

Enabling Audiovisual Metadata Interoperability with the European Digital Library

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Abstract. *Europeana*, the European digital library, museum and archive, will become a reference point for accessing various kinds of cultural contents, including audiovisual contents, in the near future. Thus, establishing interoperability between audiovisual collections and their specific metadata models and the European Digital Library (EDL) is an important issue. We propose a flexible approach for mapping between metadata models and a lightweight method for deploying metadata associated with audiovisual content. Further, we discuss its application for enabling interoperability between audiovisual archives and the EDL.

1 Introduction

There exist a number of portals for accessing cultural digital contents. They target different user groups and many collections are only accessible to professionals. Several initiatives in the domain of audiovisual archives (e.g. INA's Archives pour tous, BBC Open Archive, Beeld en Geluid online public collections¹) as well as in the domain of libraries are heading in this direction. *Europeana*², the European digital library, museum and archive, developed by the EDLnet project, will become in the future a reference point for accessing various kinds of cultural contents, including audiovisual contents. An important issue is to obtain a high interoperability between audiovisual collections and *Europeana*, in order to enable a wide user community unified access to various types of cultural heritage content.

This paper is organised as follows: Section 2 discusses the state of the art of interoperability of audiovisual metadata with the European Digital Library and the Semantic Web. Based on this analysis we propose in Section 3 a flexible approach to mapping audiovisual metadata to EDL compatible target formats and a lightweight deployment mechanism and discuss its application to interfacing with the EDL. Section 4 concludes the discussion.

¹ a comprehensive list can be found at <http://del.icio.us/VideoActive>

² <http://www.europeana.eu>

2 State of the Art

Interoperable metadata is a key issue for accessing audiovisual content collections. Metadata exchange is hindered by the diversity of metadata formats and standards that exist to cover the specific requirements in certain steps of the audiovisual media production process and in different communities [2]. An overview of existing standards and formats for audiovisual metadata can be found in [11]. There exists also large number of different metadata models and formats for describing the various types of cultural heritage assets (cf. [13]).

Due to this diversity, mapping between different metadata standards is of critical importance. Unfortunately, the “Rosetta Stone” of metadata standards does not exist, i.e. there is no single metadata standard or format that can represent all the different types of metadata, the different structures and granularities of various types of media descriptions [2, 13]. Previous work has shown that this is not even possible in the audiovisual archive domain [3], i.e. there is no single standard or format that satisfactorily covers all aspects of audiovisual content descriptions. A metadata mapping approach using one generic intermediate format is thus not feasible. Due to the number of different formats and standards involved, defining mappings between each pair of formats is also not a feasible approach, as the number of required mappings grows exponentially.

2.1 Audiovisual Content and the Digital Library Community

The digital library community has done significant work in order to establish common metadata models and interoperable metadata representations. However, the EDL and the audiovisual archive community have still not achieved interoperability and the efforts for establishing protocols and formats for interchange are in a very early stage. According to [5] there is ongoing work between the EDL project and the DISMARC³ and VideoActive⁴ projects. DISMARC intends to develop an application profile for audio objects (using metadata terms from the Dublin Core Metadata Initiative plus the Dublin Core Libraries Application Profile [6]). VideoActive uses qualified Dublin Core and MPEG-7. Both projects plan to provide an OAI-PMH⁵ interface to their systems.

One important aspect that distinguishes audiovisual content from other media types is the temporal dimension of media items. This is one of the main issues that need to be addressed in order to establish interoperability with other cultural heritage collections. The current EDL metadata model lacks support for representing temporal segments of content and annotating them with specific metadata (support for intra-object descriptions is only one of the long-term

³ <http://www.dismarc.org>

⁴ <http://videoactive.wordpress.com>

⁵ Open Archives Initiative, Protocol for Metadata Harvesting, <http://www.openarchives.org>. OAI-PMH is a low-barrier mechanism for repository interoperability. It is a set of six verbs or services that are invoked within HTTP that can be used to exchange documents according to any XML format as long as it is defined by XML schema.

goals [9]), which is commonly done in audiovisual archives, at least for a subset of the collection. For example, major broadcast archives document often more than 50% of their collection analytically [7], i.e. with intra-object metadata. Further aspects which are specific to audiovisual content are among others the number of different objects related to the production of the content (e.g. scripts, story boards), the number of versions that may exist (e.g. rushes, several edited version for different markets and distribution channels), the fact that the semantics of audiovisual content severely depends on the context in which it is used and the much more complex rights situation.

2.2 Interoperability with the Semantic Web

Interoperability of access portals for cultural digital content with the Semantic Web is of growing importance. The EC working group on digital library interoperability [9] defines Semantic Web interoperability with the outside world as one of its goals. In the MultiMatch project⁶, OWL is used as a representation of the internal metadata model, which can also serve as a gateway to the Semantic Web. The representation of multimedia metadata in formats that are interoperable with the Semantic Web is still an active research issue. If multimedia objects are described beyond simple cataloging, diverse and partly complex elements need to be represented. A number of multimedia ontologies have been proposed, partly defining new metadata schemes, partly representing existing ones (e.g. MPEG-7). A good overview on the work on multimedia ontologies can be found in [8]. COMM⁷ is a new recent proposal for a multimedia ontology. Recently interoperability issues regarding multimedia ontologies have been discussed [15].

One issue that has to be considered is the amount of metadata resulting from the fine-grained description of multimedia content. In a scenario, where just the visual modality of a video is described by low-level descriptors of key frames, one million triples are required to represent only a single hour of video⁸. Given the amount of multimedia data to be accessed in a realistic scenario, this suggests that Semantic Web technologies cannot be easily applied to all metadata in a repository but one has to consider very carefully which part of metadata is suitable for being represented in a Semantic Web compatible format.

3 Flexible Approaches to Mapping and Deployment

In [4] we have recently investigated issues with real-world multimedia assets regarding the Semantic Web. Based on this analysis and the lessons learned from diverse projects in the cultural heritage domain we propose a novel approach to enable interoperability between audiovisual metadata and the European Digital Library. The approach contains two main elements:

⁶ <http://www.multimatch.org>

⁷ <http://comm.semanticweb.org>

⁸ <http://lists.w3.org/Archives/Public/public-xg-mmsem/2007Jan/0001.html>

- A flexible approach to *mapping* that avoids the scalability problem of the currently common mapping approach, i.e. defining hand-crafted mappings between distinct pairs of standards.
- A lightweight approach for the *deployment* of metadata along with the audiovisual content. The term “deployment” is to be understood very broadly as a publication to any target system, e.g. the EDL, some search portal, the Semantic Web.

3.1 Mapping based on Formal Semantics of Metadata Standards

Instead of defining mappings for each pair, we propose to formalise the semantics of the standards involved (e.g. Dublin Core, EBU P_Meta, MPEG-7, etc.). The formal description relates common concepts of content descriptions to their respective manifestations in the different standards. The formalisations can then be used to derive mappings for certain pairs of standards [14]. This is a more efficient and generic approach to the problem avoiding the need for specific mappings for each pair of standards.

As explained in more detail in [14, 12], the semantics of a multimedia standard or of a profile are described using an ontology and rules. For example, we have formalised parts of the semantic constraints of the MPEG-7 Detailed Audiovisual Profile (DAVP) [1] and of the MPEG-7 format used to represent master shot boundary reference data of the TREC Video Retrieval Evaluation⁹. By relating the concepts in the ontologies of each of the standards to common concepts found in audiovisual content descriptions, mapping can be established.

Using this approach a generic service can be implemented, which provides mappings between different standards (or profiles thereof) based on the formalisations that have been defined.

3.2 Lightweight Deployment of Multimedia Metadata

Although there exists an array of multimedia metadata formats (e.g. MPEG-7) that can be used to describe what a multimedia asset is about [11], interoperability issues regarding the actual consumption arise. To enable true interoperability, we advocate the use of the RDF data model¹⁰ for deploying *existing multimedia metadata formats*. More specifically, we propose a solution that allows hooking existing multimedia metadata formats into the Semantic Web: *RDFa-deployed Multimedia Metadata (ramm.x)*. With ramm.x, media assets published on the Web link existing descriptions represented in a multimedia metadata format to a formal representation (ontology), see also [11, Sec. 4]). We propose to use RDFa¹¹ to deliver the metadata along with the content being served. RDFa is a serialisation syntax for the RDF data model intended to be used in (X)HTML environments, defining how an RDF graph is embedded in an (X)HTML page using a set of defined attributes such as @about, @href, @rel, etc.

⁹ <http://www-nlpir.nist.gov/projects/trecvid>

¹⁰ <http://www.w3.org/TR/rdf-concepts/>

¹¹ <http://www.w3.org/TR/rdfa-syntax/>

In [10] we have recently shown that ramm.x can serve as an excellent device for dealing with lightweight multimedia metadata deployment in the cultural heritage domain. The ramm.x use cases¹² indicate the potential applicability of the approach; further research is under way.

3.3 Application in the Context of EDL

There are two aspects that need to be considered when applying the proposed approach in the context of EDL: the metadata representation itself and the container format. As RDF is becoming more common in the DL community, it can serve as a suitable exchange format data model. For example, both in the EDL project [5] as well as in the Bricks project¹³ the use of RDF/OWL is proposed as a way of mapping between metadata schemes without defining specific converters or a “super-scheme”. The most common format is of course the Dublin Core Library Application Profile (DC-Lib)¹⁴. ramm.x can be used to reference services being capable of producing DC-Lib descriptions.

In terms of deployment OAI-PMH has become the standard protocol for harvesting information from different collections in the digital library domain. As OAI-PMH can incorporate different XML based representations, also RDF can be embedded. Moreover, defining RDFa embedding in OAI-PMH could be considered.

4 Conclusion

We strongly believe that it is possible to overcome the limitations found nowadays in digital libraries and archives by exploiting Semantic Web technologies. Related activities in standardisation bodies, such as the W3C Video on the Web workshop¹⁵, indicate the importance of the issues discussed herein. In this paper we have proposed a flexible approach for mapping between metadata models. Further we have rendered a lightweight method for deploying metadata associated with audiovisual content and discussed its application for enabling interoperability between audiovisual archives and the EDL.

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¹² <http://sw.joanneum.at/rammx/usecases/>

¹³ <http://www.brickscommunity.org>

¹⁴ <http://dublincore.org/documents/library-application-profile/>

¹⁵ <http://www.w3.org/2007/08/video/>

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