

<b>Name of lead institution/organisation</b> The University of Hull
<b>Name of proposed project</b> RepoMMan (Repository Metadata & Management)
<b>Project partners</b> N/A
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<b>Objective(s) proposal will meet</b> (Please indicate the objective(s) your proposal addresses as outlined in paragraph 17 of the Circular, i.e. i, ii, iii or iv) Objective ii (cultural & practical issues) Objective iii (Evaluating repository specs, software & tools)
<b>Length of project and total cost to the JISC over its life</b> 2 Years
<b>2 Years, Cost of proposal to the JISC in each year or part year (a project year runs from June - May)</b> 2005-2006= 2006-2007=
<b>Proposed project start and end dates</b> 1 <sup>st</sup> June 2005 – 31 <sup>st</sup> May 2007
<b>Outline project description</b> RepoMMan will assist the development of repository infrastructure in several key areas by:  <b>Assessing the feasibility of automated population of object metadata</b> within an authenticated environment by (a) extraction of descriptive metadata from simple digital objects (b) drawing contextual metadata from existing institutional sources such as portal profile or enterprise directory via a Personal Metadata Profile and related profiles mapped to appropriate metadata schema. Feasibility to be assessed against the needs of Research, Learning and Administration <b>Conducting detailed user requirements analysis</b> to underpin this effort, based around innovative and proven online technology and conventional means, particularly focussing on both existing repository/storage usage, and the boundary between personal and institutional repository space. This requirements analysis will be Accompanied with an exploration of <b>associated DRM issues</b> . <b>Adapting a generic workflow framework</b> to the requirements of common repository tasks within an approach based around Service Oriented Architecture. Validating this in the context of broad research and research collaboration use by <b>providing a human interface to workflow</b> through standards-conformant portal and Sakai Collaborative & Learning Environment frameworks.

# RepoMMan: Repository Metadata & Management

## 1 Introduction

From Callimachus to Dewey, the Library community has attempted to provide easy, or at least organised and rational, access to scarce resources. Whilst changes in printing and publishing have certainly modified the degree of scarcity, the artefacts a library houses remain necessarily limited. They are limited by physical bounds, by financial considerations, and frequently by the context in which they may be used.

By whatever shorthand the emerging “information age” is referred, it applies a fundamentally different set of parameters to issues surrounding academic and administrative publishing and access. The information age brings the challenge of organising access to abundant, rather than scarce, resources. In the current exploration and initial take-up of digital repositories by universities, this change of emphasis requires considered attention. Certain solutions, which applied in an earlier age of scarcity, may not be particularly suitable when set in the context of information abundance. Institutions must be prepared to combine the ability to learn from previous experience with an appropriate measure of challenging assumptions.

The growing interest in, and development of, a variety of local, regional and national repositories is one response to the abundance of digital materials. Much of the promise of institutional repository services, and a large part of the business case for such services, lies in their enabling the maximum use and re-use of rapidly growing digital asset collections. It is important to maintain the perspective, however, that development of institutional repositories forms part of an emerging and connected national (and potentially international) repository infrastructure. Given this perspective, and the significant number of institutional repository uses which may require interfaces to disparate systems, flexibility and support for interoperability standards and common specifications are not an optional extra, but essential criteria for a repository framework. This is likely to be further emphasised as the general movement towards Service Oriented Architectures within Higher and Further Educational Institutions gathers pace.

### 1.1 Obstacles: understanding user requirements and processes

Technology-related projects have a disturbing tendency to seek information regarding user needs and requirements after the event of software development. The University of Hull has placed great emphasis on acting to reverse this. By a combination of traditional interviews and innovative web-based survey a considerable amount of user requirements data has been gathered for a range of purposes. The CREE Project survey<sup>1</sup>, for example, which solicited detailed information regarding user search behaviour, obtained over 4,500 responses from the HE and FE community. *RepoMMan will utilise similar methodology to gather data supporting greater understanding of user needs, locally and potentially from a wider audience, requirements, processes and behaviour across a range of potential institutional repository uses. A particular focus will be on how users currently interact with systems and data that might be considered repositories in nature if not by name. The data gathered by these means at regular intervals during the lifecycle of RepoMMan will both underpin development, and form an essential component of the IDEAL project management process (see Project Management p7). In addition it will provide a valuable resource for the Higher and Further Education community.*

### 1.2 Obstacles: the metadata barrier

Whilst there is little shortage of technical and process-oriented obstacles to repository take-up and use, few feature as strongly in end-user comment as those surrounding the generation of metadata. Effective metadata underpins effective discovery, location and potential re-use. The creation of metadata, however, is both time consuming and laborious. This factor has stimulated the growth of a range of project and development activity aimed at the automation of metadata creation. Generally, these methods revolve around the extraction of key information from digital content itself. Although much of this activity might be classified as “R&D”, some of these methods are now escaping from the laboratory to the production environment. *RepoMMan will take a combinatory approach to automated metadata creation. Where robust technology exists to extract descriptive metadata from simple digital objects (for example, office documents and certain types of digital image), RepoMMan will deploy and validate its use. This will be combined with a novel approach to the creation of contextual metadata, which will draw on the experience of the University of Hull institutional portal deployment.*

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1 <http://www.hull.ac.uk/esig/cree/documents.html>

Users of institutional systems should not need to repeatedly enter information regarding their role or preferences, particularly where this is already stored as part of an enterprise directory or portal deployment. Whilst this objective is frequently identified in business process redevelopment, it is less frequently applied to the creation of metadata. After authentication, applications should ideally access and communicate such information as is required to provide a user with a seamless experience tailored to their need, role and preferences. Once stored, this information should be available to be consumed by other services, such as those underpinning an institutional portal, Virtual Research Environment, VLE, or a desktop application forming part of a Personal Learning Environment (PLE). By effectively “warehousing” person and role information from a variety of back-office systems in a portal profile or enterprise person directory, a potentially rich source of contextual metadata is created. This information may range from the simple name/email/organisational unit of the creator to enabling a choice between modules taught, potentially each with its own keyword profile. Applying this information to the creation of metadata after authentication to an institutional system such as a portal, VLE or PLE, by, for example, pre-population of editable fields, has enormous potential to both increase accuracy and decrease repetition in metadata creation.

*RepoMMan will carefully evaluate available contextual information elements which might meaningfully be drawn together in this manner, and suggest a number of implementation routes based around the creation of a range of profiles, including role based “Personal Metadata Profiles”. RepoMMan will suggest implementation routes suited to institutions both with and without portal implementations*

### **1.3 Institutional Repository Development at Hull**

The University of Hull has continued to iteratively develop a General Information Strategy, following its initial introduction as part of a JISC initiative in the late 1990s. The last such iteration, in the summer of 2004, identified the development of repository infrastructure as a critical strategic architectural element. Subsequent investigation and planning identified four overlapping repository development areas or strands:

- Learning objects<sup>2</sup>
- Images
- Research artefacts and research outputs
- Meeting the needs of the Freedom of Information Act

*RepoMMan will undertake investigative work across these four areas or strands, identify user requirements based on current and potential use in these areas and validate the applicability of drawing contextual metadata from a range of institutional systems against the elements of common metadata schema. Detailed technical development work will provide a demonstrator in the specific area of research artefacts (shareable or private works in progress, notes, references etc) and research outputs (for example, book chapters, conference papers, ETDs). A further specific strand of technical development, building on user needs and process analysis, will investigate and establish interfaces between the research repository and a Collaborative and Learning Environment deployed for inter-institutional research collaboration. The Universities of East Anglia and Hull are currently deploying such an environment (the Sakai C&LE) to meet the collaborative needs of Humanities research under the JISC VRE Programme. The alignment of these two distinct activities will bring further substantial benefits for the community.*

### **1.4 Choice of repository framework**

As may be inferred from the initial deployment priorities indicated above, key institutional criteria include considerable flexibility and support for standardised interfaces (preferably based around Web Services specifications). Despite the considerable strengths of DSpace, particularly as an ETD solution “out of the box”, lack of versioning together with questionable scalability effectively precluded its use.

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<sup>2</sup> Whilst a uniform repository infrastructure is in many respects desirable, it is recognised that the uneven development of repositories for specific purposes may not always make this possible. The majority of the areas and strands above will be built using Fedora (Flexible and Extensible Digital Object and Repository Architecture – see below). In the area of Learning Object storage and retrieval, the University is currently conducting an exploration of the HarvestRoad Hive repository. This work is undertaken jointly with the Advanced Distributed Learning CoLab at the University of Wisconsin, HarvestRoad and Sun Microsystems, and forms the Federated Learning and Digital Object Repository Research Initiative.

ePrints was similarly rejected due to the lack of proven flexibility for use with the wide range of institutional assets and scenarios identified and the technical platform. The considerable scalability offered by Fedora, together with ingest and export of information in standardised XML formats and documented SOAP and REST interfaces at both object and repository level made it a logical choice as a basis for initial investigation and deployment<sup>3</sup>. *RepoMMaN will validate this judgement providing a report on our experiences with Fedora after the first year of the project.*

Although Fedora presents a flexible repository framework, its successful deployment for any of the purposes indicated above relies on the provision of an equally flexible framework to support workflow. This will enable the repository framework to be adapted to meet the requirements of existing University processes, together with future needs highlighted by the user needs analysis and process mapping activities. *RepoMMaN will evaluate workflow frameworks supporting learning, research and administrative processes, and will validate this evaluation against a reference implementation based around research processes.*

### 1.5 RepoMMaN: summary objective and outcome matrix

	(a) Technical	(b) Research
1	Evaluate potential flexible workflow frameworks with which to augment Fedora repository framework	User needs analysis and process mapping for the three areas above Current storage and repository uses Potential storage and repository uses
2	Test feasibility of descriptive metadata extraction from simple objects	Study investigating applicability of extraction of contextual metadata from institutional systems to form "Personal Metadata Profile" for the purposes of Research Learning Administration
3	Implementation of application of contextual metadata on item(s) entry	Study investigating DRM Implications of 1b and 2b
4	Embed 3a interface with Sakai Collaborative & Learning Environment deployed in UEA/Hull VRE Programme Project	

RepoMMaN will start in June 2005 and run for two years.

## 2 Project description

### 2.1 Technical development strand

An effective workflow engine will separate user experience from repository services, shielding the user from the complexity required to complete requests and provide a simple but flexible task-based interface. In responding to user actions a workflow engine will coordinate requests with services defined in the workflow. Definition of the workflow processes needs to be complex enough to deal with the invocation of a number of different services, and make routing decisions based on the outcome of previous steps in the process.

Workflow issues have been recognized for some time as part of the articulation of Service Oriented Architecture. Central to this concept is the ability to address the orchestration of a number of discrete Web Services providing a coherent interface for the end user. These issues are currently being addressed by a number of standards development activities. Working on similar problems in a different domain space (eLearning), the JISC ASSIS project identified the Oasis managed Web Services for

<sup>3</sup> dSpace vs Fedora, Ralph LeVan, OCLC Research, provides a useful summary of the issues [www.oclc.org/research/memberscouncil/2004-05/levan.ppt](http://www.oclc.org/research/memberscouncil/2004-05/levan.ppt) (Validated 30 March 05 ... ID)

Business Process Execution Language (WSBPEL) as an appropriate standard on which to base development activities<sup>4</sup>.

The Fedora architecture has been designed to allow for individual repository functions to be called via the APIs. Both the Fedora Management API (API-M) and Access API (API-A) can be accessed using WSDL definitions over SOAP. The creation of a workflow engine can therefore use WSBPEL to define calls to, one or a number of, repository functions using the Web Services standards.

The adaptation and deployment of a workflow engine will of necessity adopt a layered model with separate tiers for presentation, Model-View-Controller (MVC) and process control. The presentation layer will be created as Java servlets, allowing deployment of the workflow engine on Java application servers, and JSR-168 portlets that can be used with any conformant portal framework or JSR-168 conformant container. The MVC layer will coordinate and dispatch requests and responses between the presentation and process control tiers. To reduce development effort and avoid unnecessary duplication of effort, the most likely implementation will use existing MVC functionality found in the Spring framework. Finally, the process control layer will, following the evaluation of available packages, use the WSBPEL runtime environment to call services and process responses according to the pre-defined workflow definitions.

Technical work around metadata population will focus in two areas. RepoMMan will conduct a summary investigation on the feasibility of deploying existing solutions to the extraction of metadata from simple objects. The implementation of pre-populating object entry forms with contextual metadata profiles, including the "Personal Metadata Profile" will be provided via both JSR168/WSRP conformant portal framework, and with the Sakai Collaborative & Learning Environment. The core of this work will be based around personal information warehoused within a portal profile or Enterprise Directory, mapped to appropriate metadata schema.

The technical strand of RepoMMan will adopt a test-led approach to development. This ensures that the testing of software is an integrated part of the overall process and also leads to better conformance with standards for interoperability. Before programming activity takes place UML diagrams will be produced providing a full, documented understanding of both the problem and the proposed solution. The external evaluation of outcomes will be achieved where possible by releasing findings and tools to the community, especially the Fedora community, for review.

### 2.1.1 Workplan

ID	Description	Timescale (months)
WP-D1	Development of 3 tier workflow engine	1-12
WP-D2	Investigation of tools to author BPEL processes	3
WP-D3	Fedora evaluation	12
WP-D4	Workflow engine integration with institutional portal framework and collaborative environment	13-15
WP-D5	Implementation of metadata population from "Personal Metadata Profile"	13-18
WP-D6	Investigation of descriptive metadata extraction from objects	19-22
WP-D7	Final version of systems and user documentation	23-24

### 2.1.2 Deliverables

ID	WP	Description	Delivered by (month)
D-D1	WP-D1	Document listing available WSBPEL runtime environments, evaluation criteria and evaluation results	2
D-D2	WP-D1	Deployment and documentation of WSBPEL runtime environment	3

<sup>4</sup> <http://www.hull.ac.uk/esig/assis-requirements-v1p0p0.pdf>

		testbed	
D-D3	WP-D2	Selection of, and familiarity with, WSBPEL authoring tool	3
D-D4	WP-D3	Iterative development of research use case	6
D-D5	WP-D1	Java code and Spring configuration enabling integration between MVC and WSBPEL tiers	9
D-D6	WP-D1	Java servlet user interface	11
D-D7	WP-D1	Java portlet user interface	12
D-D8	WP-D3	Report on experiences with Fedora in the first year of the project	12
D-D9	WP-D4	Deployment of workflow engine in institutional uPortal framework	13
D-D10	WP-D4	Deployment of workflow engine in collaborative environment	15
D-D11	WP-D5	Report on investigation of methods to access user profile data from portal framework and other sources such as an enterprise directory	15
D-D12	WP-D5	Implementation of methods to automatically populate metadata fields for users of both portal and collaborative environments	18
D-D13	WP-D6	Report on feasibility of automatic extraction of object metadata	22
D-D14	WP-D7	Full systems documentation including details of testing.	24
D-D15	WP-D7	Full user documentation describing how tasks are completed	24

## 2.2 Research strand

### 2.2.1 User requirements

In considering the potential use and benefits of repositories within an institutional context it is important to recognise that many of the activities that will and can be undertaken within a repository already take place on an everyday basis. Users already interact with a range of data stores, even if they are not always aware of this or how the data is managed and/or structured behind the scenes. File stores, local library and archive collections, image collections, network resources etc. are all accessed by users as part of their learning, teaching, research or administration activities. This existing use can help to inform the nature of how an institutional repository should be presented to users, in order to facilitate its take-up and use alongside existing services. An institutional repository also, of course, has the potential to offer additional functionality and services and it is essential to identify user requirements above and beyond what they can currently do to understand how such services could be implemented.

User requirements analysis will be undertaken to discover what stores of data and associated functionality are used. A local survey will be held, with the potential to be used with a wider audience, using established and successful techniques deployed successfully by both the PORTAL and CREE projects, to gather data. This will be used to inform repository development, and specifically the implementation of research use cases. The survey will be complemented by a series of detailed interviews with a cross-section of staff and students to more closely identify current and potential uses of repositories.

### 2.2.2 Metadata generation

Metadata can take various forms, including technical metadata about the object itself, administrative metadata for contextual and/or local management purposes, and descriptive metadata describing the content. Manual generation of this metadata has revealed difficulties in ensuring that a full and accurate metadata record is stored with the object, limiting future use. There is increasing interest in automatic metadata generation, and in the use of metadata profiles that can be automatically attached to an object when it is deposited. The use of locally held information can offer a wide range of preset, and quality-assured, metadata and there is a need to investigate what requirements there are for this and how such profiles might be created.

The feasibility and requirements for metadata within preset personal metadata profiles will be investigated through extensions to the interviews carried out as part of the user requirements analysis

and a functional requirements analysis of what would be required within such profiles. This will also include how acknowledged metadata standards might be utilised in this context. Specifically, the needs of those working in learning & teaching, research, and administration will be addressed, taking into account the multiple roles that users often have to adopt.

### 2.2.3 Data integrity

The generation of any data or document automatically generates a range of data integrity factors that address the validity and authoritativeness of the data itself. All data has associated rights and the ongoing management of those rights is needed to ensure protection of usage; all data comes from somewhere and this provenance is key to a user being able to trust it for use in their study and/or work; and different data will have different levels of quality, and it is imperative that a user is aware and can be assured of the quality of what they are using. The user requirements analysis and the automatic generation of metadata profiles will raise issues in all three of these areas.

A literature review will be carried out toward the end of the project to ensure that the most up-to-date developments in DRM, provenance and QA can be taken on board. Specific emphasis will be given to the issues that have arisen in these areas from the user requirements analysis and investigation into personal metadata profiles. The literature review will inform the community on these issues and the project will carry out activity to investigate the application of possible solutions within the Fedora framework.

### 2.2.4 Workplan

ID	Description	Timescale (months)
WP-R1	User requirements analysis examining current and potential use of repositories within the repository development areas of learning, research and administration	1-9
WP-R2	Feasibility and requirements study of the use of contextual metadata for the identified institutional use cases	10-18
WP-R3	Investigation into the Digital Rights Management issues raised by WP-R1 and WP-R2	19-24

### 2.2.5 Deliverables

ID	WP	Description	Delivered by (month)
R-D1	WP-R1	Criteria and toolkit for survey	2
R-D2	WP-R1	Criteria and associated materials for interviews	4
R-D3	WP-R1	Report on user requirements survey data	6
R-D4	WP-R1	Report on user requirements interview data	8
R-D5	WP-R1	Final report on user needs analysis identifying current repository usage, possible future usage and mapping of user repository process	9
R-D6	WP-R2	Identification of feasibility and requirements for and source of, core personal metadata profile	12
R-D7	WP-R2	Identification of feasibility and requirements for and source of, personal metadata profile for Research	14
R-D8	WP-R2	Identification of feasibility and requirements for and source of, personal metadata profile for Learning	16
R-D9	WP-R2	Identification of feasibility and requirements for and source of, personal metadata profile for Administration	18

R-D10	WP-R3	DRM literature review examining issues raised by the user requirements analysis and metadata profile generation	20
R-D11	WP-R3	Investigative report on the DRM implications of the issues raised by user requirements analysis and metadata profile generation, with particular emphasis on the boundary of institutional and personal use. Identification of potential solutions.	24

### 3 Project Management Methodology

The project management approach taken for RepoMMan closely follows the IDEAL (Initiating, Diagnosing, Evaluating, Acting, Learning) framework adapted from the Carnegie-Mellon Software Engineering Institute Capability Maturity Model (CMM). This development framework has been proven across a substantial number of projects, and is well suited to a project requiring the rapid iterative developments such as RepoMMan. Further details of the Capability Maturity Model and IDEAL framework are available from <http://www.sei.cmu.edu/cmm/> (validated 23 March 05 – ID).

### 4 Risk Assessment

Risk	Probability	Impact	Action to prevent or alleviate risk
Technical staff recruitment difficulties	M	M	Base work on in house skills/resources and student helpers
Not enough user requirements data is collected to validate use cases	L	M	Ensure survey is widely taken up through targeted advertising, personal contact and departmental meetings Ensure an appropriate number of interviews take place across a representative sample of users
Data collected is too localised to Hull for wider use	L	H	Ensure data is gathered in a way that allows it to be extracted for generic use National basis for survey will ensure wider applicability
Data collected not detailed enough to develop use cases from or test environment within Fedora	M	M	Ensure an appropriate level of data is collected based on an assessment of requirements for the use cases Run use cases past interviewees to ensure applicability and suitable depth
Implementation in Fedora is more problematic than thought	M	H	Ensure involvement with Fedora community to assist with any problems as they arise
Metadata generation work fails to provide a workable solution	M	L	Be prepared and able to adopt findings as they stand pending further investigation

### 5 Dissemination

The following routes will be used disseminate the findings of the project to the widest audience.

- A project website will be established during the first month of the project.
- Appropriate papers at conferences/meetings in the following areas: repositories, Fedora, information management, user behaviour, SOA, Web Services
- Articles in appropriate journals, e.g., Ariadne, and at least one peer-reviewed publication in the field of information management
- Through the CETIS Metadata & DR SIG, Enterprise SIG, together with Fedora and broader Open Source communities, via conferences, meetings, and discussion lists

It is proposed to reserve a proportion of dissemination funding until the end of the project to enable the short-term continuation of ongoing dissemination opportunities. These will take place within six months of the project end-date.

## **6 Community Benefits**

RepoMMan will deliver significant benefit to two principle communities. The broad JISC and Higher Education community will particularly benefit from the research-based outputs of RepoMMan, together with the validation of workflow based web services approaches required by the further adoption approaches based around Service Oriented Architecture. Fedora specific aspects will benefit the more focussed community of universities evaluating or deploying Fedora as an institutional repository solution.

### **6.1 JISC**

- User requirements gathering methodologies and results will be applicable for use at other institutions, and assist them in assessing their current state of development and examination of local user requirements
- Repository use cases will be fed back to the community and will be grounded in existing user activity, rather than purely hypothetical repository uses.
- Particular emphasis will be given in the investigation and report on DRM issues to boundary issues between personal and institutional repositories. This will add to the body of research in this area to the general benefit of the community.
- The report on metadata generation covering specific requirements and addressing associated DRM issues will be fed into the continued discussion on this issue. This will be of particular relevance to those working in the context of an institutional portal or collaborative environment. The conclusions reached will also be of benefit to any institution developing or deploying an Enterprise Directory
- Further experience of Service Oriented Architectures, with a particular emphasis on coherent presentation of discrete services for the end user.
- Add to the growing body of experience in adopting or integrating generic workflow solutions to the needs of web services orchestration, thus contributing not only to requirements of the Repositories programme, but also the Distributed eLearning Programme (DEL), eLearning Framework (ELF) and Integrated Information Environment.

### **6.2 Fedora**

- Further, detailed investigations of how the Fedora framework can be integrated into other frameworks, such as, Spring.
- Experience and technical knowledge of how Fedora can be deployed in both an institutional portal framework and a collaborative environment
- A workflow engine addressing one of the recognised principle weaknesses of Fedora

## **7 IPR**

- IPR of content being used within the project: the materials to be used within the repository will have their IPR checked and cleared before use
- IPR of software developments: these will be released back to the community and the Fedora project in accordance with the open source license requirements of this software. They will also be made openly available to the HE and FE communities in accordance with JISC Terms and Conditions

## **8 Sustainability**

This work will be part of work over a three-year period to implement a repository framework at the University of Hull, and is based around core institutional objectives. The University of Hull undertakes to continue to disseminate output from both the research and technical project strands within the JISC, Sakai and uPortal Communities during the life of the project, and after project funding expires. This will build on Hull's active active engagement and contribution to these communities.

Outputs from the project will continue to be used after the end of the project. The survey and interview criteria will be re-used as appropriate to support ongoing development of the repository. The use cases will continue to inform the repository development and will be amended, expanded and disseminated as required.

## **9 Budget**

A summary of the budget is provided below. The project requires two full time staff for the duration of the project from JISC contributions, a Project Manager/Researcher who will be subcontracted by the University (Richard Green) and a yet to be appointed software developer. The University of Hull will contribute the time of Ian Dolphin as Project Director, Chris Awre as a repository systems and user needs analysis expert and Robert Sherratt for oversight of technical development. The University of Hull will also contributing overheads for the full time project staff. These are not demarcated in the budget below, but will be added when Hull adopts a FEC model. Additionally funding will be made available for 25 days consultancy from Icodeon and others, including Sakai partners, for their experience of working with Web Services specifications and BPEL. As all of the participants in the project, with the exception of Icodeon, are based at Hull it is expected that the majority of the travel budget will be spent on dissemination activities.

## 10 Key personnel

### **Project Director: Ian Dolphin**

Ian Dolphin is Head of e-Strategy at the University of Hull, where he is responsible for advising on ICT strategic direction, including the University portal implementation. Ian is a member of the Board of Directors of the Java Architectures Special Interest Group (JA-SIG), the Sakai Project, and the Advisory Board of The Sun Global Education and Learning Community (GELC). Ian is also a member of the JISC Integrated Information Environment Committee (JIE), and the Middleware, Distributed eLearning and Virtual Research Environment Programme Advisory Boards.

### **Technical Lead: Robert Sherratt**

Robert is Head of Development for the e-Services Integration Group, responsible for facilitating the development and operation of digital university systems and processes, in particular the services delivered within the evolving framework of the institutional portal. This requires effective management of the development process, the need to maintain an understanding of associated technical issues and standards, and liaison with staff both within Academic Services and across the University. Robert and his team are responsible for the University of Hull portal, launched in 2003, using an open source, Java portal framework (uPortal). More recently Robert has been Project Manager for two successful JISC projects in the domain of eLearning, the ELF funded ISIS project and the DEL funded Assis project.

### **Repository Domain Specialist: Chris Awre**

Chris Awre is Integration Architect within the e-Services Integration Group, with a remit to examine, advise on and facilitate the integration of existing and future university systems and processes, particularly those being delivered within the university portal. The role involves communication and liaison across Academic Services and university departments to plan such services, and coordination between initiatives to enable efficient and effective use of information. Current effort is focussing on the delivery of library services to further enable the provision of these in the contexts of learning, teaching and research. This includes managing the JISC-funded CREE project investigating how users make use of Internet search tools. Chris has a background as a systems librarian at Charing Cross & Westminster Medical School and Imperial College in London, and has most recently worked for the UK's Joint Information Systems Committee as Programme Manager for portals, presentation and the FAIR programme covering the use of institutional repositories.

### **Project Manager: Richard Green**

Richard spent the first thirty years of his career in secondary education; over half of them as a senior manager. As a senior teacher and then assistant headteacher he was responsible for building up the most successful IT department in his Local Education Authority. Towards the end of his time in schools Richard was seconded to the University of Hull for two years to manage the million-plus ECU 'Mentor Project' which investigated the feasibility of using emerging internet technologies for foreign language teaching in secondary schools. He was responsible for coordinating the work of project teams in three countries, writing many of its official reports, and for all the project's dealings, both technical and administrative, with the European Commission. In 2003 Richard left secondary education to pursue his interests in ICT full time. Since then he has worked with colleagues at Hull University to develop an award-winning, interactive, archaeology website based around a public access repository of research output, he has developed an on-line record system for a DfEE funded project running in local schools and he is currently working with the University's Computing Services team to develop a single, coherent web-presence combining all their many services and information systems.

### **Technical Consultant: Warwick Bailey – Icodeon**

Warwick Bailey is director of Icodeon Ltd, an e-learning products and services enterprise. Warwick has extensive experience in the development of e-Learning systems using the IMS standards and service oriented architectures. Warwick has written a full implementation of SCORM 1.2 and was an invited developer with the MIT Open Knowledge Initiative. Warwick has recently project managed an IMS QTI implementation for Cambridge University/UCLES and was lead architect for a European project to enable remote access of sensing and control. Warwick was the lead developer for the JISC funded Assis project, investigating the technical solution required to integrate tools provided by the ELF framework using Web Services.