

Macquarie E-Learning Centre Of Excellence  
(MELCOE)

Research Activityflow and Middleware Priorities project

***“RAMP”***

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## Executive Summary

The Research Activityflow and Middleware Priorities (RAMP) project seeks to improve national research effectiveness by addressing two of the most challenging components of the DEST/JISC E-Framework for Education and Research and the DEST Accessibility Framework – the areas of people-oriented workflows for research processes, and open standards authorisation for protected repositories.

While there has been major investment in research infrastructure such as bandwidth, high performance computing and data storage, there has been relatively little investment in systems to support “process-oriented” research requirements, such as:

- managing the research enterprise lifecycle (from grant planning to grant submission, to project initiation, to project lifecycle management, to research outcome dissemination),
- implementing auditable evaluation processes for assessing research quality (RQF assessor workflows, journal/conference peer review management, etc),
- designing and tracking article submission processes for Institutional Repositories,
- flexibly configuring and running online research collaboration processes (such as staged collaborative analysis and discussion for PhD/Postdocs around raw data, leading to interpretation, visualisation, and ultimately publications), and
- process-oriented research data collection from human subjects (such as in the humanities, and social and cognitive sciences).

The common element of the above examples is people-based workflow, or “activityflow” as it is described in the RAMP project. Activityflow is defined as workflow involving two or more human actors, often acting concurrently (not just sequentially) over multiple steps, potentially in multiple roles, co-ordinated by a software system that allows for authoring, running and tracking (including auditing) of activityflows. As many researchers collaborate across institutional boundaries, activityflows must be capable of running in distributed (trans-organisational) contexts.

A key focus of the RAMP project is capturing E-Research activityflows so that they can be analysed, shared, re-used and adapted. This will lead to a national website providing a library of “actionable” best practice activityflows for common research processes. This approach draws on the success of capturing and sharing “Learning Designs” within e-learning, and applies it to the challenges of people-based workflow in E-Research. This work will be complemented by theoretical analysis of workflow standards and languages as applied to E-Research.

The second challenging component of the E-Framework that RAMP addresses is open standards authorisation (using XACML – eXtensible Access Control Markup Language). There is an increasing need for flexible management of protected content as part of repositories such as Institutional Repositories, E-Reserves, etc, but most approaches to protected content rely on hardwired or proprietary authorisation mechanisms that are inefficient, costly, inflexible and promote system lock-in.

The RAMP project will address the need for open standards authorisation through the creation of a generalised XACML authorisation module that could potentially be adopted by any repository system. This module will be implemented and tested initially using the Fedora repository, based on existing work on Fedora and XACML from MAMS and ARROW. Subsequent implementation with other repository systems will be explored.

The final stage of RAMP will unify the workflow and authorisation components through a “fusion” project to explore interaction and integration between these two areas, and their overall combined impact on the E-Framework. This fusion project will lay the groundwork for potential future work in unified workflow and authorisation services, and their interaction with other E-Framework services.

The partners for the RAMP project are:

- University of Melbourne
- Australian National University
- Charles Sturt University
- University of Southern Queensland
- Macquarie University Library (acting as liaison to the Innovative Research Universities Australia (IRUA) Libraries network – consisting of Macquarie University, Flinders University, Newcastle University, Murdoch University, Griffith University and La Trobe University), and
- ADL Australia.

An international expert panel will advise the project on technical and strategic issues.

The membership of the panel includes:

- Charles Severance (University of Michigan and Lead Architect, Sakai)
- Scott Wilson (Bolton University, JISC and author of the E-Framework)
- Murray Leach (Senior Manager, New Zealand Ministry of Education)
- Sandy Payette (Cornell University and Leader, Fedora Project)
- Dan Rehak (Co-Director, Workforce ADL Co-Laboratory)
- Nigel Ward (ADL Australia)
- John Walsh (University of Michigan and Kuali/OneStart Workflow)
- Kerry Blinco (IMS Australia, E-Framework and RUBRIC)
- Andrew Treloar (ARROW and DAR3T)

Letters of support from partners and experts accompany this proposal. Additional partners and experts may be added to the project in special circumstances.

The structure of the project is closely modelled on the successful MAMS project, and RAMP will liaise closely with the ARROW, APSR, DAR3T and RUBRIC projects. The project will run from 1<sup>st</sup> of July 2006 to 31<sup>st</sup> of December 2007.

## Project Background

In late 2003, the Macquarie E-Learning Centre of Excellence (MELCOE), working in conjunction with 10 Australian universities and international experts from the US, UK, New Zealand, was successful in obtaining \$4.2M in DEST funding for the 2003-2006 “MAMS” (Meta Access Management System) project (Dalziel, 2003a). This project outlined a ground-breaking agenda for development of national identity and access infrastructure for the higher education and research sector, with a particular focus on the needs of repositories.

In late 2005, an evaluation of progress to date on the MAMS project by the Director of Middleware for Internet 2 (Klingenstein, 2005) indicated outstanding outcomes across the MAMS project, including: the implementation of a national testbed federation with over 500,000 identities (MAMS, 2005); extensive liaison and collaboration across the higher education sector in gathering requirements for identity and access management (Dalziel & Vullings, 2005); development of two crucial software systems for privacy and attribute management which complement Shibboleth (“ShARPE” and “Autograph”, MAMS, 2006); liaison with Grid and High Performance Computing communities (Vullings, Buchhorn & Dalziel, 2005); and integration of MAMS systems with repository work undertaken by projects such as ARROW and APSR. Since this review, the “ShARPE” and “Autograph” systems have been chosen for the NSF National Middleware Initiative release (9) – the first Australian developments to achieve this international recognition (Carmody, 2006).

The MAMS project has demonstrated the ability of MELCOE, working with its partners, to make progress in some of the most difficult areas of national IT infrastructure for education and research. These outcomes have been achieved by development of an excellent technical team, rigorous project management, ongoing liaison with international peers and an over-arching vision of the problemspace.

During the same period as the MAMS project, MELCOE has led a second internationally recognised project in the field of workflow for e-learning (Dalziel, 2003b, 2005a). Known as “LAMS” (the Learning Activity Management System), this development has not only had significant pedagogical implications for education, but has also broken new technical ground in the field of people-based activityflow systems. In late 2004, the LAMS team began a complete redevelopment of software to create a new generalised workflow/activityflow system. To date this has been applied to e-learning needs, but the redeveloped system is also applicable to research activityflows. Perhaps most importantly, the conceptual and implementation lessons learned over five years of development of activityflow for e-learning can now be readily applied to E-Research contexts.

The RAMP project builds on the lessons learned and outcomes from MAMS, together with MELCOE’s significant pre-existing capacity in activityflow research and implementation (from LAMS) to break new ground in “process oriented” research IT.

## Research Background

### *Improving Research Effectiveness and National Research Priorities*

Improving national research effectiveness is a major goal for all developed countries in a world where economies are increasingly driven by information and intellectual property rather than physical resources and traditional manufacturing. Complementing this international trend are the Australian National Research Priorities (DEST, 2003):

- \* An Environmentally Sustainable Australia;
- \* Promoting and Maintaining Good Health;
- \* Frontier Technologies for Building and Transforming Australian Industries; and
- \* Safeguarding Australia.

These priorities identify specific local challenges for Australia, and hence areas for particular focus in improving national research effectiveness.

There are many ways to enhance research effectiveness – both systemic and discipline-based. Among systemic approaches, IT infrastructure has played a crucial role in recent years. Significant investments in IT infrastructure include Australia's network and bandwidth capacity (such as AARNet); high performance computing facilities (such as APAC and its state partners) and data storage (including both facilities for massive data storage such as the APAC national facility, as well as institutional repository projects such as ARROW, APSR and various others in the DEST SII funding rounds). Recent years have seen major progress on network and bandwidth issues in Australia.

### *JISC/DEST E-Framework for Education and Research & DEST Accessibility Framework*

As networking requirements are increasingly solved, application and middleware challenges become more pressing. A crucial dimension to next generation application and middleware infrastructure investment is mapping requirements to “frameworks” that describe the broader needs for IT for research and education. The ultimate goal of these frameworks is to reduce duplication and wheel-reinvention, and to enhance seamless linking (or “interoperability”) between disparate systems. Two leading initiatives in this field are the DEST/JISC E-Framework for Education and Research (JISC/DEST, 2005), and the related DEST “Accessibility” framework. These frameworks seek to describe a range of “services” that can be combined in many ways to provide solutions to national education and research needs using open standards and where appropriate, open source software.

The most well-known representations of these frameworks are the “bricks in the wall” diagrams that attempt to identify the wide range of possible services as individual “bricks”, and often group them into loosely related categories (giving the appearance of a wall). This approach has been useful in identifying the range of possible services, and focussing discussion and planning for future development of IT infrastructure.

### *E-Framework Problems: “Whole of fabric” services*

One of the challenges for this approach is that not all “bricks” or services are of equivalent size in terms of development effort, difficulty, and impact on other services within the “wall”. As both Wilson (the author of the E-Framework, see Wilson, 2004) and Dalziel (2005b) have noted, three particular services stand out as especially challenging due to the fact that they impact almost every aspect of the framework; these are identity/access/security (including authorisation), management and workflow. These three “problem” services have been collectively referred to as “whole of fabric” services, in the sense that any solution to these problems is likely to have an impact on all other services that make up the “fabric” of the framework. Conversely, without a solution to these “whole of fabric” services, the whole framework is unlikely to achieve coherency and effectiveness (regardless of success within other individual services).

The identity/access/security service has been the central focus of the DEST-funded “MAMS” (Meta Access Management System) project. This project has achieved significant progress in this difficult field, based on work by the MAMS team in conjunction with leading international experts, particularly those of Internet 2 in the USA, and related JISC-funded projects in the UK. The success of the MAMS project (see Background above for details), both in technical achievements and comprehensive project management is a foundation to the current proposal.

However, the two other whole of fabric services (management and workflow) have received relatively little major investigation to date in recent framework projects; and within the identity/access/security area, there has been little work on open approaches to authorisation. While there have been a number of small initiatives that examined a narrow slice of one of these problems (eg, some JISC repository projects that have investigate repository submission workflows), there has been no equivalent large-scale investigation of comparable size to the MAMS project. Given (a) the outcomes arising from the large-scale MAMS approach, (b) the e-framework challenges noted above, and (c) the existing MELCOE expertise in workflow/activityflow, there is a strong basis for a large-scale investigation into people-based workflow for research – this forms the first major strand of the RAMP project.

The second major strand for the RAMP project is open standards authorisation (using XACML – eXtensible Access Control Markup Language). This area remains a key gap between the existing repository work of projects such as ARROW, APSR, DAR3T and others, and a significant whole of fabric challenge for the E-Framework. Both of these strands are described below.

#### *Strand 1.1 - Activityflow for Research and Education*

While there has been major investment in research infrastructure such as bandwidth, high performance computing and data storage, there has been relatively little investment in systems to support “process-oriented” research requirements, such as:



- managing the research enterprise lifecycle (from grant planning to grant submission, to project initiation, to project lifecycle management, to research outcome dissemination),
- implementing auditable evaluation processes for assessing research quality (RQF<sup>1</sup> assessor workflows, journal/conference peer review management, etc),
- designing and tracking article submission processes for institutional repositories,
- flexibly configuring and running online research collaboration processes (such as staged collaborative analysis and discussion for PhD/Postdocs around raw data, leading to interpretation, visualisation, and ultimately publications), and
- process-oriented research data collection from human subjects (such as research that combines structured tasks including surveys, cognitive testing, review/interaction with multimedia, etc) in the humanities, and social and cognitive sciences.

The common element of the above examples is people-based workflow, or “activityflow” as it is described in the RAMP project. Activityflow<sup>2</sup> is defined as workflow involving two or more human actors, often acting concurrently (not just sequentially) over multiple steps, potentially in multiple roles, co-ordinated by a software system that allows for authoring, running and tracking (including auditing) of activityflows. As many researchers collaborate across institutional boundaries, activityflows must be capable of running in distributed (trans-organisational) contexts.

This area has received surprisingly little international investigation to date as a generalised phenomenon. Despite many years of research and implementation of machine-to-machine computational workflows (such as in Grid computing, as well as in corporate workflow systems), only recently has “people based” workflow been recognised as a domain in its own right (through the work of the “BPEL for People” (IBM, 2005) working group related to the BPEL OASIS workflow standard, see OASIS, 2006a). Even within BPEL for People, the specific challenges of concurrent multi-actor, multi-stage workflows remain unaddressed, and hence many of the needs of the education and research sector remain out of scope for corporate workflow/activityflow systems.

There are many advantages to activityflow systems for research, such as:

- greater standardisation of common or repeatable research processes, leading to higher quality outcomes and improved efficiency;
- the ability to share descriptions of common research processes both within institutions, and between institutions – including the ability to adapt and localise shared research processes;

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<sup>1</sup> The focus here is on the collaborative assessment, decision and rating process of RQF assessor teams, rather than submission of articles to repositories for RQF purposes, such as outlined by Sale (2006).

<sup>2</sup> The term “activityflow” is used in this project to identify collaboration-oriented human workflows, as opposed to machine-to-machine workflows or machine-to-individual workflows. This RAMP definition should not be confused with the “activity” component of early versions of the Business Process Modeling Language (BPML – activity has since been replaced with the word “process”), or “activityflow language”, which is a niche form of machine-to-machine workflow (CoverPages, 2003).

- greatly improved accountability and audit for processes involving multiple actors across multiple steps – such as for research assessment (eg, RQF assessor workflows), as well as for research itself (eg, as a deterrent to academic fraud); and
- providing a process-oriented checklist to ensure the ordered completion of relevant research tasks.

MELCOE is a world leader in the field of people-based workflow through its experience over the past 4-5 years in developing LAMS (Learning Activity Management System, see Dalziel, 2003, 2005) – a system which has received international acclaim from education experts such as Diana Laurillard (JISC, 2004). While early work on LAMS was focussed on e-learning activityflows, a recent complete redevelopment of the software has allowed the LAMS developers to build a generic activityflow engine for the education and research sector which manages people-based workflows (LAMS, 2006). The redevelopment includes a pluggable activity tools architecture to allow for different activity tools to be brought together for different purposes. Of particular note is that the visual authoring environment for building activityflows (which forms part of the core engine) is equally applicable for either E-Learning or E-Research – different activity tools are simply substituted into the authoring “palette” to suit an E-Learning or E-Research focussed application.

The new architecture makes it possible to create an application based on a suite of learning based activity tools for e-learning activity flows; whereas a different application could be created based on a set of research-based activity tools for managing research processes. In other words, a people-based workflow authoring and delivery system (an “education workflow engine” – education in the sense of the education and research sector, rather than just e-learning) can be used with one set of pluggable activity tools for learning (a “Learning Activity Management System”), whereas a different set of pluggable activity tools designed for research processes could be used to create a different application focussed on research (a “Research Activity Management System”). This second system is sufficiently flexible and powerful to potentially address examples of “process oriented” research requirements such as those described on the previous page.

Beyond the specific requirements of activityflow for research is the general context for online research collaboration, and the role of activityflow as a component of this wider environment. In the UK this area is referred to as “Virtual Research Environments” (VRE – see JISC, 2006 – as opposed to a Virtual Learning Environment for e-learning – VLE), and significant existing work in this field has investigated systems that provide a context for research collaboration (but do not include activityflow features). The leading software in this area is Sakai (developed in the US by Michigan, Indiana, MIT and Stanford with support from the Mellon Foundation, see Sakai 2006), with some interest in other systems such as Moodle, uPortal and Gridsphere. Sakai has been of particular interest in Australia for research collaboration, with four Australian universities having joined the Sakai Partner network (ANU, Melbourne, Monash and Charles Sturt, see CSU, 2006) with this as a

focus area. Given this context, there is a strong foundation for investigating the integration of activityflow systems with these more general research collaboration environments, particularly Sakai. As a result, the RAMP project will use integration of activityflow with Sakai as a basis for investigating and demonstrating the general needs for integration between research collaboration and activityflow systems. Integration of activityflow with other systems such as Moodle, uPortal and Gridsphere will also be investigated where possible.

A major outcome of this component of RAMP will be a library of best practice activityflows for common research processes (such as grant submission and management, team based research collaboration, repository submission workflows, etc). Through the implementation of the RAMS software, these activityflows will not merely be descriptions of research processes, but rather they will also be “actionable”, in that they can be run with groups of researchers directly from RAMS. These best practice activityflows will be developed internally by the RAMP team, iterative through workshops with project partners, and through the outcomes of mini-grant projects to partners. A section of the project website will provide a national repository of these activityflows for use (and adaptation) all Australian researchers.

#### *Strand 1.2: Analysis of existing workflow languages and approaches*

The experience of developing LAMS over five years, combined with the ability to implement the new generation of the system for E-Research activityflows (not just E-Learning sequences), provides the basis for fundamental new research into the nature of process-oriented systems of research and education. The lessons learned from the practical implementation of LAMS are invaluable for a more general theoretical analysis of existing workflow languages, and other related workflow systems, such as a range of open source corporate workflow systems (such as Intalio, etc) as well as development of a workflow system to complement the “Kuali” open source higher education ERP system funded by the Mellon Foundation in the US (this project runs parallel to the Sakai project). The focus on this fundamental analysis will be the implications of existing workflow languages, open standards and activityflow systems for future evolution of the research and education sector over the next five to ten years.

#### *Strand 2: Open Standards Authorisation using XACML*

The second major strand of work for the RAMP project is in open standards authorisation, using the XACML (eXtensible Access Control Markup Language, see OASIS, 2006b) open standard as a basis for this work. Almost all current repositories use proprietary or “hardwired” inflexible approaches to authorisation, resulting in enormous difficulties in moving secure/protected information from one application to another – with the frequent result of vendor lock-in to existing systems. Hardwired/proprietary approaches also greatly limit the ability to provide unified (potentially national) policies for access to secure/protected information in federated

contexts (such as those now possible through the implementation of Shibboleth for a national federation). Hardwired/proprietary approaches also potentially lead to security risks for protected information where no appropriate access restrictions can be specified using existing systems. Finally, hardwired/proprietary approaches make it very difficult (if not impossible) to change authorisation rules to suit changed research or legislative requirements that were not envisaged at the time of development of the original repository software. All of the above provides a strong argument for a policy-based open standards approach to authorisation to ensure flexibility and to avoid system lock-in.

The MAMS project (including collaboration with ARROW and Fedora) has conducted initial investigation into the use of XACML for repositories. One aspect of this work is the development of standard XACML policies based on common repository use cases – this work is progressing well as part of the “B+” XACML working group of ARROW and MAMS (Blake, 2006). The MAMS project will continue to work with ARROW on this area.

Separate from the policies themselves is the need for XACML based authorisation software. A (very) simple XACML-based repository demonstrator (based on Fedora) was successfully developed within MAMS during 2005. Following a demonstration and discussion with Sandy Payette of Fedora, together with consideration of its potential use for other repository projects such as DSpace, e-Prints, CORDRA and other Grid-based large dataset repositories, it was determined that a need exists for development of a generic “authorisation software library” (a software module that can be incorporated into many other software applications) for repositories based on XACML.

To demonstrate the practical use of this library, further development of the existing MAMS XACML Fedora demonstrator is warranted – and this proposal received support from Sandy Payette, as well as others in the repository area when discussed during the period of the Open Repositories 2006 conference hosted by APSR in early 2006. As a result, the second major strand of work for the RAMP project will be to develop a generalised XACML authorisation system for repositories (as a generic software “library” or module), and to test its implementation on a range of repository use cases using Fedora (such as protected content in an Institutional Repository, protected E-Reserve content, protected past exam papers and protected image/sound/multimedia resources such as those required for PARADESIC, AISTIS repositories of sacred images, protected multimedia for military training such as with SCORM/CORDRA, etc).

This strand will also seek to test the XACML authorisation system with other repositories (such as CORDRA, DSpace, etc) as appropriate to their current architecture and development priorities. In the event that other systems are not at an appropriate development stage to adopt the system during the life of the RAMP project, technical documentation of how to adopt the system will be provided to allow other projects to adopt it at an appropriate later date.

### *Strand 3: Fusion of activityflow and open standards authorisation*

The final stage of RAMP will unify the activityflow and authorisation components through a “fusion” project to explore interaction and integration between these two areas, and their overall combined impact on the E-Framework. While this work will necessarily be preliminary (as it requires substantial outputs from the first two strands as a prerequisite), it will explore and document a number of fusion points between activityflow and open standards authorisation.

Examples of potential interaction/integration areas to explore and document include: use of repository submission activityflows with XACML-based repositories; use of XACML for access to E-Research activityflows; and use of XACML for management of roles and privileges in E-Research activityflows.

This fusion project will lay the groundwork for potential future work in unified workflow and authorisation services, and their interaction with other E-Framework services.

### **Objectives of the Project**

The project continues the three guiding philosophies of the earlier MAMS project, updated to suit the specific needs of the RAMP project as follows:

#### *1. Build on existing developments and collaborations wherever feasible*

As outlined above, the first strand (activityflow for research) will build on the lessons learned from the LAMS project, as well as related workflow developments in open standards (eg, BPEL, BPEL for People, BPML, etc), ERP systems (eg, Quali workflow), open source corporate workflows systems (eg, Intalio) and related work. The project will maintain close liaison with related international efforts through a national and international expert advisory group (see below), including liaison with groups such as Sakai, Quali, NZ Ministry of Education, Fedora, VRE implementations in the UK, ADL Australia and other related projects. The RAMP project will also work closely with existing FRODO and MERRI projects, especially those dealing with generalised research infrastructure such as MAMS, ARROW, APSR, DAR3T and RUBRIC.

#### *2. Use open standards/specifications, and develop open source software*

The RAMP project will seek to adopt general open standards (such as HTTP, XML, etc) wherever possible and appropriate. The project will investigate open standards for workflow/activityflow as a core part of its theoretical review in Strand 1.2. Strand 2 will be based on the open XACML standard for authorisation/access control. As with the MAMS project, all software developed during this project will be made freely

available as open source software using an OSI (Open Source Institute) certified license.

### *3. Adopt a pragmatic, legacy-driven approach and liaise with related projects*

As already noted, the RAMP project will build on existing development both within Australian and internationally in a range of areas such as activityflow (LAMS), workflow (Grid workflow, BPEL, BPEL for People, BPML, etc), collaboration environments (eg, Sakai, Moodle, uPortal, Gridsphere) and repositories (Fedora, DSpace, GNU Eprints, CORDRA, etc). The focus of all development in the project is based on recognising legacy environments and focussing on rapid iterative development of demonstrators to gather requirements to form the basis of future production system development. The project will liaise closely with FRODO and MERRI projects, particularly MAMS, ARROW, APSR, DAR3T and RUBRIC.

## **What will be done**

Following the successful approach of the MAMS project, the RAMP project will focus on three main types of activities: Capacity building and requirements gathering; Technical solutions; and Implementation experience. While significant technical work is always required in projects of this nature, the complementary capacity building/requirements gathering and implementation components ensure significant community involvement in both the inputs and outputs to the requisite technical work. Activities for each stage are described below.

### *1. Capacity Building and Requirements Gathering*

Both research activityflows and open standards authorisation are important but relatively new areas of development for Australian E-Research, so a key aspect of the early stages of the project are conducting workshops around Australia to explain the core concepts of these areas so as to build technical and organisational capacity across research groups, and to iteratively gather requirements for systems development and implementation. The requirements gathering process will use the successful “Demonstrator” approach of the MAMS and COLIS (Dalziel, Philip & Clare, 2005) project to rapidly illustrate potential features, gather detailed feedback, conduct rapid prototyping and development, and repeat the process of requirements gathering several times during the time of the project.

Workshops will be complemented by a detailed project website, including articles, white papers, technical documentation and related information. In addition to general requirements gathering workshops around Australia, specialised technical workshops on specific topics will be run at Macquarie for relevant experts (such as the “Virtual University” and “Shibbolising Service Providers” workshops run for the MAMS project) – these specialist workshops made be used to complement the mini-grant programs.



## 2. Technical Solutions

The Research Background section above outlines many of the general technical challenges to be addressed in the project. The following section summarises major areas of technical work within the project (under the major headings outlined). While not all areas may be achievable within the time and budget constraints of the project, they provide a roadmap for current and future development. Individual items which may not be completed within current constraints are marked with a \* below.

### *Strand 1.1: Activityflow for Research and Education*

- Creation/adaptation of activity tools to match core research collaboration processes so as to create a “Research Activity Management System” (RAMS) – this element will be ongoing and evolving throughout the project arising from iterative feedback – most of the items below for this strand are sub-components of this overall technical area
- Extensions to the core “education workflow engine” to allow for advanced research workflows, including branching, conditionality, and data input/data output across activity tools; as well as “editing on the fly”\* of “running” activityflows in changing contexts
- Extensions to tracking and audit\* functions to allow for advanced recording of research progress and outcomes, including detailed reports (both web and print based) for individual activities and aggregate\* activityflows, and the ability to build custom reports\* (using a “Business Intelligence” style approach to research tracking/auditing).
- Development of activity tool templates to assist external developers (eg, mini-grant recipients, ie, grant type B – see below) in building new research activity tools that meet the requirements of the overall framework; as well as development of “wrapper” tools for encapsulating or integrating existing research tools within an activityflow framework
- Integration of activityflow systems with related research collaboration environments, such as Sakai, Moodle\*, uPortal\* and Gridsphere\*; with a particular focus on exploring detailed activity tools integration with Sakai as a model for other systems in the future.
- Development of generalised technical specifications to describe core configuration and content requirements for common activity tools (eg, forums, document sharing, etc).
- \*Extensions to the visual activityflow authoring environment to allow for multiple visual representations and n-tiered visualisation of activityflows across different granularities of activity detail, including visualisation of multi-tier aggregated activity flows
- \*Development and testing of advanced research collaboration tools such as desktop and application sharing, and voice/video over IP and their integration with activityflow systems, including investigation of potential solutions for tracking, audit, etc.

- \*Exploration of flexible delivery environments for research activityflows, including pure HTML, HTML + Flash, HTML + Java Applets, mobile computing environments and non-networked desktop environments (combined with later synching of activities when networking is available)
- Integration of activityflow systems with repositories, including repository submission workflows, metadata management, and multi-actor\* approval processes
- Development of activityflow tools for people-oriented data collection, together with tracking/audit functionality for research outputs
- Development of multi-role activityflow monitoring to allow for collaborative research assessment by different assessors with different role requirements (such as evaluator, ranking, research assessment leader, etc).
- \*Integration of activityflow systems with relevant access and identity frameworks, such as Shibboleth, including options for self-registration and automatic account creation, to assist with rapid deployment of trans-organisational activityflows
- Development of a best practice activityflow library, and sharing of this library with all Australian researchers through a national repository as part of the RAMP website.

*Strand 1.2: Analysis of existing workflow languages and approaches*

- Review of major workflow and related process/activityflow languages, standards and specifications to create a metamodel of people-oriented workflow requirements
- Analysis of gaps in major workflows standards (especially BPEL) from the perspective of people-oriented workflow as applied to E-Research
- Proposals for new/modified specifications to address gaps in existing standards
- Review of lessons learned from e-learning workflow/activityflow developments, and exploration of areas of commonality and divergence with research activityflows

*Strand 2: Open Standards Authorisation using XACML*

- Review of MAMS outcomes for XACML-based repository features and requirements
- Liaison with related repository projects (ARROW, APSR, RUBRIC, DAR3T) for open standards authorisation requirements
- Creation of a generalised architecture for the function of a XACML authorisation library within repositories and related systems, including documentation of relevant interface points and information flows, and relevant standards
- Iterative development and testing of a XACML authorisation library based on the Fedora repository for demonstration purposes, and as applied to a range of protected repository use cases, including protected content in an Institutional Repository, protected E-Reserve content, protected past exam papers and protected image/sound/multimedia resources such as those required for PARADESIC, AISTSIS repositories of sacred images, protected multimedia for military training\* such as with SCORM/CORDRA, etc
- Investigation of specialised requirements for XACML based repositories of very large datasets, such as in Grid/HPC contexts



- \*Development of architectures for high security environments where data may not be downloaded/accessed directly, but only through XACML protected analysis systems (such as XACML controlled web-based statistical analysis and reporting tools)
- Implementation and testing of the ARROW “B+” XACML working party suite of access policies within the XACML authorisation library
- Documentation of lessons learned from Fedora implementation of an XACML authorisation library for similar implementation in other repository systems (eg, DSpace, EPrints, CORDRA, etc).
- Development of web user interfaces for core repository functionality based on XACML based protected resources (both access and submission), as well as simplified XACML policy creation and editing\* (XACML Access Policy Editor)
- Exploration of the fusion of activityflow and XACML open standards authorisations for repositories and related workflow system (NB: this activity would be conducted later in the project once significant progress on all strands has been achieved.).

### *Strand 3: Fusion of activityflow and open standards authorisation*

- Explore and document use of repository submission activityflows with XACML-based repositories
- Explore and document use of XACML for access to E-Research activityflows
- Explore and document use of XACML for management of roles and privileges in E-Research activityflows
- Contribute understandings from activityflow and authorisation fusion project to E-Framework discussions

### *3. Implementation Experience*

During the first year of the project (Jul 06-Jun 07), the main technical implementation outcomes will be a series of Demonstrators for both activityflow and open standards authorisation, with these Demonstrators used to continue to drive iterative requirements gathering, feedback and further development. As these Demonstrators evolve in maturity to meet the needs of partners, we anticipate trial implementations of these systems in the latter part of the project (Jul 07-Dec 07) to evaluate real world outcomes, and provide a basis for future production-level implementations. This approach draws on the implementation process used within the MAMS project, particularly for the national testbed federation.

To complement these technical implementations, the theoretical analysis will produce a foundational white paper in the area of people-based workflow for E-Research, together with a range of related articles on specific challenges and opportunities in this field. This will be contributed to the E-Framework and related groups working on describing middleware and IT infrastructure (such as NCRIS). Any developments of technical standards/specification will be contributed to relevant national or international standardisation groups where appropriate.

As all software produced for the project will be made freely available as open source software, the RAMP project will explore opportunities for packaging of the outcomes with related open source systems (eg, Sakai, Fedora) to aid in the easy adoption of the outcomes both in Australia and internationally. The project will provide full technical documentation of system outcomes, including provision of “easy install” CDs and related components to aid the rapid, easy adoption of software developed within the project.

The project will also work with vendors who are seeking to build sustainable business over the implementation of open source systems, such as IBM, Novell and a variety of specialist firms. The project may also explore options for commercialisation of open source services arising from project outcomes in the absence of a large vendor providing appropriate services that meet the needs of the E-Research and education sector (this could follow the successful open source sustainability model implemented by the LAMS Foundation and LAMS International). Further investigation of sustainability and services commercialisation will be conducted in the latter stages of the project based on evolving outcomes during 2006-2007.

In the event that significant development work remains to be done at the end of the project, coupled with unexpended funds (due, for example, to the difficulty of finding and retain enough excellent technical staff, as has been a challenge within the MAMS project), then opportunities for ongoing development beyond the current timeframe of the project could be explored with DEST.

### **The Role of RAMP Partners**

The role of RAMP Partners will follow the established engagement model used in the MAMS and COLIS projects. During the early stages of the project, partners play an important role in participating in requirements gathering workshops, and giving advice on project directions, including feedback on Demonstrators.

As the project progresses, partners are encouraged to participate in “mini-grant” funding rounds which involve implementation of project outcomes in their local institution with support from the core RAMP team. Mini-grant applications from RAMP partners are given preferential scoring in grant selection processes. In the later stages of the project, RAMP partners provide the basis for ongoing implementations of project outcomes (such as systems that are appropriate for trial or production implementations). These implementations often form the basis of wider sector adoption as good practice “exemplars”, as demonstrated by early implementers of the MAMS Shibboleth testbed.

The RAMP project expects to provide three mini-grant rounds during 2007, with all grants valued at \$40,000, and generally covering an implementation period of 3-6 months. The rounds are as follows: (A) implementation and testing of activityflow system for modelling existing (and new) research activity workflows (this round will

lead to “best practice” activityflow examples for inclusion in the national repository); (B) software development of new (or extensions to existing) research activity tools to be integrated into the activityflow framework; and (C) implementation and testing of XACML Fedora repository for managing protected content (such as Institutional Repository content, E-Reserve, past exam papers, images/audio/multimedia, etc). The first and third rounds are mainly focussed on strategic and implementation issues, and while they require at least one team member with some technical skills for installation and configuration, they do not require any programming expertise. For the second round, at least two years experience in Java programming is required to achieve the grant outcomes. Finally, there are opportunities for additional involvement from RAMP partners with specialised skills in core project areas – negotiation of additional involvement is conducted in the start-up phase of the project.

RAMP partners are expected to participate in project workshops and provide feedback as appropriate to their context and expertise. Partners are encouraged (but not required) to submit proposals for mini-grant projects for taking forward project outcomes. Partners are also encouraged to document and give presentations about their experiences of implementing RAMP outcomes at conferences and similar events.

### **Role of MELCOE and other groups from Macquarie University**

MELCOE will provide overall leadership of the project under the direction of the Chief Investigator, Professor James Dalziel. MELCOE has expertise in all the major areas of this proposal together with an existing group of core technical staff that can be immediately deployed to this project, followed by additional research and developer appointments during the start-up phase of the project to expand technical and project management capacity.

As with external partners, MELCOE will liaise with relevant internal Macquarie University groups related to the goals of this project. These groups will play a similar requirements gathering and feedback role for the project (often working in conjunction with external partners as part of general requirements gathering sessions), with a particular focus on using well understood local requirements to ensure the appropriateness of MELCOE development outcomes for “real world” usage. This internal liaison will draw from the experiences of groups such as the Macquarie University Research Office (and its “IRIS” – Integrated Research Information System requirements); the Macquarie University Library (which has extensive expertise in repositories and management of protected digital resources); the Macquarie Centre for Cognitive Science (for feedback on requirements for activityflow applied to research data collection with human subjects) and other similar campus groups involved in the management of research collaboration.

### **Project Management and Governance**

The RAMP project will follow the adapted PRINCE2 project management methodology used in the MAMS and COLIS projects. The PRINCE2 approach provides a well defined structure for management across multiple layers of the project (steering committee, project boards and project teams) together with procedures for documenting progress through a series of “gates” to assist with risk management and mitigation.

Overall governance of the project will be led by a steering committee of relevant stakeholders and technical experts. Given that there is considerable overlap between the technical expertise and governance experience required for the RAMP project and the existing MAMS project, exploration of sharing of responsibility across the two projects will be conducted at start-up (for example, MAMS and RAMP steering committee meetings could be run back-to-back, with a number of members in common to oversee both projects; or a single committee could be created).

In addition to the MELCOE roles of Chief Investigator (Professor James Dalziel) and Project Managers (Ernie Ghiglione and Chi Nguyen), the RAMP steering committee will include an experienced expert in the field who is also a member of the Macquarie University senior management (Maxine Brodie, University Librarian), and at least three other external experts from partner universities, and potentially one industry representative (such as Brian Hay, Telstra – who is currently a member of the MAMS steering committee).

Complementing the steering committee will be a technical reference group of national and international experts to provide a sounding board for technical challenges during the life of the project, as well as to assist with liaison with other leading international projects. The proposed members of this international reference group are:

Charles Severance (University of Michigan and Lead Architect, Sakai)  
Scott Wilson (Bolton University, JISC and author of the E-Framework)  
Murray Leach (Senior Manager, New Zealand Ministry of Education)  
Sandy Payette (Cornell University and Leader, Fedora Project)  
Dan Rehak (Co-Director, Workforce ADL Co-Laboratory)  
Nigel Ward (ADL Australia)  
John Walsh (University of Michigan and Quali/OneStart Workflow)  
Kerry Blinco (IMS Australia, E-Framework and RUBRIC)  
Andrew Treloar (ARROW and DAR3T)

### **Usefulness of the Project for other HE Institutions and the Community**

The DEST/JISC E-Framework for Education and Research and the DEST Accessibility framework represent world best practice in designing the future IT infrastructure for E-Research. The RAMP proposal identifies the most difficult elements of the E-Framework that urgent require solutions (two of the three “whole of fabric” services: identity/access/security – including authorisation; and workflow).

The proposal describes an agenda for major progress in addressing these challenging areas, with the ultimate outcome being the enhancement of national research effectiveness.

More specifically, the project will provide Demonstrator systems for the key areas of (a) people-based activityflow for E-Research processes and (b) open standards authorisation. These Demonstrator systems have numerous benefits: they encourage more informed decisions about future systems acquisition through detailed understanding of relevant functionality; they allow pilot implementations to uncover both technical and organisational requirements for future production deployment; and as the software is freely available as open source, it can be further developed into production systems where appropriate and desirable.

Any university or research organisations can immediately adopt the outcomes of this project without restriction, and through the open source code, the outcomes can be altered or extended to suit local requirements.

The key outcomes of this project will be significantly increased efficiency in research workflows and managing protected repositories; greater understanding of “whole of fabric” services within the E-Framework; greater sharing of best practice in workflows and repository management; stronger accountability and audit trails for research and research management; and reduced system “silos” through seamless linking between identity, workflow and authorisation systems.

### **How the information will be disseminated to other institutions**

Following the successful example of the MAMS project, the RAMP project will maintain a detailed website and content management system for providing information about project progress, access to white papers and articles, and details of events and opportunities for collaboration. This website will include an area for a national repository of best practice activityflows available to all Australian researchers.

Complementing the website will be a series of workshops around Australia for iterative requirements gathering and live exhibitions of Demonstrator systems. These workshops provide the foundations for partner involvement in the project to help shape requirements and development agendas through the use of Demonstrator systems for gaining informed feedback. As with past MAMS workshops, these will be open to all interested parties.

All software developed within the project will be made freely available under an Open Source Institute (OSI) certified license. Source code, installers, documentation and related technical information will be provided via a public website – either the project website, or an open source software repository such as Sourceforge.

Additional dissemination of project outcomes will be achieved through presentations at national and international conferences, and articles in appropriate research journals.

## **Risk Management and Mitigation**

The RAMP project will follow the risk management and mitigation strategies using with the MAMS project, based on processes outlined in the PRINCE2 project management methodology. Regular reporting of risks to the steering committee will be conducted throughout the project (including ongoing email reporting in the case of any urgent risks that might arise between meetings), and a Project Board will conduct internal risk analysis, management and mitigation. A risk register will be developed during the start-up phase of the project to help track and manage risks on an ongoing basis.

## **Accompanying Documents**

### RAMP Project Partners

University of Melbourne (Letter of Support)  
Australian National University (Letter of Support)  
Charles Sturt University (Letter of Support)  
University of Southern Queensland/RUBRIC Project (Letter of Support)  
Macquarie University Library (acting as liaison to the Innovative Research  
Universities Australia (IRUA) Libraries network – consisting of Macquarie  
University, Flinders University, Newcastle University, Murdoch University,  
Griffith University and La Trobe University) (Letter of Support)

### International Expert Panel

Charles Severance (University of Michigan and Lead Architect, Sakai) – Emailed support\*  
Scott Wilson (Bolton University, JISC and author of the E-Framework) – Letter of Support  
Murray Leach (Senior Manager, New Zealand Ministry of Education) – Letter of Support  
Sandy Payette (Cornell University and Leader, Fedora Project) – Emailed support\*  
Dan Rehak (Co-Director, Workforce ADL Co-Laboratory) – Letter of Support  
Nigel Ward (ADL Australia) – Letter of Support  
John Walsh (University of Michigan and Quali/OneStart Workflow) – Emailed support\*  
Kerry Blinco (IMS Australia, E-Framework and RUBRIC) – Letter of Support  
Andrew Treloar (ARROW and DAR3T, Monash University) – Emailed support\*

\* Emailed support indicates an emailed response indicating support for this project, but without a formal Letter of Support on letterhead. In these cases, an accompanying document is not provided.



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