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LiroleM. A Virtual Studio/Institutional Repository for the University of Lincoln

Final Project Report

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Executive Summary

The primary aim of the Lirolem project was initially to build a repository capable of handling the material that was generated by the students of the Lincoln School of Architecture, with a view to using it as teaching material in future years. A second aim was to provide an Institutional Repository that was capable of handling research materials in a variety of formats.

Our initial approach was to conduct a survey of staff in the school of architecture with a view to finding out what they would need from such a tool but there was relatively little interest expressed from members of staff, other than those directly involved in the project. We therefore expanded the scope of the vision for the repository so that it became a more conventional Institutional Repository. An alternative method, closer to the original vision of the School of Architecture's Virtual Studio Project was devised using a combination of Blackboard and the Learning Objects LX wiki plug in. This allowed students to post examples of work in progress to the wiki, with a view to creating finished products suitable for ultimate deposit in the Repository. While this remained some way from the original vision we were concerned to ensure that the Repository continued as far as possible to meet the requirements of the School of Architecture, and so the early part of the project was concerned with evaluating different Repository software packages.

As a result of our evaluation we chose to use E-prints for the Repository, partly because they had a reliable, well tested product which already had some multimedia capacity but also because we were able to enter into a contract with E-Prints Services to develop the Repository in the ways that we wanted, namely to develop its multimedia handling capacity and ensure that it remained fully OAI-PMH compliant, so that it would work with other services that are being developed by the Repository Community.

At the same time, the project officer drew the attention of the Project Team to the growing Open Access movement, and we saw the advantages that this would have as a model for the intellectual property rights management of materials deposited in the Repository. The project officer wrote and disseminated a business case for an Open Access mandate. This brought the Repository to the attention of the University's senior management and more pertinently to the attention of the Research Policy Committee who immediately saw the advantages that an Open Access Institutional Repository would have in promoting the University's research profile.

The principal output of the project has been the establishment of the Lincoln Institutional Research Repository (<http://eprints.lincoln.ac.uk>) in which all members of the University are able to deposit material. A review process is in place, whereby members of the project team can assess the quality of submissions and either make them live in the Repository, or return them to the original author with suggestions for improvement. The Repository facilitates the deposit of full text material, or metadata only records. The public release of full text material can be embargoed for public release for a period of time to comply with publishers' requirements, or if preferred this material can be made available to registered users of the Repository

Other outputs have been the production of Service Usage Model Document, which describes the services that the Repository uses, the production of user guides and the production of a conference paper, which was delivered at the MACE conference in Venice, 20-21 September 2008, briefing papers for management on Open Access, interim and completion reports to JISC and a project wiki that contains all these documents which is available at http://learninglab.lincoln.ac.uk/wiki/index.php/Institutional_Repository

Currently there are 1039 records in the repository, although 900 of these are still embargoed as they formed part of the University's last RAE submission and permission has not yet been granted by the authors to release them. Researchers are depositing material at the rate of one or two items a week, although we have yet to install a fully functional analytical package to measure usage. Finally work is ongoing to develop the Repository further, particularly in the areas of simplifying the procedure for the

deposit of material, creating a more visually appealing interface to match the original requirements in the school of architecture. Our development work was very much focussed on ensuring the repository was fully standards compliant and thus able to take full advantage of the outputs of other projects, in particular the MACE and SWORD projects

Background

The LiroleM project was, from the start closely linked with a project already running in the University. This was the Virtual Studio project which was investigating the feasibility of providing electronic access for staff and student, to the growing collection of student work carried out in the School of Architecture in previous years. At the same time the university had been attempting to collate its outputs for the 2008 Research Assessment Exercise, and in doing so had built a significant digital archive of research material which needed to be more effectively managed and made available to the higher education community.

The project provided an opportunity to facilitate the archiving of research by staff as they produced it rather than asking colleagues to participate in a time consuming retrospective compilation of their research, but there was also a need for a digital archive that could cope with multimedia formats, largely, but not exclusively driven by the demands of the Virtual Studio project. Lincoln also has a very active teaching and research culture in Media, Fine Art, Animation as well as architecture, and we wanted to facilitate the archiving and making available of materials in formats other than text.

Aims and Objectives

Our overall aims were firstly to build a usable repository which would be accessible to all staff, capable of handling multimedia formats, and secondly to create a culture of repository use in the University

These were translated into more specific objectives

Firstly we needed to actually build a repository. The University had previously implemented an out of the box repository (Eprints version 2) for the specific purposes of the RAE but this had not been widely publicised and did not have the functionality we needed. We also needed to ensure that the repository software worked as it should, was compliant with appropriate standards, and that project staff understood how to use it. Broadly all of these objectives were achieved although we contracted out some of the implementation work to Eprints Services. We also had to make some compromises between the original user requirements as set out in the proposal, and the longer term sustainability of the repository, which was essential if we were to attract wider institutional support. For example towards the end of the project we made a decision to refocus the repository on research papers rather than teaching materials, as we originally intended. Strategically we felt it was important that the Research Policy Committee directed the advocacy work around the repository, as the committee was likely to carry more weight with researchers.

2) To ensure that stakeholders were aware of the repository, and both willing and able to make use of it.

This has certainly been achieved in terms of the principal stakeholders, although the school of Architecture has expressed some reservations about the design of the user interface and the compromises that have to be made between their own style of working and the lengthy processes necessary for compliant depositing of material.

3) To create a service model document that clearly sets out what services the repository will make available to the user community

This has been achieved, although not yet fully implemented and can be read at <http://eprints.lincoln.ac.uk/policy.html> We have also submitted a service usage model to the e-framework web site, available at <https://e-framework.usq.edu.au/users/wiki/DevelopmentSUMLiroLem>

4) To produce high quality user manuals to help users make fullest use of the repository
This objective has not yet been met, but this is because the steering group mentioned above has been tasked with responsibility for advocacy of the repository. However, we have produced a guide on how to deposit materials, available in the project wiki
http://learninglab.lincoln.ac.uk/wiki/images/0/03/Depositing_Your_Work_in_the_Repository.pdf

Changes to our objectives

Perhaps the most important change that we made during the life of the project was the realisation that we had to adopt of an open source approach to material deposited in the repository. This was quite a radical concept for some of the project staff, and remains so for some of our potential users, but we came to the view that the repository would not be sustainable for any length of time if users had to negotiate a network of complex intellectual property rights templates before depositing material. We do of course make it clear to users that they may not upload protected material without the permission of the rights owner, but we encourage them to use one of the variations of the creative commons licenses for their own work so that others may freely access and build upon what they have done.

The second important change was that we realised that our original intention of working with a single school and then expanding to the whole institution was not viable within the limits of the project. The demands that the School of Architecture wanted to make of the repository, were quite different from the demands that an institutional repository would make. A fuller account of this is given in a conference paper accepted for the MACE Conference, (Venice, Sept, 2008) by O'Coill, Earl & Winn, in Press <http://eprints.lincoln.ac.uk/1617> Certainly the repository as currently configured has achieved the aim of creating a systematic way for students and staff at the Lincoln School of Architecture to access examples of high quality student work from previous years. The problem is that architecture staff and students had "little interest, patience or time from the publishing workflow that EPrints requires" (O'Coill, Earl & Winn, 2008: 152)

For this reason the emphasis of the project was shifted to ensuring the longer term sustainability of the repository, through the attraction of much wider institutional support. This inevitably meant shifting towards a focus on the institution's research output, but the desire to accommodate multimedia resources effectively, and have a largely text based interface did mean that students were reluctant to upload their work. However there has been some interest from researchers in the institution and while their number is still small there has been an enthusiastic response from those who have uploaded their materials.

Methodology

The basic approach to the project consisted of four stages. Firstly we planned to analyse user needs, select and install an appropriate repository package, make appropriate adjustments to that package based on the user needs analysis, and finally to market the repository to the wider user community.

Our first priority was to get colleagues on board, as many technology projects in higher education tend to be rather small scale, and interest in the work is limited to the project team. This is of course not a sustainable model, as once the project has finished, the results of the work are often lost. For this reason we started by trying to meet a real perceived need that existed in our School of Architecture and working with a separate project that they had already begun. Our first attempts at engagement involved fairly conventional research methods, surveying staff, meeting with other project teams. As detailed in the implementation section this wasn't particularly successful, and we soon discovered, that our aims and those of the staff involved in the architecture project were not as close as we would have wished. Nevertheless there was sufficient interest in the repository to proceed with the development work.

We then began the process of evaluating which repository software to use. There were three main contenders, Intralibrary, D-Space and E-prints, and we examined instances of all three in use. We discovered that in terms of functionality there was little to choose between them, but all would need some development work. We invited four (does anyone have a copy of the original invitation to tender here) suppliers, the three named above, and the University of London Computing Services services, who also offered a repository development service, to tender for our requirements. We chose E-prints Services as they were best able to meet our requirements, and were prepared to undertake the development work that we needed. Having made our decision, we held a meeting with them, to describe the work that needed to be done. Importantly from a methodological point of view, we set up TRAC, a web-based software project management and bug/issue tracking system emphasizing ease of use and low ceremony. It provides an integrated Wiki, an interface to version control systems, and a number of convenient ways to stay on top of events and changes within a project. This proved extremely useful when working with E-prints services.

However, as we progressed we realised that the original concept of a virtual studio had more in common with a wiki than a repository (as understood within the academic world), The Project Officer set up a Virtual Studio on Blackboard using the Campus Pack modules. Within the tight confines that a Blackboard System Administrator has, we had a Virtual Studio space that third year students were invited to test. This was still some way from our original vision of the Virtual Studio but it did allow students and staff to upload materials, create galleries of designs, discuss their work and blog. In principle, this seemed closer to what the Architects wanted. The Project team decided to shift the emphasis of the project on the grounds that it would be a waste of resources to chase user requirements that we had little chance of meeting within the resources of the JISC Project. We felt that it was more important to ensure the long-term sustainability of the repository which required continued and wide ranging Institutional support. By this point, we had decided to use EPrints and EPrints Services to develop the repository. The tender made it clear that this was a sound and affordable decision. We felt that EPrints, despite it still largely catering for text objects, is a sustainable platform with a large community of academic users and developers.

Our next target was to engage the the attention of senior managers within the university which we did by writing a Business Case for the sustained investment in the repository. A Steering Group was established, including the Head of the Library, Head of the Research Office, our Online Manager and other relevant and interested staff. Unfortunately staff changes meant that the business case was pushed down the university's policy agenda, so in a renewed attempt to get the attention of senior. Management, we asked that it be put on the Agenda of the Research Policy Committee meeting. In the event the Senior Pro-Vice Chancellor asked to meet with the Project Officer to discuss the repository and our plans for it. The outcome of this was that the Project Officer was asked to discuss the repository at the next Research Policy Committee meeting, write an article for a University research newsletter and to speak with the new Dean of Research, who, since then, has shown genuine enthusiasm for the repository.

The importance of all this is that it illustrates very clearly that project teams need to be flexible in their approaches to methodology. It is unlikely that the strategy for implementation designed in the project initiation document will survive the rigours of exposure to the real world, and so a clear focus on the outcomes is in many respects more important than specific methods of achieving them. We did change tack, but we have established a repository that is sustainable and meets nearly all of the criteria we set out to achieve.

Implementation

The original aim of the project was to create an institutional repository more or less from scratch. As noted above the University had been using an Eprints repository in order to facilitate its RAE submission but this was used in a purely administrative context, there had been little or no advocacy work and there was little awareness of its existence across the university, nor was there much apparent knowledge of repositories in general. Our initial concern was therefore to work with academic staff to raise awareness of the value of a repository, which is why the original focus was on the development of a repository in a single school. We felt that it would be easier to engage a small group of academic staff with the project than attempt to raise awareness across a large and very diverse institution. We also decided that it would be essential to appoint a project officer with some

experience of working with repositories, as very few of the existing staff had this kind of experience. We started by considering the value of using the existing repository for this project to manage those materials that the school of architecture already had. In the event this proved to be rather more difficult than we had anticipated. While there was quite a lot of content in the research repository most of the material had been submitted by temporary staff so there was no real culture of engagement.

Our first step was to create a project team with the intention of holding regular meetings. This consisted of the project manager, staff from the School of Architecture, and Library and Learning Resources. The initial meetings were well attended and began the work of the project by setting in motion the necessary procedures for the appointment of the project officer. While this work was under way we drafted and circulated a survey of the needs of the school of architecture staff with the aim of finding out what sort of student work they would find a repository useful for, what formats, what sort of quality criteria might be applied. In fact there was a very disappointing response to this survey, but we were able to use what we had, to inform our later "user stories" approach. There was also considerable discussion of the approaches to be taken to managing metadata early on but few firm conclusions were reached.

Another important issue was increasing our own knowledge of the repository software. One member of the project team attended the training provided by Eprints at Southampton university, as at this stage we envisaged that we would be doing most of the project work ourselves. We also briefly attempted to evaluate other repository software packages such as Dspace and Intrallect, although we were unable to get the trial version of Dspace to work correctly, and while we were quite impressed with the Intrallect software, we thought that the user interface might prove too complex for our users. In any events the licensing costs proposed by Intrallect were some way beyond what our budget could support.

The Project Manager attended the first JISC programme meeting in London in July 2007 and this proved very useful in focussing the project on engaging with the user community. At the same time we ran into our first obstacle in that we were unable to install our repository software on the same server as the RAE repository because of institutional concerns about software conflicts rendering the RAE material inaccessible.. This became a significant problem for the project over the next few months as it effectively prevented further development work being done on the repository itself for some months.

However, we were able to appoint a project officer, Joss Winn who began work in early September. Clearly, his first task was to get an understanding of the project, so as well as meeting project and architecture staff, and contacting Eprints, he downloaded a test version of Eprints on to his laptop which did enable us to continue testing and development and confirm that it did accept images and video. It didn't recognise an MP3 audio file, which was surprising because it is supposed to recognise audio files although these objects were not available for preview This was clearly a problem as users expect to be able to preview these types of files rather than rely on a text description. It also made us realise that we would not be able to develop the repository to its full functional specification on our own, so we decided to use some of the funding to commission a professional repository provider to do the development work. We invited tenders from four organisations, Eprints Services, Intrallect, BioMed (Dspace) and ULCC (University of London Computing Centre). The first three of these responded, and we chose Eprints Services because they were able to respond to the specification at a reasonable cost. Intrallect quoted us a price beyond our budget, and BioMed advised us that they were unable to meet some of the multimedia requirements that we had specified. We finally signed the contract with E-prints in December and they began work almost immediately.

As the academic year began attendance at project team meetings began to fall off as a result of increased demands that other duties placed on team members. However, a second issue relating to the provision of hardware for the repository came to the fore, and we were forced to negotiate the purchase and installation into the university network of a server blade for the repository. This did delay much of the project work and it was not until December that we were able to hold a meeting with Eprints Services staff to thrash out the details of the technical requirements. In the meantime Joss had been working to raise awareness of the importance of Open Access and looking at some of the implications of Web 2.0 for the project. Many of the functionalities of Web 2.0 did seem appropriate for the Virtual Studio Aspect of the project. Examples, included media sharing, blogging & wikis, tagging

& social bookmarking, social networking, collaborative editing tools and syndication & notification. While the work on the development of the repository was delayed by the hardware issues we were able to develop, with the staff of the school of architecture, a wiki for students to collaborate on the production of materials, with the ultimate intention of producing materials of sufficient quality to be deposited in the repository. One of our earlier ambitions had been to develop some form of synchronicity between the repository and the university's Virtual Learning Environment and we used the Learning Objects LX Wiki tool within Blackboard to develop this. Our ultimate aim was to achieve a single click deposit from Blackboard to the Repository, but the structure of the repository and its metadata requirements required Blackboard development work, particularly in the area of authentication issues. More significantly, we began to realise that we had in fact two projects running, which while they had something in common, could not be merged. If the repository was to become truly Institutional it did need a wider audience, and so we decided to concentrate on developing the repository as a research tool, while continuing to support the work that the architects were doing. This was facilitated by the growing interest that was being taken in the repository by the Research Policy Committee which proved very important to the work of the project team as it meant that the senior management of the University was taking an interest in the project and saw it as a valuable addition to the University's resources. Joss wrote and circulated a paper on open access to the senior management, which has proved very valuable in supporting the continuing development of the repository after the project funding was complete.

At the same time we were working on projects to support the development of the repository. One of our objectives for the project was to write a service usage model for the repository, and the project manager attended a workshop on writing such a model at Aston University, which was held in early October 2007. We did produce an SUM document, and while we found the process of writing it valuable, in that it focussed our attention on how the repository would function and what services it would offer, we did wonder whether the finished product was worth the effort. After all, we were using E-Prints and within the scope of the project we were not planning to do anything to extend or fundamentally alter the well defined and understood services that E-prints provides. The SUM approach is clearly useful where software is being developed from scratch, or whether software services are being brought together to develop a new application but repositories generally use the same set of services for each installation. As a result of the JISC programme meeting held in Bristol, in November Joss made contact with the SNEEP project team, which was working on a project to increase the web 2.0 functionality of the repository by giving the user community a facility to discuss the items within the repository directly within the context of the Eprints's item page. In the event we were not able to incorporate the comment facility into the finished version of E-prints, because the SNEEP products do not yet work over secure socket layer, which is the default method of installing E-prints.

Returning to the advocacy stream of the project, we prepared a business case for the continuing development of the repository and an institutional open access mandate. We were also able to establish an Open Access and Institutional Repository Steering Group to work on a project to push for an institutional OA mandate. This was help by the successful development to a usable level of the customisation work with E-prints services, and the installation of the repository in early March. We did have some early teething problems with the speed of the server that the software was installed on, but these were resolved through working closely with the University's Computing Services Dept, and E-print services. The repository finally went live in the first week of May 2008.

So at the end of the project we have a new repository that meets the basic objectives of the JISC LIROLEM Project, but not the full expectations of the School of Architecture's Virtual Studio. However the work we did in ensuring the repository was OAI-PMH compliant and establishing the visual metadata platform has provided an excellent platform for allowing visual searching through the interface being developed through the MACE project. (<http://portal.mace-project.eu>) , and will facilitate deposit through the simplified SWORD project. The repository is now on the agenda of senior Management. During the course of the project, we shifted focus from the Virtual Studio to an Institutional Repository because it became clear that over the long-term, there was a more realistic chance of developing a widely used and supported application that benefited every faculty sooner, rather than later. Students and Staff, are using repositories such as Flickr, YouTube and Facebook in their daily lives and are increasingly expecting to engage with University provided applications with

the same expectations of functionality, connectivity, look and feel. Work is continuing on advocacy, and on discussions with faculties who contributed the e-prints 2.0 material.

Outputs and Results

As it stands, the repository is a full-featured EPrints 3.1.1 repository. Open Access Institutional Repository with improved multimedia functionality, although we have not yet achieved the full web 2.0 functionality. Some of this functionality has been achieved such as bookmarking, but commenting and tagging are still being worked on as the SNEEP project outputs cannot be used over SSL. E-prints Services are still working on our requirements in this area.

The Repository can be seen at <http://eprints.lincoln.ac.uk>. It has been designed to match the University's corporate style and thus is seen as a key part of the University of Lincoln's technology portfolio. Each e-print has a set of thumbnails associated with it. For example an e-print might consist of a conventional text article, some supporting images, or a sound or video file. The entry page for that e-print will display a scrollable bar containing thumbnails or an icon for each resource. There is a demonstration eprint of the multimedia and browsing capabilities of the repository at <http://eprints.lincoln.ac.uk/1543/> (This is a fly-through of the real School of Architecture building at Lincoln)

The upload procedure is still more complicated than we would like, and this has been confirmed by some of our users. However this has not entirely dampened enthusiasm for the repository, and users have reported requests for material that they have deposited, from a number of international sources. We have written user guides to the deposit process which are available on the project web site at http://learninglab.lincoln.ac.uk/wiki/images/0/03/Depositing_Your_Work_in_the_Repository.pdf but we do feel that the upload process is overly complicated. We are aware of other developments in this area, such as the Sword Project One of our original aims was to use some sort of wiki like functionality to allow students to work collaboratively to create and select material for ultimate deposit in the repository, subject to a quality control mechanism, where the teaching staff would act as the ultimate arbiters of whether a resource was worth preserving. This proved to be very challenging and in the end unnecessary, as we decided that research and teaching materials do not mix well in the repository in its current form. However we did develop a collaborative space within Blackboard which can be used for this purpose (figure 1). Each student uploads their images to the wiki along with any supportive text that they have, and the tutor can then select all the individual items and add them to the repository. This has not yet become accepted practice, and is still rather time consuming. We had hoped to develop a single click upload to the Repository from Blackboard, but this has not yet been possible. This was a slightly disappointing compromise, but we are still interested in developing this kind of functionality, but given the changed priorities for the repository we have decided to place more emphasis on the advocacy of Open Access and the Institutional Repository and on embedding an IR workflow in each academic department.



(Fig 1: The Blackboard Wiki)

Outcomes

The aims of the project were to lay the groundwork for the establishment of an institutional repository that will support a wide variety of non textual materials while not excluding conventional text based materials. More specifically, we wanted to assess the kinds of content that Colleagues would want to store in the Repository, identify who its key users would be, identify what repository services we could offer, establish the respective responsibilities of the library and user communities, to establish appropriate models of metadata and intellectual property rights management.

Overall, we are quite satisfied that we have met our overall aim, although the repository's final form differed quite significantly from our initial proposal in that it is much less focussed on the single discipline of architecture that we had originally envisaged. This is largely because design disciplines, remain largely marginal in the debate around educational technology. There was also an initial mismatch between the conceptions of the project team about the nature of repositories, and the requirements of the discipline. A repository was only a small part of the vision for the Virtual Studio, which was conceived of as a comprehensive collection of web based digital resources, but which would be used within the School of Architecture to establish a culture of "designerly research" where students would retrieve resources develop their own analysis based on these resources, and contribute to the creation of a resource. This is of course rather more ambitious than most repositories. Secondly, there was a strong feeling that designerly enquiry in architecture is intuitive and subjective and the requirement for repository users to adhere to a consistent and coherent set of standards for metadata was alien to the way of working in the discipline.

Given these issues, we decided that the project could only be sustainable if the emphasis on repository development was shifted from the single discipline of architecture, to a more conventional institutional repository. Our initial proposal had always envisaged working with other multi media disciplines beside architecture, and we had always made an effort to publicise our work across the university, so there was considerable interest in what we were doing from researchers. This was helped by the emphasis we were placing on an open access model for the repository

While there was some initial resistance from a small number academic staff, who were a little uncertain about what they saw as a radical departure from the traditional publishing model, and felt that the repository might damage their relationships with publishers, we were able to work with the Research Policy Committee to develop a commitment to Open Access at the University. Indeed the ethos of open access has been extended into the development of the Lincoln Academic Commons. This is the generic term we are using for a suite of tools including the repository, Neo, a journal of student work, and OWPS, the Lincoln Occasional Working Papers Series.

The repository is now fully operational and uses the standard Dublin Core metadata standards, provided by e-prints services. We had originally intended to use the PBCore standards for metadata, as we felt the audio, images, video, performing arts and composition item types were more appropriate for our needs but we discovered that E-prints services were implementing sufficient changes in version 3.1 to meet our needs, and we were somewhat reluctant to depart too far from the basic E-prints Service model as we wanted the finished version to be available to the wider repository community.

We decided to use the JACS subject headings as we felt that these were more appropriate to a modern university than the default Library of Congress Headings provided by E-Prints. We also felt that they were more comprehensive, they're far more user-friendly than LoC subject index headings, they acknowledge the existence of disciplines such as computing and media studies, they allowed a measure of interoperability with other learning object repositories, and they were just about established enough to assuage the librarians' fears about total cataloguing anarchy.

Who Benefits?

The existence of a digital repository is a major addition to the University's portfolio and is already proving valuable to researchers who are making their work available to a wider public. Anecdotal evidence from colleagues suggests that they are receiving enquiries about papers from institutions

around the world. Teaching staff are able to access complex learning materials from a variety of sources and are of course able to continue to access work they have done at Lincoln should they move to other institutions, later in their career.

We have ensured that university staff and students can deposit materials in the Repository by fully integrating it with our Lightweight Directory Authentication Protocol (LDAP) so that users can log in using their university network usernames and passwords. Material deposited is still subject to review by repository editors. In terms of read access to material in the repository, all materials are open access and can be read by anybody, unless the contributors have specified otherwise. A range of permissions can be applied to any repository item, ranging from full text public access, to metadata only public access, and items can be embargoed for a specific time period.

There have also been significant indirect benefits of the project. While the establishment of the academic commons was not an initial part of the project, students are being supported in the publication of their own work. The University is also committed to the development of research informed teaching, which involves transformation of the perception of the student from a consumer to a producer and the Lincoln Academic Commons has been a key facilitator of this development.

Conclusions

Perhaps the most important lesson we learned was that it is essential to be flexible with regard to the project plan. While we are very satisfied with the outcome of the project, the finished repository does differ quite significantly from the original vision. The reason for the difference is that we engaged with potential users throughout, and this has been the key to our success in establishing a well used repository.

Secondly, the project work illustrated the importance of working across the institution. The idea of working with a single school, though sound in theory, was found to be ineffective in practice. This was largely because the school had its own requirements, which the JISC programme could not really meet. It is also a fact of life, that it is more difficult to secure institutional project in terms of infrastructure for a single school project. Understandably departments are not enthusiastic about funding initiatives that others will benefit from them, even if there is a longer term benefit for all, built into the work. Our initial difficulties in getting the hardware set up to meet our requirements were alleviated through establishing good relations with Computing Services, our work in publicising the repository was helped greatly by gaining the support of the Research Support Policy Committee.

Thirdly we had to acknowledge the importance of contracting out some of the technical work associated with the development of the repository. While repository software is often presented as being "out of the box" software, our experience was that considerable development work was needed before the repository was rendered usable. We did have some specific and rather unusual requirements, and so we were, to some extent prepared for the need to buy in outside help. However, even with our earliest experiments with repository software, we found that the "out of the box" functionality was very limited and unsuitable for what we wanted to do.

Finally, we need to acknowledge that the project funding only covered the start of the work associated with the Repository. Clearly it is essential that a functional repository has to be created, and that it is easy to use. Although we have been largely successful in promoting the repository among researchers, there is still a considerable amount of work to be done in terms of raising awareness of the repository among the wider academic community. We believe that the open access ethos is central to this work. There is also some further work to be done in revisiting the deposit process.

Implications

How can others build on our work?

For the wider community the most significant development associated with the project is the development of an open access ethos for academic research papers. We believe that this is essential if academic work is to become more creative. As Lessig (2004) argues the traditional model of intellectual property is inimical to creative work. While we are not suggesting that repositories should deprive creators of adequate reward for their work, we do feel that users should license their work under some form of creative commons license if they (repositories) are to maximise the potential that they have to allow researchers and teachers to build on each other's work. Creativity is always built on the creativity that preceded and surrounds it, and so we strongly believe that the default licensing position for deposit in any repository should be Open Access. This would also facilitate the full functioning of a network of repositories, as users tend to be frustrated when their search results return a positive match, only to be told that the full text of the resource is not available for them to read.

What are the implications for users and the community?

As Salo (2008) points out achieving mandated use of open access is more difficult to achieve in practice than in theory. "Institutional repository managers are mice in mouse holes, bells in hand, looking out helplessly at the immense faculty feline. They have no authority over faculty...Simply put, the institutional repository and services associated with it must provide value to faculty on *faculty terms* before it will see more than scant, grudging use".

This is the challenge that our work has highlighted. The most significant implication for the rest of the community and for JISC is that it is not enough to build a repository, although to do so is in itself a significant undertaking. There must be a good reason for academic colleagues to use the repository, and it may be useful for the Start up and Enhancement Programme to be followed by an "embedding" programme.

What new development work could be undertaken to build on the work?

One very significant finding from our work with our colleagues in Architecture is that the upload process is unduly cumbersome, even though we have streamlined this process and produced reasonably simple guides to the process. While it is difficult to see how the requirement to add sophisticated metadata can be avoided, we do feel it is essential to simplify the process. We are currently drawing up a specification for a web form interface for deposit through the work being done by the SWORD Project, although this is in its early stage.

Another requirement, specific to our project is the development of "Light box" functionality for the images in the repository. This is somewhat similar to the concept of a shopping basket on an e-commerce site in that the user is presented with a set of search results and they select those they wish to examine in more detail by clicking on them. These are then saved, and further selections can be made based on subsequent searches and downloaded. When the user is ready, they have a collection of resources which they can save as a personal collection. This is currently being worked on by e-prints services and will be available in a subsequent release of the Lincoln Institutional Repository.

Statistics

139 full text records have been deposited in the Institutional Repository since it went live, and there are approximately 900 records from our previous RAE submission under review, 211 of which are full text. Unfortunately we are not in a position as yet to provide an analysis of the number of requests we are receiving, but we intend to implement Google Analytics or Interoperable Repository Statistics as soon as practicable. Finally, we are very keen to make use of the social bookmarking tools being developed by the Sneep project, as the ability to mark, tag, and make notes on e-prints seems essential if a repository is to achieve its potential to provide feedback, and disseminate research.

References

Lincoln Repository and Academic Commons sites

Lincoln Institutional Repository – <http://eprints.lincoln.ac.uk>

Lincoln Academic Commons - <http://commons.lincoln.ac.uk/>

Neo – a journal of student work - <http://ojs.lincoln.ac.uk/index.php/neo>

Lincoln Occasional Working Papers - <http://ojs.lincoln.ac.uk/index.php/owps>

Books/Articles

Lessig, L., 2004. Free culture : how big media uses technology and the law to lock down culture and control creativity. New York, N.Y.: Penguin Press.

Salo, D. (2007) *Innkeeper at the Roach Motel* [Online]. Available from:
<http://digital.library.wisc.edu/1793/22088> [Accessed Jun 22, 2008].

Other relevant JISC projects

Sword Project - <http://www.ukoln.ac.uk/repositories/digirep/index/SWORD>

Sneep Project - http://sneep.ulcc.ac.uk/wiki/index.php/Main_Page

Appendixes

Appendix 1: Survey instrument used in Architecture staff needs analysis

The University has been successful in obtaining a grant from JISC to investigate the creation of a repository of previous student work. One of our first objectives is to conduct a survey of the staff of the School of Architecture, to find out how best to organise the materials within the repository. The results of the survey will be used to determine how the data in the repository is described and structured, and so we are anxious to get as good a response as possible to the survey.

1) Have you ever used previous student work as a teaching aid?

Yes↑ No↑

2) Would you consider doing so in future?

Yes↑No↑

3) What do you think are the main benefits of using examples of previous student work in teaching? Please list two or three brief points.

4) If you were to use student work, how would you go about finding an example of the sort of work you

were looking for. Please rate the following in order of importance.

1. I'd remember the name of the student and search for that.↑
2. I'd just browse through the old models, photographs and briefs lying around the office↑
3. I'd search for building type↑
4. I'd look for particular drawing techniques↑
5. I'd search by year of design↑
6. I'd search by project title↑
7. I'd search by site analysis↑
8. I'd look for themes (e.g. transparency)↑
9. I'd search by place.↑

5) What type of material would you find most useful in your teaching (Please tick all that apply)

Models ↑
Videos ↑
3-d walkthroughs ↑
Briefs ↑
Photographs ↑
Maps/Plans ↑
Presentation Panels ↑

6) What criteria would you use to select material for inclusion in an archive. (Please tick all that apply)

The project was awarded a good mark. ↑
The project is a good visual demonstration of what the designer was trying to achieve. ↑
There are a variety of different formats used to convey the designer's objectives. ↑
The project is unusual (e.g. an unusual building type, a difficult exhibition theme) ↑
The project tackles a difficult issue. ↑
The project illustrates an important point in the learning of architecture ↑

7) There is an issue around how materials are to be put in the repository? Would you prefer to archive them yourself (if suitable training were offered) or would you prefer this to be done by a specialist person. Please delete as applicable

Self archive /Third party

8) Apart from teaching, what else might you use archived material for? (Please tick all that apply)

As a resource for research (e.g. on changing practices over the longer term) ↑
As samples for visiting boards and external examiners ↑
As publicity material ↑
As a way of making more physical space available to us. ↑
As a way of making material available to students off campus. ↑

9) Would you be interested in following up this discussion with a brief interview with a member of the project team, focussed on looking at samples of work you are familiar with that we might put in the repository.

Yes /No

If you answered yes to question 9 please enter your contact details, and convenient dates for the interview here.

Thank you

Appendix 2: Invitation to tender sent out to repository suppliers

Tendering Specification: LIROLEM/Virtual Studio Project University of Lincoln.

Project Overview

The University of Lincoln has been granted funding by JISC to establish a digital repository for multimedia and audiovisual materials. It is intended that the Services developed by the Project (LIROLEM) will eventually be made available to other University departments following a successful pilot in the School of Architecture.

The pilot aims to create a 'Virtual Studio' for staff and students. It is intended that the Virtual Studio becomes an environment where the processes of research, design and practical resolution become interconnected and ideas, information and illustrations are made more widely accessible. The Project aims to enhance students' learning experience by promoting external comment on student work and to improve the level of engagement and interest in history and theory by providing multimedia packages for the delivery of lectures and seminars.

Tendering Process

Detailed technical and functional specifications will be written for the successful vendor. At this stage, we are looking to secure a contract to acquire and development/customise existing repository software as well as an on-going maintenance agreement. A *basic outline* of the technical and functional requirements is given below. Essential requirements are indicated as 'must haves' and desired functionality is indicated by 'should haves'.

Please indicate what work your company can and cannot realistically undertake and *deliver prior to February 2008*. Finally, please can you provide a breakdown of indicative costs for the work required. If you have any questions regarding the requirements below, please contact:

Joss Winn
Tel. 07789485910
Email: jwinn@lincoln.ac.uk
University of Lincoln
Brayford Pool
Lincoln
LN6 7TS

Requirements

- The repository must authenticate users against Active Directory.
- The repository must run on virtualised Windows or Linux (Red hat) servers at the University of Lincoln.
- The repository must make full functionality available to all users and administrators through a web browser.
- The repository should integrate with the University's Blackboard Learning System <www.blackboard.com> by inheriting permissions/trust from Blackboard or Active Directory.
- The repository must be branded to conform to current University style sheets <www.lincoln.ac.uk>
- The repository should meet current Web Content Accessibility Guidelines defined by the W3C.
- The repository data must be held in a non-proprietary format and conform to recognised open standards.
- A clear repository upgrade and migration path to other repository software must be demonstrable.
- The repository must be OAI compliant.
- Authorised users must be able to create users and groups with different levels of permissions over repository objects and actions.

- Authorised users must be able to deposit and catalogue multimedia and audiovisual digital objects (i.e. video, images, audio, animations) as well as text documents. A workflow approval process must be in place.
- Authorised users must be able to deposit and view batches of objects, compound objects as well as single items.
- Authorised users must be able to add/edit metadata for batches of objects as well as single items.
- Authorised users must be able to import and use keyword authorities such as the 'RIBA Architectural Keywords'.
- Authorised users must be able to catalogue materials using the PBCore metadata standard. A schema is available from <www.pbcore.org>
- All users must be able to download materials individually or collectively as IMS Content packages.
- Authorised users must be able to link items together using relation types defined in PBCore standard. <<http://www.pbcore.org/PBCore/relationType.html>>
- All users must be able to preview, view and download items in sets as defined by relation types and user permissions.
- All users must be able to preview all files without downloading them (i.e. thumbnails for images and possibly video, embedded video player, PDF conversion for text documents, etc.)
- All users should be able to add 'tags' and 'comments' to existing items in the repository according to their permissions.
- All users should be able to email search results as URL.
- All users should be able to create a basket/lightbox to 'collect' and view items in.

Appendix 3: Service Usage Model document.

e-Framework Service Usage Model Name

Provide a simple, informative name for the Service Usage Model (SUM).

- Name: LIROLEM Service Usage Model
- Alternative Names: Virtual Studio Service Usage Model

Version

Provide the e-Framework Service Usage Model Version for this description.

- 0.2

Version History

Include requested information about all versions of this document.

Version	Date	Author	Description	Organization / Project
0.1	17/10/07	Julian Bekcton	Initial Draft	JISC SUE / LIROLEM
0.2	07/11/07	Joss Winn	Initial Revision	JISC SUE / LIROLEM

Rationale

The Lirolem/Virtual Studio is a means of digitally managing and preserving the output of students and staff at the University of Lincoln, irrespective of the format in which they are produced. Initially, the repository will concentrate on teaching and learning outputs within the School of Architecture, but it is intended that the repository will also manage research and teaching and learning outputs from all University departments. The repository will permit members of the University community to deposit, describe, search for, interact with and extract material that they deem valuable for use in their research, teaching and learning. This SUM describes the specific business processes involved in the operation of the repository and the services it provides.

Classification1

¹ See definitions of the Service Usage Model Classification Scheme categories and their allowable choices at: <http://www.e-framework.org/Services/ServiceClassificationScheme/ClassificationSchemeForSUMs/tabid/817/Default.aspx>

To be provided by the submitter:			
SUM Type	<input checked="" type="checkbox"/> Domain	<input type="checkbox"/> CORE (a commonly recurring SUM; designation requires e-Framework Integrity Group approval)	
Domain(s)	<input checked="" type="checkbox"/> Learning & Teaching	<input checked="" type="checkbox"/> Research <input type="checkbox"/> Libraries	<input type="checkbox"/> Administration <input type="checkbox"/> IT Services <input type="checkbox"/> Common
Maturity	<input checked="" type="checkbox"/> Immature	<input type="checkbox"/> Mature	
Purpose(s)	<input type="checkbox"/> Exemplar	<input checked="" type="checkbox"/> Application	<input checked="" type="checkbox"/> Modelling <input type="checkbox"/> Toolkit
XOR (exclusive "or")	<input checked="" type="checkbox"/> Service Genres	<input type="checkbox"/> Service Expressions	
Development Status	<input type="checkbox"/> Proposed	<input checked="" type="checkbox"/> Developmental	<input type="checkbox"/> Prototype <input type="checkbox"/> Production
Deployment Scale	<input checked="" type="checkbox"/> Isolated	<input type="checkbox"/> Ubiquitous	
State Behaviour	<input checked="" type="checkbox"/> Stateful	<input type="checkbox"/> Stateless	
Transactional Behaviour	<input checked="" type="checkbox"/> Transactional and ACID	<input type="checkbox"/> Transactional but Non ACID	<input type="checkbox"/> Non-Transactional
Batch Behaviour(s)	<input type="checkbox"/> Individual	<input checked="" type="checkbox"/> Batch	
Time-Constraint Behaviour	<input type="checkbox"/> Hard Real Time	<input type="checkbox"/> Soft Real Time	<input checked="" type="checkbox"/> None
Service End Point	<input checked="" type="checkbox"/> Provider	<input type="checkbox"/> Requestor	<input type="checkbox"/> Transcoder (both requests and provides)
Authentication/ Authorization Dependency	<input checked="" type="checkbox"/> Auth-Dependent	<input type="checkbox"/> Auth-Independent	
Protocol Binding(s) (only applies to service expression-based SUMs)	<input type="checkbox"/> Web Service <input type="checkbox"/> SOAP	<input type="checkbox"/> REST <input type="checkbox"/> HTTP	<input type="checkbox"/> Other
To be determined by the e-Framework:			
Status	<input type="checkbox"/> Approved	<input type="checkbox"/> Placeholder <input type="checkbox"/> Unapproved	<input type="checkbox"/> Superseded <input type="checkbox"/> Withdrawn
Confidence Level	<input type="checkbox"/> High	<input type="checkbox"/> Medium	<input type="checkbox"/> Low

Notation [optional]

List and explain the conventions and terminology used that are essential for understanding the rest of the Service Usage Model description. A complete list should be included in Terms (below).

Object: A non-specific term to refer to either an item, set or resource.

Item: A single discrete file, in any format, stored in the repository. For example, a text document, image or video file. Where there are multiple files with a common theme, for example, representing different chapters of a book, each file should be treated as an item.

Set: Multiple files with a common theme. For example, a series of consecutive images or pages of a book.

Resource: A total piece of work submitted by a repository contributor. This may consist of several items and/or sets.

Description

The purpose of the SUM is to explicitly articulate the main business processes around the setting up of a multimedia learning object repository.

This SUM describes a technical solution to the problem of managing multimedia teaching and learning resources in the School of Architecture. Currently these are composed of different file formats such as written documents, videos, drawings, photographs and 3-D models. The repository model should not be 'flat' but rather encourage and facilitate the non-hierarchical interrelation between objects.

- Users must be able to compile whole resources as well as create metadata for the individual items that make up the total resource.

- Users must be able to search descriptive (e.g. 'title'), administrative (e.g. 'date deposited') and technical (e.g. 'file format') metadata as well as being able to browse through a hierarchical classification scheme, displaying where possible, thumbnail images of items.
- Users must be able to retrieve items and be offered the opportunity to retrieve other related items that make up a resource. In addition, related resources should be suggested for further exploration.
- Users must be able to interact with repository objects without necessarily downloading them. e.g. preview files, add comments, 'bookmark' personal sets of objects, tag objects, create personal notes for objects. In effect, each user must be able to create their own repository environment.
- Metadata in the repository will be made available to other repositories through the OAI protocol.

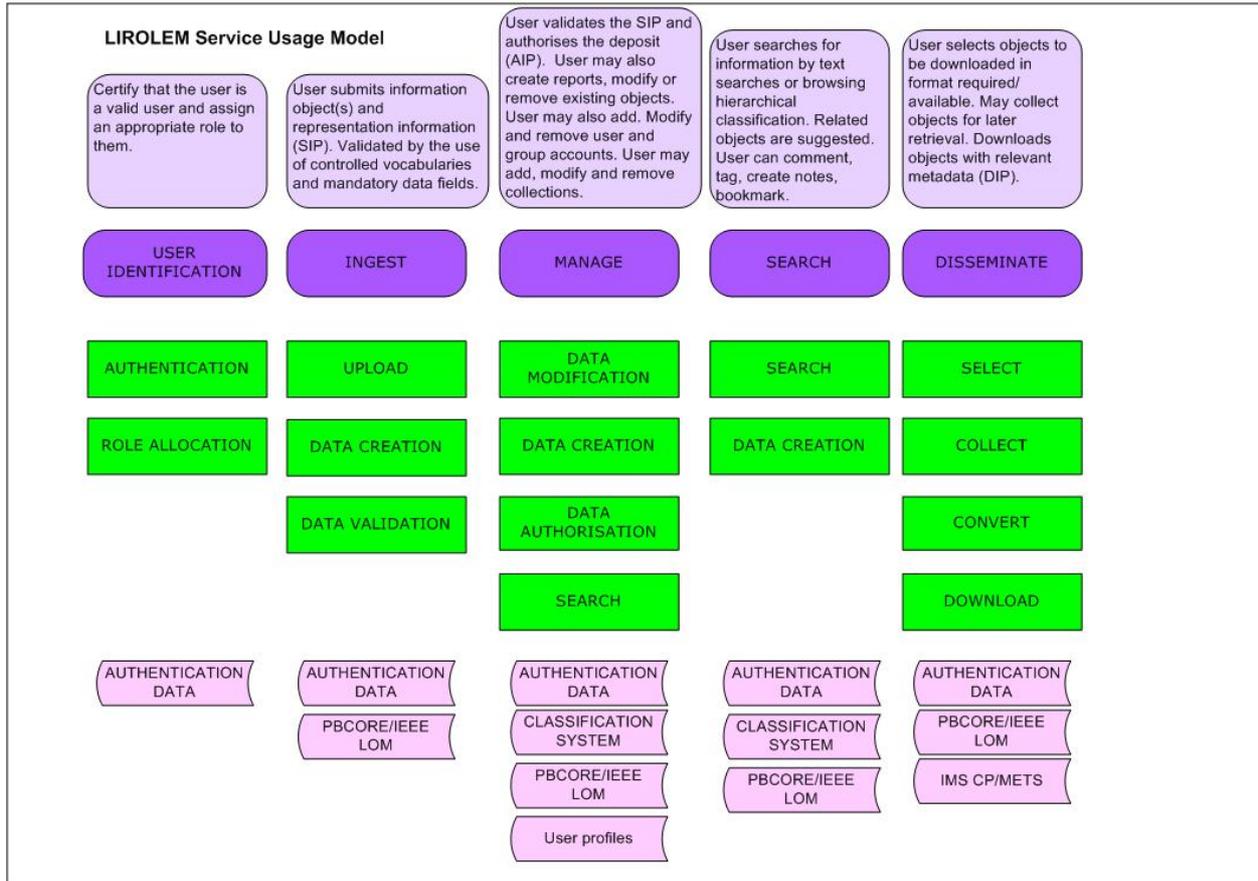
Business Process Modelling

Staff in the School of Architecture were awarded a Teaching Fellowship for a web-based teaching resource project that achieves the following objectives:

- Demonstrate the inter-connectedness of the processes of research, design and practical resolution and make ideas, information and illustrations more widely accessible.
- Enhance students' learning experience by promoting external comment on student work.
- Improve the level of engagement and interest in history and theory by embracing multimedia in the delivery of lectures and seminars.
- Provide a framework for future expansion of web-based teaching in design that will be useful for students engaged in research in history/theory units, studio design units and technology units across all levels and programmes.
- Integrate students' learning in history and theory units with their understanding of design practice in the studio context.
- Move away from the conventional lecture and essay approach towards promoting research as an activity embedded in design projects.
- Access examples of high quality student work from previous years.

In summary, School of Architecture staff proposed a teaching and learning resource which de-compartmentalises the teaching of architecture theory and design practice by creating an online environment where the processes of theory and design are shown to be interconnected through the use of customised multimedia repository software.

SUM Diagram



Usage Scenarios [optional]

Submission of an object to the repository

A User is authenticated to submit a 3D model and explanatory text document (2 items) to the repository. She selects the option to upload both items simultaneously. Following the upload, she is prompted to complete the mandatory and optional submission metadata shared by both items. Following this, she is prompted to enter further metadata specific to each item. She is then prompted to make any associations with existing objects in the repository, automatically being suggested her own work. She is then allowed to review her submission and modify or delete her current objects and metadata. Finally, she is prompted to complete the submission by agreeing to the Terms & Conditions of submission and defining the Terms & Conditions by which her work is made available to others. The data is validated to ensure all mandatory information has been submitted. The objects are then held for Administrator review and approval.

Applicability

This SUM is to be used to set up the repository from scratch. It sets out the business processes and workflows involved in creating the repository and will be used in discussions with the repository software suppliers to assist them in developing the repository to the University's requirements.

Functionality

Outline the individual system functions that the Service Usage Model provides in terms of messages, data (documents) and steps within the individual functions; include constraints and conditions but do not include implementation-specific information. If appropriate, include an illustration of how the functions work together via their related data and processes.

- **Authentication and Authorisation:** A User navigates to the repository either from another web application or directly to the login page. An attempt is made to authenticate them and once authorised, they are allocated a role depending on the group they are members of. Depending on the assigned role, specific functionality is permitted. If the user cannot be authenticated, a message is shown to that effect and the option to register for an account is offered. If the user can be authenticated, they are shown their personal repository environment with options for permitted functionality.
- **Ingest:** If the user has been authorised, they are able to upload objects from their local PC. They are able to select one or multiple files to upload simultaneously. Once uploaded, the file formats are verified as permitted and the user is prompted to enter data about the objects. They are then prompted to link the objects to existing objects in the repository. After linking, they are prompted to review and edit the metadata they have submitted. They are then prompted to agree to the Terms & Conditions of the repository and choose the licence by which the objects will be made accessible to others. If they agree to the T&C, the objects are deposited for review and their status is pending. An RSS feed (for admin users) is updated to show that new items are waiting to be verified by an administrator.
- **Manage:** A user is authenticated as an administrator. Items being held for review and verification are held in a distinct collection accessible only by an administrator. A 'collection' is not an actual grouping of files on a filesystem but merely objects grouped by a status label in the repository which users can engage with based on their role allocation. Collections can be created by an administrator on this basis. Data fields for more than one item can be edited as a batch. Uploads for an administrator work as described above with the exception that they are immediately deposited and do not need to be reviewed. Search works as described below. An administrator can report on user activity (log in, log out, popular searches, failed searches, data in, data out, etc.) and repository content (keywords used, licences used, content accessed, content not accessed, content file size, etc.), exporting the reports as csv documents.
- **Search:** A user can search for and view objects in the repository in three ways: Browse a hierarchical classification scheme based on a formal keyword authority; text (boolean) searching; browsing a community 'tag cloud'. Search results are presented to the user visually (e.g. thumbnail images) in order of relevance. Clicking on the item will display the preview version (as image – text as PDF image, video or audio preview) with relevant metadata. If the item is part of a set or resource, a link to the set or resource is shown to the right, too. Below are related items that are part of the set or resource. When searching, the user can write shared comments and private notes for each object, bookmark the object in their personal profile and add tags that contribute to the community tag cloud and facilitate searching.

- **Disseminate:** An authorised user can download items, sets or resources from the repository. One or more items can be selected for simultaneous download, choosing to include relevant metadata or not. Specific packages can be exported for download such as IMS or METS. Items can be downloaded immediately following a search or later from a privately bookmarked collection. The user is able to choose a limited number of formats that each item can be downloaded as. Users must agree to the Terms & Conditions for each object. Content is transcoded, packaged and the user is prompted to download the file to their local PC. The transaction and acceptance of T&C is recorded.

Structure & Arrangement

Services: Security, user management, submission, object store, metadata management, search, transcoding, rights management, dissemination and reporting.

Data Sources: User profile information; data object & object representation information (SIP); provenance, context, reference and fixity information (AIP); METS, IMS Packages, IEEE LOM, PBCore, Dublin Core/OAI-PMH (DIP). For SIP, AIP & DIP, see OAI Reference Model.

Co-ordination:

- The *Security* service authenticates and authorises the user to use the upload, metadata management, search, transcode and download services.
- The *User Management* service creates, modifies and removes users and their permissions.
- The *Submission* service permits the ingest of data objects and object representation information (SIP) to the repository.
- The *Object Store* service tracks data objects being submitted and disseminated from the repository.
- The *Metadata Management* service, creates, modifies, verifies and removes all content metadata (descriptive, administrative and technical) in the repository, as well as private user metadata (notes, bookmarks) and shared user metadata (tags, comments). Metadata is linked to objects (items, sets, resources), Licences and users. Provenance, context, reference and fixity information (AIP) is completed for the data object and validated.
- The *Search* service allows a user to search data managed by the metadata management service, according to permissions granted by the user management service. The search service returns and displays search results drawing from the object store service and metadata management service.
- The *Transcoding* service converts data objects from the source format to another format. This occurs at submission time to create preview thumbnails of images and clips of video and audio and also as requested by the user prior to dissemination. Transcoding is performed according to rights applied to the data object.
- The *Rights Management* service requires the application of terms and conditions (a 'Licence') to the data object.
- The *Dissemination* service permits the download of transcoded data objects and selected metadata (DIP) according to the Licence applied to the data object.
- The *Reporting* service permits the audit and reporting of transactions by each of the above services.

Applicable Standards [recommended]

OAI
PBCore
IEEE LOM
IMS Global Content Model
METS
Dublin Core
HTML
OAI-PMH
ATOM
RSS

Design Decisions & Tradeoffs [optional]

The repository has to use the University's LDAP/AD for authentication. As outlined in the Business Process Modelling Section, the objectives of the Virtual Studio require the repository to manage multimedia data objects and allow a community to comment and re-purpose these objects for use in teaching and learning. To enable effective search, analysis and retrieval of these objects, a transcoding service is deemed necessary to convert the original data objects into suitable formats for preview and dissemination. The data objects being submitted to the repository should not be third-party copyright and therefore an extensive digital rights management service is not required. The services should be possible to implement using Eprints 3.

Project Acronym: Lirolem
Version: 1.0
Contact Julian Beckton
Date: 27/10/2008

Data Sources Used

User profile information: Active Directory information transmitted over LDAP.

Data object: The bitstream

Representation information: The JPEG standard

Provenance, context, reference and fixity information: The totality of metadata associated with a data object.

METS, IMS Packages, IEEE LOM, PBCore, Dublin Core/OAI-PMH: Export metadata standards.

Services Used

User identification

Ingest

Manage

Search

Disseminate

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