2007

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Publication details

Wilson, K, Billington, L, Moir, S & Carpenter, S 2007, 'Development of a metadata application profile at the State Library of New South Wales', *Proceedings of the 13th Information Online Conference*, Australian Library and Information Association, Sydney.

DEVELOPMENT OF A METADATA APPLICATION PROFILE AT THE STATE LIBRARY OF NEW SOUTH WALES

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Abstract

In 2004 the State Library of New South Wales (SLNSW) launched the atmitchell.com initiative to develop a new technology platform to manage the digitisation of its unique and significant collections and make them available via the Internet. To enhance the development of atmitchell.com the library is implementing a new archival collection management system (ACMS), digital object management system (DAMS) and web content management system (WCMS). In 2006 a team of staff at the Library developed a Metadata Application Profile (MAP) that specifies a set of metadata elements to meet the metadata and search requirements for atmitchell.com.

Introduction

The State Library of NSW (SLNSW) has been digitising, managing and publishing content, including web content, since 1999 when a special unit was formed to create and deliver resources in digital form. By 2001 the Library was producing 2,050 digital images per annum. In 2006 the number of digital masters scanned in a year had increased to 24,087[1]. The images are accessible on the Library's website through exhibition-style web pages which provide contextual and curatorial information; as well as via links from records in the Library's online catalogues.

However, the manual processes, architecture and technology infrastructure that have been used will not support future electronic delivery services requirements

In July 2004 SLNSW launched an initiative called atmitchell.com with the aim of establishing a new technology platform to increase the digitisation of the Library's unique and significant Australiana collections to reach a wider audience via the Internet.

Early in the project, SLNSW adopted the strategy to implement the project in three main horizons or phases. Each horizon has specific objectives that once achieved will help build the foundation for the next horizon. Horizon 1 is the education or brand awareness phase. Horizon 2 is the propagation phase that also provides the sustainable business and technology platform for subsequent Horizon implementations. Horizon 3 is the innovation phase.

This paper discusses the background of the atmitchell.com initiative and the development of the Metadata Application Profile for the new systems to be implemented in Horizon 2.

Development of atmitchell.com

As part of the Horizon 1 development, SLNSW introduced a concept called Journeys. The Journeys link key heritage items and digitised material with

[1] Total of 97,082 digital masters scanned from 2001 to July 2006

curatorial knowledge and expertise, enabling a client-focused presentation or view on the web.

In March 2005, the Library launched the atmitchell.com Horizon 1 website (http://www.atmitchell.com) with the online journeys Voyages of Discovery, Antarctica, and the Macquarie Era. To promote the atmitchell.com online brand and educate the market on the Journeys concept most of the design and development in the Horizon 1 atmitchell.com website was focused on user experience elements such as graphic design, site look and feel, site navigation and interactive flash elements.

Since the March 2005 Horizon 1 launch, SLNSW has added new journeys including Aviation in Australia sponsored by Qantas, Indigenous Australians sponsored by Rio Tinto, Cricket in Australia sponsored by Sir Ron Brierley and the Guinness Peat Group, Temples of Commerce sponsored by Woodhead International, People and places: Historic Homesteads sponsored by Peter and Ellie Hunt, Law and Justice, and Joie de Vivre! the French in Australia, sponsored by Accor Hotels.

SLNSW Collections

The SLNSW collections, with a particular focus on Australia and the Pacific, are a major national cultural asset valued at $1.9 billion. Research development within the Library's collections include Australian history, culture and literature, Indigenous and Torres Strait Islander studies, Antarctic exploration, family history and genealogy, business and management, social sciences, applied science, biography, health and law.

There are over five million items including monographs, pictures, posters, ephemera, sheet music, talking books, maps, CD-ROMs, newspapers, microfilm and fiche, films and videos, computer software, kits, sound recordings, photographs, objects, architectural plans, coins and postage stamps.

Significant Items in the Collections

Some of the significant items in the SLNSW collections include:

- Original accounts of the voyages of the great explorers Abel Tasman, James Cook, Bass and Flinders, and William Bligh including 9 of the 11 known journals of the First Fleet.
- Paintings and sketchbooks by great colonial artists John Glover, Conrad Martens, Eugene von Guerard, Tom Roberts.
- Literary papers of famous authors including Elizabeth Jolley, James McAuley, Miles Franklin.
- Plans and Designs by leading architects Jørn Utzon, Harry Seidler, Glenn Murcutt.
- Extensive collections of books, newspapers, maps, manuscripts, photographs, oral history, films and videos documenting all aspects of life in NSW.
- The first Australian newspaper, the *Sydney Gazette* and *New South Wales Advertiser* 5 March 1803.
- The oldest surviving Australian photograph, Daguerreotype of Dr.

William Bland 14 January 1845.

A New Technology Platform

Soon after the atmitchell.com H1 website launch, SLNSW defined the project objectives for Horizon 2 and started working with business stakeholders to gather business and technical requirements for Horizon 2.

The main objectives of the atmitchell.com Horizon 2 project include:
• Accelerate transformation from a predominantly *physical* library to substantially increased *digital* library
• Increase the number of content journeys on the atmitchell.com website by increasing the ingestion of digital assets and web content by a significant factor and to implement streamlined business process from ingestion of digital assets through to publication of journey content to the web.
• Deliver a strategic and sustainable architecture and technology platform to support the business objectives and to implement a technology solution for the capture, management, and publication of atmitchell.com content.

SLNSW began planning for a new sustainable business and technology platform. The following major developments were identified to automate and improve digitisation, storage, metadata creation and maintenance.

1. Implement a Digital Asset Management System (DAM)
A DAM is an integrated suite of software components used to capture, catalogue, store, and manage digital assets, and to expose those assets to creative tools for producing video, audio, web, and print content. A Digital Asset Management is needed o automate the semi-manual processes to manage and store the digitised archival collection items, and provide a workflow from the ingestion of digital objects through to cataloguing and publishing to the web.

2. Implement a Web Content Management System (WCMS)
Over the past decade, the total number of internet and intranet websites maintained and hosted by SLNSW has grown. The content authoring model is centralised and web developers often have to convert, format and publish content from business owners to one or more websites. A Web Content Management system is needed to streamline web publishing for atmitchell.com and all other websites maintained by the Library.

3. Replace the Archival Collection Management System (ACMS)
The current archival collection management system, known as PICMAN, was implemented in 1992 with a customised hierarchical record structure to represent the multi-level archival collection materials. It is built on a proprietary database system (AWAIRS). The collection records are stored in a proprietary format and do not use open industry standards such as XML to represent metadata.

4. Implement a Federated Search function across repositories

Provide federated search functionality across the SLNSW data repositories: the Millennium online catalogue for published material, the ACMS for original or archival collection items, ***Infokoori*** and ***Infoquick,*** locally developed indexes to newspaper collections. SLNSW also subscribes to external electronic resources provided by suppliers from Australia and overseas which will be incorporated into the federated search functionality in Horizon 3.

Figure 1 shows the target architecture for the atmitchell.com technology platform.

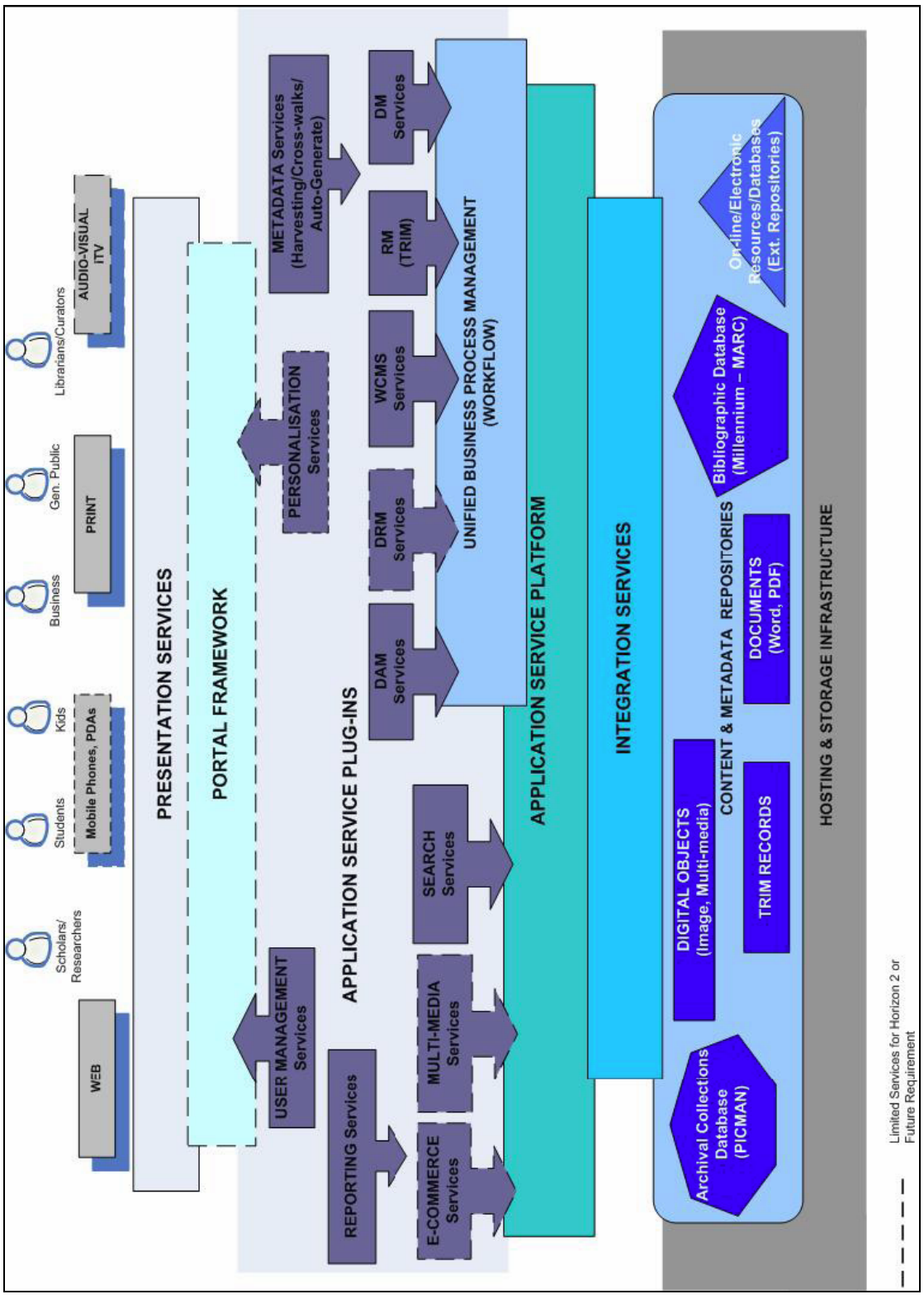

Figure 1: Target Architecture Model for atmitchell.com

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Why a Metadata Application Profile?

Erik Duval, Wayne Hodgins, Stuart Sutton, and Stuart Weibel define a metadata application profile as “an assemblage of metadata elements selected from one or more metadata schemas and combined in a compound schema. Application profiles provide the means to express principles of modularity and extensibility. The purpose of an application profile is to adapt or combine existing schemas into a package that is tailored to the functional requirements of a particular application, while retaining interoperability with the original base schemas.”

The Library recognised that it required a Metadata Application Profile to specify a set of metadata elements and crosswalks to support the management and description of archival collections, digital objects, and web content. Separate metadata schemata were needed because of the different nature of the data to be stored in each system:

- Archival collections held by the Library and stored in the Archival Management System (ACMS) - including complex multilevel collections and single discrete items
- Digital objects stored in the Library’s Digital Asset Management System (DAMS) – simple and complex objects in a range of formats
- Web Content Management System (WCMS) – describing the Library’s services and resources delivered via the Library’s web pages both internal and external, including Journeys and online exhibitions.

Requirements

The Library required a Metadata Application Profile that promoted interoperability and conformed to recognised international standards. Processes and workflows were to be automated, data to be captured once, transferred and reused between internal systems with the aim of eliminating duplication of effort wherever possible. As we embarked on developing the Metadata Application Profile many business processes and specifications such as search and display were still in development. A systems solution and architecture were still to be determined. It was expected that some requirements would change as the project matured.

The Metadata Application Profile needed to provide a standards-based, implementation neutral, logical model of the data requirements. This was seen as a framework for moving into the design process where implementation options will be examined.

Extensive “crosswalk” tables were required to support the migration of data to new formats and manage the exchange of data between systems. The crosswalks would link the metadata schema together as well as to existing repositories such as the MARC based integrated library management system.

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Scope

The Metadata Application Profile needed to support increasing levels of digitisation and online delivery of content and be extensible and flexible enough to accommodate any changes.

To meet the initial time frame of three months archival collections and digital objects were given highest priority, followed by work on developing the crosswalks.

A more consistent use of vocabularies across systems was required, and shared authority files investigated. However, once the complexities of this problem were understood it was agreed that a separate and a longer-term project would be required. The first draft of the profile would incorporate existing authority structures.

It was acknowledged early that data relating to workflow management and some collection management functions were beyond the scope of the Metadata Application Profile. These requirements were to be captured in the business requirements specifications.

Rights management metadata and preservation metadata were beyond the scope of this project. While a number of elements describing rights and preservation information associated with resources were included, it was recommended that more work would be needed and separate projects should be established to scope this.

Approach

The approach to the MAP development was influenced by the process outlined in the *British Standards, Code of practice for the development of application profiles, 2005*.

The main tasks were

1. Gather requirements
2. Identify appropriate schemas
3. Select data elements
4. Specify rules for data elements
5. Review against other requirements
6. Finalise draft
7. Create crosswalks
8. Scope requirements for XML Binding
9. Develop a maintenance plan

The deliverables were

1. An element set
2. Guidelines
3. Definition of controlled vocabularies
4. Crosswalk tables
5. Rationale

6. Search mapping
7. Binding

Archival Collection Management System

The existing catalogue for archival materials PICMAN was to be decommissioned. The new Archival Collections Management System was to be integrated with a Digital Asset Management System. A new data definition was required.

Archival collections at the State Library include extensive photographic image collections. Providing a data model to meet the requirements of (1) traditional archival collections, such as manuscripts, and (2) photographic material where the focus is on individual items, was challenging. A structural framework that supported multi-level description of hierarchically linked archival collections and the discovery and delivery of detailed item level descriptions was required.

Important considerations were:

- representation of hierarchical relationships;
- users' ability to identify the content and context of collections and to navigate complex hierarchical collections using structural links;
- the ability to present item level descriptions of digital objects.

There was much discussion on aggregation models, appropriate levels of description, and how descriptions should be associated. For example, at what level would we associate a digital object to a collection description? How many levels of description should we support? How much detail was required at each level? Would we describe item parts such as plates and maps?

The solution

We looked for examples at other large libraries, both in Australia and Internationally, talked to our colleagues in other State and National Libraries, and read widely. Most libraries managed manuscript and photographic collections separately and many were using proprietary systems.

The metadata solution was required to meet descriptive, administrative, and structural metadata requirements. Several interrelated standards would be required. An important principle was that the solution should be standards based.

ISAD(G) *General International Standard Archival Description*, is a key international standard for archival description and is supported by the international archival community. We set about identifying and mapping ISAD(G) elements against requirements, with a good high level match. While ISAD(G) provided a high level framework for archival collections metadata, we needed to build on this framework in order to define each element at the level of detail required to be represented in a catalogue or encoded for exchange.

The options were to develop local elements and schema, or adopt an existing schema. We preferred to take the ready made option if possible. MARC, MODS (*Metadata Object Description)* schema and EAD (*Encoded Archival Description*) schema were investigated. All were workable to some extent, but overall EAD appeared to match our requirements most closely.

The more we looked at EAD the more we liked it. We experimented with creating records using EAD elements and read widely. There were lots of pluses. While EAD was not widely used in Australia, it was supported by international collaboration and maintained by the Library of Congress and the Society of American Archivists. It was designed specifically for describing archival materials; had an extensive well defined tag library containing highly detailed data elements which comply with ISAD(G); as well as an XML schema and crosswalks to other standards. EAD also supported rich item level description and links to embedded digital objects.

Challenges

While the EAD tag library met our data requirements, we were uncertain about the implementation of the EAD data structure. EAD was designed to encode archival finding aids. We didn't want a traditional finding aid presentation for our descriptions. We wanted to use it a different way. Our main concern was the ability to support disaggregation of nested components for item level discovery and display. We hunted around for other organisations making innovative use of the EAD schema, but we didn't find many examples. However some people we talked with thought it could be done. We were heartened by discussions with the National Library of New Zealand and the State Library of Queensland who were considering the use of EAD in their digitisation projects.

Did we achieve our aim for interoperability? EAD has an extensive tag library and there are many options on how it can be applied. The Research Libraries Group (RLG) best practice guide was a good reference, but without a clear requirement to exchange data to a specified standard, we were required to make several assumptions. We stuck to the idea that the ability to output our data in a format that referenced an internationally recognised standard was a step in the right direction for interoperability. Following a standard provides a base line for any future conversion or exchange requirements.

The metadata profile includes a number of crosswalk tables which provide mappings to existing data and other relevant metadata standards. Content standards are also important for interoperability and the profile recommends two content standards: *Rules for Archival Description2 (RAD2)* and *Graphic materials: rules for describing original items and historical collections*.

Digital Asset Management System (DAMS)

Current System

Most of the Library's digital content is in the format of image files - TIFF and JPEG. Some content files are in text format (HTML or PDF) with a few audio or video files. Currently the metadata for digital objects is stored in a variety of systems.

- some technical metadata is automatically captured and stored with the master files
- descriptive metadata for digital surrogates of manuscripts and pictures is stored in the PICMAN archival database
- descriptive metadata for digital surrogates of published items is stored in Millennium, the Library's library management system for published materials
- structural metadata for complex digital objects is in Ebind files
- production metadata is in a Microsoft Access database

Technical metadata automatically captured and stored with the master files includes spatial resolution, colour space, size in pixels, and date of scanning. Metadata stored in the Library's Digital Register, a Microsoft Access database, mostly relates to workflow processes eg location on server, date item selected, scanned, uploaded, name of requester, project name, model of scanner, and digital scanner.

Structural information is held in an Ebind file. Ebind, or Electronic binding DTD, was developed in 1996 at the University of California, Berkeley Library. Ebind has been enhanced and customised by the State Library of NSW and has been used as the method of binding together digital images into a 'web book' for online presentation.

Currently each digital object is assigned a unique identifier consisting of a simple running number followed by a sequence number if appropriate and a role identifier eg a1475008t.jpg represents thumbnail image for the last page of a digital object with 8 pages

Requirements

For the major digitisation program planned in atmitchell.com Horizon 2 the Library needed to be able to manage a greatly increased volume of data as well as provide better support for the digitisation process and future preservation processes. Metadata are required to support:

- display of digital objects to users
- staff searching, browsing, sorting and identifying objects in the new Digital Asset Management System
- management and preservation of digital objects
- management and display of rights information

The Library also wishes to contribute to national and international repositories and these requirements are likely to change as new projects or initiatives are established.

Defining and conceptualising digital objects

We started by looking at the metadata currently collected on our Digitisation Request Forms and in the Access database. We looked at the relatively rich metadata set developed by the National Library of Australia for its Digital Collections Manager and schema being used by others around the world including the Library of Congress, California Digital Library and the Oxford Digital Library. We were very fortunate in generous advice from colleagues at the National Library of Australia, State Library of Queensland, and Brown University.

It soon became clear we needed to define what we meant by digital object. We have defined it as follows: “digital object is an assembly of one or more content files and corresponding metadata into a single, unified entity”. Examples of digital objects are a book digitised as page images; a photograph digitised as a master TIFF file and high resolution and preview quality derivatives; a report in PDF format.

The unique characteristics of digital objects present a number of descriptive challenges:

- digital objects usually contain content files representing multiple versions or manifestations of the same content – master, high quality, reference display, preview thumbnail and derivatives generated for re-use

- the format and structure of a complex digital object can change over time as a result of preservation activities

- digital objects may be “born digital” or digital surrogates of analogue works

Granularity of digital objects

The Library’s digital objects vary in their complexity. Most are single image files with associated metadata but others may be multiple images making up the pages of a diary plus a transcript and the metadata. Kebbell & Campbell, National Library of New Zealand, have categorised objects as simple, group or complex. In their model “a simple object consists of a single file that is intended to be viewed as one conceptual object”. A “digital object group consists of a set of independent but related files that have been collectively described” while a “complex digital object consists of a group of dependent files intended to be viewed as a single conceptual object”.

The vast majority of digital objects in the DAMS will be simple objects with item-level descriptions. Generally subordinate parts of a single digital object will not be described in individual metadata records.

Sometimes a number of items will be grouped into a coherent whole when the curator has decided that the characteristics of the group are of primary interest. The digital object will then be a *set* or *group* of items. A set of cigarette cards depicting test cricketers of 1932-1933 is an example of a digital object that is a group of items. Metadata are also needed to represent parent / child relationships, e.g. a diary that is a component of a manuscript collection or a page that is part of a book.

Metadata Framework

It soon became clear that no single metadata standard would meet all our requirements and that a modular approach was required. We needed to select different metadata elements (descriptive, technical and structural) from different schemas and combine them for our digital objects.

The choice of METS to replace Ebind was obvious. The *Metadata Encoding and Transmission Standard* (METS), an initiative of the Digital Library Federation and Research Libraries Group (RLG), is designed to define and structure digital objects so they can be stored, exchanged and presented to users.

METS has grown out of work by the University of California, Berkeley on Ebind's successor – an XML Document Type Definition created for the *Making of America II* (MOA2) digital objects. The METS document acts as a metadata wrapper holding the descriptive, administrative, and structural metadata for a digital object. It has the advantage of:

- being an emerging but already widely accepted standard
- using the W3C XML schema definition language
- being used by a growing number of digital libraries – OCLC Digital Archive, University of California, Berkeley, Library of Congress, Oxford Digital Library
- being very flexible and suitable to a variety of digital objects
- allowing the integration of extension schemas such as DC, EAD, MODS, TEI
- providing a single metadata framework that draws together all the content files that make–up the digital entity
- providing the syntax for expressing relationships between the pieces of a digital object

Descriptive metadata

We chose to use the *Metadata Object Description Schema* (MODS) to handle descriptive metadata for our digital objects. MODS is a good fit with the Library's requirements. As well as being fairly widely used and well supported it has the following features:

- is richer than Dublin Core and simpler than MARC
- allows for rich hierarchical description especially of complex digital objects

- its element set is compatible with existing descriptions in bibliographic databases
- has the flexibility to be combined with other XML based standards such as METS
- allows the addition of metadata elements or additional information not covered by the schema. The <extension> element may be used for "local" elements or for elements that are defined by other metadata schemas

Fifteen of twenty possible top-level MODS elements were selected to describe the work or intellectual entity represented by the digital object.

Technical Metadata for Digital Still Images

Technical metadata provides an account of how the content file was created and, if applicable, altered. Elements include the date of first creation, date of manipulation, software used.

We have assumed that most of the technical metadata will be available and harvestable from the image header file. A small number of data elements are not inherent to the file and will need to be added either as default values or keyed input. Recording these additional data elements adds time and cost and it may only be cost-effective to record and maintain the technical metadata for master images.

We looked at the work of the *Center for Digital Initiatives* at Brown University and others and selected *NISO Metadata for Images in XML* (NISO MIX) for the technical metadata associated with our digital still images. Like MODS, MIX is maintained by the Library of Congress with input from users. MIX has the advantage of being:

- a comprehensive standard developed specifically for the management of digital still images
- extensible and scalable – additional fields can be created and used
- not tied to any specific file format – Includes data elements common to all image file formats
- able to work well with existing standards and integrate with XML schemas
- able to stand alone or be used as part of a broader metadata set like PREMIS
- implemented by a number of cultural institutions including the Library of Congress

At this stage only a small set of change history elements has been selected for the profile. Detailed information about the processes applied to an image over its life cycle useful for future quality assessment or for understanding the provenance of an image, will be encompassed when a more complex set of preservation metadata elements such as PREMIS is implemented.

Other METS extenders used in the profile

Technical metadata will also be required for text content files including transcripts, manuscript papers as well as legacy contents lists and manuscript guides stored in the DAMS in SGML, XML, HTML, RTF and other formats. We chose the TextMD schema Version 2.2 to hold metadata for technical aspects of text generation whether analog-to-digital or born digital. In the interest of simplicity this element set has been kept to a minimum.

Text Technical Metadata (textMD) is an extension schema for METS developed by Jerome McDonough, New York University. It is one of the few formal standards for technical metadata that is suitable for capturing the technical aspects of text generation whether analog to digital or born digital. It is used by the Library of Congress in its AV project and is able to work well with existing standards and integrate with XML schemas

Rights metadata

Rights metadata includes information on viewing and reproduction restrictions and contact information for rights holders. For contractual and copyright reasons, some digital objects held in the DAMS may only be viewed within the Library. The Library requires a mechanism that prevents display or delivery of a digital object beyond the permissible level (eg outside the library building, in high resolution etc).

We chose the *METSRights XML schema* designed at Stanford University. It allows declaration and documentation of some basic facts about the digital object. It is maintained by the METS Editorial Board and can be used while more comprehensive rights expression languages are being developed.

METSRights:

- works with existing standards and integrates with XML schemas
- is used by Library of Congress for “I hear America singing”, the University of California, Berkeley Library and Brown University Library, Center for Digital Initiatives

We made two of the rights metadata elements mandatory to ensure that the essential rights information is captured. As the digitisation business processes evolve the rights element set will be more fully utilised.

Still to be developed

A full set of technical metadata for the management of and long term access to audio, and video in digital formats has not been included in our profile although elements in the descriptive and administrative metadata sets provide the basic information required for these formats. We will monitor the work of the National Library of Australia and the Library of Congress in these areas.

A higher priority is to ensure the Library has a standard name convention in place that identifies the digital objects uniquely and persistently in and outside the DAMS. The successful implementation of METS will on the application of

a coherent and easily maintained system of identifiers for all digital objects, their components and metadata. The Library's system of digital IDs is currently under review by our *Digitisation Reference Group* and we intend to investigate a tool developed by the National Library of New Zealand for assigning internal IDs that become the locally unique component of a persistent identifier.

Web Content Management System

The introduction of a Web Content Management system is intended to streamline the process of creating and editing web and Intranet pages, making it more efficient and less centralised. Searching for content assumes there is something to be searched and metadata assists by being an invisible helper to the content in the text. Searchable terms that add value to the web content also allow staff to repurpose the content more easily.

Dublin Core (DC) and the Australian Government Locator Service (AGLS) metadata schemata were chosen because they are recommended by the Australian federal and state governments for use by government agencies. DC is an international standard (ISO Standard 15836) and the Library has had experience in crosswalking to DC from MARC and the existing PICMAN metadata set, proving DC's capability in interoperability. DC and AGLS are simple schemes that allow for expansion. Adding metadata to web content should not be a huge burden on staff, so metadata must be easy to enter and the process as automatic as possible. Experienced metadata creators may enhance this basic metadata by adding subject access and other descriptive information to higher priority areas of the website.

AGLS is based on Dublin Core and extends the DC elements to cover concepts important to government agencies. In addition, AGLS offers a tidy list of document and service types that are government agency-specific.

Challenges

One of the challenges with web content management metadata is describing the journeys. Journeys are an important part of the Library's atmitchell.com website, providing an introduction to the Library's extensive collections by highlighting unique and significant content centred on a specific subject area (e.g. Antarctica, Cricket, Indigenous Australians). They are similar to online exhibitions. Navigators are a separate part of the atmitchell.com website. They are expert systems that guide a client in locating information held by the Library in a particular subject area (e.g. HSC English). Neither Journeys nor Navigators neatly fit into the DC/AGLS concept of "type". A control list for Audience is to be defined, a challenge given the Library's diverse client base.

Crosswalks

The final requirement of the Metadata Application Profile was to develop metadata crosswalks between the existing systems and the new metadata schema developed in the profile. The crosswalks are needed to assist the migration of existing data to the new systems and to provide technical mapping between the metadata frameworks.

The following crosswalks have been developed:

1. PICMAN to Archival Collections Management (ACM) metadata to EAD
2. ACM metadata to EAD to Digital Object Descriptive Metadata Element name to MODS
3. ACM metadata to Dublin Core
4. MARC to MODS

These metadata crosswalks support internal and external data sharing requirements and search mapping.

Implementation

SLNSW has developed a Metadata Application Profile that specifies metadata elements and crosswalks that will enable the Library to manage and describe its archival collections, digital objects, and web content. At the time of writing SLNSW has completed confirmation and review of the Metadata Application Profile with the successful tenderers for the new ACMS and DAMS. The metadata profile will continue be refined as part of the systems design and implementation process. The Library's expected time frame for implementation of the Metadata Application Profile is mid-2007.

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