

Towards an Australian Partnership for Sustainable Repositories

A National Infrastructure Development Proposal

The Australian National University (Lead Institution)
The National Library of Australia
The University of Queensland
The University of Sydney
Australian Partnership for Advanced Computing

23 October 2003

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Summary:

The Australian Partnership for Sustainable Repositories (APSR) responds to the call to develop the national research information infrastructure through a broad, repository-based architecture. First, the proposal has an overall focus on the critical issues of the access continuity and the sustainability of digital collections. Second, it will build on a base of demonstrators for digital continuity and sustainability, embedded in developmental repository facilities within partner institutions. Third, it will contribute to national strength in this area by encouraging the development of skills and expertise and providing coordination throughout the sector. APSR will actively provide international linkages and national services.

BODY

1. Background and Context

A vibrant, energetic national research enterprise rests on ready access to data and information, and to scholarly communications. Convergence within technology-based information transformation, transmission and storage leads to a vision of an information infrastructure in which of all types of information can become readily available to all researchers, independent of location, research methodology or disciplinary base. This is captured by the WINWINI aspiration – what I need, when I need it.

International communities are marshalling resources and expertise to realise this vision on a time scale that is leaving Australia in their wake. This is not because we lack a national awareness of the vision, nor because of a lack of enthusiasm, nor because of a dearth of specialist skills and expertise. Rather, it is largely because we are not bringing these factors to bear on the development of our research infrastructure in a coordinated and non-competitive way. Resource problems are of course playing a role. Without coordination and sharing expertise to create a well-informed 'network of expertise' within our relatively small higher education sector, it will be difficult to realise this vision in a national setting.

The current information infrastructure available at a typical research institution is characterised by:

- an increasing pressure on the cost, timing and access arrangements of scholarly communication,
- a rapidly increasing demand for access to research data,
- a rising importance of computational modelling,
- rapidly superseded storage and access technologies and inadequate organisational preparations, which have already created a “black hole” in the nation’s research resources,
- the need for effective access, rights management and preservation of digital objects to address digital impermanence, and
- the inability to effectively disseminate Australian research in some subject areas under current scholarly publishing arrangements.

This submission seeks funding for a collaborative effort involving, initially, the following five institutions:

- The Australian National University (lead institution)
- The National Library of Australia
- The University of Queensland
- The University of Sydney
- The Australian Partnership for Advanced Computing

Other institutions committed to the objectives of the centre will be encouraged to participate.

These partners will create and run a centre capable of meeting sector-wide objectives for the development of sustainable information resources. The centre is provisionally called the Australian Partnership for Sustainable Repositories (APSR).

The objective is that the centre will develop over its first year of operation a critical mass of expertise in digital continuity and sustainability, a deep engagement with sector-based and national implementation projects, a set of strong linkages with international developments, and an effective coordination of activities with other organisations having responsibility for national infrastructure developments. A key rationale for the centre is that the Australian higher education sector requires

a catalyst to encourage and enable institutions to take action based on best practices that will ensure continuity of access over time. A national program in digital continuity – the core program of this proposal - will serve as a national information infrastructure resource directly assisting Australian higher education institutions to identify, manage and maintain access to key research and information assets in digital forms. It will take a leading role in encouraging the development of a network of sustainable repositories that can act in a coordinated way to address the management of digital objects without which new forms of scholarly communication cannot operate.

2. Objectives

2.1 APSR Context

The raison d'être of APSR is to play an active role in the development of robust repositories within the national research infrastructure, and to this end resource allocation strategies will be focussed on implementation projects to the highest practicable degree. APSR will meet this mission through a particular approach, schematically indicated in figure 1.

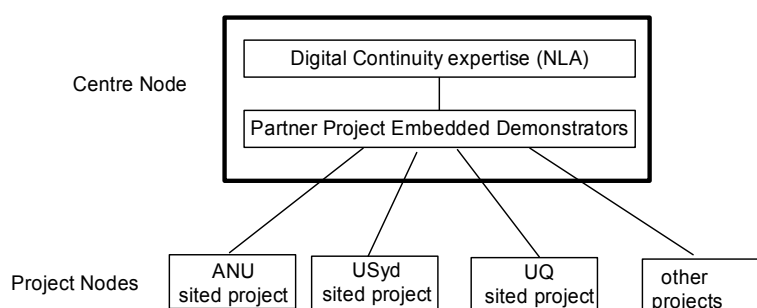


Figure 1: Activity Structure

APSR will adopt the following as a unifying theme.

Digital Continuity: Without an appropriate structuring of digital data storage and access mechanisms, much of the investment in creating digital data will be lost and the potential for future use for research, evidentiary or commercial purposes will disappear. The activities required to ensure continuity of access go well beyond the basic storing and managing of data, and include a focus on:

- how resources are created,
- using formats and standards that offer the best chances of survival,
- identifying and selecting resources of enduring value,
- recording appropriate metadata,
- assigning persistent identifiers,
- protecting data and maintaining the authenticity of content, and
- maintaining reliable means of providing access over extended periods of time.

The National Library of Australia will carry a leading role in this activity.

APSR will coordinate a collection of partner projects. These projects represent the partners' leading edge activities and expertise in information infrastructure. Crucially, the projects will serve as test-beds to instantiate the best practice in digital continuity and sustainability issues. The partner projects will be identified with the following major infrastructure themes:

Repositories: APSR commits to being a strong participant in the institutional repository movement. At the system level, one or more of the major open-source repositories (DSpace, FEDORA, eprints.org) will be adopted as the basis of a developmental program. This will allow the associated issues (such as sustainability, rights managements and metadata) to be handled in a uniform manner and appropriate business practices to be incorporated in the repository.

Access Platforms: APSR commits to providing researchers with gateways into the corpus of Australian research in selected subject domains. This will involve working with the technologies of harvesting metadata from collaborating repositories, and of federated search across collaborating repositories. This will require the relevant issues (interaction protocols, metadata standards across a domain, rights management) to be handled on a national level, in the context of international best practice. The university partners will carry these activities.

In turn, this infrastructure will be exercised in the following activity areas:

eScience: Here eScience is associated with a data-centric view, involving large data sets of experimental and computational data, in contrast to the document-centric view of scholarly communication. This program will focus on allowing researchers to work across the two views by, for example, constructing a report that seamlessly lets the reader run simulations against experimental data provided dynamically by the Access Grid.

eHumanities: This will support moving past the text-centric notion of a document in scholarly communication, to the situation of arranging a wide range of elements (expert commentary, original documentary sources, collected data, audio and video) into a web that can be traversed and explored in a number of ways. Exemplars exist (CRIO, Paradisec), and this program will develop tools and techniques, and provide a context where these can be explored by researchers. The Australian Partnership in Advanced Computing will carry the links into these activity areas.

2.2 Partner Context

A partner is a university or an affiliated organization which has: a strategic commitment to the development of institutional digital repositories; a significant implementation program involving repository technology and a collection program focussed on research materials having sector-wide relevance; a commitment to sector-wide cooperation in the development of institutional repositories; and a commitment to APSR objectives and a willingness to contribute to APSR processes. The responsibilities of participation in APSR as a partner include participation in APSR core activities, such as standards setting, evaluation, and adoption, expertise network, skills pool, international linkages and benchmarking; and membership of the Steering Committee

3. Program

The key activities of APSR indicated in figure 1 need to be augmented by a strong coordination framework to ensure that sector-wide objectives are met. The structure of APSR from this operational standpoint is schematically indicated in figure 2.

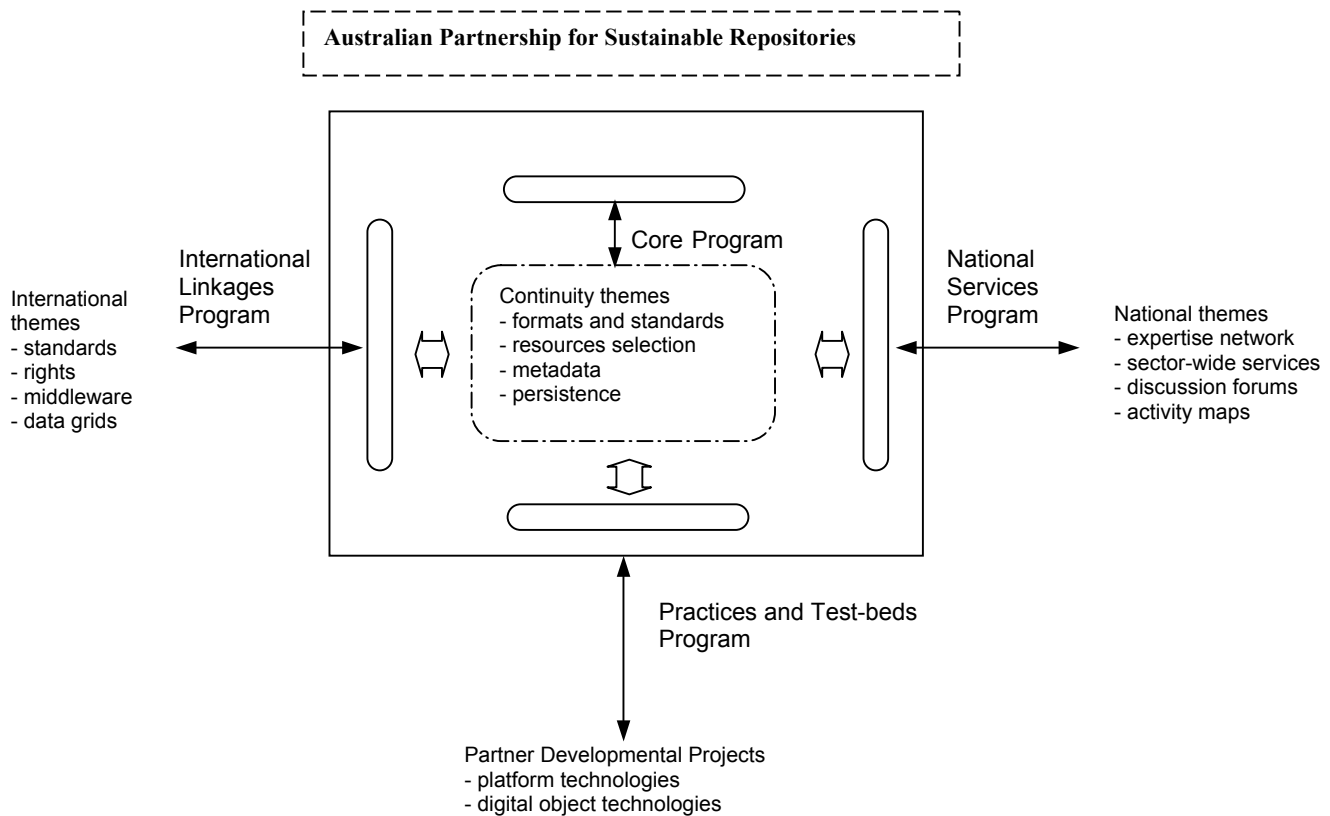


Figure 2: Operational Structure

The key features of this structure are:

- the central role of the digital continuity and sustainability themes through the Core Program,
- an explicit program linking international developments to all centre activities,
- partnerships with institutions having an operational commitment to repositories,
- strong coordination with national data-grid developments, and
- support for a national expertise network.

This section describes the APSR partnership and management arrangements, aimed at developing a broadly based partnership across the sector, followed by a description of the programs themselves.

3.1 Partnership and Management

3.1.1 The Partnership

It is planned to establish APSR as an unincorporated joint venture among partners. It will be governed through a Steering Committee representing the partners and taking overall responsibility for the project. ANU will host APSR and in that role will be accountable for external funding into the centre. An Executive Officer will be appointed to run APSR.

The APSR objectives will be pursued through four outcomes-oriented programs, namely, the Core Program, the International Linkages Program, the Practices and Test-beds Program and the National Development Program.

The relevance and importance of the APAC Grid program to the role of APSR in strengthening the national research infrastructure will be carried by an APAC-APSR Coordination Framework. This framework allows the organisations to collaborate closely and to work jointly in building and

strengthening Australia's information repositories. Where appropriate this will lead to the pooling of resources.

3.1.2 Management

The APSR management arrangements are schematically indicated in figure 3.

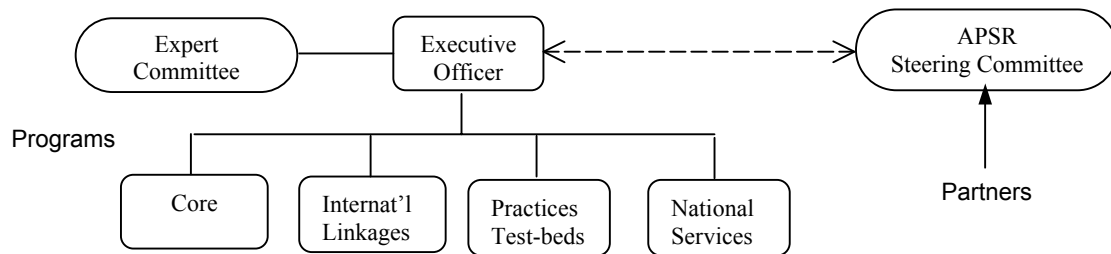


Figure 3: Management Structure

The Steering Committee will include a representative from each partner. The Committee will approve objectives, associated plans and resource allocation to the APSR programs. The Committee will also approve management arrangements, and the incorporation of new partners, including linkage arrangements within the Practices and Test-beds Program.

The Executive Officer will have expertise in advanced information management and will have leadership experience. The work of APSR will be assisted by an Expert Advisory Committee. Program leadership roles will be assigned as responsibilities to staff appointed to APSR, or otherwise made available by partners. Administrative and system support will be provided by ANU.

3.1.3 Growing the Partnership

APSR has been designed as an open partnership with low overhead participation. As a national architecture for institutional repositories evolves, institutions committed to contributing to that architecture will be encouraged to join the partnership. As outlined in the previous section, commitments to the partnership are tied to a willingness to cooperate and share information rather than to providing resources. The relatively short lead-time has limited discussion to the initial partners in whose name this proposal is being submitted. These initial partners have good reasons to believe that there will be significant expansion of the partnership once the unincorporated joint venture has been set up. The lightweight management of the APSR coordination framework and the emphasis on expertise being applied to facilities with significant user communities underlie this belief.

3.2 Programs

3.2.1 Core Program: Digital Continuity and Sustainability

This program has the following key objectives.

1. *Install and maintain a repository of generic tools, software, and documentation to facilitate the sustainability and ongoing accessibility of digital research resources.*
2. *Develop and provide aids that support the planning of sustainability repositories.*

This program will develop a proactive service that supports planning for the longer term, with tools for management decision making, including model sustainability policies and plans, cost models,

risk assessment tools, and risk indicators such as technology watch services. In more detail, the program will carry out the following services.

- *Developing tools:* Through this program APSR will hold information on and provide access to generic tools to support digital asset management. Areas that will be supported will include automated selection and data gathering, metadata creation, data interchange, use of persistent identifiers, records management, authenticity and data integrity, migration, emulation, investigation of appropriate search engines and other means of ensuring and maintaining access. Many of the tools or services the sector requires may be addressed by overseas initiatives such as file format registries and emulator archives or by local services outside the Australian higher education sector such as software archives, data recovery and disaster recovery services. Where such initiatives or resources exist, the program will act as a conduit to enable Australian universities to find the assistance they need in an appropriate form and within an acceptable timeframe. Where the required generic tools are unavailable, the program will work with other agencies in developing tools to meet specific needs within the sector.
- *Sifting information:* expertise on dealing with the information of greatest relevance to the sector;
- *Advocating standards development:* identifying existing standards and advocating standards implementation in priority areas for the sector;
- *Developing skills sets:* identifying and promoting the skill sets and attitudes in support of digital access and sustainability programs;
- *Fostering coordinated strategic planning in the sector:* standard methodologies and a vehicle for assessing and reporting on progress and needs in the sector;

While all partners will participate in this program, the National Library of Australia will be a major player in bringing its expertise in this area into the program.

3.2.2 Practices and Test-beds Program

This program has the following key objectives.

1. Develop and populate repository platforms through partner relationships which trial, prove and demonstrate functionality which both informs, and is informed by, the Core Program

APSR will begin with several projects which draw on commitments from the initial partners.

Synopses of these projects follow, and fuller descriptions are provided as appendices. Each of the projects serves the APSR mission and, in particular, draws on and develops the Core Program.

The Australian National University: Integrated Repository Framework Project

The immediate aim of the Integrated Repository Framework Project is to develop, test and populate an integrated repository using the DSpace software. Developed at MIT in conjunction with the Hewlett-Packard Corporation, the open-source DSpace is designed to accommodate multiple publishers with devolved management and publishing processes on a shared server. DSpace supports several international metadata harvesting protocols including OAI and OpenURL and is extendable. Although the initial focus will be on scholarly information resources developed within the Division of Information (for example, eprints, epress publications, digital theses and digitised texts), it is planned subsequently to extend the scope of the project to include large e-science research datasets held and managed locally and multimedia resources created elsewhere on the ANU campus by such bodies as the National Institute of the Arts (NITA) and the Consortium for Research and Information Outreach (CRIO). The project will also address issues relating to scholarly communication stewardship including peer review and accreditation, copyright and intellectual property, research assessment metrics, and economics and cost modelling. The

development of the framework will provide a national model for the use of DSpace in identifying, enabling access to and curating distributed digital resources across a range of distinct communities.

University of Sydney: e-Humanities and continuity, e-Science Applications and Infrastructure

Recent developments in e-science technologies and applications, including Grid applications, enabling high capacity linkages, complex large-scale analysis and synchronous collaboration provide many opportunities for adoption and use in the emerging areas of e-humanities research requiring such capacities. The project will demonstrate the application of e-science methodologies and infrastructure to the e-humanities, and develop sustainable digital repository and publishing models for content, derived outputs and product. It will extend the use of high level data facilities for the storage, management and complex analysis and preservation of primary source humanities research data and also build on existing collaborative relationships with the project partnership and support the expansion of these collaborations. It will work with bodies of new content to resolve issues relating to harvesting, metadata, storage, persistence and incorporation of new information into the distributed repository.

University of Queensland: eScholarship Australia

The eScholarship Australia project will assist researchers access research information, experimental results and research data available digitally across Australia. The conversion of data files, content and descriptive elements to XML using automated means appears to provide a possible solution to the challenge of improving accessibility and to this end the project will establish a demonstrator approach to the use of various affordable technologies for conversion of data to XML. The project will also involve the testing of various applications software, emphasising open source solutions, to support the resource discovery activity, and investigate database storage issues. The goals of the project will be to encourage better reporting of academic research outputs, to facilitate access to information about Australian research, to improve its visibility and usability, and to add value to existing information by standardising subject classifications and descriptions across material harvested from a range of different sources. The experience of a single institution will then be extrapolated to others Australia wide.

2. Contribute to the development of middleware to serve the purposes of 1, and in the process contribute to international community efforts to produce open software for institutional repositories.

Each collection in an institutional repository will, in principle, require a domain-specific repository view, including such elements as content ingestion mechanisms, authorisation business process, metadata refinement and search indices. This program will ensure that support for this customisation will be carried out in a common framework over the partner projects. Like the institutional repository itself this work will be carried out in the open software context.

3. Collaborate with APAC in developing the national infrastructure supporting E-research.

APAC has a proactive commitment to supporting eResearch through grid-based technologies (computing, access and data). Through this program APSR will collaborate with APAC to integrate these technologies with the web-based digital repository technologies. In the end the researcher should have a seamless view of resources, not a bi-focal one where some resources are delivered in a high-performance grid context and other resources are delivered using lower-performance web protocols.

3.2.3 International Linkages Program

This program has the following key objectives.

1. *Participate in and contribute to the development of international standards for digital access and sustainability.*
2. *Participate in appropriate programmes to develop and enhance Australian expertise in designated digital support infrastructure and to widen the national skill base.*

Through this program APSR will establish strategic alliances with relevant international industry and research organisations to facilitate participation in major international programmes and to address collectively shared challenges in digital access and sustainability. Specific relationships will be established with the JISC (Joint Information Systems Committee) Digital Curation Centre, the European ERNET (Electronic Resource Preservation and Access Network), the UK Digital Preservation Commission and the UNESCO Digital Heritage Programme. Liaison in the wider curation context will be established with bodies such as the Digital Library Federation; the National Science Foundation's Digital Library Program; the UK E-Science Programme and the Global Grid Forum.

3.2.4 National Services Program

This program has the following key objectives.

1. *Provide advisory technical services*
2. *Provide effective skills transfer opportunities*

Through this program APSR will use its tools, expertise, information sources and contacts to build an integrated set of advisory and support services aimed at addressing the sector's key requirements.

A key aim of the program is to enhance cooperation between institutions so that costs can be minimised and benefits can be shared. The program will establish working arrangements with all universities in Australia and seek multilateral cooperative arrangements based on common needs and issues. Where a bilateral collaboration offers particular benefits, appropriate arrangements will also be encouraged.

In more detail, APSR will draw on its in-house capability and expertise network to provide the following services:

- Advising on standards and best practices: advice on standards for data creation, metadata, file formats, managing long-term accessibility – including data creation, digitisation practices, file management, metadata, repository 'set up', technical infrastructure, methodologies for systematic selection of materials. Crucial to this cooperative approach will be the identification and adoption of common standards and practices. Accepted and verifiable standards are an essential component of ensuring the integrity of digital data and APSR will play a dual role in specifying standards and in advocating and participating in standards development as appropriate.
- Providing access to the experiential base within APSR Practices and Test-bed Program: to assist in raising awareness of costs, and in finding help for practical needs such as file format registries, software archives, data recovery, and disaster recovery services. APSR will also play an important coordinating role in relevant research, working with institutions to identify needs and barriers, and working with research providers to either identify existing work of interest or set up relevant research programs. To support this role, this program will set up and maintain an operational model of a digital repository as a test bed for research use.
- Problem solving: assistance with finding a consistent and informed preservation solution to institutional problems.

- Characterising service providers: information on characteristics of market place repository and sustainability services for data creation, archival appraisal and related services;
- “Continuity brokering”: advise on and facilitate the handover of responsibility where there is likely to be a need for collections of digital resources to move from archive to archive as circumstances change. This service is intimately related to developing failsafe agreements between archives, and providing a forum to consider threatened collections;
- Education and advocacy: tools, information, guidelines aimed at faculty and research students focused on protection and preservation of their research data. Also focussed on supporting education programs within institutions aimed at ‘up-skilling’ future generations. In addition to providing technical advice addressing specific needs, APSR will also seek to identify and remedy essential skills deficits through advocacy activities and by offering relevant training within the sector. Allied with this activity, APSR will establish and take advantage of contacts with organizations and programs in Australia and overseas that produce information and ideas of potential benefit to the sustainability of Australian digital research assets.
- Providing management aids: including cost models, model copyright agreements, model policies and plans, and risk assessments associated with digital continuity and sustainability.

4. Outcomes

Interpreted broadly, the main outcome of the project by the end of 2004 will be the development of a vigorous and effective national centre, here called APSR. This centre will collectively harness the energy and enterprise of its partners, and will be more effective than the institutions working independently with only ad hoc collaboration.

The concrete outcomes of APSR will include the following.

- Easy centralised access to current generic tools, software and information that support digital sustainability planning and management of digital repositories for continuing access.
- The delivery of national best practice standards and guidelines for managing digital repositories.
- A coordinated development of a distributed network of reliable higher education digital repositories.
- A focus for collaboration among higher education institutions to address issues of mutual concern concerning continuing access to digital research resources.
- Developed and supported links with international organisations.
- On-going access to important Australian research information that resides in digital form.

5. Benefits

APSR will provide benefits to the higher education sector, to other research institutions, to current and future generations of users of the research output of Australian higher education institutions.

At the national level, APSR would be core to the higher education information infrastructure, filling a gap that currently exists, and would contribute to the sustainability of digital repositories. Specifically, APSR will provide:

- A focus for the complex issues associated with ensuring continuing access to Australian research resources into the future
- A catalyst for facilitating best practice by the higher education sector
- A mechanism for harnessing existing expertise in the field of digital sustainability and maximising the potential of this in the national interest.

At the institutional level, APSR provides a context where the development of repository infrastructure can be carried out within an identified community of interest. This will provide an

efficiency dividend, as best practice solutions can be pursued without each institution having to “reinvent the wheel”. At the researcher level, APSR would also serve to strengthen confidence among researchers and creators in the reliability and integrity of information in digital form by facilitating ways of addressing their concerns. Australian research will be more accessible and better known to the overseas research community, making Australia more competitive and better able to take its place in the international research arena.

6. Dissemination of Information

Two of its constituent programs, namely, the National Services Program and the International Linkages Program, are essentially focussed on outreach activities. The relevant program descriptions (in sections 3.2.4 and 3.2.3 respectively) explicitly spell out high-level commitments to the dissemination of information.

More generally, APSR will generate, over time, an extensive collection of documents (position papers, standards statements, tutorials) and software (repository systems, ingestion tools, presentation tools). These will be treated, in the context of APSR, as digital objects and will be managed appropriately. APSR itself will be an exemplar of best practice. In particular, the objective for all software systems and tools is that they are constructed from modules and subsystems that incorporate relevant open standards. Where possible there will be a working system that is constructed from open source software that meets these standards (there may of course be systems constructed from commercial off the shelf (COTS) software that meet the standards). The open source systems will be available through a mechanism modelled on the Redhat distribution of GNU Linux. A complete set of packages (a so-called system in a box) will be supplied so that, if package dependence is met, the working system can be reliably installed and executed.

7. Implementation Timetables

The following timetable elements apply to the national centre itself. The partner projects will develop their own internal milestones.

Year One:

- Quarter 1. APSR established as an unincorporated joint venture; Steering Committee established and working effectively; Executive Officer in place, at least as an interim appointment.
- Quarter 2. All APSR programs working effectively, with assigned and appointed staff; Expert Committee established and working; partner projects integrated into APSR; main demonstrator systems available as “software in a box”.
- Quarter 4. APSR fully functional, with sector-wide recognition as a national centre. Strong outreach program, with established seminar series and training courses.

Year Two: Extended partner base; APSR-generated software systems available throughout the higher education sector.

Year Three: Consolidation of activities, with some services being moved from APSR into the main-stream institutional base; identification of and commitment to a new three-year program.

APPENDICES

A1. Partner Institutions

The Australian National University (ANU) has been a leader in the development of digital asset management systems designed to manage and preserve data in digital form and has already established a number of digital repositories. It established Australia's first E-Prints server, is now setting up an E-Press, has participated in the Australian Digital Theses Project and has created its own electronic reserve collection for high-use library materials. ANU is the lead partner and will host the Centre, provide an operating platform for its computing needs, and facilitate liaison with the higher education sector.

The Australian Partnership for Advanced Computing (APAC) was formed in June 2000 to lead the development of an Australian high-performance computing infrastructure supported by coordinated programs in research, education and technology diffusion. APAC is a national partnership of eight Australian organisations involving 27 Universities. The partnership has an organisation in each State as well as the ANU and CSIRO. Collectively, APAC and its partners have invested over \$80m in Australia's advanced computing infrastructure and expertise during the past 3 years.

APAC has submitted an application to the Systemic Infrastructure Initiative seeking Federal Government funds of \$29m for the next stage of its operation from 2004 to 2006. The mission of APAC in this stage will focus on providing the advanced computing and grid infrastructure for eResearch.

The National Library of Australia (NLA) is a national leader in the creation of digital repositories and in the development of national platforms designed to support access to and the preservation of digital resources. It has a particular expertise in the development and application of the national and international data management and description standards that are required to support such ventures. In addition, it is an active participant internationally in projects related to digital sustainability. Notable examples of its achievements include the development of an integrated digital resources management and access system which involved the building a Digital Object Management System for hierarchical collections, a persistent identification and resolving system, and online delivery systems for digitised collection materials. In addition, the NLA was among the first few libraries in the world to put in place systems to support collecting and providing access to online publications. PANDORA: Australia's Web Archive was developed in-house for this purpose in 1997. PictureAustralia, a national cooperative venture designed to provide online access to a wide range of Australian pictorial images in digital form, is another highly successful digital service provided by the library.

NLA will provide preservation perspective and expertise to the project, and will provide guidance, training and expert input to the Centre's programs.

The University of Sydney Library established the Scholarly Electronic Text and Image Service (SETIS) in 1996. In recent years, SETIS has expanded its activities to support a wide variety of digital projects including electronic publishing.

In addition to the expertise of Library staff, the University has a number of other staff members and postgraduate students who are involved in digital projects. There are at least fourteen major

projects underway within the University which are concerned with the management of digital objects. These include eScience and eHumanities repositories which have national and international significance.

The University of Sydney has the capacity to provide expertise on a range of areas including metadata, standards, repository management, intellectual property, content collection and preparation as well as e-publishing. The sources of advice include Library and academic staff as well as external partners with whom the University participates nationally and internationally.

The University of Queensland has considerable expertise in creating and managing digital collections. The Library has participated in a number of nationally significant projects such as the Australian Digital Theses project, the AVEL Sustainability Network, the WebLaw initiative (where UQ was the lead institution), ePrints@UQ (an open access repository of UQ research), and the DigiLib project (architectural images of Queensland). A project on digitisation of oral tapes has also taken place. The Library is a contributing partner to PictureAustralia. The Library has considerable expertise in Web-database integration programming, system administration and hosting, metadata, including an existing metadata repository code library (developed by UQ Library Technology Service staff for the WebLaw project) and in programming languages such as Perl, PHP, Java and Javascript.

A2. Personnel

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