Video Description Schemes in Broadcasting

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20th December 2005

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Abstract

The large amount of information in audiovisual archives makes it quite difficult to efficiently locate a resource for re-use or re-purposing. In response to the needs of industries and users to solve this problem, different organisations have recently initiated active work in the definition of interoperable frameworks and representation for metadata. This paper presents recommendations given by user and standardisation organisations and addresses some of the main metadata initiatives that are relevant to broadcasting. It also presents some proposals to enable the interoperability between the different solutions.
Keywords: *audiovisual material, metadata, interoperability*

1 Introduction

The effective use of an audiovisual archive is not possible unless some extra information is introduced to help describing the multimedia material (not only audio and video descriptors but also business and management information). The main benefits of this information, usually referred as 'Metadata', are [1][2][3][4]:

- effective re-use of archived material;
- efficient re-purposing;
- faster and flexible archive searching;

- video material interchange among different producers and organisations;
- digital rights management;
- improvement in file organisation and management (including backup, content verification, charging, etc);
- development of new business models, services and market opportunities to make profitable costly content assets.

Metadata is data about data, or complementary information about the form and content of a resource. Structured metadata is divided into elements, each of which describes a particular aspect of the information resource. Consistency is important for effective information management and retrieval, so clearly defined standards must be set and widely applied.

During the last few years, a number of organisations and individual institutions have been working towards the definition of a uniform audiovisual description schema as well as description languages and descriptors.

However, metadata is usually not only content but also domain-dependent [5] which means that different sub-sets and variations have been designed for a specific audiovisual application or usage context (radio and television broadcasting, audio and video post-production, multimedia libraries, news agencies, Web TV, etc), or focusing on specific aspects of the production, archiving or distribution process. An obstacle for the common use of generic standardised metadata models is also that a model often reflects the business model of organisations. From another perspective, when such focus does not exist, standards or description schemes usually grow in dimension and complexity in an attempt to satisfy all the requirements. For these reasons the level of implementation of standardisation is limited.

As the workflow of both essence and metadata are evolving from the traditional linear content chain to an asset centric chain, interoperability among metadata schemes or descriptors is even more fundamental.

Currently, descriptive metadata created during earlier stages of the production process is either lost or has to be manually re-entered in the archive. The asset centric model should collect and keep metadata during the full life-cycle of essence, from preproduction to archiving.

EBU recommends [6] that a MAM (Media Asset Management) is required to support the following metadata categories:

1. Cataloguing
2. Descriptive
3. Indexing
4. Technical data about Essence and physical carriers

Some of the most important work that is being carried out by different organisations as a response to the needs of industry and users on metadata for

networked audiovisual systems include, but are not limited to, the ones presented in the next sections. These standards are essential so that a unique representation with unique meaning is used and machines can be used to perform automatic tasks to search and operate in media. This automation is the only way to handle and conveniently exploit the huge volumes of essence currently in storage (many hundreds of thousands of hours).
These approaches share similar objectives and have developed some correspondence between their frameworks. However there is also important divergence that will require nontrivial harmonisation and synchronisation.
This paper presents some of the most important proposals concerning metadata in broadcasting, focusing mainly on the archive and production systems.

2 Metadata Schemes

Currently, most television archives use a common and short list of items [7] that include descriptive information (Title, Episode Number, Duration, Technical Sheet, etc), technical information (Recording Format, Colour, Sampling, etc), cataloguing information (Tape Number, Archive Number, etc) and broadcasting information (Broadcast Date and Channel).
Although these descriptors can be regarded as almost standard, there are still a lot of problems concerning the interoperability of systems and the usability of the archive as, for example, due to simplicity of the models used, locating a specific image in a video stream is still very difficult and time consuming. Moreover, the incorrect use of the scheme is frequent due to the poor and limited number of available descriptor (e.g. the same field is used to list timecodes and descriptive information).This approach makes it quite difficult to easily access a required image.
This situation lead to an attempt of standardising metadata as a process of associating extra information to essence and making items really available. Different solutions have been proposed for the normalization of metadata. Media and broadcasting related organisations like the International Federation of Television Archives (FIAT/IFTA), the European Broadcasting Union (EBU), the European Telecommunications Standards Institute (ETSI), the Society of Motion Pictures and Television Engineers (SMPTE) and the ISO Moving Picture Experts Group (MPEG) have proposed and normalised their own schemes. Simultaneously, generic solutions to be used in different activity areas, such as the Dublin Core Metadata Initiative (DCMI), were also proposed.
Each of these solutions has its own structure and list of descriptors with different degrees of complexity.

2.1 EBU P/META standard

As an illustrative example, the EBU's P/META [8] proposal, which supports the exchange of metadata — with or without content — based on agreed definitions of Attributes, AttributeType values, Sets of Attributes, Sets of Sets, Unique Identifiers and Protocols in a scenario of Business-to-Business (B2B) between three identified actors (Producer, Distributor and Archive), defines four different classes to which content that can be the object of exchange has to belong:

1. Programme: an audio-visual work that has been defined and created by a commissioning decision.
2. Programme Group: a collection of Programmes.
3. Programme Item: a constituent part of a Programme.
4. Media Object: a single component of a programme or item, of a single media type. It is continuous in time.
5. Brand: a collection of assets with a recognisable collective identity.

The diagram in Figure 1 represents the relationships between each of the classes defined in this standard.

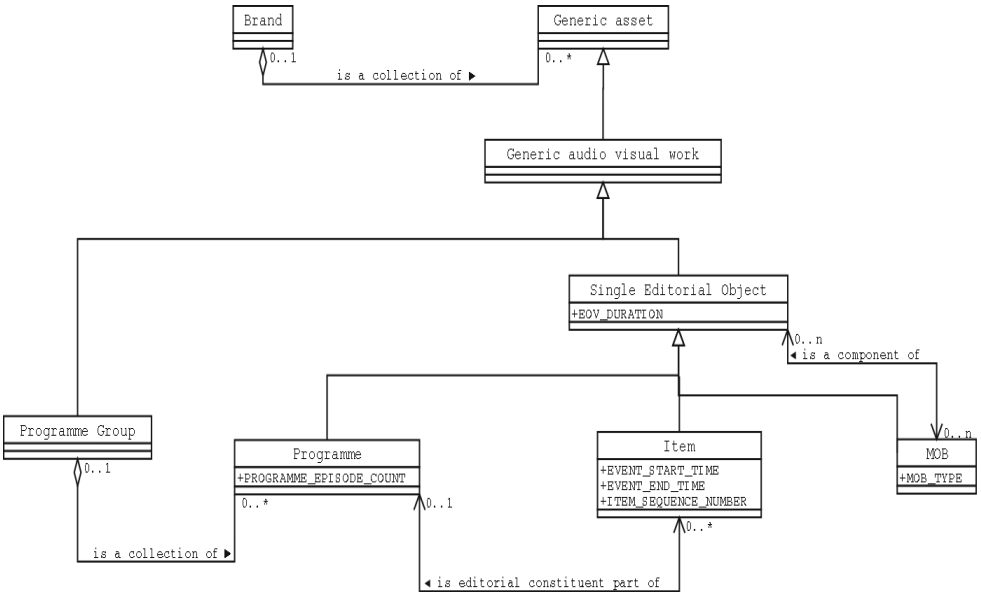

Figure 1 – EBU P/META main entities

2.2 The SMPTE metadata proposals

The number of SMPTE standards for the definition and transport of metadata in a television environment is quite complex. Different phases as well as different areas are involved in this process. Some recent and important standards include the SMPTE Metadata Dictionary (MDD) [9][10] and the MXF DMS-1 scheme [12].
SMPTE defines a set of descriptors — the 'Metadata Dictionary' — covering different aspects of the production chain. Within these scheme, metadata elements are organized into a hierarchical structure of nodes and leaves as defined in [11].
The top level forms one of the 15 defined classes (nodes) that are further divided in sub-classes (sub-nodes) which enable increasingly fine node definition. Entries within a subclass are the data elements or leaves. Each of the defined classes represents a collection of metadata elements with common characteristics.
Figure 2 presents a partial view of the SMPTE dictionary tree structure showing examples of existing nodes and leaves.

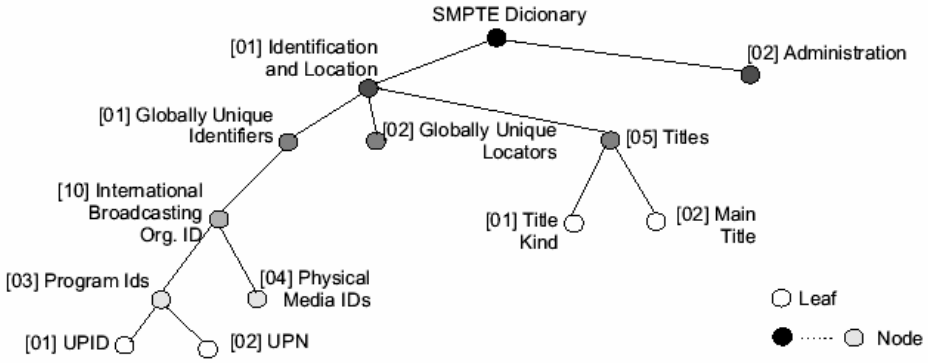

Figure 2 – SMPTE Metadata Tree Structure

The Dictionary consists of Structure [9] and Content [10] and its metadata elements cover aspects that range from technical information on video/audio encoding characteristics, to information on how the essence was processed/manipulated, who was the supplier and what are the rights, and interpretive information as a narrative summary or a title. Individual items (or metadata elements) are referenced through a two-part 16-byte universal label, as defined in SMPTE 298M [13], that is numerical (language independent) and unique.

3 Metada Harmonisation

Although each of the initiatives claims to address different objectives and cover different areas of the business, interoperability and mapping between different namespaces is an important issue in order to have a transparent flow of metadata through the whole chain and between content owners.
This need for integration is recognised in all the standard committees. Since 2000, MPEG-7 Ad Hoc Groups have been started to harmonise MPEG-7 and other schemes. In P/Meta special care has also been taken on the mapping between its Attributes and other schemes, namely SMPTE MDD and DMS-1, although their final purpose is somehow different [14]: MXF is intended to allow the interchange of finished material while P/Meta has a broader scope of metadata exchange and supports all business transactions even before any material exists and SMPTE MDD aims at supporting metadata in the domain of programme making in the broadcast environment.
Mapping between P/Meta and SMPTE MDD and DMS-1 is provided and Attributes not covered by SMPTE will be registered for inclusion into the dictionary. Table 1 presents a mapping example between SMPTE Frameworks and Sets and P/Meta Attributes.

DMS-1 Set	**DMS-1 Attribute**	**P/Meta mapping**
Scene Framework	Scene Number	A148: ITEM_SCRIPT_SCENE_NUMBER
Production Framework	Integration Indicator	A225: ISAN_PROGRAMME_TYPE_CODE
Episode	Episode Number	A104: PROGRAMME_EPISODE_COUNT
Episode	Total Number of Episodes	A96: PRG_EPISODE_QUANTITY
Rights	Copyright Owner	A83: ORG_NAME or S12: PERSON

Table 1 – SMPTE and P/META mapping example

Harmonisation between different metadata approaches is most of the times difficult or even impossible as they are intended for use in different areas of a broadcast facility and follow different approaches. Some mapping initiatives have been happening but until now achievements didn't lead to a universal solution.
The use of more than one scheme and the development of gateways at the interfaces of different systems is thought to be the best solution. Hybrid solutions can also be implemented allowing the use of complementary aspects from each of

the schemes. The identification of each of the schemes can be provided by the definition of different XML namespaces.
The use of a dictionary can also be used to facilitate the mapping between two different standards. As SMPTE, the MPEG-7 dictionary provides a flat list of elements that facilitates the implementation of a mapping table between MPEG7 and SMPTE standards as illustrated in Table 2.
Due to the complexity of most of the existing standards and the difficulty to apply them in a real environment, a new model based on the usual material organisation of news programmes in the broadcasting industry was developed. This scheme follows most of the recommendations of the mentioned standards and enables the hierarchical organization of video material. Mappings between this new model and the existing standards were defined enabling the integration of the developed prototype with other implementations through the use of this common gateway.

SMPTE	**MPEG7**
Framework	Description Scheme Profile
Set	Description Scheme Descriptor
Dictionary	Dictionary
Item	Descriptor Data Type

Table 2 – SMPTE and MPEG-7 mapping

4 Conclusions

The metadata schemes briefly introduced in this paper are the most important and recent developments on the definition of description schemes in the area of audiovisual systems.
Some other initiatives coming mainly from the traditional information systems and archivists world are also going on. However most of their results are incorporated in the solutions presented here or they cover aspects not related to video archiving. ISAD-G [15] that provides general rules for archival description irrespective of the type of material and form of archive, TV Anytime Forum [16] that cover aspects directly related to the consumer and are expected to to enable the creation of personalised programme guides that help on the tracking of programmes that correspond to the consumer preferences and the International Association of Sound and Audiovisual Archives (IASA) Cataloguing Rules [17] for the description of sound recordings and related audiovisual media are other proposals.

Harmonisation between different metadata approaches is most of the times difficult or even impossible as each solution is intended for use in different areas of a broadcast facility and follows different approaches. Some mapping initiatives have been happening but until now achievements didn't lead to a universal solution.
The use of more than one scheme and the development of gateways at the interfaces of different systems is thought to be the best solution.

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