

Metadata Diversity – An overview on Metadata Standards and Schemas

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Abstract

Information resources are available in various kinds of media and forms. Diverse metadata standards and schemas exist to describe them which is crucial for preservation and archiving, organisation, resource discovery and information retrieval across platforms. A new metadata standard is being developed with the combination of existing metadata standards and schemas to solve emerging media and document formats. The paper presents an overview on various types of metadata standards and schemas.

Keywords: Metadata Standard, Metadata Schema, Access Points, Diverse data formats

1. Introduction

In the recent years the knowledge communities have been publishing their scholarly work in diverse formats beyond the text realm. Metadata is the structured data about information sources is a key to retrieve relevant information that provides meaningful access points for the searchers. There exist different metadata schemas and standards that are best suited to different knowledge communities according to their scope, purposes and priorities. The present paper provides an overview on various Metadata schemas and standards.

2. Metadata :

Metadata is the descriptive and classification information about digital object or digital resource, is crucial for preserving and sharing of information resources. The communities

and content providers in all the areas are on constant lookout for refinements and agreements in the semantics of specialized metadata to enable new formats internationally. No single type of metadata can suit every application, every type of resource, and every community of users. A metadata framework¹ can be viewed as having five key components (i) A schema - the categories of information you choose to record (ii) Vocabulary - specific 'words' or 'values' you enter into those categories (iii) Conceptual model - the underlying model that describes how all the information and concepts inherent in a resource are related to one another (iv) Content standard - practical standards that describe how specific information should be entered within metadata schema categories (e.g. Cataloguing Cultural Objects) and (v) Encoding - which is concerned with the way the metadata is presented (e.g. XML).

3. Metadata Schemas and Standards: Definitions

A metadata standard will normally support a number of defined functions, and will specify elements which make these possible. A metadata standard support the following functions²:

- (i) Descriptive Metadata enables identification, location and retrieval of information resources by users, often including the use of controlled vocabularies for classification and indexing and links to related resources
- (ii) Technical Metadata describes the technical processes used to produce, or required to use a digital object
- (iii) Administrative Metadata is used to manage administrative aspects of the digital object such as intellectual property rights and acquisition. Administrative Metadata also known as meta-metadata deals with information concerning the creation, alteration and version control of the metadata itself.
- (iv) Use Metadata manages user access, user tracking and multi-versioning information
- (v) Preservation Metadata deals with digital resource preservation activities such as migrations and checksum calculations.

Semantic definitions include both Metadata Structure Standards and Metadata Content Standards. Metadata Schemas develop in response to a community need, widely used and gain acceptance while still in development to enable the best possible description of a resource type of their needs. The development of such schemas tends to be controlled through community consensus combined with formal processes for submission, approval and publishing of new elements³. These schemas when ratified by professional, national or international bodies such as ICA (International Council on Archives), BSI (British Standards Institution) and ISO (International Organization for Standardization) become standards.

NISO (2004) states that a metadata schema⁴ consists of a set of elements designed for a specific purpose, such as describing a particular type of information resource. The Report of the American Library Association Committee on Cataloguing : Description and Access Task Force on Metadata (CC:DA 2000) states that metadata schema⁵ provides a formal structure designed to identify the knowledge structure of a given discipline and to link that structure to the information of the discipline through the creation of an information system that will assist the identification, discovery, and use of information within that discipline.

A metadata element set has two basic components⁵: (i) Semantics – definitions of the meanings of the elements and their refinements and (ii) Content – declarations or instructions of what and how values should be assigned to the elements.

4. Types of Metadata standards and schemas

Unfortunately a unique definitive metadata standard does not exist for so many diverse formats of documents or digital objects, type of user community, type of institutions. Metadata schemes are the sets of metadata elements designed for a specific purpose, with meaning of each element specifying the content / syntax rules. The following table lists out some of the metadata standards.

S. No.	Name of the Metadata Standard	Details
1.	Describing Archives: A Content Standard (DACS)	DACCS ⁶ published by the Society of American Archivists (SAA), a US implementation of international standards (i.e., ISAD[G] and ISAAR[CPF]) is an output-neutral set of rules for describing archives, personal papers, and manuscript collections, creators of archival materials and can be applied to all material types at all levels of description, and the rules are designed for use by any type of descriptive output, including MARC 21, Encoded Archival Description (EAD), and Encoded Archival Context (EAC). DACS facilitates consistent, appropriate, and self-explanatory description of archival materials and creators of archival materials. The Second Edition of DACS consists of two parts: Describing Archival Materials and Archival Authority Records.

2.	EXIF (Exchangeable Image File Format)	EXIF ⁷ is a technical metadata standard developed by JEITA (Japan Electronics and Information Technology Industries Association) according JEIDA/JEITA/CIPA specifications. It specifies the formats that can be written to and read from a digital still image file itself, images, sound, and ancillary tags used by digital cameras, scanners and other systems which can handle image and sound files. This standard consists of the Exif image file specification and the Exif audio file specification.
3.	e-GMS (e-Government Metadata Standard)	The e-GMS ⁸ is the UK e-Government Metadata Standard, an application profile of the Dublin Core Metadata Element Set. The e-GMS as part of the e-Government Interoperability Framework (e-GIF) defines how content of UK public sector bodies such as web pages and documents in order to make such information more easily managed, found and shared. The metadata standard consists of mandatory, recommended and optional metadata elements.
4.	ISO 19115:2003(E) — Geographic Information: Metadata ⁹	ISO 19115:2003 describes geographic information and services providing information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data. This is applicable to the cataloguing of datasets, clearinghouse activities, and the full description of datasets; geographic datasets, dataset series, and individual geographic features and feature properties. Its principles can be extended to other forms of geographic data such as maps, charts, and textual documents as well as non-geographic data.
5.	PREMIS	The PREMIS ¹⁰ Data Dictionary for Preservation Metadata provides a "dictionary" of core metadata elements used to support the preservation of digital objects and ensure their long-term usability. PREMIS provide a conceptual framework for preserving digital and non-digital resources is developed influenced by a conceptual model called the Open Archival System (OAIS). The PREMIS Editorial Committee coordinates revisions and implementation of the standard. An XML-encoding for PREMIS intended to facilitate its use with other XML-based metadata such as METS is available on website.

6.	Resource Description and Access (RDA)	Resource Description and Access (RDA) ¹¹ published by Library of Congress, is the cataloguing and data content standard that is used to create and change bibliographic data and provides guidance on how to enter into library-based metadata schemas. RDA is believed to replace Anglo American Cataloguing Rules (AACR).
7.	Machine Readable Catalogue (MARC)	MARC ¹² is a very extensive and formalised metadata standard to describe bibliographic material and non-book material or archival collections of library. MARC developed by US Library of Congress is a rigid way of encoding its data having hundreds of potential categories. It is used to create records that can be used by computers, and to share those records among libraries. MARC 21 is the predominant version as a result of the harmonization of USMARC, CANMARC and UNIMARC. The MARC 21 family of standards now includes formats for authority records, holdings records, classification schedules, and community information, in addition to the format for bibliographic records.
8.	Dublin Core Metadata Initiative (DCMI)	The Dublin Core ¹³ Metadata Element Set (v 1.1) ¹⁴ is a vocabulary of core fifteen elements which are broad and generic, for use in wide range of resources description. Dublin core is a part of a larger set of Dublin Core Metadata Initiative (DCMI) contains vocabularies, DCMI Metadata Terms [DCMI-TERMS], sets of resource classes (DCMI Type Vocabulary [DCMI-TYPE]), vocabulary encoding schemes, and syntax encoding schemes. The terms in DCMI vocabularies are used in combination with other compatible vocabularies in the context of application profiles and on the basis of the DCMI Abstract Model [DCAM]. DCMI Namespace Policy [DCMI-NAMESPACE] ¹⁵ describes how DCMI terms are assigned Uniform Resource Identifiers (URIs) and sets limits on editorial changes made to the labels, definitions, and usage comments associated with existing DCMI terms.
9.	Text Encoding Initiative (TEI)	The TEI ¹⁶ based on SGML is a standard for describing and encoding literary texts, used by libraries, museums, publishers, and individual scholars to present texts for online research, teaching, and

		<p>preservation. It is a set of Guidelines specifying encoding methods for machine-readable texts, in humanities, social sciences and linguistics. TEI Header provides metadata about work, the remainder of the file 'marks up' the transcribed text, indicating chapters, paragraphs, and other noteworthy features. TEI Lite is the simplified version of TEI.</p>
10.	<p>Metadata Encoding and Transmission Standard (METS)</p>	<p>The METS¹⁷ schema is a standard for encoding descriptive, administrative, and structural metadata regarding objects viz., a digitised book, with bibliographic data, images and transcribed text, expressed using the XML schema. METS standard developed by Library of Congress can structure or "package" other metadata or data for exchange or delivery by embedding or link to other XML-based metadata (e.g. MODS, MIX, PREMIS or TEI).</p>
11.	<p>Metadata Object Description Schema (MODS)</p>	<p>XML based schema, MODS¹⁸ is a bibliographic element set used for a variety of purposes particularly in Libraries. It consists a subset of MARC fields and uses language-based tags, regrouping elements from the MARC 21 bibliographic format.</p>
12.	<p>MIDAS Heritage: the UK Historic Environment Data Standard</p>	<p>MIDAS¹⁹ provides a framework data standard for recording all types of historical and cultural heritage digital assets (e.g. buildings, archaeological sites, shipwrecks, areas of interest, artefacts and ecofacts), their management related activities, map depiction (GIS) and information sources. MIDAS has been developed by English Heritage on behalf of the FISH.</p>
13.	<p>Encoded Archival Description (EAD)</p>	<p>EAD²⁰ maintained by the US Library of Congress and Society of American Archivists, is used for encoding finding aids such as inventories, indexes, or guides that are created by archival and manuscript repositories to provide information about specific collections or archival materials, for use in a networked environment, allows the standardization of collection information in finding aids within and across repositories. EAD adopts a multi-level approach to describe, breaking it from whole into groups, series and individual items, provides an XML encoding for archival descriptions. To enter data into EAD, archivists use guidelines of DACS content standard.</p>

14.	IEEE Learning Object Metadata (LOM)	LOM ²¹ is an open data model developed by Institute of Electrical and Electronics Engineers, encoded in XML, is used to describe a digital learning object and resources. It supports the reusability of learning objects, to aid discoverability, and to facilitate their interoperability, in online learning management systems (LMS). LOM is a double IEEE and IMS standard and it is integrated in IMS Content Packaging ²² . It can also be used to describe the package as a whole, but also individual elements. The first part of IEEE LOM ⁴⁹ consists of set of metadata categories and the later part outlined how LOM was to be encoded as XML. UK LOM Core ²⁹ is UK version of the IEEE LOM developed by CETIS (the Centre for Educational Technology Interoperability Standards).
15.	Functional Requirements for Bibliographic Records (FRBR)	FRBR ²³ is an international conceptual model published by IFLA, for describing information resources as entities and their relationships within a library context. FRBR is not a metadata schema, but used to analyse existing schemas or influence new schemas or content standards.
16.	NISO Technical Metadata for Digital Still Images	NISO Technical Metadata ²⁴ is a "data dictionary" of categories of data used to describe the technical aspects of raster-based digital images (e.g. TIFF, JPEG, GIF) and enable users to develop, exchange, and interpret digital image files. It uses MIX standard to represent it as XML for other XML-based schema (e.g. METS).
17.	PBCore (Public Broadcasting Metadata Dictionary)	PBCore ²⁵ (Public Broadcasting Metadata Dictionary) is used to describe digital and analog media, for use by television, radio and web broadcasters to easily retrieve and shared among colleagues, software systems, institutions, community and production partners, private individuals and educators. The PBCore XML Schema Definition (XSD) defines the structure and content of PBCore.
18.	SMPTE (Society of Motion Picture Technical	SMPTE ²⁶ metadata data dictionary is for video, audio and multimedia data in their various forms. SMPTE metadata must conform to 'dictionary structure standard' and 'metadata dictionary recommended practice' (SMPTE RP 210) which is a registered set of

	Experts) Data Dictionary	metadata element descriptions. SMPTE dictionary alone is rarely used.
19.	SPECTRUM	SPECTRUM ²⁷ is a UK standard for museum documentation used to document museum procedures and objects. SPECTRUM is developed and maintained by the Collections Trust.
20.	TV-Anytime	TV-Anytime ²⁸ is a metadata specification used in Electronic Program Guides (EPG) or in web pages to describe multimedia content. The consumer uses the most visible parts of metadata, the attractors/descriptors, to search and select content available from a provider. Another set of TV-Anytime metadata describes user preferences, representing consumption habits, and defining other information such as demographics models, for targeting a specific audience. TV-Anytime schema cannot easily be incorporated into other metadata models.
21.	XMP (Extensible Metadata Platform)	XMP ³⁰ is an XML-based open Adobe standard, used within Adobe's imaging software and other tools. XMP can integrate other metadata schemas and write this data into an image file.
22.	Cataloguing Cultural Objects (CCO)	CCO ³¹ developed by Visual Resources Association (VRA) is a data content standard, guides in entering data into schemas relating to cultural objects, viz., VRA Core and CDWA Lite.
23.	P/Meta	P/Meta ³² developed by European Broadcasting Union's is a flexible metadata standard used to exchange media between professional media broadcasting organisations. P/Meta is language and system independent.

The following table lists out some of the Metadata encoding schemas:

S. No.	Name of the Schema	Details
1.	Categories for the Description of Works of Art (CDWA)	Categories for the Description of Works of Art (CDWA) ³³ is an extensive metadata schema for objects viz., art, architecture, material culture, groups and collections of works, and related images. Maintained by the Getty Research Institute, CDWA consists of 532 categories of which some are core and mandatory. CDWA Lite ³⁴ is

		the XML coding of selected categories of CDWA intended to work with the CCO data content standard and OAI-PMH .
2.	HTML (Hyper-Text Markup Language)	HTML ³⁵ consists of tags and elements enclosed in angle brackets. A web browser reads HTML files and displays them into visible or audible web pages. HTML describes the structure of a website semantically, making it a markup language.
3.	SGML (Standard Generalized Mark-up Language)	The Standard Generalized Markup Language (SGML ³⁶) defines generalized markup languages for documents. An SGML document have three parts: (i) SGML Declaration, (ii) Prologue, containing a DOCTYPE declaration and markup declarations together make a Document Type Definition (DTD), and (iii) instance itself, containing one top-most element and its contents.
4.	XML (Extensible Mark-up Language)	XML ³⁷ allows users to create their own tags to annotate web pages. XML and its related standards, such as namespaces, and schemas, form a common means for structuring data on the Web but without communicating the meaning of the data.
5.	RDF (Resource Description Framework)	RDF ³⁸ a metadata data model evolved as mode for conceptual description and a mechanism to provide more meaning to information on the web.
6.	MIME (Multipurpose Internet Mail Extensions)	MIME ³⁹ an Internet standard that extends the format of email supporting (i) Text other than ASCII (ii) Non-text attachments (iii) Message bodies with multiple parts (iv) Header information in non-ASCII character sets.
7.	IPTC	International Press Telecommunications Council (IPTC) ⁴⁰ is a descriptive metadata schema used to read from an image file itself, can be embed directly into the header of image files. IPTC Core, a standard for using IPTC within Adobe's XMP schema. IPTC Photo Metadata standard was released in 2008.
8.	ISAD(G)	General International Standard Archival Description (ISAD(G)) ⁴¹ metadata elements are used to describe archival collections by adopting a multi-level approach, from whole to groups, series and

		individual items. The development of EAD and European SEPIADES schema are influenced by ISAD(G).
9.	MIX (NISO Metadata for Images in XML)	MIX ⁴² is an XML-based schema for encoding the NISO Technical Metadata for Digital Still Images developed and maintained by Library of Congress is intended to use with METS.
10.	MPEG-7 and MPEG-21 (Moving Pictures Expert Group)	MPEG-7 ⁴³ is a multimedia metadata schema used to describe time-based digital image, video or audio content by segmenting and attributing metadata to each. It is used alone or as a schema within models viz., METS or MPEG-21. MPEG-21 ⁴⁴ provides an XML framework for "packaging" sets of metadata and files representing complex digital resources. The Digital Item Declaration Language (DIDL) and Rights Expression Language (REL), are used to describe the digital resource, and provide rights-related information respectively.
11.	SEPIADES (SEPIA Data Element Set)	SEPIADES ⁴⁵ based on ISAD(G) provides a metadata schema, uses multilevel approach to describe archival photographic collections does not provide a particular encoding. It was developed by SEPIA Project as a set of "Recommendations for cataloguing photographic collections". A cataloguing tool which incorporates the standard and generates records in a Dublin Core format compatible for OAI-PMH has been developed.
12.	VideoMD and audioMD	VideoMD ⁴⁶ and audioMD ⁴⁶ was designed by the Library of Congress are used to describe the top 36 technical elements of digital video and audio recordings expressed as XML used in conjunction with other systems, such as within METS records respectively.
13.	VRA Core	The VRA Core ⁴⁷ originally based on CDWA, describes art or cultural images with 17 core categories. An XML encoding for VRA Core (4.0) draws on CCO content standard.
14.	Conceptual Reference Model (CRM)	The CRM ⁴⁸ is a conceptual model developed by CIDOC of the International Council of Museums (ICOM), provides formal definitions and structures to describe the concepts and relationships used in cultural heritage documentation in museums or archives.

		CRM represented as XML is used within Semantic Web applications, is a tool used for analysing and mapping existing schemas or as a guide to creating new schemas.
15.	OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting)	The OAI ⁵⁰ Protocol for Metadata Harvesting (OAI-PMH) provides a means of requesting metadata records from OAI-compliant repositories. The data is harvested from data providers and is made available in a standard XML format and this harvested metadata can then be searched together from one place by a service provider.

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