions.

None.