

Libraries and E-Learning: Organisational and Technical Interoperability

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ABSTRACT

Recent years have seen instructional technology and online learning join academic computing, administrative computing and library services as a major focus of investment and planning on campus. In many environments it is likely that a large part of the student and teacher experience will be managed within a systems framework which manages the learning life-cycle and interfaces to multiple systems and services. This poses interesting questions about how libraries surface their information resources in these new learning spaces and how they "fold" information into the learning experience. It also raises new political organisational and service questions about who does what and how services can best evolve. This paper explores these issues from a range of perspectives with particular reference to developments within Australian university environments.

INTRODUCTION

For the last decade, universities have been grappling with the growing complexities arising out of the pervasive influence of information and communication technologies. The underlying preoccupation has been with the means of managing the IT infrastructure supporting academic computing, administrative systems and library systems. Each domain has had its own particular challenges with issues of reliability and cost-effectiveness being constant themes. The growing interdependence of the various systems environments led to a focus on organisational restructuring as a solution to a range of political and functional problems.

Towards the end of the decade, it became apparent that organisational restructuring in itself was not the answer. Put simply, the bringing together of libraries, IT services, management information systems and (sometimes) flexible learning centres has not necessarily led to better service outcomes. There have been many examples of tightly converged organisational structures which have failed to demonstrate noticeable changes in existing service cultures and, conversely, there have been examples of rather disparate organisational structures demonstrating highly innovative service solutions.

Libraries, in particular, have often been buffeted by the wind of organisational change and, in many cases, have suffered enormously by being effectively down-graded in the drive for IT efficiencies. The general conclusion to be drawn from this past decade is that no amount of organisational restructuring can overcome the deep cultural and

political perspectives inherent in the respective service domains. Librarians, IT personnel and those leading the teaching and learning support services, still have very different world views of the means by which services should be organised. Underlying this ongoing cultural and professional struggle are four key concepts, namely, the nature of the learning experience, service convergence, interoperability and sustainability. All four concepts deserve some comment as part of this analysis.

THE LEARNING EXPERIENCE

Perhaps the most encouraging feature of the debate over the past year has been the rekindling of interest from both pedagogical experts and technologists is the nature of the learning experience to be derived from online environments. With hindsight, it was to be expected that the sheer struggle of implementing learning management systems, and in getting academic staff to use them, would temporarily overshadow concerns about the quality of the learning experience. The present generation of learning management systems are limited in functionality, however, they have facilitated a wide and varied range of online interaction in the teaching arena. As a broad generalisation, academic staff have mainly automated existing practices very much within the boundaries of traditional classroom practices. They have reached what I have coined "the high end of the cottage industry phase" and attention is now turning to the creation of a new learning paradigm based on the much more sophisticated technologies and systems now available. In a recent article, Donald P. Buckley stated that:

"Reaching the goal of the Learning Paradigm will require the interpretation of several critical approaches:

1. The ultimate goal is a transformation to learning-centred communities, which can be achieved with learning-centred technology.
2. Transitioning to learning-centred technology will require transformational faculty development.
3. Transformational faculty development must be coupled to institutional change.
4. Course-management systems will be a critical enabling force driving the institutional change.

Librarians need to be alerted to the fact that information, as they would know it, does not appear in this description of transformational change and herein lies a particular challenge which is central to the second concept which is service convergence.

SERVICE CONVERGENCE

As observed earlier, there is a fundamental difference between organisational structural convergence and service convergence. Structural convergence is driven by

the providers of service, whereas service convergence begins with user needs. The question is, therefore, what a student or staff member requires to be comfortable and successful in an online learning and information environment. The coupling of learning and information is quite deliberate because no online learning environment can be successful without relatively seamless access to information resources at the point of need. The challenge remains to find a balance between systems support, "learning containers", information resources and sound pedagogical principles.

Service convergence in this context acknowledges no organisational boundaries. Service goals will of necessity require multiple inputs and minimal ownership of traditional inputs.

TECHNICAL INTEROPERABILITY AND SYSTEMS COMPONENTS

The term interoperability has become the most potent symbol of the need for service convergence in the emerging online learning and information environments. Readers would be well advised to refer to my recent article on this subject ⁽²⁾ which explores the many facets and interpretations of the term interoperability. In the context of this paper, I wish to concentrate on the implications of technical interoperability, rather than its wider connotations.

The technical capability supporting the so-called "learning space" is evolving with considerable speed and the interaction of traditional library systems with this systems component framework needs careful attention. Almost all universities now have one or more learning management systems which handle the administration and delivery of units of study with varying degrees of complexity. To date, they have been fairly closed systems but a new generation of systems is about to be launched with greater functional richness and more open systems architectures.

Over the past three years, content management systems have been introduced, primarily as a means of controlling website development. The explosive growth of the web has been matched by a huge effort within institutions to develop websites as a "window" to particular sets of information. There is a confusing array of responses to harnessing this web "swamp" of information and, as Browning and Lowndes ⁽³⁾ have observed:

"In reality a Content Management System (CMS) is a concept rather than a product. It is a concept that embraces a set of processes. Institutional needs are often highly individual (reflecting the heterogeneity of their processes and back-end systems) and so the task of implementing a CMS will inevitably contain significant bespoke components."

They also observe that there are: "Substantial overlaps with document management systems, knowledge management systems, enterprise application integration systems, e-commerce systems and portals.

For most institutions this remains a vexed and confusing area. The potentially all-embracing nature of the CMS environment invokes "turf-wars" and the organisational implications of maintaining such a controlled environment are, as yet, little understood.

In the past year the market has also seen a growth in systems designed to manage learning objects. The term "learning object" is itself still in a stage of semantic evolution but a learning object generally has a mixture of content, assessment and learning outcomes which are tightly bound for a particular learning topic of at least five minutes duration.

Learning Content Management Systems (LCMS's) have emerged as a means of managing repositories of learning objects. The most significant aspect of this latest development is the separation of course management and learning content ie. the deconstructing of course content that was previously tightly bound in the traditional LMS environment.

The positioning of LCMS's in the learning space remains a very contentious issue because little is understood of how such systems should interact with an LMS and the resultant traffic management problems remain as a major challenge for resolution.

SUSTAINABILITY

In almost all university strategic plans there is a very clear online learning agenda which is rarely matched by the organisational or technical infrastructure needed to deliver the declared goals.

In many cases, new online services and infrastructure have been added to traditional services and infrastructure which puts great pressure on all parts of the institution. For some time, libraries and IT services have been competing vigorously for resources and there is now enormous demand from faculty members for resources to boost online learning infrastructure. Sustainability, therefore is a key issue and long-term sustainability is unlikely without a realignment of business goals and a transformation of organisational and learning practices.

Libraries are particularly vulnerable in the current climate because of their inability to find an adequate balance between the print and online information resource requirements. They face a further threat if they are unable to find a role in the online learning space that is both seamless and relevant.

LEARNING AND INFORMATION SPACE

It is gradually becoming clear that there are a number of "chunks" which make up the learning and information space in the online environment. In the Australian context there has been a concerted attempt to map this space and to develop specifications within the IMS Global Learning Consortium context to facilitate effective access management. A much more expansive explanation of the role of IMS in this context is contained in my recent paper on interoperability⁽²⁾, however, this paper will confine its attention by way of example, to the Collaborative Online Learning and Information Services (COLIS) project sponsored by the Commonwealth Government of Australia, Department of Education, Science and Training (DEST)⁽⁴⁾.

COLIS has depicted the functional "chunks" in the learning and information space as shown in Table 1.

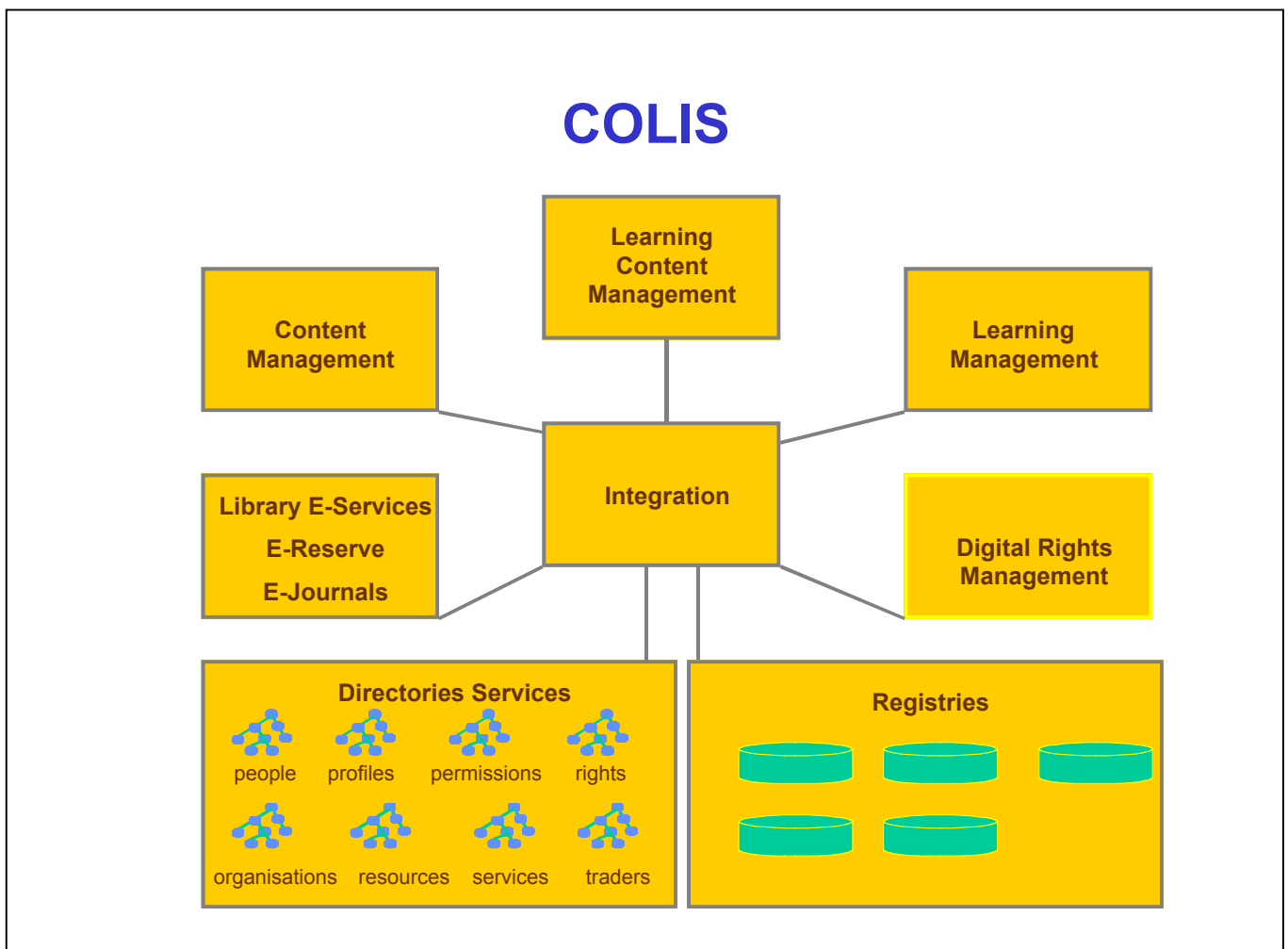


Table 1 Functional view

The complexities of the interactions required to make this learning and information space "come-to-life" are most challenging and the outcome of preliminary work is depicted in Table 2.

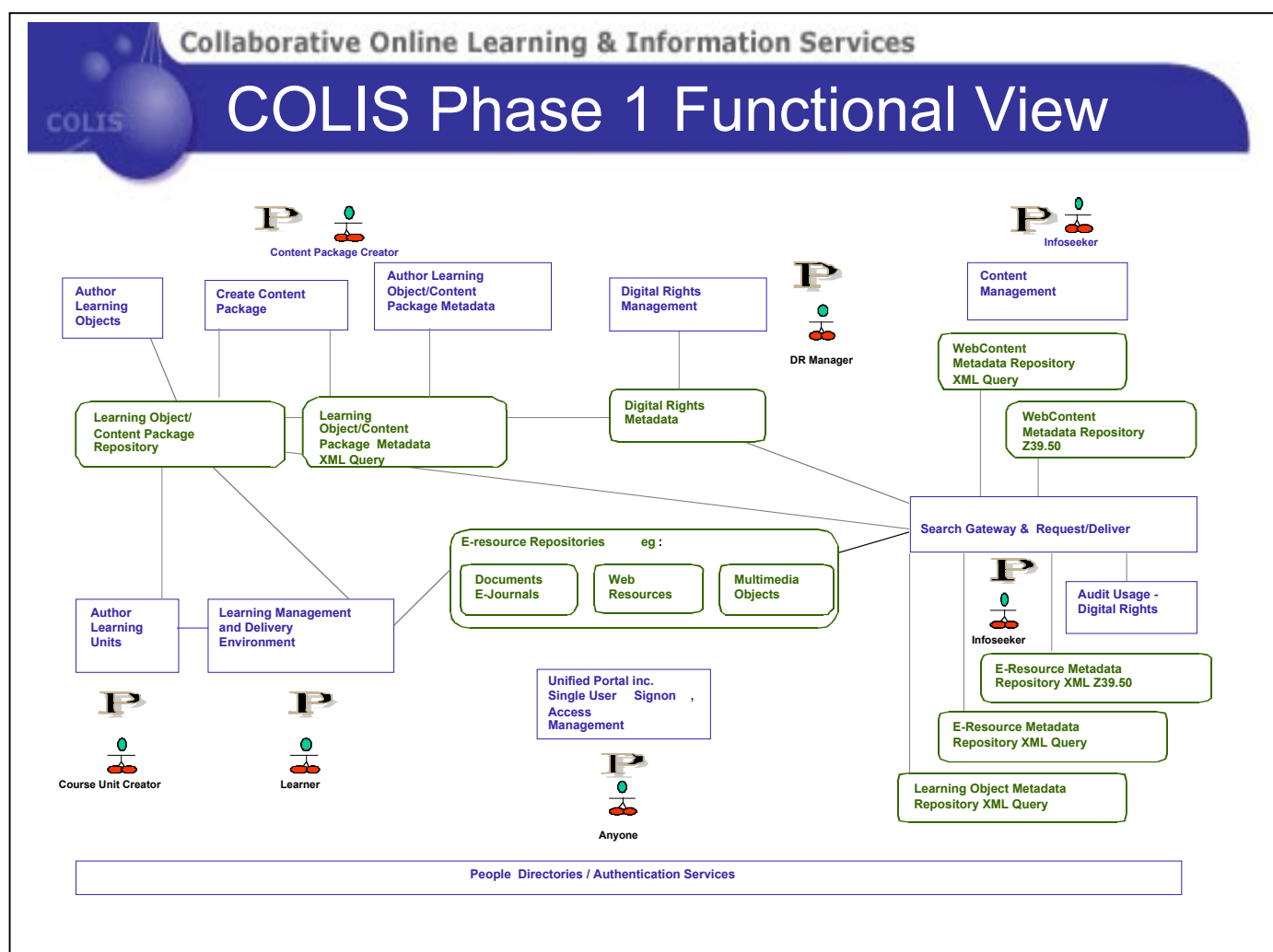


Table 2

Work will proceed during 2002 to build demonstrator examples which show how these systems chunks can be integrated, preferably in an incremental manner. COLIS partners are already aware that any institutional implementation of such an environment has massive implications for academic staff, students, and the managers of existing systems. In essence, it foreshadows a new way of doing business and libraries, above all, need to position themselves carefully in order to ensure that information services "fold" into the new environment.

INTELLECTUAL CAPITAL MANAGEMENT INFORMATION MODEL

Most of the analysis so far has concentrated on the systems view of the learning and information space. It is probably necessary, however, to facilitate a new higher level information model to help inform all parties as to how they can participate in the institutional systems framework.

In an interesting paper, brandon-hall.com staff⁽⁵⁾ attempt to reconceptualise the learning /information space using the concept of intellectual capital management. In doing so, they trace the convergence of more traditional information, learning and knowledge management concepts through to the development of enterprise-wide systems frameworks. The main purpose of their paper is to outline a framework for open-standards compliant, scalable and component-oriented architectures capable of sustaining the total quality service approach inherent in the concept of "Intellectual Capital Management".

The summary of the capabilities is worth summarising in full, because it provides both an agenda and a checklist for all service providers, including librarians, in terms of the technical, organisational and professional challenges that lie ahead.

The brandon-hall.com categorisations are as follows:

User platform:

- Portal-based access to a variety of content, activities, communities and tools, based on user profile. (Tools and functionalities can be turned on or off, based on user or community profiles.)
- Powerful search capabilities across structure, content and metadata.
- Dynamic delivery/access to specific content, activities and communities based on profiles, assessment or other data, or queries.
- User-configurable pro-active agents which monitor sources and repositories to automatically alert users to relevant new information.
- Wireless and other alternative access.

Creation and assembly of content and activities:

- Object-oriented content and activity creation and/or integration with leading XML and other authoring tools.
- Easy importing of external or existing content.
- Templating for content creation by general contributors.
- Powerful search capabilities across structure, content and metadata.
- Easy content reuse.
- Publishing to any number of devices, including web.

Content and activity management:

- A relational or object-oriented repository (support for multiple repositories also desirable) of content and activities, which allows granular storage of XML content and all other formats, with descriptive and category metadata to facilitate retrieval.
- Integration of external content, portals, etc.
- Work-flow, lifecycle, process automation and security functions applied to the validation and publishing of content.
- Automatic indexing of unstructured content, automatic categorisation to a taxonomy and automatic creation of taxonomies to provide content in context.
- Link management capabilities for maintaining relationships among elements.

Development and management of individuals and communities;

- Integration of tools for virtual meetings, virtual workspaces, virtual classrooms, discussions, group scheduling etc.
- Management of individuals, competencies, expertise, temporary and permanent groups/communities.
- Peer-to-peer information sharing.
- Features to allow users to rate content, provide alternatives and comments.

Manager and administrator platform

- Monitoring and reporting for "people manager," training coordinators, knowledge or content managers, etc.
- Management of resources and facilities for training, meetings, etc.

Connectivity and integration

- Integration with ERPs and other corporate applications.

It is interesting to note that this form of generic categorisation is applicable to both corporate and public sector environments and it assumes that learning and information are keys to successful enterprises, regardless of their type.

LIBRARIANS IN THE LEARNING SPACE

The remainder of this paper takes a closer look at several major areas where libraries can contribute to the "fleshing-out" of this new information model. Such an analysis assumes, however, that libraries must work in close collaboration with other key stakeholders within the institution. It also assumes that some areas previously thought of as being strictly library domains may have to be redefined in a wider institutional context.

METADATA INFRASTRUCTURE

There is an ever-increasing range of metadata issues to be resolved in creating the new learning and information space. It is somewhat ironic that librarians, as long practising metadata professionals, should have been so side-lined over the past decade in the development of metadata for virtual environments on the Internet.

There are a number of major issues underlying the current metadata debate which I (McLean⁽²⁾) have previously characterised in the following form:

- a fundamental lack of understanding of the difference between using metadata for the purpose of discovery within and across service domains and the use of metadata in business applications, such as content management systems or learning management systems;
- confusion over the distinction between a standard and an application profile;
- an obscure(to most) debate about the use of XML as against RDF bindings;
- a misunderstanding of the role of the Open Archives Initiative Protocol⁽⁶⁾ which only allows metadata to be harvested and does not provide for native searching of a repository;
- a lack of knowledge of how content management systems can handle multiple metadata schema;
- no firm appreciation of the role of controlled vocabulary and thesauri;
- uncertainty about the role of common search protocols such as Z39.50, as against emerging Web-based search protocols;
- a second-guessing of new technologies as a means of addressing the complexities of cross domain distributed searching;
- no clear idea of how searches based on exposed metadata translate into actual delivery of information or learning objects.

This imposing list of "unknowns" is not meant to send negative signals, but rather to highlight the breadth and complexity of metadata challenges.

In the institutional context there is a need to consider carefully at least three different domains requiring metadata support namely, the library domain, the Web/Internet domain and the learning object domain. Each domain has its own particular demands and it remains unclear as to how these different requirements are to be incorporated into the projected learning and information space. Of crucial importance in resolving this metadata infrastructure, is the emergence of a consensus between the Dublin Core Metadata Initiative (DCMI) and the IEEE Learning Object

Metadata Standard (LOM) that application profiles incorporating multiple schemas are needed to support online learning and information environments. A full account of the joint DCMI/IEEE, LOM statement on Principles and Practicalities will appear in D-Lib Magazine in the April, 2002 issue ⁽⁷⁾ .

It is important to establish, as soon as possible, whether the three metadata domains identified above can be accommodated in one institutional application profile or whether, in fact, there are multiple application profiles. It is important also (see the COLIS example) to establish where metadata repositories sit in relation to the multiple systems framework which supports the learning and information space. There is the wider issue of the maintenance of registries and the related issue of directory support, and these matters need to be addressed at an international level by relevant agencies. The immediate institutional challenge is clear enough and it remains to be seen as to how the metadata environment is managed ⁽¹⁾ .

DIGITAL RIGHTS MANAGEMENT

Digital Rights Management (DRM) has emerged over the past year as a matter needing careful consideration within the learning and information space agenda. DRM is really about managing digital assets and, as yet, there is no broad consensus on the scope of digital assets management required within the higher education environment.

A study has just been completed in Australia of the DRM business requirements for higher education and it will be published shortly by the Commonwealth Department of Education Science and Training⁽⁸⁾ . The use scenarios contained in this report are drawn from library and teaching practices and they indicate that new management perspectives will be required to implement DRM infrastructure from a systems viewpoint. It is clear that DRM cannot be simply "bolted-on" to existing systems, rather that it must be embedded at various appropriate levels in the learning and information systems infrastructure.

It is encouraging that an alliance has been formed between the COLIS project team and the Open Knowledge Initiative (OKI)⁽⁹⁾ team based at MIT to embed the DRM systems requirements within the broader OKI learning systems architectures. This will provide a "point-of engagement" for the stakeholders in universities, including librarians, to develop policies and procedures for effective management of digital assets.

Most of the technical standards development work to date has concentrated on technologies for enforcement of rights, which is of particular concern to software vendors.

The global education communities however, represent a large creator and consumer network where enforcement represents only one aspect of the business. It is vital that there be international collaboration to develop an unambiguous statement on the nature of digital assets management for education communities and on the requirements for DRM infrastructure.

PORTALS

It is most important that librarians position themselves carefully in the protracted portal debate. Over the past couple of years the use of the term "portal" has broadened to cover a complex array of problems relating to resource discovery and access management. In my recent paper (McLean⁽²⁾) the following observations were made with regard to the portal phenomenon.

- "The fundamental distinction between searching for the known, as against the unknown, needs to be borne in mind constantly in the planning and evaluations stages,
- There is a basic difference between "window-shopping" and being able to "buy-what-you-see".
- Most applications, by definition, will have a task-focussed portal to assist users;
- Most task-focussed portals have the ability to cover some, but not all, of the wider service spectrum portal space.
- The underlying portal technology ultimately depends on the use of directory services to match people and resources.
- The weaving of task-focussed portals into a single presentation layer for the user is a desirable goal.
- Cross-domain discovery still presents enormous challenges to the portal concept.
- The effectiveness of portals is inextricably linked to the application of metadata schemas.
- Users will continue to use multiple portals.
- The cost of maintaining portals is often underestimated."

In most cases libraries have assumed that the "information" portal is their province but the advent of content management systems, often managed by other groups in the university context, challenges this assumption. It is by no means clear how the various views of institutional and web activity will mesh together from the user's viewpoint or from the systems viewpoint. In general institutional mechanisms to deal with this area of activity remain weak and, in many cases, non-existent. It is in this context that agreement on a high-level information model, such as that postulated by the brandon-hall.com staff, becomes a pressing necessity.

AUTHENTICATION, AUTHORISATION AND DIRECTORY SERVICES

The realisation of an integrated learning and information space is heavily dependent on underlying infrastructure for access management encompassing issues of authentication, authorisation and directory services. Progress in developing effective access management infrastructure has been slow for a number of reasons including:

- Different "world-views" of the nature of the problem being solved between librarians and IT directors, with librarians regarding it as a matter of access to global information resources and IT directors viewing it as being primarily a matter of security and access control.
- A fundamental blurring of the distinction between authentication and authorisation, with the latter being a much more difficult challenge because of the multiple proprietary systems being accessed.
- A lack of appreciation of the role of directory services in terms of access management relating to people, resources and services.
- A preoccupation with institutional access management protocols at the expense of much needed distributed services architectures.
- Heavy reliance on proprietary directory solutions which do not scale.
- Little concept of how portal technologies link and take advantage of directory services.

It is crucial that librarians continue to develop and articulate their access management requirements, but that they do so in the learning/information space, rather than solely the library information space.

CONCLUSION

This brief analysis of the organisational and technical challenges inherent in the emerging learning and information space suggests that the time is ripe for concerted action at the institutional level to integrate systems and services and to press for national and international collaboration on the standards and specifications necessary for global interaction between learning and information communities.

The potential contribution of the library community is considerable but this will only be realised by adopting a much broader view of the service spectrum and by engaging more actively with technical colleagues and with those responsible for delivering the learning experience.

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