CREATING METADATA BEST PRACTICES FOR DIGITAL A/V RESOURCES

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1. Abstract

The University of Illinois Library is in the process of creating new and updated metadata best practices documentation for digital audiovisual (A/V) resources to augment guidelines established in 2007. The goal has been to create documentation that is simple enough to provide general guidelines to the entire campus community while ensuring the integrity of the metadata submitted with A/V resources to the library that work for both the access and the preservation of resources created and purchased by the campus. The library underwent a research phase that spanned a period of several months, interviewing stakeholders and surveying the current state of the art in the broader metadata landscape. After the research phase, it was decided to limit the scope of the recommendations to a set of required and optional metadata elements only, leaving the choice of schema selection to the ingesting repository systems. However, recommendations for potential schemas have also been included for reference. Further recommendations have been made for automated metadata extraction tools such as MediaInfo[22] and Jhove[23] that will increase the level of metadata uniformity in the digital A/V resources currently being created and managed by the campus, while facilitating submission to the library's preservation repository. This paper will outline the findings from the research phase and share the new and updated library's Digital A/V Metadata Best Practices.

2. Introduction/Background

The University of Illinois Library UIUC has provided institutional-based metadata best practices since 2007 when the library embarked on its first large-scale digitization project. The metadata best practices included different metadata aspects, such as a separate best practice guideline for different formats, (e.g., text, image, audio, and visual) along with descriptive, administrative, and preservation metadata guidelines. As the volume of digital resources increased over the years and the library began developing and implementing a preservation repository for digital resources, the need to have a new and updated metadata best practice document for A/V resources emerged. As a first step, the library decided to have an initial research phase to identify the primary metadata requirements for digital A/V resources as well as to gain a broad view of the current metadata landscape with regard to available metadata standards and institutional best practices presently employed by other academic libraries. Several primary questions have been the focus of initial investigation including:

- Why should we have different metadata for A/V resources?
- What are the characteristics of metadata for A/V resources?
- What metadata standards are available?
- What are the commonly used/needed metadata elements for A/V resources?
- Which elements are optional and which are required?
- What tools are available for technical metadata extraction?

This paper will briefly detail UIUC Library's exploration into each of these questions and share the lessons learned from the process that can and should be considered when creating new, user-friendly metadata best practices.

22 http://mediaarea.net/en/MediaInfo
23 http://sourceforge.net/projects/jhove/

3. Findings

3.1. Why should we have a different metadata for A/V resources?

Digital A/V resources carry with them a variety of essential characteristics that differ greatly from conventional analog library resources. When one considers the wide variety of compression formats, file types, software and hardware requirements, and creation and dissemination methods associated with digital A/V files, it becomes quickly apparent that more than a traditional set of descriptors is necessary to capture and preserve all of their essential characteristics. As Minglian, Xingxing, and Jiuzhen explain:

> Different media types mean different characteristics of information resources in format, storage environment, and reading equipment...The media types of audiovisual resources include text, image, audio and moving picture...[The] storage mediums of audiovisual resources [are] quite complicated. DVD, LD, VCD, videotapes of many specifications, CD, recordings, audiotapes, and magnetic tapes are the most commonly used storage mediums. Meanwhile DVW, MII, DVC, SX, DS, digital streaming tapes and hard disk are also in the market. The content on these storage medias can be made into different compression formats according to its purpose, such as TIFF, GIF, JFIF, and PICT...Compared to other kinds of information resources, creators and physical characteristics for audiovisual resources are very complicated, especially for film and video recordings.[24]

Having established the need for unique metadata for digital A/V resources, the specific characteristics of digital A/V objects were examined to gain a better understanding of what these unique metadata requirements are.

3.2. What are the characteristics of metadata for A/V resources?

Metadata requirements for digital A/V resources can be divided into three distinct categories: structural, descriptive, and administrative. Structural metadata is used to link the metadata record itself to the digital resource.[25] It also describes the configuration of complex objects that are comprised of multiple parts or sections and is often closely associated with the content management system. Since digital resources are not placed on physical shelves in the sense that books and physical objects are, this form of metadata is necessary for ensuring a clear understanding of the constituent parts of a resource, its extent, and its relationship to other items within an institution (a digital copy of an image as related to the original analog print).

Descriptive metadata is metadata that summarizes the content of the digital object including such elements as 'Title', 'Author', 'Subject', and 'Publisher'. This can be defined further as the metadata that represents the intellectual content and the pertinent information about its (the metadata's) creation.[26] This descriptive metadata is then enriched through the use of administrative metadata which can be subdivided generally into three distinct metadata classes: technical, rights management, and source metadata. Technical metadata describes the characteristics of the file proper (e.g., file size, color-space, sampling-rate, encoding, and compression). Rights

24 Minglian, D., Xingxing, Y. and Jiuzhen, Z., "A Study on Audiovisual Metadata". ***International Conference on Dublin Core and Metadata Applications***. last modified October, 2004. http://dcpapers.dublincore.org/pubs/article/view/776/772

25 "Metadata and Digital Video," JISC. Accessed April 21, 2014: http://www.jiscdigitalmedia.ac.uk/guide/metadata-and-digital-video

26 "Metadata Best Practices," University of Colorado Digital Library. Accessed April 21, 2014: https://www.cu.edu/digitallibrary/cudlmetadatabp.pdf

metadata describes copyright status, user restrictions, licensing, and any other constraint that might affect the use of the resource. Finally, source metadata describes the source from which the digital object is derived. There are varying degrees of granularity or description which can be produced through the employment of each of these different types of metadata, the degree of which will have to be determined by the institution based upon the essential characteristics of the digital resource and the needs of their user community.

3.3. What metadata standards are available?

There are a variety of metadata standards from which to choose when considering the preservation of digital A/V resources. A wide selection of these standards were explored in the initial research phase of this project including: AudioMD, METS, METSRights, MODS, MPEG7, MPEG21, PBCore, PREMIS, Qualified Dublin Core, and VideoMD.

AudioMD, VideoMD, PBCore and PREMIS are particularly strong metadata schemas for describing digital A/V resources with METS serving as a powerful wrapper for combining elements from different schemas based on the needs of the user community and the repository. However, after an initial investigation it was determined that the actual prescription of any one metadata standard went beyond the intended scope of the project (which is to create a simple guideline for the entire campus community—neophyte and expert alike) and was secondary to the actual definition of key or required metadata elements. Nevertheless, the final document will include a section pertaining to available metadata schemas with links to appropriate documentation, a list of which can be found in Table 1.

Standard	Documentation
METS	http://www.loc.gov/standards/mets/
METSRights	http://www.loc.gov/standards/rights/
MODS	http://www.loc.gov/standards/mods/
MPEG7	http://mpeg.chiariglione.org/standards/mpeg-7/mpeg-7.htm
MPEG21	http://mpeg.chiariglione.org/standards/mpeg-21
MPEG's DDL	http://mpeg.chiariglione.org/standards/mpeg-7/description-definition-language
MPEG's RDD	http://mpeg.chiariglione.org/standards/mpeg-21/rights-data-dictionary
PBCore	http://pbcore.org/index.php
PREMIS	http://www.loc.gov/standards/premis/v2/premis-2-0.pdf
VideoMD/AudioMD	http://www.loc.gov/standards/amdvmd/

Table 1: Potential Metadata Standards for Digital A/V Resource Description

3.4. What are the commonly used/needed metadata elements for the A/V resources?

The California Digital Library (CDL) Guidelines state: "Whenever possible, provide the most granular and richest metadata possible."[27] This is a commendable goal, but one which must also be tempered by the needs of the user community. A list of possible A/V metadata elements was compiled (see Table 2) during the research phase, extracted from publicly available institutional standards as examples of current elements in use. Though there is some degree of overlap between certain numbers of these, they nevertheless provide a fairly comprehensive representation of the scope of available metadata elements for digital A/V resources.

Element	Description
Alternative Modes	Equivalent modes of the item.
Aspect Ratio	The ratio of horizontal and vertical proportions.
Bit Depth	How much data is sampled when information is digitized, encoded or converted
Channel Configuration	The arrangement or configuration of specific channels.
Checksum	Ensures file completeness and integrity.
Color Space	The color space of the resource, (RGB, CMYK, black, white, gray scale, color etc.).
Contributor	The people or organizations that contributed to the item's creation.
Contributor Role	The responsibilities of the person or organization.
Coverage Spatial	Geographic location covered.
Coverage Temporal	The covered time-span.
Creator	Person or group primarily responsible for the item's creation.
Creator's Role	The responsibilities of the person or group designated as creator, (producer, writer, etc.)
Data Rate	The data rate for the individual item, (frame rate etc.).
Date Created	The date the item was created.
Date Issued	The date the item was issued.
Description	A prose description of what the item is about.
Dimensions	The dimensions of the physical object, (letter box, jewel case, etc.)
Duration	The overall length of the item.
Encoding	The method by which the item is compressed by scheme.
File Size	The size of the digital item.
Genre	Description of an item's genre.
Identifier	Unique ID for the item, (e.g. UPC code).
Language	The primary language or languages used in the resource.

27 "Guidelines for Digital Objects," California Digital Library. Accessed April 21, 2014. http://www.cdlib.org/services/access_publishing/dsc/contribute/docs/GDO.pdf

Element	Description
Location Digital	The location of the digital item.
Location Physical	The location of the physical item.
Media Type	The type of media, (e.g. text, moving image, sound, etc.).
Migration	Administrative information about migration events.
Physical Description	Physical description of the item, (e.g. CD, DVD, etc.)
Playback Speed	The rate at which the item should be played.
Publisher	The organization responsible for the distribution of the item.
Publisher's Role	The responsibilities of the publisher.
Recording Equipment	Brand, name, and model number of recording equipment.
Related Identifier	Identifier to locate the items related to the described resource.
Rights Link	URI to the rights statement.
Rights Summary	A rights statement describing how the item may be used.
Sampling Rate	How often the data is sampled for digitization.
Subject	Headings or keywords related to the topic.
Title	The title of the item or track.
Tracks	The number and type of tracks found in the item.
Type	The type of media in the track.

Table 2: Possible A/V Metadata Elements

3.5. Which elements are optional? Which are required?

Having reviewed a rather large list of possible metadata elements, it is important to again emphasize that the selection and use of any one element will depend largely upon the institutional needs of both the repository and its users. Several institutions' standards were reviewed and it was found that most only required a small 'core' set of elements, leaving the rest as optional. Five institutions were consulted including: the University of Colorado, (UC) the University of Notre Dame, the University of North Carolina, Rutgers University, and UIUC's own previous guidelines from 2007. They were selected based upon the availability of their best practices documentation to a web search. Though most institutions had a lengthy list of optional or available metadata elements, UC and UIUC were the only two of the five that had a set of clearly required elements. These elements included: 'Date of Original', 'Collection Name', 'File Format', 'File Size', 'Fixity', 'Holding Institution', 'Identifier', 'Language', 'Preservation Level', 'Publisher', 'Relationship', 'Rights Management', 'Sub-collection Name', 'Subject', 'Title', and 'Type'. These findings were influential in the development of the new UIUC library's metadata best practice documentation.

3.6. What tools are available for technical A/V metadata extraction and automation?

There are a number of freely available metadata toolkits and extractors for digital media. The most widely used and highly recommended in our interview process (detailed below) was the MediaInfo tool. MediaInfo is a unified display of the most relevant technical and tag data for video and audio files. It extracts a wide variety of technical metadata elements from a fairly representative selection of media file formats (see Table 3). MediaInfo is free and open source and can be downloaded by anyone who works with A/V resources. Seven other metadata toolkits were considered and are listed below with descriptions derived from their respective websites:

1. **DC Meta Toolkit**[28] – Free and open source, the Dublin Core Meta Toolkit gives DSpace administrators the ability to convert large amounts of information from their desktop database programs into DSpace compatible Dublin Core metadata. The toolkit provides a number of out-of-the-box database structures to ease data collection as well as enabling users to create custom converters for existing databases.

2. **DROID**[29] – Also free and open source, the DROID (Digital Record Object Identification) is an automatic file format identification tool. It is the first in a planned series of tools developed by The National Archives of the U.K. under the umbrella of its PRONOM technical registry service.

3. **ExifTool**[30] – ExifTool is a platform-independent Perl library plus a command-line application for reading, writing and editing meta information in a wide variety of files. ExifTool supports many different metadata formats including EXIF, GPS, IPTC, XMP, JFIF, GeoTIFF, ICC Profile, Photoshop IRB, FlashPix, AFCP and ID3, as well as the maker notes of many digital cameras by Canon, Casio, FLIR, FujiFilm, GE, HP, JVC/Victor, Kodak, Leaf, Minolta/Konica-Minolta, Nikon, Nintendo, Olympus/Epson, Panasonic/Leica, Pentax/Asahi, Phase One, Reconyx, Ricoh, Samsung, Sanyo, Sigma/Foveon and Sony.

4. **JHOVE**[31] – Another free and open source tool, JHOVE is a format-specific Digital Object Validation API written in Java. Currently supported formats are AIFF, ASCII, Bytestream, GIF, HTML, JPEG, JPEG 2000, PDF, TIFF, UTF-8, WAV, and XML. Documents are analyzed and checked for being well-formed (consistent with the basic requirements of the format) and valid (generally signifying internal consistency). JHOVE notes when a file satisfies specific profiles within formats (e.g., PDF/X, HTML 4.0).

5. **Metadata Extraction Tool**[32] – Free and open Source, the Metadata Extraction Tool was developed by the National Library of New Zealand to programmatically extract preservation metadata from a range of file formats like PDF documents, image files, sound files, Microsoft office documents, and many others. The tool was initially developed in 2003 and released as open source software in 2007. The current version can be downloaded from the SourceForge download page.
6. **Metadata Extractor**[33] – The Metadata Extractor is a straightforward Java library for reading metadata from image files. Like the others, it is also free and open source and will process files of type: JPEG, TIFF, PSD, PNG, BMP, GIF, Camera RAW (NEF/CR2/ORF/ARW/RW2).

7. **VLC Media Player**[34] – VLC is a free and open source cross-platform multimedia player and framework that plays most multimedia files as well as DVD, Audio CD, VCD, and various streaming protocols. It is useful in a metadata context in that it will open most audio/visual file types and return technical metadata.

28 http://www.wijiti.com/projects/dcmetatoolkit
29 http://www.nationalarchives.gov.uk/information-management/projects-and-work/droid.htm
30 http://www.sno.phy.queensu.ca/~phil/exiftool/
31 http://sourceforge.net/projects/jhove/
32 http://meta-extractor.sourceforge.net/
33 https://code.google.com/p/metadata-extractor/
34 http://www.videolan.org/vlc/index.html

	mkv	ogg ogm	Riff	mpeg 1/2	Mpeg4 M4a	mp2 /mp3	Wm	Qt	Real	Ifo	AC3	DTS	AAC	MAC	Flac	Other Audio
General	Part	Yes	Part	Yes	Yes	Yes	Part	Part	Part	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Duration	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Author	No	Yes	No		Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes
Title	No	Yes	No		Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes
Subtitle	No	Yes				Yes								Yes	Yes	Yes
Location	No	Yes														
Album	No	Yes			Yes	Yes	Yes							Yes	Yes	
Track number	No	Yes			Yes	Yes								Yes	Yes	
Track count	No				Yes	Yes	Yes									
Set number	No				Yes	Yes										
Set count	No				Yes	Yes										
Date	No	Yes			Yes	Yes	Yes	Yes	Yes	Yes						
Recording date	No					Yes										
Comment	No	Yes	No		Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	
Copyright	No	Yes	No			Yes	Yes	Yes	Yes	Yes						
Url	No	Yes				Yes										
Other tags	No	Yes			No	Yes	No	No	No					Yes	Yes	
Video	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes						
Codec	Yes	Yes	Yes	Yes	Yes		Yes	Yes	No	Yes						
Bitrate	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes						
Aspect	Yes	Yes	Yes	Yes	Yes		Yes	Yes	No	Yes						
Frame rate	Yes	Yes	Yes	Yes	Yes		Yes	Yes	No	Yes						
Encoder																
Encoder settings																
Audio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Codec	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	
Bitrate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Channels	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Sampling rate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Language	Yes	Yes								Yes						
Encoder						Yes										
Encoder settings						Yes										
Text	Yes	Yes														
Language	Yes	Yes														
Chapters	No	Yes														
Language	No															

*Source: http://mediaarea.net/en/MediaInfo/Support/Formats

Table 3: MediaInfo Information Extraction Capabilities by File Type

3.7. Stakeholder Meetings

During the research phase, two meetings were held with potential expert stakeholders: UIUC Library's Media Preservation Specialist, and Illinois Public Media's Director of New Media. The meeting with the Media Preservation Specialist was beneficial in that it started the conversation about what minimum requirements would be appropriate for the standard. Though nothing concrete was established at that time, the meeting established the endorsement of MediaInfo as a primary metadata extraction tool.

Illinois Public Media's Director of New Media provided invaluable practical advice for the development of the standard. As important elements, he recommended: 'Title', 'Description' (narrative or time based as need be), 'Contributors', 'Subject', 'Genre', 'Fixity', 'File Size', and 'File Duration' based on his experience as an administrator of the A/V resources as well as with his involvement in the development of PBCore—a metadata standard widely used in the public broadcasting community. He also emphasized that the rest of the metadata, particularly the technical and administrative metadata could be extracted automatically and again recommended MediaInfo as a preferred tool suggesting that the emphasis not be placed on the technical aspect as this could be easily generated by machine. He further emphasized the importance of capturing digital A/V metadata as close to the time of production as possible by the people who produce it, ensuring that good file naming conventions are in place.

4. UIUC Library's New Metadata Best Practice – Our approach

As the target audience for this new documentation is meant to be the general campus community—untrained in the metadata requirements of institutional repositories—it was decided to focus only on metadata element types without stipulating the use of any one metadata schema or standard. This decision was arrived at in part through conversations with stakeholders as outlined above, and also through the anticipation of the needs and abilities of the documentation's target audience. Standards and schemas will be applied to the metadata by the library upon ingestion.

The primary focus of the best practices documentation is centered on the creation of descriptive metadata with an emphasis on 'up-stream capture'—meaning capturing the file's metadata as close to the source of production as possible—and includes recommendations for possible metadata workflows and file naming conventions. A list of required metadata elements is then outlined as follows:

- Title
- Identifier
- File Format
- Date
- Rights Management
- Holding Institution
- Collection Name
- Preservation Level
- Fixity[35]

These required elements were selected as they address both the access and preservation requirements of the library and comprise a basic representation of descriptive, administrative (rights, technical, and provenance), and preservation metadata. A further list of optional elements is outlined in the documentation including:

35 This element is populated with a checksum generated using a tool such as the Microsoft File Checksum Integrity Verifier (MFCIV) for Windows machines (http://www.microsoft.com/en-us/download/details.aspx?id=11533), or the Terminal application on a MAC.

- File Size
- Language
- Publisher
- Subject
- Type
- Relationship

The documentation also includes a list of A/V metadata resources including references to the technical metadata extraction tools as outlined above. The recommended technical metadata extraction tool is MediaInfo for its ease of use and comprehensive coverage and a short tutorial is included showing how to use the MediaInfo tool and discussing its various capabilities including the export of metadata to HTML and .txt files.

The documentation has been kept as simple as possible. Bibliographic jargon has been avoided and concepts and terms have been used and defined to be accessible to the least initiated audience. The goal has been to create guidelines that can be quickly consulted and easily understood. However, more advanced resources have also been included to aid content creators who desire to transform their local metadata to conform to a given standard. These more advanced resources include Extensible Stylesheet Language Transformations (XSLTs) that transform metadata created in Excel into metadata standards, the Metadata Object Description Schema (MODS), the library's descriptive metadata standard for preservation packages, and PBCore, a standard supported by the public broadcasting community.

5. Lessons Learned/Conclusion

The importance of metadata is well known. As an institution that is traditionally responsible for bibliographic control, the library has been trying hard to provide best practices and guidelines for metadata creation and resource management. However, the University of Illinois Library has learned that providing metadata best practices and guidelines is different from creating *useful* metadata best practices and guidelines as documents and available resources that content creators outside of the library are aware of and actually use.

While updating and creating new and enhanced metadata best practices for the A/V resources, the library learned that:

1. Metadata best practice documents should be created for content creators, not for librarians, especially not for catalogers and metadata librarians who are trained in bibliographic control and metadata creation. Content creators know their collections and resources, but not metadata standards and library specific terms. As such, documents should use terms that are well known in the community that are familiar to content creators and managers.
2. By the same token, metadata documents should be designed for users who will use them. Instead of introducing metadata standards, it is important to identify what is important for access and preservation. The standard can be introduced as an end product generated by a tool included in the document. That is why the new metadata best practices will include a couple of XSLTs that transform metadata created in an Excel format into MODS and PBCore, so content creators can transform their local metadata to a certain standard when the contents are provided to any service portal for access and preservation.
3. Meeting with stakeholders should be considered when creating metadata best practices. Interviewing stakeholders provides insightful advice based on their practical use cases, which then help to design best practice documents that include key information and structure for users.
4. Outreach planning should also be started when creating metadata best practices. Users often do not know where or whether best practice documents and resources are available. Content creators should be informed where the metadata best practice documents and tools are so that they can get help to create metadata in a more stand-

ardized and consistent way, which will make their contents more discoverable and increase access. Heretofore, the University of Illinois Library's Metadata Best Practice documents have been available only from the library's Digital Content Creation Unit homepage. But now, the documents are also available from the Metadata Service Unit's webpage with additional resources available inside and outside of campus. For the new best practices, the library is planning to arrange meetings with content creators on campus and workshops for metadata best practices that include hands-on practice and demonstrations of metadata tools and XSLTs.

The University of Illinois Library is responsible for access and preservation of digital A/V resources created and managed on campus. In order to carry out this responsibility, the library tries to provide up-to-date and easy-to-use metadata best practices for content creators, so they can use the documents for creating consistent and quality metadata that ensures both access and preservation of resources for now and in the future.

6. Resources

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