Metadata and Licence Model for Music Resources in VARIAZIONI

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Abstract

This article introduces the music metadata model and the licence model defined within the eContentPlus VARIAZIONI project[1] based on FRBR. After analysing the limitation of traditional cataloguing approaches for music, and the difficulties of applying FRBR, the Variazioni metadata model defines a flexible model that takes into account the different nature of musical assets (libretto, master class, live recording, poster, etc.) as well as the musical analyst requirements and structural metadata between different media files. This metadata model is complemented by a licence model defined in MPEG-21 and implemented with Axmedis technology.

1. Introduction

The Variazioni Project is an eContentPlus Project funded as Content Enrichment Project with a lifespan of 30 months, starting on September 2007. The project is being coordinated by the musical private institution Fundación Albéniz and counts with several additional musical institutions (Lithuanian Academy of Music and Theatre, Koninklijk Conservatorium Brussels, Escolal Superior de Música e Artes do Espectáculo do Porto, Sibelius Academy, and Association Europeenne of Conservatoires, Academies de Musique et Musikhochschulen) and technical partners (Germinus XXI, Rigel Engineering, Exitech, Universitat Pompeu Fabra and Università degli Studi di Firenze).

The purpose of Variazioni is to provide a Content Enrichment Portal where users and musical institutions can publish, annotate and access musical contents, including its protection. In order to validate its approach, the project will provide a minimum of 700 audiovisual hours, 1000 audio hours and 2000 written documents.

Variazioni project aims at enabling the enrichment of musical content metadata provided by musical institutions and end users, and considers different types of musical contents (master classes videos, digitalised scores, etc.).

The purpose of this article is to give an overview of the Variazioni metadata model and its rationale, which have been the problems for applying traditional cataloguing systems or available standards.

2. Limitation of traditional cataloguing approaches formusic

In order to review the relevant metadata standards for Variazioni, the relevant metadata standards table for cultural heritage projects developed by the project MultiMatch [Ire07] has been updated, refined and extended for the music sector, as shown in Table 1.

After reviewing these standards [Igl08], the first conclusion is that any of the reviewed standards deal with the cataloguing of music resources with enough detail for fitting user requirements in terms of search facilities and collocations. In addition, there are important limitations in traditional cataloguing systems for music resources Traditional library cataloguing records, based on AACR2R [AacrURL] cataloguing rules and MARC [MarcURL] bibliographic and authority standards have provided a solid foundation for the required descriptive metadata elements for searching and retrieving works of music and are used

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by music cataloguing agencies worldwide [Hem02]. Nevertheless, several authors have pointed out the limitations of using traditional cataloguing systems for the music domain [Mini02, Hem02].

	Schemas	**Controlled Vocabularies**	**Projects** **Other**
Libraries	FRBR, MARC, MODS, METS, RDA, DC, IAP	DDC, UDC, LCSH, FRAD	EDLNet OAI-PMH
Museums	CDWA, VRA, CIDOC-CRM	AAT, TGN	-
Education Sector	IEEE LOM	-	-
Audio visual sector	MPEG-7, MPEG-21	-	-
Music sector	Music Brainz	Musaurus, Music Thesarus, RILM	Variations, Music Australia, Harmos

Table 1: Relevant metadata standards for Variazioni

The main observed limitations are:

- *Lack of adequate structural* [Hem02]. Traditional cataloguing systems such as MARC lack of structural metadata which provides facilities for navigating in the internal structure of the object, such as track descriptions or time or page ranges. There are precursors of structural descriptors in AACR2/MARC, such as table of contents notes, notes about duration or the 856 tag [Hem02] for the universal resource locator (URL), but they do not allow the user to adequately search and navigate the subsections of the digitalized work.

- *Lack of adequate administrative metadata* [Hem02]. Although the MARC bibliographic record includes administrative metadata, such as copyright date, date the record was created or updated, and notes about access restrictions and file format, they are limited in scope. It is missing administrative metadata for recording technical, access rights and preservation elements.

- *Limits of the conventional on-line catalogue* [Hem02]. Search results do not group related items and users cannot take advantage of collocations. In contrast, an object oriented metadata model can improve comprehensiveness and precision of search results [Mini02], since a work can be linked to all its instantiations, roles of contributors are clearly delineated and linked to appropriate entities, etc. For example, traditional approach considers only the role author, which could be performer, composer, conductor, etc. Other examples include the title (title of the track, the container, alternative title, etc.). and the dates (date of performance, composition, record creation, etc.).

- *Impervious, pre-coordinated, multi-faceted headings* [Hem02]. The nested style of creating uniform titles and subject headings may be efficient for the cataloguer but it is often impervious to the searcher. For example, [a Sonatas. m piano. n no. 21. op. 54. r C major. o arr.] contains information about the title of the work (a), instrument (m, medium of performance), number or section (n), etc. Most catalogues do not provide separate search options for the title building blocks, and is left to the users to retrieve using keywords. Regarding subject headings, the same problem arises [Hem02]. Library of Congress music subject provides multi-faceted strings headings (such as "Sonatas (Saxophone and piano)" or "Accordion music (Jazz)") or multi-field headings (such as "*Topical*: [Woodwind instruments. x Reeds.] *Form*: [Jazz. v Discographies]. *Geographical:* [Composers: z Austria]").

- *Weak relationships between fields describing separate works* [Hem02]. If a record includes more than work, it is not possible to link key access points (title, performer , subject heading, etc.) to the right work, but to the whole record, restricting the search options.

- *Insufficient links between versions of a work* [Hem02]. AACR2 and MARC do provide insufficient linking facilities between versions of a work (opera, score, etc.), mainly based on uniform titles, which leads to inefficient keyword search facilities.

- *Low expressivity for musical entities*. Musical entities are described with text, which lead to introduce the same musical entity with different forms. This is the main reason to establish complex authority control rules. In contrast, a multidimensional (object oriented) model improves data accuracy and promotes its consistency, since main entities are only introduced once.

FRBR (Functional Requirements for Bibliographic Records) [IF98] has accomplished a shift in the

cataloguing area, putting emphasis on a conceptual model which is focused on the Work rather than on the Manifestation. FRBR has been applied previously in the musical domain, and new library standards, such as RDA or IAP are based on FRBR. Our conclusion is that FRBR is a good starting point for defining and modelling Variazioni metadata.. This conclusion could be considered in a wider scope. According to Gartner [Gar08], "*given the complexitiy of metadata requirements, it is perhaps not surprising that no single standard has yet emerged which addresses them all. Nonetheless, the emergence of the standards detailed in this report, all of which are based on the Functional Requirements for Bibliographical Records (FRBR) conceptual model, and the interoperability allowed by their common language, does allow for a coherent metadata landscape to be constructed on a sector-wide basis.*"

Regarding METS, METS and MPEG-21, are two standards which attempt to provide overall frameworks within which descriptive, administrative and structural metadata and have emerged from different communities [Gar08]. While METS comes from the library community (the MARC standards office), MPEG-21 comes from the multimedia community. Variazioni counts with experts in MPEG-21, and the resulting metadata will be available in MPEG-21.

The general followed approach will be based on defining the metadata model required by Variazioni partners. A **metadata crosswalk** will allow interoperability of Variazioni metadata model to be used by other communities with use a different metadata schema. In particular, for Variazioni is particularly relevant providing OAI-PMH interoperability in order to be integrated in the European Library in the future. Since OAI requires Unqualified Dublin Core metadata. A crosswalk to EDLNet metadata will be included.

Regarding the standards developed in the museum community, they deal with aspects not relevant for Variazioni (physical location or provenance of the items) and, in addition, there is an adaptation of FRBR, so-called FRBRoo, which provides an effort in modelling CIDOC CRM based on FRBR entities.

3. Adaptation of FRBR for Variazioni

This section discusses how the FRBR conceptual model can be applied in Variazioni. In order to understand better the relationship with FRBR, a first identification of FRBR entities per musical content type has been carried out as shown in Table 1.

Variazioni Contents	**FRBR 1st Group Entities**			
	W	**E**	**M**	**I**
Master class	Master Class	Master Class Event	P	MF
Score	C	Editorial Event	P	MF
Concert	C	Concert event	P	MF
Image*	Image itself (or P)	["Event"]	P	MF
Studio Recording	C	"Event Production"	P	MF
Libretto	C, 'Textual Work'	"Editorial Event"	P	MF

Table 1: Identification of FRBR entities. Legend (W)ork, (E)xpression, (M)anifestation, (I)tem, (C)omposition, MC (Musical Content) (P)roduction, MF (Media File

From this exercise, several issues have arisen:

(a) Expression and Work entities are not easy to identify in some cases, such as Master Classes or Conferences. This happens because the intellectual or artistic activity (Work) emerges while the activity (Expression) is being carried out. A similar issue has been previously reported for Western Music or Jazz improvisation in FRBRList [FRBRList] or MusicAustralia.

(b) According to FRBR, an Expression is the realization of one and only one Work entity. This can create some problems while cataloguing if the final digital file contains several Expressions (for example, a video recording with several performances or a digitalised score book with several scores, or a CD in only one track) and there is not a segmentation tool available in the system.

(c) The main Work entity in the music domain is Composition. Nevertheless, in some musical contents, such as Master Classes or Conferences, the Composition is not the intellectual / artistic activity of the Master class / Conference, but It is commonly used to exemplify a concept. They are used as subjects.

(d) Managing image and 'event material'. The image content is problematic. For example, let

us consider a concert, where there are a video recording, an audio recording and photos of the event. One natural alternative is considering all of them are 'Manifestations' of the same Expression (the Concert) but recorded in different media (image, video or sound). The main problem is that the photo may not be easily linked to the performance of one particular Work, but to the general event. A similar case happens for cataloguing related material such as the announcement poster of the Concert. According to [IF06], these augmentations (illustrations, notes, glosses, etc.) of the Expression should be considered separate Expressions of their own separate works, but this makes hard the cataloguing.

(e) In digital libraries, the distinction between Manifestation and Item is not so relevant, since there is only one copy of the work (the digital media). FRBR cannot be considered as a data model, but as a conceptual schema. FRBR does not even require implementing the four entities of the first FRBR Group [IF06].

(f) While FRBR follows a top-down approach for cataloguing, cataloguing follows a bottom-up approach. Users or librarians catalogue an Item, not a Work. Users should have an easy interface in order to catalogue their media files, without being aware of the FRBR model. Expertise in implementing FRBR in standard databases [Ayr04] has shown its utility for end users to find relationships between items, which were hidden before its implementation. Nevertheless, these experiences have shown that since FRBR provides several alternatives during the cataloguing process, this can add complexity to the general understanding of the process. Some examples of these difficulties are to decide whether music and lyrics should be catalogued as different items, the definition of relationships between expressions (i.e. an interpretation (e1) based on a libretto (e2) of a work (o1)), as the cataloguing of expressions based on improvisation, such as jazz music and folk traditions.

(g) Cataloguing can be done in an iterative way. Depending on the available resources, a media file can be uploaded and catalogued with very few metadata

Based on these observations, an adaptation of FRBR for musical resources is here proposed.

Since the FRBR model has been adapted, FRBR entities has been renamed and redefined, in order to avoid confusion to the reader[2]. In particular:

- Work has been limited to Compositions. A **Composition** is an original piece of music.

- Expression has been redefined as Musical Content. A **Musical Content** (Musical Content Type) is a classification scheme of digital items which defines the nature and descriptive metadata of the digital item. Some of the musical content types identified are Master Class, Conference, Libretto, Musical Score, etc.

- Manifestation has been renamed as **Production**. A **Production** maintains all the metadata related to the physical edition of a Musical Content, as well as the structural metadata when the manifestation is composed of more than one Media Fragment. The structural metadata can include the order of different Media Fragments or the starting and end points of one media file with different fragments (pages, seconds, frames, etc.).

- Item has been renamed as Media Fragment. A **Media Fragment** is a media file or a fragment of it, and maintains all the relevant metadata of the media file, including its title and licence.

In order to clarify these elements, here follows an example of how the same items are catalogued according to standard FRBR (W: Work, E: Expression, M: Manifestation, I: Item) and Variazioni Music Application Profile (C: Composition, MC:Music Content, P: Production, MF: Music Fragment).

W1. J. S. Bach's Six suites for unaccompanied cello
- E1. Transcription for classic guitar by Stanley Yates
  - M1. Publication of the guitar transcription by Mel Bay Publisher in 1988
    - I1. Exemplar of the book in library 1.
    - I2. Separata of the guitar edition in library 1.
- E2. Performances by Janos Starker recorded in 1963 and 1965
  - M1. Recordings released on 33 1/3 rpm sound discs in 1965 by Mercury
  - M2. Recordings re-released on CD in 1991 by Mercury

In Variazioni metadata model, the structure would be as follows.

[2]A similar approach of renaming entities have been followed previously by Variations and IAP.

MC1. Score. Transcription for classic guitar by Santley Yates

- C1: J. S. Bach's Six suites for unaccompanied cello
- P1: Book edition
  - MF1: Media file of the book (page range if book includes more compositions)
- P2 Separata of the guitar edition
  - MF2: Media file of the separata

MC2. Studio Recording. Performances by Janos Starker recorded in 1963 and 1965

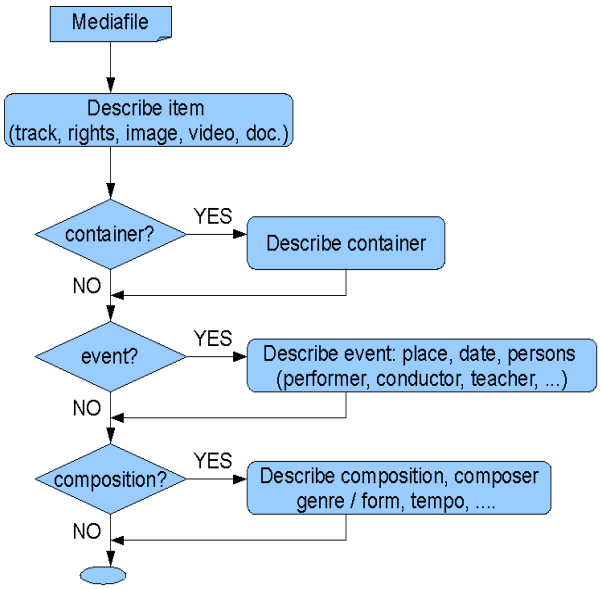
- C1: J. S. Bach's Six suites for unaccompanied cello
- P3: Recordings released on 33 1/3 rpm sound discs in 1965 by Mercury.
  - MF3: Suite 1 media file (and details of the fragment, full or time range)
    - C2: J. S. Bach Suite 1 for unaccompanied cello [is-part-of C1]
  - MF4: Suite 2 media file (and details of the fragment, full or time range)
    - C3: J. S. Bach Suite 2 for unaccompanied cello [is-part-of C1]
  - …
  - MF8: Suite 6 media file (and details of the fragment, full or time range)
    - C7: J. S. Bach Suite 1 for unaccompanied cello [is-part-of C1]
- P2: Recordings re-released on CD in 1991 by Mercury
  - MF9: Media file of the suites or details or the fragments (time range) in one media file

From this example, the main differences of the model can be outlined.

First of all, according to FRBR, and Expression has one and only one Work, and this has supposed the shift in focus from the resource (Manifestation) in the traditional cataloguing world to the Work in FRBR. Our proposal consists of modifying the cardinality of the relationship *hasWork* between Work and Expression, from 1-1 in FRBR to M-M (many-to-many). This allows solving some of the previous issues pointed out: (a) , since Compositions (Works) are not mandatory for a Musical Content (Expression); and (b), since one Musical Content (Expression) can have more than one associated Compositions (Works).

Another interesting change is the usage of the relationship *hasSubject*, in particular for linking any element of the model with *Composition*. FRBR only considers this relationship for Works. In our case, for example, for Master classes, several Compositions could be the subject (or example) of a master class. In the example previously presented, a composition can be assigned as subject of a Music Fragment, suppressing the need for a new Expression. This is depicted in Figure 1, which points out two different kind of semantic relationships between Composition and Musical Content: *isRealizedAs* and *hasSubject*. In terms of search ability, we have not found the need to distinguish between both in the implementation of the model. Furthermore, it is possible to define the subject of a media fragment, allowing a direct

Finally, the process of identifying the entities of the model is hard for end users, and a simple process for guiding the cataloguing has been defined, which is shown in Illustration 1.



llustration 1: Variazioni Cataloguing Process

8. Licence Model and Content Protection

The Variazioni project has integrated a Digital Rights Management (DRM) solution in order to control the usage of the content. In this way, Variazioni can ensure that only registered users have access to the content and thus, fulfil the content producer's requirements in this sense.

The Variazioni License Model is based on the MPEG-21 Rights Expression Language [Xing04] and considers not only the licensing from content distributors to end users, but also the step from content providers to content distributors. In other words, any content distributor that may wish to transfer or grants any right to an end user needs to own the

corresponding rights granted from the rights owner (content creator or distributor).
In the VARIAZIONI project, a content provider corresponds to the party owning the rights for a piece of work, whereas the distributor is the VARIAZIONI portal. Therefore, the VARIAZIONI portal needs to own the corresponding rights granted by the content providers in order to be able to give access rights to all its members.
Several license models have been considered during the specification of the Variazioni project:

- *PlayNoCond*. The granted user can play the content without any restriction.
- *PlayFeePerUse*. The granted user can play the content by clearing a specific fee every time the content is played.
- *PlayTimesAmountTime*. The granted user can play the content a limited number of times during a limited time interval.
- *PlayTimesInterval*. The granted user can play the content during a limited time interval.

However, since the access to enrich the content is open without any restriction to all the users registered in the Variazioni portal, the *PlayNoCond* license model has been selected for being deployed.
Table 2 depicts a license that is produced by DID:Distributor for enabling the UID:EndUser to play with no restriction the object OID:Identifier.

```
<?xml version="1.0" encoding="UTF-8"
standalone="yes"?>
<r:license
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#"
xmlns:mx="urn:mpeg:mpeg21:2003:01-REL-MX-
NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-
NS" xmlns:sx="urn:mpeg:mpeg21:2003:01-REL-SX-
NS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"
xsi:schemaLocation="urn:mpeg:mpeg21:2003:01-
REL-R-NS ../schemas/rel-r.xsd
urn:mpeg:mpeg21:2003:01-REL-SX-NS
../schemas/rel-sx.xsd urn:mpeg:mpeg21:2003:01-
REL-MX-NS ../schemas/rel-mx.xsd">
 <r:grantGroup>
   <r:grant>
    <r:keyHolder>
     <r:info>
     <dsig:KeyName>UID:EndUser</dsig:KeyName>
     </r:info>
    </r:keyHolder>
    <mx:play/>
    <mx:diReference>
      <mx:identifier>OID:Identifier</mx:identifier>
    </mx:diReference>
   </r:grant>
 </r:grantGroup>
 <!--The license is issued by the distributor.-->
 <r:issuer>
   <r:keyHolder>
     <r:info>
       <dsig:KeyName>DID:Distributor
       </dsig:KeyName>
     </r:info>
   /r:keyHolder>
 </r:issuer>
</r:license>
```

Table 2: PlayNoCond license model. The content can be used without any restriction.

The Variazioni project uses the AXMEDIS technology [AxmURL] to create protected content objects whose access is restricted to those that own a license with the corresponding access rights based on the Variazioni license model.
For this purpose, the Variazioni portal is linked to the AXMEDIS DRM servers so that whenever a protected object is generated, the corresponding licenses are automatically produced to grant all the Variazioni registered users the access right.
The protected objects can be used by any user:

- that is registered on the AXMEDIS servers, i.e. that owns a personal user certificate;
- that owns an AXMEDIS player, which is installed and certified, i.e. which has been linked to the user and device by means of an automatic and transparent process given the user certificate.

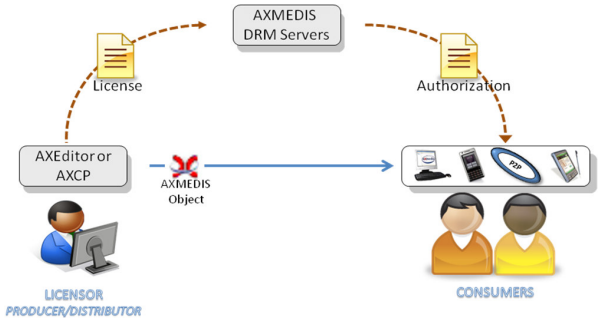


Illustration 2: Usage of the AXMEDIS technology in Variazioni for content packaging, protection, distribution and consumption.

The protected content objects can be then accessed by users by means of any of the AXMEDIS players for

PC, PDA, STB, mobile, etc. The AXMEDIS ActiveX Player can be used to integrate the AXMEDIS player into any HTML page, thus making the integration simpler. The AXMEDIS players can be downloaded for free from the AXMEDIS Portal [AxmURL].

9. Conclusions and Future Work

The web2.0 user participation along with the new technological advances define a new landscape where metadata plays an important role for content search ability and exploitation. Musical assets have been inadequately catalogued with traditional standards, and there is a need for defining more precise metadata schemas for musical resources.

This article presents a novel model, based on FRBR, for musical resources which has been formalised as a Dublin Core Application profile, and has been implemented in the Variazioni project [VarURL].The main advantages of the model are its ability for collocated contents and navigation within the metadata model.

In addition, a flexible licence model has been formalised in MPEG-21 Rights Expression Language and implemented with Axmedis Platform.

Our ongoing work is the validation of the model with end users, since this model has been validated with musical analysts from the musical institutions which participate in Variazioni.

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