

# **Developing port.hull – The University of Hull Portal**

## **A JISC Case Study October 2003**

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**JISC**

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- Annex 2: Criteria for Evaluating Portals (October 2001)
- Annex 3: Scores for Portal Evaluation (December 2001)
- Annex 4: Web Services: A Discussion Paper (December 2002)

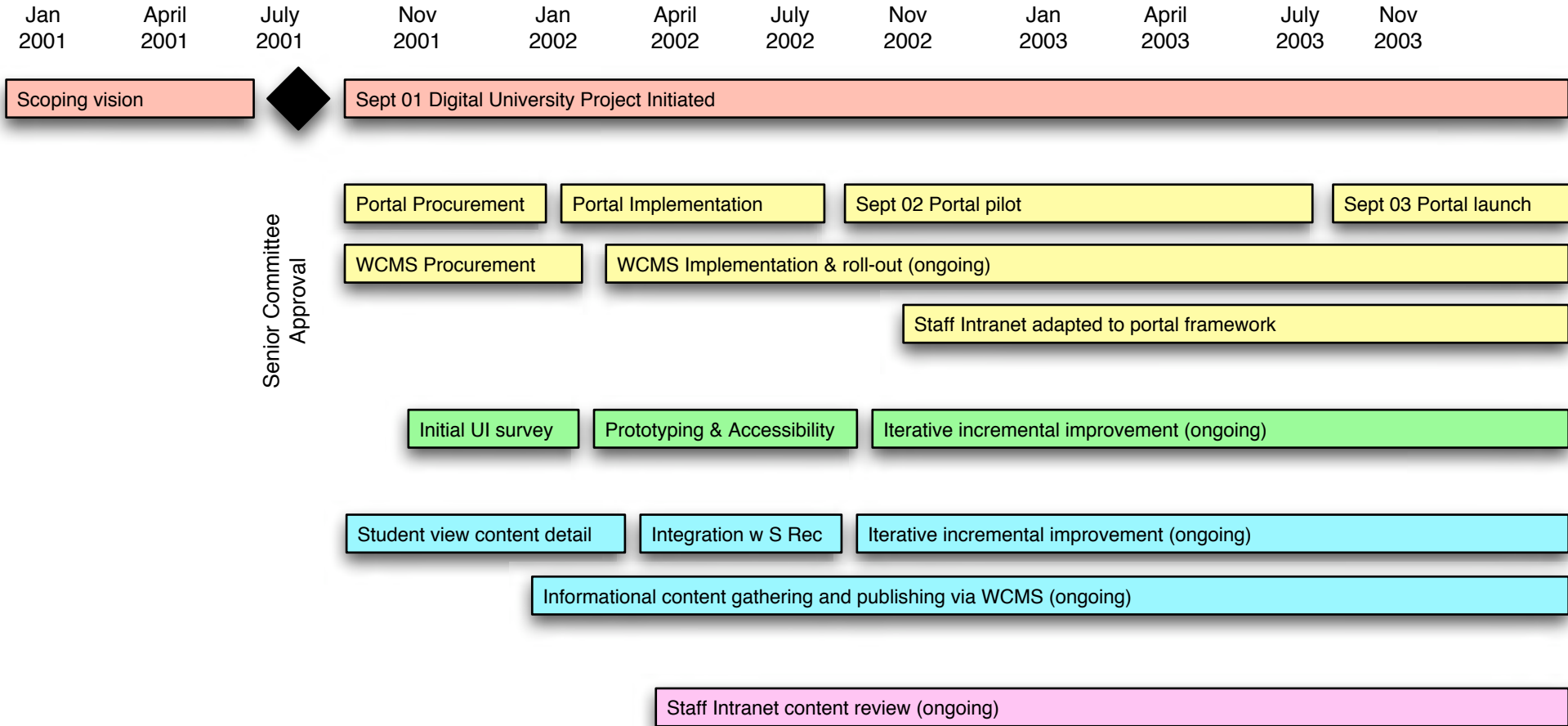
## Executive Summary

With the release of "Building the Digital University" in June of 2001, the University of Hull embarked upon an ambitious programme of activity which is transforming the value of information within the institution. This report, commissioned by the Joint Information Systems Committee (JISC), offers a view of this activity just over two years after commencement, and includes pointers to current and future directions.

Milestones along the way have included:

- careful consideration of existing University practice and process, with a view to modelling those which are appropriate in the digital realm, and re-engineering any which are perhaps no longer relevant in a 21<sup>st</sup> Century institution such as Hull
- widespread consultation with stakeholders from across the University, in order better to understand their needs as creators, curators, changers or consumers of institutional assets
- development of a Web Content Management System that is devolving responsibility for content in the institutional Web presence to those most able to ensure its continued currency and relevance, whilst ensuring robust control over quality, audit and infrastructure from the centre
- unveiling of the first iteration of an institutional portal, port.hull, to all staff and students in September of 2003, with a view to continuing development of this window onto a wide range of underlying institutional systems over the coming years
- continued and active engagement with a global community of interested parties working towards the common goal of a digital university, culminating in the appointment of Ian Dolphin to the Board of the Java Architectures Special Interest Group (JA-SIG) in July 2003, and Hull's recognition as the first Sun Microsystems Centre of Excellence in the Digital University in November.

# University of Hull Portal Development Timeline - Key events and Processes



# Background

The University of Hull is a medium-sized university with a total of 17,000 students and 2,500 staff. It is located in the city of Kingston upon Hull, some 200 miles north of London, with a second campus in the coastal town of Scarborough in North Yorkshire.

The university vision is summarized as  
"To be an achievement-driven university with a sound financial base supporting the regional and global community by:

- Developing students strong in scholarship and well equipped for life
- Producing world class research in selected areas
- Attracting, retaining and developing committed and high-performing staff
- Providing significant benefits to our business partners"

The city of Kingston upon Hull, along with many others in the north of the UK, has suffered a sharp decline in its traditional industrial base over the last twenty-five years. The city is currently re-inventing itself as a "Digital City", and has attracted considerable funding from UK government regeneration programmes. Kingston upon Hull is unique in the UK in having its own telecommunications carrier, Kingston Communications. The infrastructure provided by Kingston Communications has attracted significant investment from the BBC as a national flagship for digital media services. The University of Hull actively partners these organizations to raise educational attainment in the sub-region.

In common with most other UK Higher Education Institutions, the University of Hull undertook two major developments related to the development of what might broadly be defined as information systems from the mid 1990s. The first of these developments was the convergence, in 1996, of the services represented by Libraries, Computing, Corporate Systems (MIS) and the then Centre for Teaching and Learning Support within the unified management structure of a converged service - Academic Services. This reorganisation had a significant strengthening impact on the ability of the University to undertake a holistic review of a range of core information-related processes, and marshal resources to address deficiencies within a strategic development framework.

**Figure 1: Academic Services Organisation, 1996-2003**



The second major development was the formulation of that strategic framework into a General Information Strategy in 1998. This strategy recognised, and formalised a commitment to redress historic underinvestment in ICT infrastructure, and focussed institutional attention on the role of ICT within a wider redefinition of internal and external processes. The General Information Strategy recognised the increasingly important role of the World Wide Web, both in the context of communicating information to staff, students and other constituents, and enabling interaction with key institutional systems. From this broad strategic vision the university moved to the development of a Staff Intranet from 1999-2001. A number of factors influenced the initial focus of development for the Staff Intranet, most significant of which was the disparate range of vendor-provided and home-grown information systems within the University<sup>1</sup>. These systems presented a variety of interfaces to (primarily) staff users, and commonly required multiple authentication points. The development of a Staff Intranet recognised that these applications frequently exposed a range of functionality which, although appropriate for staff whose main role involved the extensive use of a particular application, were overly complex for those staff who required rapid and easy access to a more limited range of functionality.

The initial two-year development of the Hull Staff Intranet therefore aimed:

- to assess the functional requirements of corporate applications for key segments of the staff of the university
- to provide those functions within a secure Web environment requiring a single authentication point

Staffing for this development effort consisted of a re-purposed Academic Services Libraries Web developer post, which was transferred to the central Office for Academic Services. Additional part-time development effort was drawn from Academic Services Corporate Systems, the team responsible for the development and maintenance of the principal systems concerned.

A number of limitations were recognised at an early stage:

- By its very nature, a Staff Intranet was limited to use by staff. A parallel development would be required to enable access to appropriate systems by the student population of the University.
- Resources were not available to address even limited integration across the full range of University information systems. Library systems and Virtual Learning Environments were deliberately excluded from planned work at an early stage.
- Although it was judged entirely feasible to provide the functionality required within a Web interface, the technologies required were both immature and rapidly evolving. Given the diversity of systems the development aimed to integrate, there was an acute awareness that it would be difficult, in the short term, to provide a coherent and consistent technical architecture to accomplish this. Technologies used included Perl and CGI scripting, reflecting "state-of-the-art" Web development at the time.

- That although the very development of a Staff Intranet recognised the increasingly significant role of the World Wide Web, its development did not address management of the institutional Web space itself. Given the burgeoning nature of that Web space, and the range of central and departmental providers, a clear tension existed between the speed of Staff intranet development and the desire of internal agencies to take advantage of the Web rapidly.

## **Initial Scoping and Evaluation, Gathering Institutional Support, Project Planning**

Although several formal and informal meetings had been held from 1999 onwards regarding the development of a Student Intranet at Hull, human resource issues had effectively prevented practical progress and more advanced planning. During the course of an internal re-organisation in early 2001, responsibility for detailed project and pre-project planning was allocated to Academic Services Interactive Media<sup>ii</sup> (formerly part of the Centre for Teaching and Learning Support). This unit had a background in the production of e-Learning resources for HE and schools, and was augmented during the course of the re-organisation with staff responsible for the development of the Staff Intranet. This team therefore combined considerable experience in visual and user interface design, together with a range of technology skills and practical experience of project based activity.

Pre-project planning consisted of the following phases:

- Production of a draft vision document
- Review and consultation on this draft within Academic Services
- Production of a public draft vision document
- Review and consultation within the University
- Discussion at the senior University committee, Planning and Operations Committee
- Production of a project initiation document containing practical and organisational details, timescales and short-medium term objectives for the first, two year phase of the project

The production of an over-arching vision document was viewed as critical to secure buy-in at every level of the institution. The document outlined broad objectives, indicated current developments in ICT within Higher Education and the breadth of issues these highlighted, indicated an overall development methodology, and pointed to a range of potential priority areas of work within an overall framework and institutional context.

This framework and context was sharply differentiated from some of the wilder Dot.Com claims surrounding the "virtual university" and e-Learning, and instead focussed attention on institutional processes within an environment that could be categorised as hybrid for the foreseeable future. This environment would encompass traditionally taught on-campus students augmented by online provision, to distance learners taught by a variety of traditional and e-Learning methods. After noting the experimental nature of online learning initiatives at the time, this was summarized in the following terms:

"Hence it becomes clear that a prerequisite of any major new institutional direction is the creation of the digital university, or the e-campus. This is categorically not the same as creating a 'virtual university' for the purposes of delivering on-line teaching and learning. Creating a digital university means looking at all the key business processes of a university, and then recreating, reintegrating and enhancing these processes in an online environment. Building the digital university is an opportunity to re-invent our frequently archaic information flows and process controls in ways more applicable to modern day universities."<sup>iii</sup>

## **The Role of the Institutional Portal**

A survey of developments within Higher Education, particularly in North American Universities, led the project planning team to the early conclusion that the previous conceptualisation of vertical slicing into "staff" and "student" systems was not necessarily appropriate. Examination of early portal implementations, such as the PAWS (Personal Access Web Services) initiative at Louisiana State University<sup>iv</sup>, and early work undertaken by the then Java in Administration Special Interest Group<sup>v</sup>, indicated the potential strength and benefit of a portal framework. Rather than the creation of multiple interfaces to institutional systems per group of users, a portal framework potentially provided a presentation layer which not only differentiated users by group, but which would also allow individual users to customise a range of content. The vision document, "Building the Digital University" summarised both the key systems to be presented, and the presentation layer itself:

"Through analysis of the fundamentals of the e-campus, we can identify five essential, interrelated components that together will create the rich working and learning environment we seek to establish.

- The Corporate Intranet, providing University staff with access to a widening range of information and communication resources, and to means of conducting an increasing amount of their business in a secure, online environment.
- The Student Intranet, providing students with access to student-centred information, learning resources, course management and communication facilities, as well as the ability to conduct financial and administrative functions online.
- The Digital Library, providing access for all our staff and students, wherever they are located, to networked information resources, which may in turn be disclosed locally, nationally or internationally.
- The Public Web site, providing a key means of marketing the University and of communicating with a vast community of students, potential students, alumni and others.
- E-learning systems, providing the University with the capacity to enable learning and teaching in a flexible, place-independent, online environment, and enhancing the existing campus learning experience.

This does not mean presenting users of these systems with five apparently different interfaces. Central to the concept of the digital university is a single interface enabling access to a range of information sources, applications, and communications facilities. Certain of these sources and facilities exist already, or are under development. Examples within the university include our corporate databases, the functionality provided by virtual learning environments, information held on Web pages, or in library catalogues. Other sources are externally sourced, such as library electronic resources available by subscription, or resources provided by national subject gateways and the developing DNER. The information and functions we describe will be bound together and integrated by a presentational layer forming an institution-wide portal.<sup>vi</sup>

A series of diagrams were provided to accompany and illustrate the latter paragraph, and are published in Annex 1 of this case study.

### **Priorities**

Several immediate conclusions flowed from this perspective, and were detailed in the vision document. They may be summarized as follows:

1. Project structures would require great flexibility, and the involvement of key staff across the institution in specifying detailed content and undertaking process review. Although reporting through the established University committee structures, the project would

require a broadly based steering group, together with flexible teams of varying size assembled to address specific tasks and development areas.

2. The creation of an institutional portal would be significantly more complex in nature than the creation of any traditional Web site. In addition, although capable of resolution into clearly defined and finite stages, the portal would be subject to a process of continuous iteration and development beyond the suggested two-year initial implementation. The project therefore required a production methodology more akin to software design than Web site creation. The Carnegie-Mellon Capability Maturity Model, and in particular the IDEAL Model based upon the CMM, were suggested on the basis of previous experience.<sup>vii</sup>
3. That the initial phase of the project should examine a greater range of best practice in portal development within Higher Education, and establish a range of detailed evaluation criteria by which to judge existing portal offerings and their feasibility for deployment by the University.
4. The integration of external sources of content required a close watch on a range of emerging standards in the business environment, and the alignment of development effort for the institutional portal with that undertaken around both the DNER (now JISC Information Environment).
5. Development work for the Staff Intranet had indicated the feasibility of providing Web interfaces to core corporate database systems, and valuable experience in this area. The need, however, to move to more technologically consistent, coherent and standards-informed interfaces to these systems was apparent. This approach would also facilitate repeatability and re-use of informational and other resources where practical.
6. Clear information silos existed within the range of systems deployed by the University. These silos existed for a variety of reasons, ranging from pre-Web and proprietary technologies, through to licensing issues which effectively prevented any significant measure of integration without significant additional cost.
7. Additional external factors, including impending legislation regarding accessibility for individuals with disabilities, were likely to have significant impact on development objectives, and should be integrated as far as possible with detailed project planning. Given the potentially global reach of the Web, this required a view not only of SENDA in the UK, but also international developments such as the s508 and ADA in the US, EU Employment Directives, and the DDA in Australia.
8. Accessibility was squarely located within a focus on user-centred design, both in terms of content (what was to be surfaced within the portal, in terms of applications, information and transactions) and in terms of visual and interface design (how and where those elements would be surfaced). The definition of the term "user" was deliberately as inclusive as possible:  
"Issues of equity and equality surround the provision of information and the communications resource we describe. As far as possible, these resources should be accessible to all our learners. They should not exclude users with disabilities, those from different cultures, or distance learners on low bandwidth and frequently temporary Internet connections. These design and implementation challenges will be integrated with our planning processes from the outset."<sup>viii</sup>

## Managing Web-Based Content

Closer examination of what had been termed, in shorthand, “the Public Web site” effectively initiated a second, parallel, track of development activity for the first phase of the Digital University Project. In common with many other universities, institutional Web space at Hull contained a mixture of central and departmental content for a variety of administrative, teaching, learning, research, and personal purposes. Although a central Web developer had been employed by the University from 1997, a wide variety of personnel, processes and tools were deployed to manage the institutional Web presence as a whole. The lack of an overall perspective or strategic framework for the management of Web based content created a range of issues to be addressed, including:

- Inconsistency and inaccuracy across University Web space
- Widely variant visual and navigational design
- Additional strain on staff development and training resources due to the range of skills required and software used
- Difficulty establishing peer support and sharing of good practice
- Difficulty establishing effective re-use of information (including accessible versions, and versions for a range of access devices)
- Concerns regarding the safety of raw-format critical information

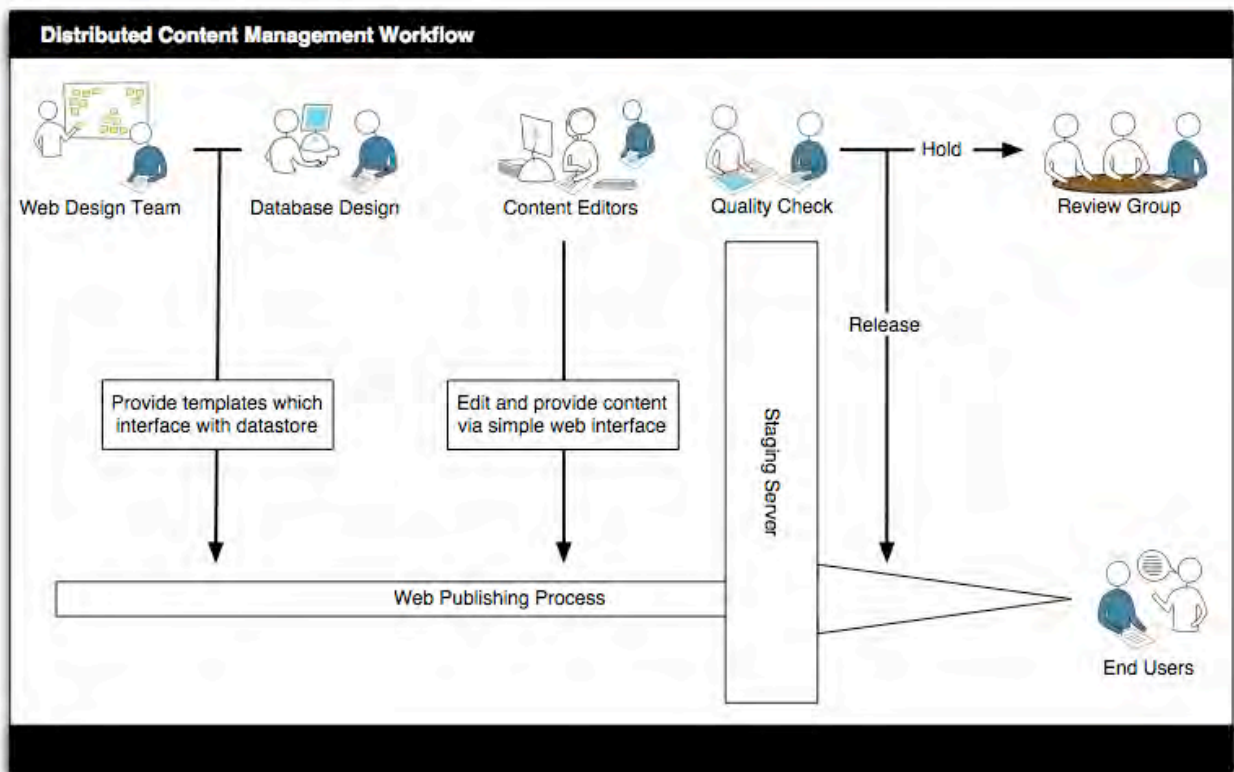
Clearly, if the vision of an institutional portal for Hull included an element of the aggregation of Web page-based information, improvement in the processes by which that information was published, and the technology surrounding Web publishing required both renewal and development effort.

The vision document, “Building the Digital University”, proposed evaluation of database-driven distributed Web content management systems for the University, based around the following key criteria:

- In order to distribute basic content production and editing rights to those with direct responsibility for content (thus improving currency and accuracy, the editing interface should be as simple as possible, and familiar to a broad range of technically literate, but not necessarily technically focused users.
- Web based content should be treated as mission-critical information, and stored in corporate databases with appropriate security and safeguards.
- Web based content should, if possible, be published through a series of templates, enabling ease of re-use for a range of users and a variety of access devices, and thus reducing the need for each content editor to become a visual design, information architecture or user interface specialist.
- A Web content management system should embed elements of workflow, facilitating the development, distribution and adoption of basic quality assurance mechanisms.

It was considered critical that these criteria (particularly the last) began from, and were located within the publishing process, rather than from particular technological perspectives. A snapshot analysis of a sample of Web publishing activities across the institution as a whole was undertaken, which generated a basic visualisation of essential workflow characteristics.

**Figure 2 Web Content Management Workflow**



**Information Silos: Virtual Learning Environments**

The experimental nature of e-Learning systems has been noted. This experimentation had, by the point the Digital University Project entered a pre-planning stage, resulted in the deployment of four e-Learning systems within the University: Blackboard (at the most basic level of subscription), Merlin (a home-grown system originating in language learning), FirstClass (used almost exclusively in language learning) and Business First (a Microsoft Exchange based system in use with Business Studies from the Scarborough Campus). These environments had little or no connectivity with other campus systems, thus creating significant duplication of effort in user and module management. In addition, only one of the deployed systems claimed adherence to common specifications or standards, such as those developed by the global IMS Project, thus effectively "locking" content within the specific system. It was judged that this factor would, in all probability, create difficulties in both content re-use and migration.

A specific point was elaborated in relation to content within the learning environment. The experience of the JISC funded ICONEX (Interactive Content Exchange) Project had illustrated the difficulty in establishing meaningful connections between interactive content and a monolithic learning environment. Although a minor perspective in the context of the principal direction and immediate programme of actions being established by the Digital University Project, this provided a small illustration of the benefits of developing a more flexible and less tightly bundled range of services to support online learning. It further highlighted the requirement for a portal framework to be flexible enough to incorporate new services (such as learning object repositories), in addition to existing services.

"Building the Digital University" noted that no single environment or pedagogical model "...will meet either the requirements of every tutor in each discipline in which it is used, or the learning styles and needs of every learner in every geographical location"<sup>x</sup>. Drawing on material produced by the JISC, however, it advocated movement in the direction of connected systems and services within a Managed Learning Environment. This MLE would consist of a range of loosely-coupled services fronted by a unified user-facing portal presentation layer. Given the range of systems in use, their often experimental nature, and the degree of departmental independence they represented, it was viewed as critical that this perspective did not suggest or suppose "a monolithic approach to online teaching and learning"<sup>x</sup>. This emphasis was given in order to meet concerns expressed by a number of academic staff that the unified presentation layer the project sought to create might presuppose a uniform learning environment.

### **Senior Committee Presentations and Decisions**

"Building the Digital University" attempted to present and establish a broad vision in language which (in the main) was comprehensible to the non-technical reader. It was accompanied by a series of visualisations translating occasionally abstract concepts into more concrete and easily understood scenarios. Similarly, wherever an example of the indicated approach could be found in practice, screenshots or other images were retained and incorporated (for example, a series of screenshots from early portal implementations in the US). These visual elements were extensively used in presentations, and played a significant role in helping a range of audiences grasp both the underpinning concepts, and practical benefits of the proposed developments.

Initial documentation had been produced within Academic Services, and extensively reviewed within Academic Services by both management groups, and staff with responsibility for technical and non-technical areas. Prior to submission to the appropriate University committee (Information and Communications Committee, which oversees IT infrastructure and strategic development) wider consultation was undertaken by means of largely informal one-on-one or small group meetings of relevant staff. Care was taken to ensure that this consultation included both key staff in the processes most impacted by the proposed development, and a representative selection of staff who were more likely to be categorised as "end users". Similar informal consultation was undertaken with students, through Hull University Students Union.

More formal consultation was undertaken following the submission of "Building the Digital University" to Information and Communications Committee, with comments invited prior to submission to the senior University committee, Planning and Operations Committee. Following a presentation by Richard Heseltine, Director of Academic Services and Librarian, and Ian Dolphin, Head of Academic Services Interactive Media, the overall objectives of the project were approved by Planning and Operations Committee at its meeting of July 2001. Information and Communications Committee was mandated to conduct detailed project planning, establish structures and commence the project in the Autumn of 2001.

### **Project Initiation**

Detailed project planning was conducted over the summer of 2001. This effectively decomposed the broad targets of establishing a pilot portal and Web content management system at the end of year one into more narrowly focussed quarterly and six monthly objectives. It was considered that rather than operating from a detailed central, top-down

plan established annually, that much detailed planning would be conducted by the project working groups themselves. Development strands were identified which, as far as was practical, uncoupled dependencies within the overall project. This approach enabled useful work to be undertaken in discrete areas of activity without unnecessary pauses on a single critical path.

Four broad development strands were established within which detailed working groups would operate:

- Technical Infrastructure
- Student "Intranet" content
- Staff Intranet development and harmonisation
- Public Web site redevelopment

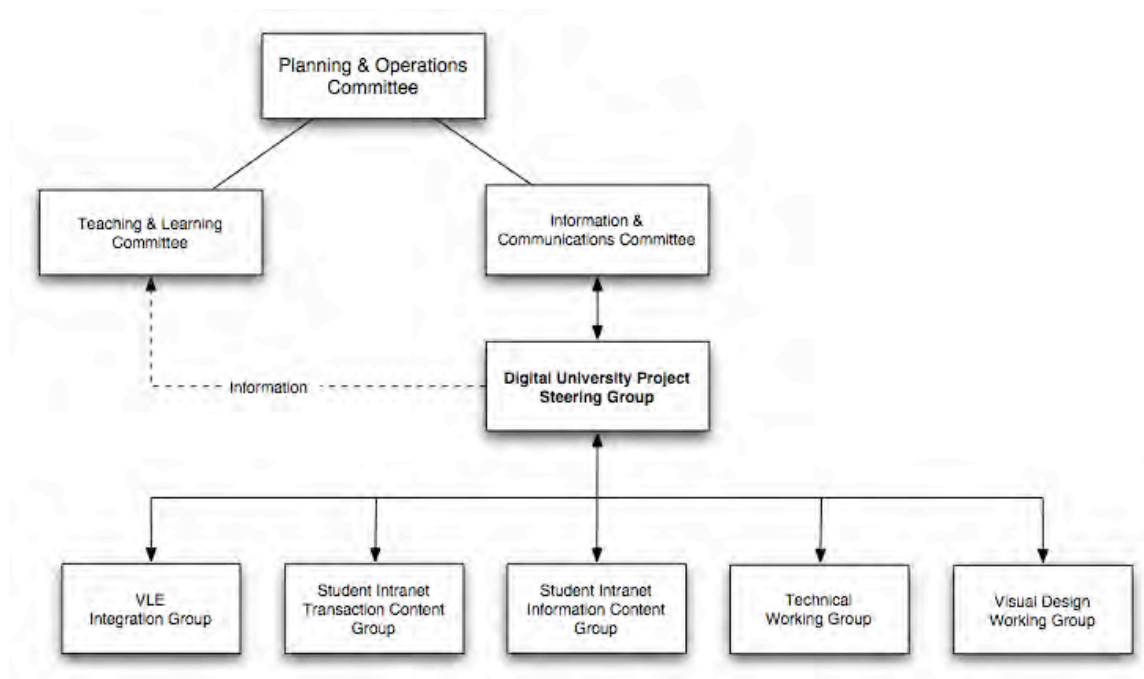
### **Structure**

During consultation phases, considerable concern had been expressed that the breadth of the project might result in unwieldy and inflexible structures. Many of those with a technical background considered that the areas outlined for development were particularly volatile, and this may frequently require streamlined decision making processes. It was therefore determined to establish a broadly based Steering Group, with membership drawn from the Academic, Administrative and Development areas, name an overall project manager (Ian Dolphin, Head of Academic Services Interactive Media), and establish a series of working groups of varying size and composition. The Digital University Project Steering Group met for the first time on the auspiciously binary 01-10-01 (1<sup>st</sup> October 2001), with the following terms of reference:

- "To lead the development of a University Portal, encompassing and integrating Staff and Student Intranet developments, together with systems facilitating the management of the University Public Web Site, and integrating elements of virtual learning environment(s) deployed by the University where appropriate.
- To liaise with internal and external agencies in pursuance of these objectives.
- To produce regular progress reports for ICC
- To provide Teaching and Learning Committee with appropriate informational reports.
- To advise ICC on strategic and technical requirements within the scope of the project."<sup>ix</sup>

Rather than meeting as standing committees, project working groups would meet when required, vary in size according to purpose, and would have considerable responsibility for translating major objectives into measurable detailed plans. Working Groups were further expected to co-opt and release additional members for particular areas of work or tasks. The Digital University Project Manager and Development Manager of Academic Services Interactive Media participated in each working group.

**Figure 3 Digital University Project: Phase 1 Project Structure**



It should be noted that the project working groups, by their very nature and purpose, brought together individuals from sections and departments not necessarily accustomed to close joint work. The devolution of much detailed planning to those groups was also designed to build a sense of common ownership of solutions and activity. Redevelopment of the Staff Intranet was timed to commence in the second year of phase one of the Digital University Project. Three main factors influenced this decision: the identified priority to target information and applications for students, limited availability of the technical staff the project required, and the immaturity of Web Service Standards. Whilst it was clear that Web Services offered great promise for a thoroughgoing architectural review of Staff Intranet applications, practical implementation (and even finalised specifications and standards) were some considerable distance away.

**Detailed Planning Objectives**

Within the broad development strands indicated above, project planning processes identified the following discrete objectives, with further detailed planning undertaken by the respective working groups:

**Technical Infrastructure:**

- |            |  |
|------------|--|
| Months 1-3 | Portal framework procurement<br>Establish detailed evaluation criteria<br>Evaluate state of the market<br>Identify potential solutions<br>Conduct operational tests<br>Review test results<br>Document and publish proposals (Milestone) |
| Months 1-3 | Content Management System procurement<br>Establish detailed evaluation criteria<br>Evaluate state of the market  |

Identify potential solutions  
 Conduct operational tests  
 Review test results  
 Document and publish proposals (Milestone)

Months 1-3      Establish information and visual design criteria (Milestone)  
 Survey accessibility requirements  
 Visual design prototypes  
 User preferences

Months 4-6      Establish detailed infrastructure requirements (Milestone)  
 Months 4-6      Establish functional prototype for user testing (Milestone)  
 Months 4-6      Implementation plan for pilot (Milestone)

Student "Intranet" content

Months 1-3      Establish Scope of Informational Content  
 Detailed workplan

Months 1-3      Establish Scope of Transactional Content  
 Detailed workplan

User needs and requirements

Months 1-6      Functional requirements draft  
 UCD activity (card sorting)  
 Functional prototype

VLE Integration

Months 1-6      Scoping Study

### Staffing Implementation and Development Effort

This outline plan operated under several constraints, not least of which was the availability of staff to undertake implementation and development activities. In addition to evaluation and development effort provided by Academic Services Interactive Media, consisting of a Development Manager and 1.5 FTE developers, further development effort was drawn on a part-time basis from across Academic Services Computing, Corporate Systems and Libraries. Given the established immediate priorities, most of the effort in the initial phases of the project came from Academic Services Corporate Systems.

Detailed Breakdown:

Proportion Staff Time	Grade	Post Type	Time Period	Actual Person Months
Portal Deployment				
0.5	Other Related 2	SysAdmin	24	12
0.1	Other Related 1	SW Developer	6	0.6
0.25	Other Related 1	SW Developer	18	4.5
Web Content Management				
0.5	Other Related 2	SW Developer	9	4.5
0.5	Other Related 1	SW Developer	18	9
0.1	Other Related 3	DB Admin	24	2.4
				<b>33</b>

## **User Consultation, User Needs Analysis, Accessibility Design**

The adoption of policy by a senior university committee or committees, even when conducted with broad measures of consultation, does not guarantee the communication of the detail of that policy or the development activity flowing from it to the institution as a whole. User involvement was therefore regarded as critical to the success of the project, and undertaken in the following closely related areas:

- Communication of overall project vision and progress
- Portal functionality and visual design
- Accessibility design

### **Communication of overall project vision and progress**

Although potential users of a portal might be familiar with the concept in general from their experience of using the Web, many would not be familiar with a portal in an institutional context. Prior to detailed work establishing user needs and requirements of an institutional portal, awareness raising activities were undertaken to demonstrate the range of potential uses. This was particularly significant in the context of the parallel development of Web content management system implementation: a great number of users would not simply be consumers of information presented by a portal, but also producers of that information.

In the early months of the project, a Web site was constructed to provide a dissemination conduit for basic project documentation. This was accompanied by a range of staff development sessions at six monthly intervals, clustered in two lunchtime sessions on the Hull campus, and one at the smaller Scarborough campus. These sessions were advertised in a conventional manner, with flyers for departmental noticeboards, and notices in the weekly printed University Staff Bulletin. Attendance at these sessions was generally good, with over one hundred staff attending each cluster. The vast majority of those attending expressed support for the general aims of the project, and expressed significant interest in becoming involved directly in pilot use. A number of early pilot users of the Web content management system were identified from staff development activities. It was possible, through dialogue with a range of staff in these meetings, to establish the project with a solid grounding in institutional reality, and approach the management of user expectations.

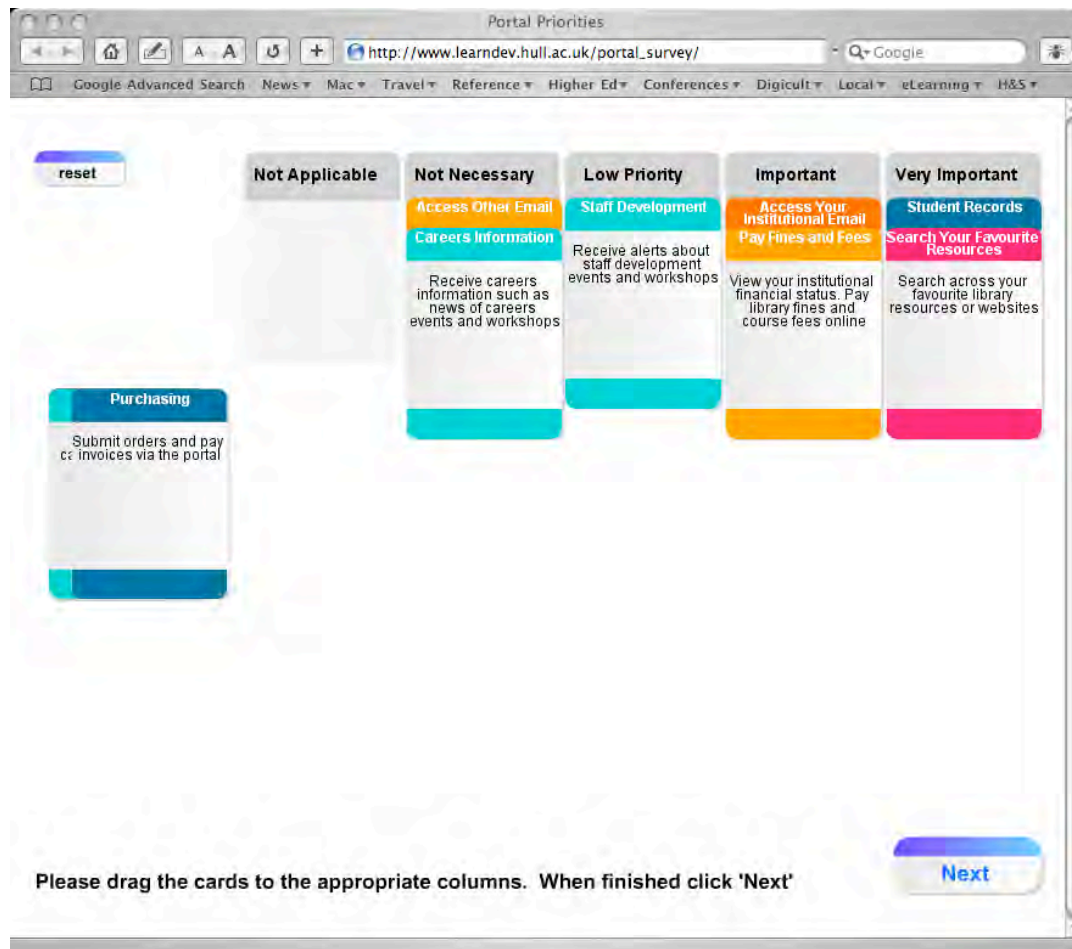
### **Portal functionality and visual design**

The project faced a similar, although slightly simpler, range of issues with potential student users. Prior to the selection of a portal technical framework a series of activities were undertaken to begin the process of gauging student user requirements. The first of these activities was paper-based. A visualisation of how a University portal might appear was produced to illustrate the concept. This was accompanied by two sets of cards, the first of which had a specific function, such as "University e-mail" and "view library loans", the second of which were broader categories such as "personal details", "Libraries" and "Student Union", analogous to the 'tab' headings within a typical portal. A representative selection of students were invited to sort the headings in order of importance, and group more detailed function cards in order of importance under the headings. This arrangement was then photographed with a digital camera for later analysis. Suggestions for additional functionality were invited as part of the process. This exercise produced an initial, limited indication of the functions student users required and the priority assigned to them, together with a view of how these functions might best be grouped.

In September 2002, the PORTAL (Presenting natiOnal Resources To Audiences Locally) project, a partnership of the University of Hull and UKOLN funded under the JISC FAIR Programme

began a more detailed analysis of a range of user requirements. This analysis focussed on user requirements in terms of external sources of information and applications which might be surfaced within an institutional portal, but located this within the broader context of institutional services. A Macromedia Flash learning object simulating a card sorting exercise<sup>xii</sup> was repurposed to capture data, potential users dragging cards with a range of functions over the appropriate heading ranging from “very important” to “not applicable”.

**Figure 4: Online Card-sort Exercise**



[http://www.learndev.hull.ac.uk/portal\\_survey/](http://www.learndev.hull.ac.uk/portal_survey/)

The innovative nature of the object enabled the majority of users to complete the survey more rapidly than a conventional Web based form. During the active survey period 650 staff and students completed the exercise, providing valuable data on a range of user preferences which closely informed the design of the prototype Hull portal. The online survey was augmented by a series of focus groups and one-to-one interviews at a range of HE and FE institutions.

Documents relating to the PORTAL Project, including detailed results from the survey and other user consultation can be found at

[http://www.fair-portal.hull.ac.uk/pubs\\_and\\_pres.html](http://www.fair-portal.hull.ac.uk/pubs_and_pres.html)

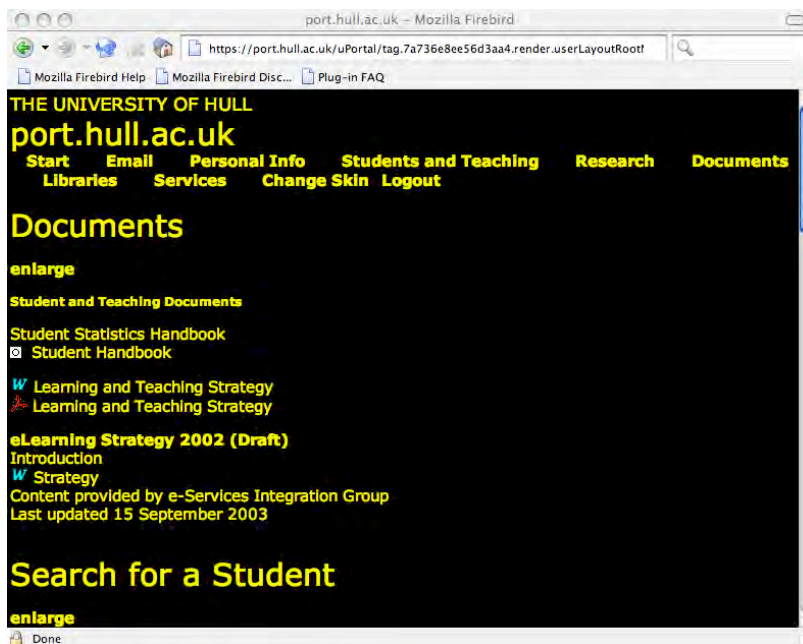
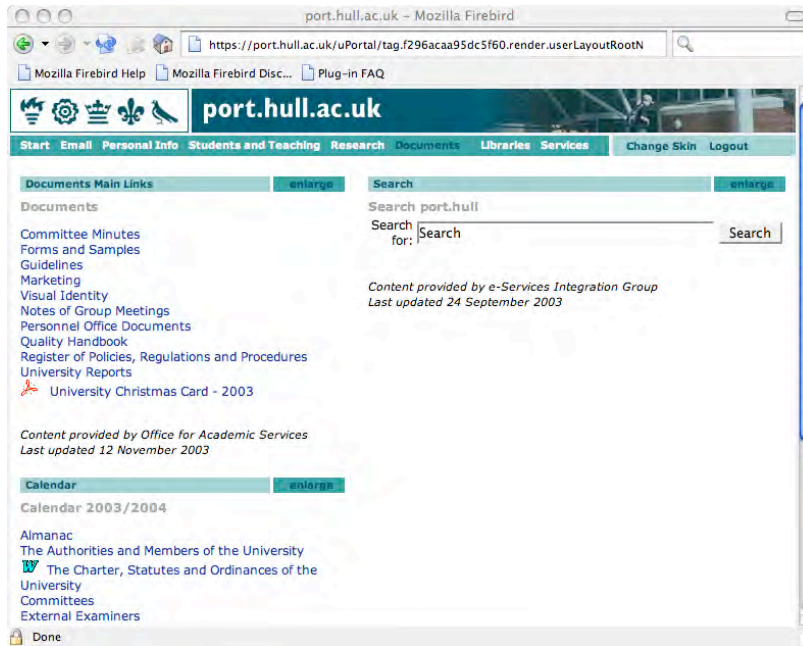
The card-sort tool itself is capable of adaptation for a range of purposes, and is available for download from the Iconex learning object repository at <http://www.iconex.hull.ac.uk/>.

### Accessibility Design

The Digital University Project had noted the legal requirements of impending UK legislation regarding accessibility, and in the context of supporting distance learners, taken cognizance of

legislation in the US, Australia, and the European Union. Considerable effort had been invested, as a consequence, in the production of accessibility conformant Web pages from the Web content management system. Rather than adopt the philosophy of "design for all", two publishing templates were designed, "standard" and "enhanced", respectively. These pages had been submitted to automated testing and achieved WCAG Level 1 and 3 ratings. The University of Hull Disability Advice Service were involved in both production and testing of Web Content Management System output. This provided valuable experience for adapting the appearance of a portal framework to meet accessibility guidelines. Technical details of the transformation are provided in the portal implementation section of this case study.

**Figure 5 : University of Hull Portal Visual Appearance**



## Portal Evaluation

The Digital University Project Technical Working Group met in early October 2001 to agree the scope of the portal framework evaluation process. To assist in the process of evaluation, the Group adapted an existing portal evaluation rubric developed by San Diego State University (see Annex 2). This rubric was discovered by a simple Web search with Google, and provided a solid basis with which to begin the evaluation process.

From an initial survey of some fifteen portal products or potential solutions, it was agreed to evaluate two commercial generic portal solutions and one open source Higher Education portal solution (uPortal, from the then Java in Administration Special Interest Group). This selection was subsequently narrowed to one commercial product and uPortal. Detailed evaluation was undertaken with a local installation of the two products, connected to a sample corporate database together with authentication against the University OpenLDAP service. Hardware appropriate to the purposes of evaluation was identified as temporarily available within Academic Services Libraries. This development hardware proved invaluable. This process concluded in late November. Scores for the commercial product under evaluation together with uPortal, against the criteria indicated in the rubric are attached to this case study as Annex 3.

An important consideration in the evaluation process was the ability to customise the interface of each portal framework in terms of visual appearance, and modification of the functional layout. This factor would be of critical importance in developing a distinctive "branding" for the Hull portal, and providing an accessibility standards conformant interface. Whilst both portals allowed easy adaptation of the visual appearance of the portal, including the application of University branding and stylesheets, it was impossible to significantly modify the layout of the commercial product. The uPortal architecture based on XML and XSL enables complete control over the layout of the portal as well as the visual appearance.

Technical issues arising during the course of evaluation were largely and necessarily concerned with the integration of each portal product with existing University IT infrastructure. In practice this meant that each product had to be able to authenticate to an OpenLDAP directory, and use Ingres on Solaris/SPARC as an underlying database repository. The commercial product required considerable technical assistance to meet these requirements. However, uPortal worked "out of the box" for both, reflecting the flexibility of the framework and the Higher Education background of the uPortal framework development.

Initial concern was expressed by evaluators regarding the propriety of deploying Open Source software at an enterprise level. In evaluating a community-based product, it was clearly essential to gain at least some knowledge of the community supporting that product. Alongside evaluation against the established rubric, JA-SIG mailing lists and Web sites were evaluated to judge the level of support available. A member of the Technical Working Group attended the Summer 2001 JA-SIG conference to gather similar information. It became clear that an institution deploying uPortal could anticipate considerable levels of support from colleagues facing similar problems and issues. The number of collaboratively produced uPortal add-ons, aside from being of considerable practical use, were further evidence of an active and engaged community of development and use. Although not formally represented in the evaluation rubric, this factor was significant in the subsequent adoption of uPortal by The University of Hull. Given even results in the evaluative scoring, and the relative purchase costs of the two platforms, the technical working group recommended the selection of uPortal as the University portal platform. This decision was approved by the Digital University Project Steering Group in January 2002.

## Implementation

Following the selection of uPortal in January 2002 as the Hull portal framework, the Digital University Project produced a three stage implementation plan. The first stage consisted of scoping hardware requirements, initial implementation of uPortal and familiarisation with the uPortal Framework. The second stage required the development of the portal interface, content and applications for student users. The results of this stage would be incorporated into a pilot for a relatively small number of users from September 2002. The final stage had two parallel strands, the inclusion of the evaluation, feedback and experiences of the pilot and the integration of the Staff Intranet. This work resulted in a production version of the portal for both staff and students, launched as a service in September 2003 under the name port.hull, for the start of the new academic year.

### Initial uPortal Implementation

The Technical Working Group specified hardware sufficient to establish the pilot uPortal installation. A server appropriate to these needs was procured by Academic Services Corporate Systems in January 2002; a SunFire v880 server<sup>xiii</sup> running the Solaris operating system. Funding for this initial server was located within the Corporate Systems budget for the then current financial year.

The software required to run uPortal was installed on the server including the uPortal database repository (Ingres 2.6) and the application server Resin from Caucho. Resin was preferred to Apache Tomcat following performance testing where Resin was found to be significantly faster than Tomcat. Connection pooling for the database was identified as an early priority. uPortal was connected to the database repository using the Ingres native connection pooling which gave improved reliability and performance. An interface to the University OpenLDAP authentication service was configured, allowing portal users to authenticate against that service.

There was a clear requirement, given the sensitive and sometimes confidential nature of the data transmitted from the portal to the user, for this transmission to be encrypted. Connections to the portal for both pilot and live service would therefore be over SSL (Secure Sockets Layer). During the course of the pilot phase an examination of appropriate SSL acceleration technologies would be undertaken.

### Web Content Management System Implementation

Following the decision to proceed with the implementation of a web content management solution, an evaluation of the products available at the time was undertaken. This evaluation considered a number of key criteria established in the formative stages of planning the Digital University Project: that the system should be a flexible, template-based, distributed, and self-service authoring system, with Web-based content stored in a central corporate database, and the potential to implement basic workflow. Cost factors were significant in procuring the system. The central database would, therefore preferably use existing University Ingres licences.

It became rapidly apparent that many the commercial Content Management vendors were still operating in an environment heavily coloured by the Dot.Com bubble, and that this was reflected in their pricing structures. The evaluation process found no system meeting all the established criteria. This factor, together with high costs, led to the decision to purchase components, but integrate these components with an in-house system. The Web Content Management System infrastructure was built in Java, with administration information and

content stored in a corporate database (Ingres) via JDBC. All the administration, editing and publishing functionality is presented to the user through a Web interface.

The Web Content Management System was intended to give non-technical users the ability to edit Web content in a WYSIWYG environment. To meet this need, licences for eWebEditPro from Ektron were purchased. This product provides editors with an interface similar to that of a word-processor, thus providing initial user comfort, and reducing training costs. eWebEditPro provided an additionally useful feature, in that it produces content which is saved as XHTML. This has proved invaluable when surfacing content produced by the system in the portal, removing the need to re-parse HTML content to ensure it is well-formed before display.

In the light of UK legislation in 2001 (SENDA applied to education from September 2002), it was essential to develop a system which had the ability to re-use content in order to produce an accessible version of a site. This functionality was built into the system by means of output through multiple templates, produced by the e-Services Integration design team. Initially two templates were designed, a base version meeting Web Content Accessibility Guidelines Level 1 and a high-contrast version conforming to Web Content Accessibility Guidelines Level 3. Users therefore had only to edit and maintain basic content once to produce multiple versions of the same site or output. It was anticipated that this system would be eventually extended to encompass output for a variety of different devices, such as Personal Digital Assistants or WAP enabled mobile telephones when demand arose.

The beta version of the Web Content Management System was completed in Summer 2002. Academic Services staff then tested the system by redeveloping the Academic Services Web site. Following the successful conclusion of this test, core central information sources were transferred to the new system. These consisted of content held in the Staff Intranet, a Web site produced by Student Support Services, and the online Student Handbook Web site. The latter two had already been identified as essential content for any student portal pilot.

Feedback from the majority of users was positive, finding an initial training session of 30 minutes was sufficient to enable them to edit content successfully. Initial access to editing functions was provided through the Staff Intranet. Following the launch of the University portal, access to editing features is integrated with uPortal.

This approach provided the University with a working Web Content Management System which met essential criteria at a fraction of the cost of a commercial product, and also provides considerable flexibility to adapt to changing needs over time.

### **Pilot**

Once the installation and configuration of the portal had been successfully completed consideration was given to the nature of the pilot service. As staff continued to use the Staff Intranet the pilot would be created for students, but also enable staff access. After discussion, the Digital University Steering Group decided that a "vertical slice" of the student population in all year groups in a number of departments was the most appropriate way to proceed to test the implementation. This had the benefit of being a representative sample, and provided the opportunity to work with a limited number of staff in departments to evaluate information and transaction needs in order to develop and enrich the implementation. Following performance testing by staff in Academic Services, and comments and testing from others in the JA-SIG community, it was decided to proceed with a pilot of 700 students in September 2002.

Two departments were identified for the pilot, Geography located on the Hull campus and the Centre for Internet Computing on the Scarborough campus. These were felt to provide a

representative sample in terms of academic background and ICT familiarity and skills. It was also considered important in a recently merged institution<sup>xiv</sup> to include both Hull and Scarborough. Awareness of the portal was raised through a number of events and publicity organised with each department, in addition to staff development sessions.

The first stage of preparation for the pilot created a distinctive version of the uPortal interface for the University of Hull. Using the uPortal skin system, where a number of graphics and stylesheets are applied as one skin to the portal output, a University skin was created. Skins ensure that each institution can quickly and easily brand their version of uPortal. In addition to changes to the interface, the layout was modified, as was the structure and display of individual channels. The changes to the layout and channels were achieved by updating the XSL sheet which controls portal rendering. Included in the pilot was an early attempt to produce an accessible version of the portal in the form of a high-contrast skin. This modified channel layout to enhance navigational control by screen reader software, and rendered portal content as yellow text on a black background for optimum visual clarity.

Following user consultation and needs analysis a layout for the portal pilot was created providing access to channels of student content. The channels created for students involved in the pilot covered two broad areas; information-based content and transactional content.

Information-based content was largely drawn from the existing online Student Handbook and the newly restructured Student Support Services website. Following a series of meetings with content providers, both sources of information were incorporated into the University Web Content Management System. As the portal pilot was only available to a small number of students, but the information of direct relevance to all students and staff, content was therefore published as a series of stand-alone web sites. This provided a striking confirmation of a major benefit of the Web Content Management System: information providers were only required to enter the information once, at which point it could be published wherever necessary in a variety of formats.

Rather than attempt to reproduce the scale and complexity of the stand-alone Web sites, they were effectively "scraped" and surfaced within port.hull as summary information, together with links to detail which could be accessed as users felt appropriate. Exemplar external content was provided in the form of an RSS news feed from the BBC Web Site.

Following extensive consultation with a range of staff from administrative, planning and quality services, together with those concerned with data protection, a range of student transactions with corporate databases were specified in detail. These specifications were then implemented as a series of applications developed by staff of Academic Services Corporate Systems. The applications allowed students to review and update selected appropriate personal details held centrally by the University. Students were provided with access to a range of information held in University systems concerning their academic career and personal details including:

- Student number (view)
- Title / Forename / Surname (view)
- Disability code (view)
- Place of birth (change)
- Domicile (change)
- Nationality (view)
- Ethnic origin (change)
- Mobile telephone number (enter)
- Alternative email address (enter)

- Programme of Study and module registration details (view)
- Address information for term, home and correspondence (limited change)
- Emergency contact details (change)
- Examination and module results (view)

It should be noted that this was the first time the facility to directly access these details, and update a subset of them, had been provided to students at the University of Hull. The lengthy specification period (including the development of audit trails for potential changes) enabled the development of a thorough view of requirements. It also enabled the project to ensure that staff in responsible departments and sections both understood and supported the proposed developments.

Transactional applications developed in this strand of the project used a web-enabled version of ABF, the Ingres text-based development framework. This allowed development staff to use familiar tools, and reduced the requirement for re-skilling. Applications were integrated with uPortal using an adapted version of CWebProxy<sup>xv</sup>, a highly configurable channel created by uPortal developers specifically to integrate existing application development frameworks such as ABF.

Access to university e-mail from the portal was ranked highly in user needs analysis surveys. In September 2002, when the portal pilot was initiated, Academic Services Computing provided the first Web interface to email available at the University. This used the open-source product IMP<sup>xvi</sup>. Based on experiences within the uPortal community, a simple solution was devised to enable single sign-on to the IMP service displaying the user inbox within the portal.

Integration with institutional directory services is widely regarded as central in any portal implementation. As the University of Hull does not have a single authoritative directory service, it was decided to implement the uPortal default database table as the source of directory information. This default table is designed around the EduPerson Specification. Scripts were written by Academic Services Corporate System to repopulate the table each night from the Human Resources and student databases, ensuring current and correct profile data. The default uPortal EduPerson profile was extended to include Hull-specific elements: Faculty Code, Department Code, User ID, and Programme of Study<sup>xvii</sup>. It should be noted that this use of the uPortal profile is not regarded as permanent, simply workable until a more robust person directory / identity management solution can be identified and implemented. Enabling the effective warehousing of person information in this manner demonstrates the flexibility of the uPortal framework: institutions which do not have consolidated enterprise person directory services may still effectively implement a portal framework, without what is widely regarded as a key infrastructural pre-requisite.

Prior to the launch of port.hull as a pilot service an investigation into the costs of technical support from the main commercial provider of support for uPortal was undertaken. Although the costs of this support were considered reasonable, budgetary pressure at the time ruled out the purchase of support. The experience of the pilot service demonstrated that the knowledge, expertise and speed of response of the uPortal community, mainly via the JA-SIG mailing lists, was usually adequate to deal with any problems encountered. More complex problems required submission to the uPortal bug list or investigation of the source code.

### **Pilot Evaluation and Feedback**

Feedback forms were incorporated into port.hull prior to the pilot launch. In addition, comments from pilot users involved in interviews for the PORTAL Project WorkPackage 3, "Defining Requirements of the Institutional Portal" were also noted. Specific feedback from users tended

to concentrate on the port.hull interface. Feedback from users indicated that they were frequently confused by the four controls associated with each channel (detach, minimize/maximize, enlarge and remove). The removal of three of these options has produced no adverse comments, and no further comments regarding this aspect of channel control. Users control channel behaviour with a single, contextual, "enlarge" or "reduce" control.

In order to enhance the accessibility of port.hull, real-world testing was performed with users of assistive technologies. These resulted in a number of modifications to the visual appearance and functionality of port.hull. Visual tabs for individual sections were replaced by text links, and other extraneous graphics presenting problems to a range of assistive technologies were removed. Access keys were added to each section menu tab, enabling the use of keyboard shortcuts to navigate the layout. The further development of the accessibility enhanced University uPortal "skin" involved the removal of tables from the layout, rendering channels in one vertical column. All changes were achieved through the iterative development of the XSL stylesheet rendering the portal. The flexibility provided by this aspect of uPortal greatly facilitated these modifications, enabling a rapid cycle of prototype, test and implementation.

### **Staff Intranet Redevelopment**

In order to be compelling for staff, and indeed for port.hull not to be regarded by them as a retrograde step, the presentation of existing Staff Intranet content and applications had to migrate to the new framework by the launch date of September 2003. It was accepted that Staff users might require acclimatisation time with a new system, particularly at the start of a new session. A period of one month was allowed when both the staff view of port.hull and the Staff Intranet would be available.

In contrast to the information accessed from the port.hull student view, the information-based content for the Staff Intranet was already held in the University Web Content Management System. This content was reviewed with the sections and departments responsible, but the process proved relatively rapid. The nature of this information-based content – frequently links to Word or Acrobat documents, rather than extensive Web-based content – allowed it to be entirely surfaced within port.hull. In order to achieve this a channel was written using the uPortal Application Programming Interface. This channel reads and parses information-based content published by the Web Content Management System, and displays the information, including links to documents, within channels in the portal.

Transactional content was integrated using two methodologies. A simple Java/XML framework was developed, and used to convert some of the older applications into the new framework. For more complex database reports, and applications that could not be converted by this method, the uPortal CWebProxy channel was used. Two additional channels were included which were present in the student view: the IMP email inbox and BBC RSS news feed.

Early in their evolution, Academic Services identified the potential of Web Services specifications and standards to resolve many of the problems surrounding the integration at a portal level of heterogeneous data sources and applications<sup>xviii</sup>. It was clear that these specifications and standards would be neither be ratified or implemented in time to assist greatly with the migration of the Staff Intranet within the redevelopment timeframe. The adoption of Web Services standards, including impending support for Web Services for Remote Portlets (WSRP) in uPortal<sup>xix</sup> increase the likelihood that as applications and services are refined in both port.hull initial views, this technology will fulfil some of its promise.

## Launch

The University portal, port.hull, was launched as a service to all staff and students at the start of new academic session in September 2003. Whilst the staff view of the portal contained a comprehensive range of information, the student view contained what was considered to be a minimal number of critical services. These services had been tested thoroughly during the pilot phase. Despite being limited in number, many of these services were available to students for the first time in disintermediated form. To maintain student interest in the portal, the timed release of additional services was planned to coincide with significant events in the University calendar. The first of these additional services is the publication of student examination timetables in November 2003. This is the result of a development effort integrating personalised output from the Scientia examination timetable Web server with a uPortal channel.

For the first year of port.hull both staff and students have been prevented from modifying their personal layout. The decision to restrict layout modifications in this way is based around consideration of three principal factors:

- the need to familiarize users gradually with the additional navigational features and complexities of a portal, when compared to a traditional Web site
- the need to familiarize those who support port.hull users with those same features: providing two role-based views greatly simplifies the issues facing support staff until they become familiar with the full support and resource implications of portal deployment.
- experiences relayed through postings to the JA-SIG mailing lists, suggest that, until users gain greater understanding of the possibilities and potential of customisation, little actual customisation takes place

A review will take place following the first year of port.hull to consider which aspects of customisation will be enabled. This will involve both user consultation, and establishing a consensus around the correct balance between institutional presentation and personal customisation. The review will carefully consider additional features provided in the next release of the uPortal framework, including the facility to aggregate layouts. This enables a greater degree of fine-grained control over the default layout of individual user and groups. It is anticipated that a future strand of development activity will work with sections and departments to make use of these extended personalisation features, together with the Web Content Management System, for purposes which almost approach groupware functionality.

The hardware infrastructure supporting port.hull remained consistent since the pilot, with the live portal and database repository sited on the Sun Fire v880. This implementation, however, produces a single point of failure. Work was undertaken during the pilot to scope the technical architecture required to provide a more robust and scalable solution with a view to removing the single point of failure, providing expansion capability, and addressing significant increase in use. The use of some form of SSL acceleration, given the secure nature of portal traffic also suggested itself. Based on work undertaken by Sun Microsystems iForce Centre and IBS (now Unicon)<sup>xx</sup> presented at the 2002 Winter JA-SIG Conference, it was decided to investigate the use of a model where load balancers are sited in front of a cluster of small, inexpensive servers. During this investigation Sun announced their new range of blade servers. In addition to the standard server blade, the Sun offering included both a load balancing blade and an SSL proxy blade, which is similar in function to an SSL accelerator card. The SSL proxy blade performs all encryption processing, whilst enabling unencrypted communication between the other blades, thus improving performance of individual blades. It was considered that the Sun blade suite provided a complete and expandable solution required by the University portal implementation

## **New Service Spin-off: Digital Image Repository**

The Web Content Management System developed as part of the Digital University Project essentially manages text-based content. Parallel to the development of that system, staffing within the University Photographic Service (which formed a distinct section of Academic Services Interactive Media) was dramatically reduced by early retirement. After consultation, the Service operating statement was revised to phase out wet-process photography, and re-equip the remaining member of staff to provide an all-digital service. In order to make most effective use of digital images throughout the institution, and complement the Web Content Management System, the creation of a digital image repository was suggested. The potential for remote referencing of images from the repository through the portal would be investigated during the course of its construction.

A prototype repository was constructed which:

- Provides a web interface to enable entry of images at moderately high resolution, and automatically scale images to both medium and thumbnail resolution
- Allows the entry of a basic set of Dublin Core metadata to facilitate search and re-use
- Provides the ability for users to copy a URL for each image at each resolution, in addition to downloading each image at each resolution, to facilitate the remote integration of images into a variety of web sites
- Is capable of expansion to enable Open Archives Initiative metadata publishing

As a prototype, the digital image repository was constructed around a MS SQL Server database on Windows NT4, with a ColdFusion enabled web front-end. As the repository moves to production status, it will be transferred to Ingres on Solaris. Prior to that, a through investigation of alternatives will be undertaken.

## **External Collaboration**

Maintaining a close watch on developing standards and specifications, together with other developments across the sector, was clearly of considerable importance to sustainable and interoperable development effort at Hull. In common with most HEIs, Hull cannot afford to dedicate staff to this role, however. The efforts of national agencies, such as the JISC, in providing studies and collating information regarding developing specifications and standards continue to be of particular and practical use to local development. Similarly, whether in JISC sponsored activity, or in JA-SIG or JA-SIG UK, Hull has wherever possible taken up opportunities for networking and sharing experience across the sector. Over the course of the project these activities have included presentations at Portals 2002, the Pan European Portals Conference (2003), Educause (2003), three presentations at JA-SIG Conferences, and numerous presentations at smaller events. Several staff associated with the project have published articles in several journals, including Ariadne, SCONUL and D-Lib. These activities, naturally, have increased the profile of the University in the national and international community. It has also, in a very direct practical sense, provided access and participation in an extensive network of collaborators and contacts, effectively providing shared mutual consultancy.

Collaborative efforts have not been limited to national agencies or collaboration with other HE partners. Through involvement and active engagement with the community, the exploration of mutually beneficial areas of work were explored over time with Sun Microsystems. This dialogue, and the practical collaboration surrounding it, was formalised in Autumn 2003 by recognising Hull as a Sun Centre of Excellence in the area of "Building the Digital University".

## **Outstanding Issues: Virtual Learning Environments and Library Systems**

Shortly after it commenced, the Digital University Project established a VLE Integration Working Group, consisting of members of the University e-Learning Team, academic staff with an interest in e-Learning, and development staff. The broad remit of this group was established to address objectives outlined in the initial project documentation. Given the range of development objectives indicated in this report as first priorities, it was anticipated that this group might be little more than a forum for airing issues for the initial two-year phase of the project. This judgement proved substantially correct. A number of factors contributed to lack of progress in this area, including lack of funding to purchase more flexible versions of commercial VLEs, or to fund the further development of home-grown systems to enable integration, immaturity of appropriate standards and common specifications, extensive personnel changes, and a historic internal organisational rivalry between those involved in e-Learning within the University.

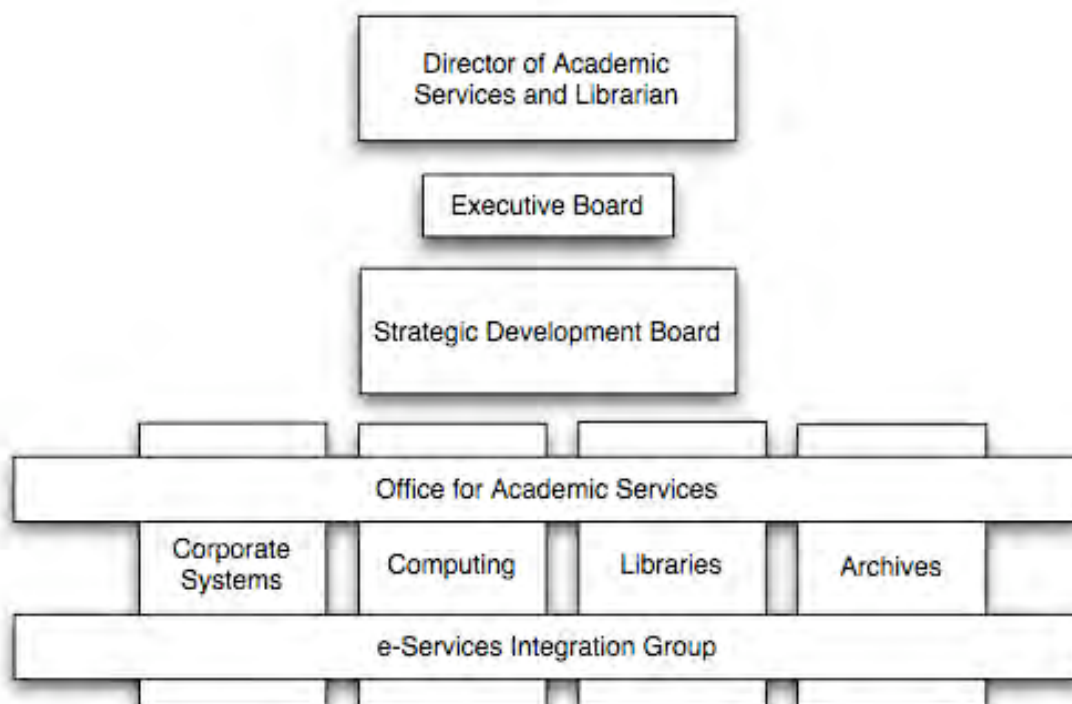
The experience of the VLE Integration Working Group has, however, generated some positive outcomes. These range from the less tangible, in terms of creating a climate of genuine dialogue and trust, to a more tangible elaborated view of how services to support e-Learning might be organised, viewed and interrelated. Whilst this remains a "work in progress", a consensus is emerging regarding the role of commercially provided VLEs in providing a robust service layer, potentially being replaced by more loosely coupled services over time, woven together with more experimental services presented through a portal layer. Considerable interest has been expressed in the work of the Open Knowledge Initiative, in particular the recent OKI/JA-SIG "SAKAI"<sup>xxi</sup> project proposal, within this framework.

Although useful information has been extracted from Library Systems, this is limited to how many items have been issued, together with outstanding fines displayed in the portal for each user. In the last analysis, this is largely a result of the lack of resource to accomplish more in the time available. Richer integration of Library systems, particularly in the area of electronic resources remains a high priority for work in the months ahead.

## Future Directions

The experience of the Digital University Project has had significant impact on the university as a whole. In the first half of 2003, this was reflected in a thoroughgoing process of renewal within the converged Academic Services Directorate. This included the reconfiguration of Academic Services Interactive Media as the e-Services Integration Group under a Head of e-Strategy, with a specific remit to work horizontally across services. Existing staffing within e-Services Integration is to be augmented by a process of internal secondment around particular development objectives. Further changes in management structure were undertaken to emphasize the need for a strategic perspective, integrated with management of services on a day-to-day basis.

**Figure 6: Academic Services Management Structure, Summer 2003.**



The iterative re-evaluation of services to support e-Learning has been indicated throughout this case study. This re-evaluation will be subject to an interim codification as an internal e-Learning architectures discussion draft by December 2003. The primary objective of this document, produced collaboratively by the e-Services Integration Group and the e-Learning Team at Hull, will be to establish a coherent set of criteria for the evaluation of services currently provided by Virtual Learning Environments, and indicate potential directions.

The Web Content Management System produced during the course of the Digital University Project meets the basic needs identified at the outset of the project. It is recognised, however, that the content management market has changed considerably over the course of the last two years, with significant reductions in the cost of commercial offerings, and development of what appear to be viable open-source alternatives. In the first quarter of 2004, these changes will be examined in detail and direction confirmed or modified accordingly. This will include content management solutions developed collaboratively within the JA-SIG framework, such as the CUCMS system, developed by Columbia University. This re-evaluation will take into account the

long-term objectives of developing beyond content management and moving towards knowledge management within what has been termed the "Knowledge Enterprise". It is anticipated that the relationship established by the Digital University Project with Sun Microsystems will bear particular fruit in this context.

In terms of infrastructure development, the deployment of the institutional portal at Hull has highlighted a lack of coherent Directory and Identity Management Services. The consolidation of existing Directory Services therefore suggests itself as a key area of activity over the next one to two year period. This will take cognizance of external identity management developments, whether in the HE sector, or public/private sector developments such as the Liberty Alliance initiative. Such a service will require flexibility. During the course of the project a number of individuals or groups of users were identified who did not appear in central directories. Around 30 such categories of users were identified over the course of the pilot and launch, including visiting staff, honorary staff, Library Associate Readers and Student Union staff, including sabbatical staff. Technical work in this area will require parallel detailed work concerning policy on appropriate rights and views of information and applications for these users.

Several areas of portal development-related activity critical to the acceptance and adoption of the institutional portal by a broad range of users have barely been touched on by the Project to date. First amongst these is perhaps the area of collaborative and communicative applications frequently termed "community building tools". These range from instant to asynchronous messaging, and include elements of groupware and document management. A scoping study surveying potential services in this area will be undertaken in the second quarter of 2004.

As the JISC Information Environment and the wider Common Information Environment mature, it is likely that an increased range of external resources will be directed to users through their institutional portal. The Digital University Project will continue to engage wherever possible with the emergence of this potentially rich information landscape, both informing, and being informed by national and international developments. The adoption of common specifications and standards by portal vendors (including JA-SIG), particularly Web Services for Remote Portlets (WSRP) and Java Specification Request 168 (JSR168), opens the perspective of content and application syndication as practical reality. In addition to work of a technical nature, however, considerable work will be required to further analyse how users wish to access and combine these resources before this reality can be realised effectively.

With an effective demonstrator in place following the launch of port.hull in September 2003, further work will be undertaken to rework processes and deepen the level of interaction available to users. Two immediate priorities have been established. The first of these involves a re-examination of the admissions and registration process, and presentation of significant elements of those processes through port.hull by the summer of 2003. The second takes user centred design to a next logical stage. Many sections and departments now use the Web content management system to create and maintain content for both a Web site and port.hull. This information is frequently presented from an organisational perspective, rather than in a location and context appropriate to the user. Experimentation will take place to tag content suitably for re-presentation in a more issue or problem driven manner, in a similar way to the "life events" view of information presented on national and local government Web sites. Work is also planned to provide richer integration of existing applications, such as access to web-based email. Mechanisms for surfacing summary information (such as the number of new or flagged messages) at appropriate other points within port.hull are actively being investigated.

The development of the University of Hull portal has so far focussed to a large extent on *access* to a variety of resources by users. This is viewed as a necessary first stage in the development process. As the Digital University Project continues to develop, it will engage core institutional processes at a deeper level. This engagement will lead from those processes which are almost exclusively internal, to those which deal to a greater extent with the world outside the institution. The developing role of the institutional portal as one focus in the local information landscape, a provider of services and resources to the local business and learning community, will become a critical mechanism for the realisation of institutional vision.

## Endnotes

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- <sup>i</sup> The University of Hull deploys a range of key corporate MIS built around CA Ingres databases. In addition it uses Library systems from Innovative, Virtual Learning Environments which are both home-grown (Merlin) and licensed (BlackBoard), a Finance System from SquareSum (Dream) and Timetabling software from Scientia.
- <sup>ii</sup> Academic Services Interactive Media became the e-Services Integration group of Academic Services in the Summer of 2003. Details of this reorganisation are provided in the closing section of this document.
- <sup>iii</sup> "Building the Digital University: A Proposal to Information and Communications Committee" May 2001 p2 available from <http://www.digital.hull.ac.uk/keydocs.html>, and included as Annex 1 of this report
- <sup>iv</sup> <http://appl003.lsu.edu/paws000.nsf/Public/AboutPAWS?OpenDocument> (Verified Oct 03 ID)
- <sup>v</sup> <http://www.ja-sig.org/> JA-SIG began as a collaboration of several HEIs to produce a portal framework appropriate to the specific needs of Higher Education. In the summer of 2003 JA-SIG renamed itself as the Java Architectures Special Interest Group.
- <sup>vi</sup> "Building the Digital University: A Proposal to Information and Communications Committee" May 2001 pp2-3
- <sup>vii</sup> The CMM and IDEAL were established by the Software Engineering Institute at Carnegie Mellon University during the 1990s. Further details are available at <http://www.sei.cmu.edu/cmm/cmms/cmms.html> (Validated October 2003 ID). A visualisation of the IDEAL model is included as in Annex 1 of this report, "Building the Digital University".
- <sup>viii</sup> "Building the Digital University: A Proposal to Information and Communications Committee" May 2001 p10
- <sup>ix</sup> *ibid* p21
- <sup>x</sup> *ibid*, p21
- <sup>xi</sup> Minutes of the Digital University Project Steering Group 01/10/01
- <sup>xii</sup> This object had been initially produced as an assessment exercise exemplar by the 5/99 Programme Iconex Project (<http://www.iconex.hull.ac.uk/>). The objects construction in Flash fed by an external XML data source enabled easy repurposing for this use.
- <sup>xiii</sup> The Sunfire V880 was configured with 4Gb RAM, and 2 x UltraSPARC III 750 Mhz Processors
- <sup>xiv</sup> The University of Hull merged with University College, Scarborough, in August 2000
- <sup>xv</sup> Further details of CwebProxy can be found at <http://www.mun.ca/cc/portal/cw/> (verified October 2003 ID)
- <sup>xvi</sup> Further details of IMP are available from <http://horde.org/> (verified ID October 2003)
- <sup>xvii</sup> The EduPerson specification is flexible in allowing institutionally determined elements. Further information regarding EduPerson can be found at <http://www.educause.edu/eduperson/>  
A report detailing metadata standards for the description of portal users can be found at <http://www.fair-portal.hull.ac.uk/deliverables.html> (Both verified october 2003 ID)
- <sup>xviii</sup> See Annex 4: "Web Services, A Discussion Paper" December 2002
- <sup>xix</sup> Two caveats should be noted. Although uPortal 2.2 will include support for WSRP, this will require extensive testing with a range of WSRP consumer and producer channels

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<sup>xx</sup> Testing and Proving uPortal's Scalability at the Sun iForce Center, Adam Rybicki Interactive Business Solutions, Inc. at <http://web.princeton.edu/sites/isapps/jasig/2002WinterOrlando/> (Validated October 2003 ID)  
<sup>xxi</sup> Details from <http://www.sakaiproject.org/sakaiproject/> (Validated November 2003 ID)