

The Hybrid Library Revisited

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Abstract:

Four years out, this paper revisits the theme of VALA2000 and looks at the extent to which integrated library management systems have been developed to operate as hybrid library systems by focussing on the National Library of Australia's requirements in this area. A range of commercial portal products now extend (and may eventually replace) the OPAC. However, there is still a gap in the market place for workflow systems supporting the routine digitisation of collection material. In addition, library system vendors are only just beginning to provide the level of support needed by libraries that wish to build innovative web-based services based on the catalogue.

Introduction

At VALA2000 staff from the National Library of Australia (Pearce et al) delivered a paper on “The Challenge of Integrated Access: The Hybrid Library System of the Future”. The term ‘hybrid library’ had been coined by the elib Electronic Libraries Program (JISC, 2002) to describe systems and services providing integrated access to both print and electronic resources. The elib hybrid library projects used broker architectures to unite heterogeneous ‘provider systems’ under a single user interface. For example, the Agora Project (2001) which had as its aim to build a Hybrid Library Management System (HLMS) was an implementation of the Models Information Architecture (MIA) in spite of the play on the LMS acronym. Such architectures take the content of provider systems as givens and focus on the use cases, schemas and protocols needed to use such systems via a single user interface. By contrast, an Integrated Library Management System (ILMS) deals with the acquisition, description and maintenance of collections as well as resource discovery and delivery. Its role is not just to provide access to a library’s collections but also to support internal operations.

The authors of the VALA paper looked at the issues arising from the development of separate systems and processes by libraries for managing physical format and electronic collections and highlighted the need for ongoing development of the Integrated Library Management System (ILMS) to deal with both kinds of collection material. They identified the need for additional technical modules to support the management of electronic resources. This would not only achieve operational efficiencies but also ensure that such resources were described using the same cataloguing rules as other collection items and could be discovered through the catalogue. At the resource discovery end, they argued that the catalogue had a central role to play as a provider system in the delivery of hybrid library services at the local level; and that union catalogues such as the Australian National Bibliographic Database had a similar role to play at a regional or national level. To operate effectively in this role there needed to be a shift in development priorities from the OPAC to the Z39.50 server.

Background to the Requirement

Twelve months previously as part of its Digital Services Project the National Library of Australia had issued an information paper, outlining its requirements for products that would assist it to develop an integrated approach to digital service delivery (National Library of Australia, 2003). The Library had an immediate need for a system to support the delivery of a service providing access to images held in Australian collections. The first product purchased was thus a Metadata Repository and Search System that could be used to aggregate resource descriptions from a range of sources and to search across other systems using Z39.50 protocols. This was put to use at once to deliver the new PictureAustralia service (<http://www.pictureaustralia.org>). In the meantime a separate request for tender was released for a Digital Collection Management System.

When the VALA paper was presented, the Library had just completed evaluation of responses to the request for tender and had failed to identify a suitable integrated solution to its digital collection management needs. A range of mature products were available in the market place to support the storage of digital objects but digital library applications were still at an early stage of development and did not have the required functionality or modularity. From this exercise, the Library learnt that there was no technical reason to store its digital objects inside a database management system. In fact that there were benefits in keeping the storage and management requirements separate in the logical systems architecture.

The Reference Model for an Open Archival Information System (OAIS) provided a conceptual framework that supported this approach through its focus on ‘ingest’, storage and access (RLG, 2002). The ‘Submission Information Package’ received from producers and the ‘Dissemination Information Package’ presented to consumers is opaque to the OAIS compliant archive. Processes to create, collect and describe electronic resources and to ensure their discovery and delivery fall outside the scope of the framework. A range of different functions might be needed to support these processes depending on the community to be served by the archive and the type of material to be archived. The Library had therefore just begun work on the specifications for two separate procurement processes at the time of the VALA paper: one for a Digital Object Storage System and one for a Digital Object Management System.

‘Buy not Build’

In spite of not having identified a suitable product through the previous procurement process, the Library was still determined to take a ‘buy not build’ approach to the digital object management requirement, preferring not to develop software in-house unless off-the-shelf products did not yet exist that met its requirements. In one specific area, however, the Library did decide to develop a software solution in-house. A Collecting System was needed to replace PAMS, a modest system that had already been developed in-house to gather web sites for the PANDORA archive (<http://pandora.nla.gov.au>). In this area, Australia was ahead of other countries taking on an archive role and suitable products had yet to be developed. The selective approach to web archiving adopted by the Library was resource-intensive. To make the service sustainable there was a need to minimise the cost of collecting each title. A small team of developers embarked on a project to build a workflow system to meet this requirement.

By separating the storage requirement from the management requirement and taking workflow support for collecting web sites out of the equation, the Library hoped to find products that could be customised over time to meet its needs. Vendors of integrated library management systems were turning their attention to digital library requirements of their customers. In the broader market place digital asset management systems were being developed for allied communities such as museums and publishers.

Digital asset management system vendors were more likely to offer products that could be customised quickly to meet the Library’s needs. They had expertise in different file formats, technical metadata and the processes required to interface with a digital object storage system. They were more likely to have used the latest Java-based technologies to develop their product and to have application-programming interfaces that could be used to develop support for library-specific workflows.

Library system vendors had a better understanding of the requirement to treat the intellectual work as the primary object for management and discovery and the need to support collection hierarchies. They also had expertise in library standards such as MARC and Z39.50, thesauri, filing and sorting algorithms and non-Roman character sets. Their business was to improve the operational efficiency of library workflows and it seemed a natural extension for them to develop modules to support the management and delivery of digital collections. However, this was not core functionality needed by all libraries and there was not a high level of support for the requirement in existing products.

Preference for an Integrated Solution

The Library had a preference for a solution that could form part of an integrated library management system. Since 1996 it had been routinely digitising new picture acquisitions and making them accessible on the web through its Images1 service. Images1 was a stand-alone system using Oracle for its metadata repository and search system and a simple, pre-Dublin Core metadata schema for resource description. Behind the scenes, another stand-alone system based on an Access database - Pictorial Manager - had been developed to enable staff to create batches of pictures for dispatch to an external agent for digitisation and to acquit the batches on their return. This was an inefficient way to operate. Staff needed special skills to use Pictorial Manager and workflows were interrupted at each point where data needed to be transferred from one system to another. Digitisation is expensive and efficiencies in this area make the difference between one-off digitisation projects to showcase treasures and digitisation as a sustainable ongoing operation to open up access to the collections.

Regardless of the solution, a key requirement of the product chosen was to enable use of the catalogue server as the master source for resource descriptions and the web interface to the catalogue as the first point of entry to the Library's collections. The Images1 collection had grown to 20,000 images by 2000 but users were still only able to discover through this service less than 5% of the Library's collection of over 600,000 paintings, photographs, prints and posters. In addition, much of the material that had been digitised was only described at collection-level in the Library's catalogue. Users had to know to search both databases to be sure of discovering the full diversity of the collection.

Keeping the Faith

The primacy of the catalogue as the first point of entry to a Library's collections is a basic tenet but keeping the faith is not always easy. Like many libraries with heritage collecting responsibilities, the National Library of Australia has an extensive range of 'special materials' in its collections – film and video, manuscripts, maps, pictures, printed music and oral history and folklore. When the Library first automated its operations in 1991, these collections were made available both through the 'whole' catalogue and through special material subsets. The idea was to enable discovery of all collection items through the whole catalogue but to provide a more tailored interface for users only interested in specific material types.

Integrated library management systems have a good level of support for books and serials but are not well-g geared to handle the specialist management requirements of non-book materials. Typically, a library with special collections will have a number of stand-alone systems - both paper and computer-based – developed to meet these requirements. Pictorial Manager was just one of a number of such systems at the National Library of Australia. It had been a long term objective of the Library to bring these systems under control by using the catalogue record as the master source of descriptive metadata for all material and the Encoded Archival Description (EAD) to describe and list material only catalogued at collection level.

In 2001, The Library extended this principle to electronic resources in its *Electronic Information Resources Strategy and Action Plan* (National Library of Australia, 2003a). In this plan a three-tier collecting model is defined that includes electronic resources archived by the Library, resources archived by other organisations (state libraries, university libraries and publishers) and resources 'linked through web addresses'. Linked resources are to be made accessible through the catalogue (and hence the National Bibliographic Database) only as long as they remain web-accessible.

The plan also includes strategies and actions for collection digitisation, licensing of Australian and overseas datasets and linking to free resources. In the section on access an undertaking is made to “provide integrated access to print and electronic resources and collections, items and parts of collections through continued development of the Library’s online public access catalogue and information portal”.

A practical example

In accordance with the plan, by the end of 2001 the Library had merged its Pictures Catalogue with Images1. The new Pictures Catalogue (<http://www.nla.gov.au/pictures>) provided a single user interface to the Library’s Picture collection. It supported collection hierarchies and allowed users to discover and request copies of material that had not yet been digitised or, if they did not want to pay for a digital copy, to suggest that an item be placed online. As a result the Library was able to combine the digitisation of new acquisitions with a new digitisation-on-demand service that reflected user priorities.

An easy option would have been to maintain two separate provider systems and to use the portal capability of the new Metadata Repository and Search System to provide a single user interface across both systems. This would have introduced new issues such as the need to merge result sets, remove duplicates and deal with different descriptive standards for captioned material and different levels of support for Z39.50 in each of the provider systems. Keeping the faith, the Library chose instead to merge the two datasets and deliver the service from a single provider system.

The Metadata Repository and Search System was used both for the user interface to the Pictures Catalogue and the provider system, with records derived from Pictorial Manager. This was because the integrated library management system could not be used for this purpose. It was nearing the end of its development life after 10 years of operation and needed to be replaced by one with a more modern and flexible architecture. The software used to deliver the user interface to the catalogue had particular limitations that meant it could not be customised to support the requirements for the new Pictures Catalogue. The Z39.50 server was also limited in its functionality. The intention, however, was to start delivering the Pictures Catalogue as a true subset of the catalogue as soon as the technology allowed it.

A decision was taken at this time to catalogue all pictures at item level as they were digitised using templates based on the collection-level record. If captions were to be created, why not direct this effort to the creation of a catalogue record rather than a pictorial list or finding aid? A project to add the existing item-level records to the catalogue was scheduled but with a lower priority than replacing Pictorial Manager with a system able to handle the digitisation of other material types and to interoperate in a seamless way with other technical service modules and the catalogue.

‘Build Not Buy’

The request for quotation for a Digital Object Management System issued in June 2000 sought products that could be used to replace three in-house developed Access databases; Pictorial Manager, PAMS and the Sound Preservation System used to manage material in analogue and digital form from the oral history collection. Development work that was proceeding separately on a Collecting System for the PANDORA Archive would effectively replace PAMS but there was still an intention to interface this with the new Digital Object Management System in the medium term.

At this stage the Library was still seeking products that could meet the bulk of the requirements with a minimum of customisation or development work. Through the procurement process it was confirmed that vendors of integrated library management systems were starting to look at the needs of their customers to manage their digital collections, but had not yet produced a marketable product. Some were attempting development in their own right, others were looking at partnerships with vendors of digital asset management systems to meet the requirement. A digital asset management system developed for the pre-press market place seemed to be the best fit. The product as developed was geared to pre-press workflows but the vendor also offered a set of application-programming interfaces (APIs) and a development toolkit that could be used to develop user interfaces to support a different set of workflows.

This was not quite the same as implementing a ‘turn key’ system, but it would enable the Library to outsource the development work to the vendor, with any new requirements hopefully being incorporated into the base product for use by other customers. Contract negotiation was commenced and detailed functional specifications written to help size and cost the development task. At the end of this process, it became clear that there was still a large gap between the capabilities of the existing product and the requirement. Although the work might have opened up new markets for the vendor, the development risk was too great and the cost too high to manage this risk. The vendor and the Library amicably agreed not to proceed with the project.

Applications may share the same data model and high-level use cases, but mission critical systems depend on user interfaces highly targeted to specific workflows. Archiving web sites is a very different activity to preparing material for printing, which is different again from digitising library materials. Acknowledging this home truth, the Library now embarked in earnest on two separate development projects, one to extend the Collecting System for the PANDORA archive to support the full set of management requirements for born-digital material, the other to develop a Special Collections Manager to support the digitisation of material in traditional formats. The first product was released under the name PANDAS (PANDORA Digital Archiving System) in July 2001; the second, under the name Digital Collections Manager, in February 2002.

While taking separate development paths, both applications were treated as components of an overarching systems architecture that had been developed for the original information paper and refined through the subsequent procurement processes (Digital Services Project, 2003b). Key principles informing this architecture include:

- Separation of the resource management layer from resource discovery and delivery.
- Treatment of the intellectual work as the primary object for management and discovery.
- Use of the Integrated Library Management System (ILMS) as the master source for resource descriptions and the Online Public Access Catalogue as the first point of entry to the Library’s collections regardless of format.
- Use of Persistent Identifiers (PIs) to cite and access digital collection items.

Being a Development House

PANDAS and the Digital Collections Manager are both complex applications. The Library has invested over 6 person years in their development and they are now functioning effectively as mission critical systems in their business areas. With an off-the-shelf product one can control user expectations as long as the fit is close enough to achieve efficiency gains compared to the system being replaced. Requirements for enhancements can be built into

contracts or the vendor's development plans for the product. Where a good fit cannot be found an application developed in-house may be the only way to address immediate priorities, particularly when the requirement is leading-edge. By working closely with the future users of the application it is also easier to be responsive to changes in the requirement.

In early specifications for the Digital Collections Manager a separation was made between management of material needing to be digitised and the digitisation process itself. During 2001 the Library embarked on a major digitisation project involving digitisation of significant Australian material, including manuscripts, maps and sheet music as well as pictures. A decision was taken at this time to bring all digitisation in-house. This required the Digital Collections Manager to be closely coupled to digitisation workflows. By working closely with the Digitisation Project, the development team was able to provide an acceptable level of workflow support as the volume of digitised material grew and procedures for describing and handling the material developed.

In parallel with the development of the Digital Collections Manager, the Library has also been working on solutions to the delivery of digital objects. Delivery systems have been developed for maps, manuscripts and sheet music and work is proceeding on a delivery system for books and serials (National Library of Australia, 2003c). These systems operate as part of a Generic Delivery System that can interface with the Digital Collections Manager to obtain the structural metadata needed to deliver complex digital objects. A real synergy has developed between the three project teams, with cataloguing policy being developed, business rules defined and system enhancements made in conjunction to deal with issues as they arise.

The downside of in-house development is the need for ongoing maintenance and development once the first version of the product has been released. Commercial companies are geared to do this, preparing a major new release at least once a year and minor releases and patches during the year as required. Without additional funding from commercial sales, the Library has already released PANDAS Version 2 and DCM Version 1.2.1 and both products have long enhancement registers. How this is to be resourced is problematic, particularly given the queue of other new projects requiring attention.

Another issue is that other libraries have started to take an interest in both applications. An evaluation instance of PANDAS has been set up for use by interested parties but even doing this has taken resources away from other projects. For the Digital Collections Manager, the Library used its own applications development framework, based on open source software. It would be nice to put something back into the public domain but a significant resource effort would be involved. It would require packaging the framework up so that it could be used with any backend database, replacing the inevitable bandaids used to bring releases in on time and generalising business rules to meet the needs of other organisations.

PANDAS supports a specialist requirement that would not be needed by many libraries. The Library recognises that it will need to continue to maintain and develop this system as long as it has a responsibility to collect and archive significant Australian web sites. A commercial partner might be able to take on this responsibility but the Library is not expecting much interest in this requirement from library system vendors. By contrast, it is still the Library's long-term goal to replace the Digital Collections Manager with an off-the-shelf product developed for the library market place.

Ebenezer (2002, note 5) records an observation that "many experimental digital library systems are too specific to their institutional context to be patent of commercial exploitation". This is particularly true where digital library systems are built to meet one-off project goals

and in separation from the other workflows needed to manage a Library's collections. The Digital Collections Manager would certainly need extensive reworking as a commercial product but it has been designed from scratch to be a logical component of the integrated library management system. There is also a need to make sure that many of the business decisions taken during the development process are shared with other communities working on solutions to the same problem to ensure interoperability between systems and services in a hybrid library environment. Library management systems were integral to the standardisation of business practices in the last century and still have a central role to play in improving the efficiency of library operations in the digital era.

As an example, standards are needed to enable behaviours to be defined for digital objects that are independent of the resource discovery services used to locate them. Ideally, the resource description should only contain a single URL that can be used to invoke an appropriate user interface for use of the object. This needs to be incorporated into cataloguing policy and supported by appropriate delivery systems. For this to happen the delivery systems need to be informed by architectures such as the Flexible Extensible Digital Object and Repository Architecture (Fedora Project, 2003) that associate behaviours with the digital object for use in its dissemination. Similarly, digital library projects such as Fedora need to be aware of frameworks like the Functional Requirements for Bibliographic Records (FRBR) (IFLA, 1998) which address some of the limitations of simple resource descriptions such as Dublin Core by acknowledging the relationships between works, expressions, manifestations and items. Both communities need to be working together at the provider system as well as the portal level, to ensure the sharing of cataloguing effort and the integration of collection management workflows, particularly for traditional format materials subject to digitisation.

The New ILMS

The Library's goals in relation to the catalogue as a central component of its hybrid library architecture have been constrained by the existing software used to deliver the integrated library management system. In 2001 the Library initiated a process that would remove some of these constraints by going to tender for a new system (National Library of Australia, 2001). Digital collection management was not included within the scope of the request for tender because of the recent procurement efforts in this area, but a range of benefits were anticipated in terms of web collection delivery (Pearce, 2002), including delivery of the Pictures Catalogue as a true subset of the catalogue. When the Library goes live with the new system in December this year, however, the Pictures Catalogue will continue to be delivered through the Metadata Repository and Search System, at least for the short to medium term. There is still quite a large gap between what is required to deliver an equivalent user interface from the catalogue and what the new product will deliver.

Customers like the National Library of Australia have the technical capability to take a base product offering and use it to develop a range of innovative web-based services to enhance collection access and delivery. The extent of what can be achieved depends on the level of support of the server for standard protocols such as Z39.50, the existence of standard Application Programming Interfaces (APIs) and the ability to customise the user interface through HTML or XML templates rather than through configuration files. While it has enormous strengths in the traditional technical services areas, the Library's new integrated library management system does not yet deliver the required level of support in these areas. It has not been a priority for vendors to address those aspects of their systems that would enable the catalogue to be integrated with other applications as part of a hybrid library service. The

majority of their customers need a product that can be installed with minimal customisation in libraries without ready access to programming expertise (Chvatal, 2003).

Many Library system vendors now include a portal product as part of their suite of offerings and a number of libraries are using these products to deliver hybrid library services. The portal extends (and may eventually replace) OPAC, the main difference in architectural terms being that they can operate as stand-alone systems, enabling them to be directed to a wider market. The Library excluded portal software from its request for tender for a new system on the grounds that it was already using such a product to deliver the Pictures Catalogue and was looking for an integrated solution. The proprietary relationship that OPACs have with the catalogue is needed in order to deliver patron-specific functions. Protocols and data schemas have not yet been developed to support the management of these functions through stand-alone portal software. Value-added services such as SFX can link a user through to the web interface to the catalogue to support 'get' workflows for items not available online, but the workflows are discontinuous for the user and a separate user interface to the catalogue needs to be maintained just to support this functionality.

Ideally, a library should have to purchase only one product to provide integrated access to its collections, regardless of format as well as enabling users to search across other key resources. No matter how well a portal product supports protocols that might enable this to happen, the provider system must have a similar level of protocol support. NISO (2003) has launched an initiative on metasearching standards and guidelines with the aim of addressing some of the issues in this area. A key driver for this initiative was the desire to move away from 'screen-scraping' as a means of interfacing with provider systems without the required level of protocol support.

Conclusion

Since the VALA paper was written there have been some tremendous advances in the area of portal development and digital object management, discovery and delivery, but there have also been disappointments. With few exceptions, development of the integrated library management system continues to proceed on a separate path from development of digital asset management systems and digital library services. Library system vendors have moved into the digital asset management and portal market by offering products that further separate access to library materials in traditional formats from born digital or digitised collections.

While libraries now have a range of digital asset management systems to choose from, there are very few available that have really addressed the workflows needed to support a "whole item" approach to the acquisition, description and digitisation of collection items. There continues to be an unnecessary distinction made between the use of MARC for describing physical collection items and the use of simple resource discovery metadata formats such as Dublin Core for describing digital collection items and digital surrogates. This is encouraging the development of separate resource description repositories for traditional library materials and online content, placing the burden on portal software to resolve differences in descriptive standards and to solve the problem of multiple records for multiple versions of the same object.

In the area of rights management the focus has been on development of standards and systems for the delivery of content that is already in digital form. There is a requirement for workflow support to enable libraries to record rights management information at work/expression level as well as at manifestation / item level that is still not being addressed by commercially-available systems.

At the National Library of Australia, the hybrid library concept continues to underpin our strategic directions but it has been a struggle to maintain this vision using commercially available products. Our response has been to expand our application development capability in order to build workflow and delivery systems that extend the systems used to manage our own collections and the National Bibliographic Database. This has allowed the Library to address leading-edge requirements but has also placed it in the uncertain role of a development house.

At the national level, while PictureAustralia remains a purely digital library service, the Library is exploring hybrid library solutions for services such as the Register of Australian Archives and Manuscripts (RAAM) and Music Australia. This has led to the initiation of a new project, the Harvester Project, which has as its aim to use the National Bibliographic Database as the master source of records for both services. It will enable the contribution of records in a range of data formats by participants as well as providing online forms for directly updating specialist repositories via the National Bibliographic Database. Working on this project has identified constraints of the current system used to deliver the National Bibliographic Database that will be addressed by the Library over the next two-three years.

The current focus is to continue to replace or upgrade existing systems with a new generation of workflow applications and utilities that operate as loosely-coupled modules within the overarching logical systems architecture defined for the Digital Services Project. Underlying these applications are two key provider systems, the catalogue and the national bibliographic database. Over time, the Library will replace components of the architecture built in-house with commercially-available solutions that enable transfer of the responsibility for maintenance and development to vendors geared to meet market needs in that area. In other areas the requirement may remain so specialised that the Library will need to continue to maintain and develop software in-house. In either case, the physical and digital collections and the data needed to support their management, discovery and delivery will live on.

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