EBU
OPERATING EUROVISION AND EURORADIO

TECH 3293

EBU CORE METADATA SET (EBUCore)

SPECIFICATION v. 1.10

Source: SP Production / MIM-AI

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Introduction

'The EBUCore is a metadata specification designed for users with different needs'.

This is version 1.10 of the “EBUCore” metadata set.

EBUCore has been designed to describe audio, video and other resources for a wide range of broadcasting applications including archives, exchange and production in the context of a Service Oriented Architecture. EBUCore is based on the Dublin Core to maximise interoperability with the community of Dublin Core users such as the European Digital Library 'Europeana'.

EBUCore 1.10 takes into account latest developments in the Semantic Web and Linked Open Data communities. A link to EBUCore RDF ontology and its documentation is provided in the "download zone". The EBUCore RDF ontology has been updated to match EBU's CCDM (Tech 3351) needs and improve mapping with other ontologies. EBUCore RDF is listed as Linked Open Vocabulary as well as RDF-Vocab for Ruby developers.

What's new in EBUCore 1.10?

EBUCore 1.10 provides a solution for dynamic acquisition metadata, a unique representation of the ITU-R BS.2076 Audio Data Model (ADM). Now 'props', 'costumes', 'timed text, "actions and "emotions' (among others) can be associated to scenes and persons or character. More information is now provided on the implementation of EBUCore RDF with multi-range properties. There are also new “how-to” sections on pretty RDF/XML, METS/FRBR mapping and the use of bi-directional properties. This document provides links to the EBUCore schema and its HTML documentation. It also provides guidelines on how to use EBUCore to implement a variety of features.

More information on EBU metadata activities is provided on the EBU TECHNICAL website (http://tech.ebu.ch/metadata).

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EBUCore Metadata Set
(EBUCore)

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1. Scope

Metadata is essential to broadcasting.

The “EBUCore” set of metadata defined in this specification has been identified as being the minimum information needed to describe radio and television content.

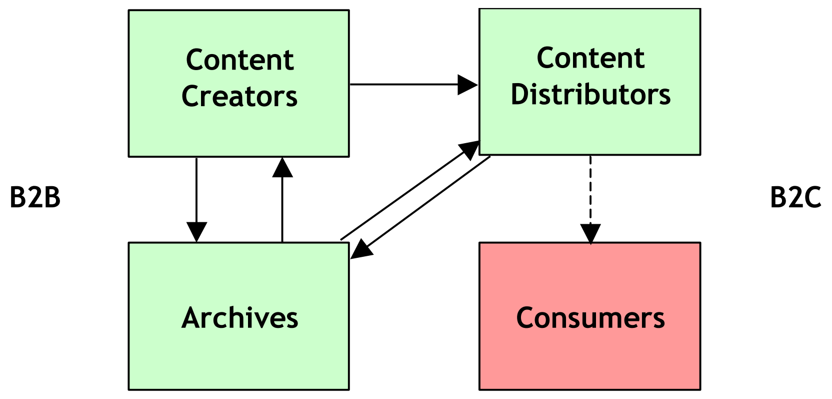


Figure 1: A basic content and metadata workflow

"If you can't find it, you don't have it!" This should not happen in modern IT-based production environments. Metadata is the glue between production operations particularly when moving towards Service Oriented Architecture and file-based production. Documenting audiovisual resources with EBUCore information is a minimum requirement corresponding to fundamental investment with guaranteed return.

This specification addresses the creation, management, and preservation of audiovisual material. EBUCore facilitates programme exchanges between broadcasters or between production facilities in distributed and cloud environments. Beyond production, EBUCore can be used to describe content for distribution (broadcast, broadband Internet, mobile or hybrid delivery). EBUCore is also the default set of technical and descriptive metadata used by FIMS, the Framework of Interoperable Media Services (http://fims.tv).

The core set of metadata presented in EBUCore is the Dublin Core for media. The Dublin Core is being used as a core metadata set by librarians and museums in cultural heritage projects. The EBUCore is recommended when describing and providing access to audiovisual content and is not limited to archives.

EBUCore takes into account latest developments in the Semantic Web and Linked Open Data communities. EBUCore is available as an RDF ontology entirely compatible with the W3C Media Annotation Working Group ontology, which model is common and based on the EBU Class Conceptual Data Model (EBU Tech 3351). An RDF representation of the EBUCore schema is accessible from the "download zone" section of this specification.

2. Core Metadata Set

2.1 Introduction

EBUCore is a collection of basic descriptive and technical/structural metadata elements used to describe audiovisual content as an extension of the Dublin Core. It is fully compatible for use in Semantic Web and Service Oriented Architectures.

EBUCore is the Dublin Core for media.

The EBUCore is a living specification. It is actively maintained and enriched.

2.2 Documentation

Following best practice, the documentation has been generated from the schema.

The documentation can be summarised as follows:

- It looks very similar to what was provided in previous versions of the specification, including uml-like diagrams, the semantics of each element and attribute, their cardinality and associated complex types, the localisation of the element in the schema, etc.
- The documentation includes the schemas imported by EBUCore i.e. the XML stub and Dublin Core.
- The documentation is constructed around dynamic links that allow easily navigating through the schema.
- Each user can decide on the level of information detail to be displayed.

This html-based documentation is attached to the specification as a zip archive to be extracted in the directory of the user's choice.

It can also be downloaded from the link provided in § 6 "Download Zone".

2.3 What is new in EBUCore 1.10

EBUCore 1.10 changes are listed in detail in the documentation and can be categorised as follows:

- Additions and corrections based on feedback from implementers. These changes are listed in annotations field at the beginning of the xsd file.
- Additions to facilitate mapping with SMPTECore, PBCore, EUSCreen, Europeana, MediaInfo, IMF-TV, IPTC, Movie Labs' Common Metadata, and other metadata projects in which EBU is directly involved, such as the European Project Memad.
- The update of the EBU extended audio model (3D and object audio) following work progress in the ITU. EBUCore is the ADM reference schema for ITU-R BS.2076-1.
- EBUCore is fully compatible with IMF in its different representation formats, for static or dynamic metadata.
- More information is now provided in the “how to” section for the correct RDF representation

of data using multi-range properties.

- There are also new “how-to” sections on pretty RDF/XML, METS/FRBR mapping and the use of bi-directional properties.

2.4 Tech. 3364 - Audio Definition Model (ADM)

The EBU has developed a new definition model that addresses all the richness of audio including 3D binaural and object audio.

The model is divided into two sections, the **content** part, and the **format** part. The content part describes what is contained in the audio (music, programme, accompanying soundtracks and their respective purpose), and will also describe things like the language of any dialogue, the loudness and so on. The format part describes the technical nature of the audio, so it can be decoded or rendered correctly. Some of the format parts may exist before we have any audio signals, whereas the content is only completed after all the signals that form it have been generated.

While this model is based around BWF, it is not intended to be solely used for BWF files, but as a more general model. Mappings to MXF streams have also been developed and tested.

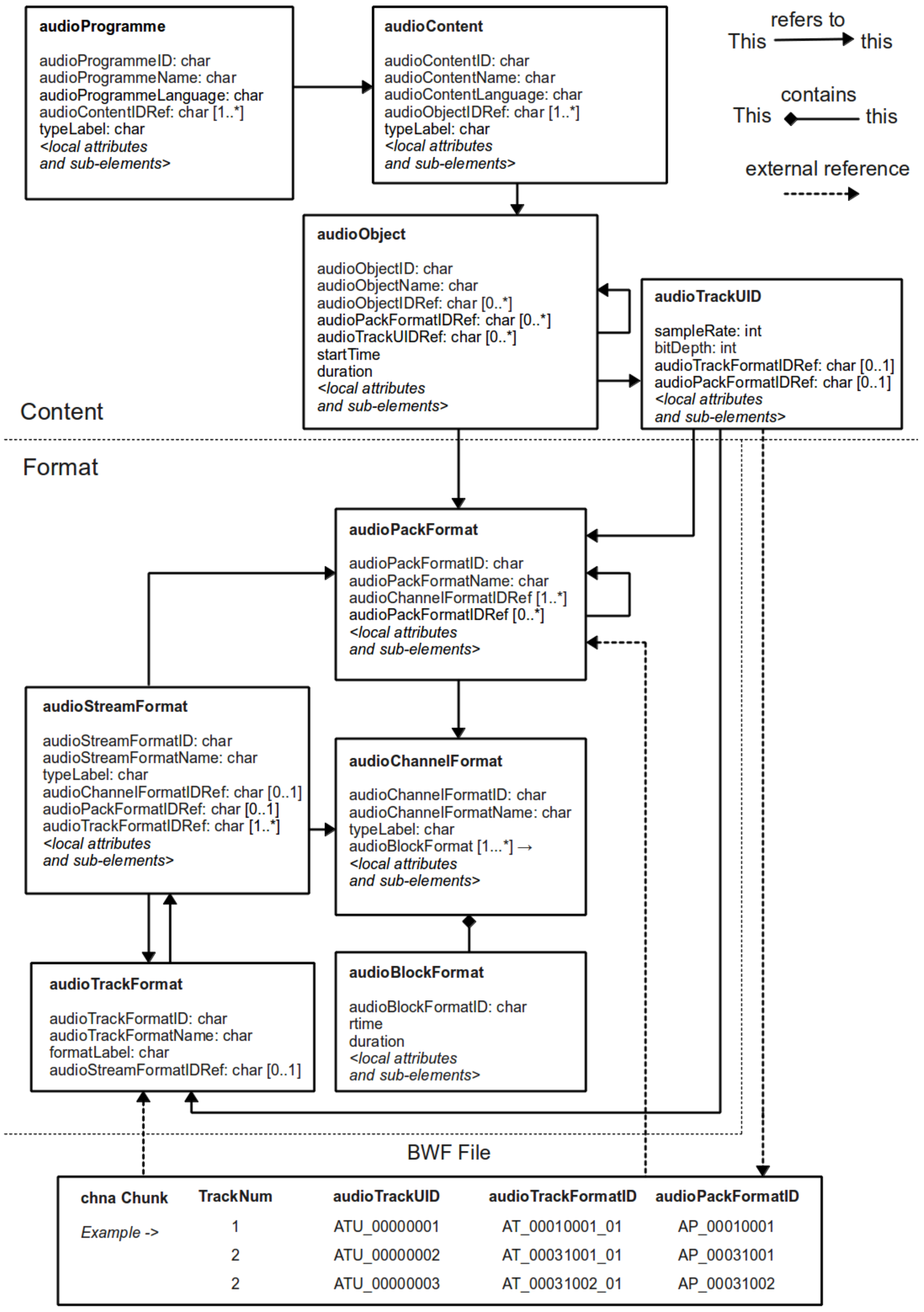
This model initially uses XML as its specification language with the EBUCore as the target schema. When it is used with BWF files, the XML can be embedded in the <*axml*> chunk of the file. When used with MXF, the XML can also be embedded in the header or footer partition of an MXF file. ADM metadata can also be provided in IMF as sidecar metadata.

The new model has been implemented in EBUCore as a new audioFormatExtended element in complement of the audioFormat element previously provided in earlier versions of the schema. This allows maintaining backward compatibility and graceful deprecation of the audioFormat element in favour of the new audioFormatExtended element.

The overall diagram of the model is given in Figure 1. This shows how the elements relate to each other and illustrates the split between its content and format parts.

The model has been adopted by ITU now leading its maintenance. The EBUCore schema is kept strictly aligned with approved ITU-R BS.2076-1 changes.

Several example files are available from the EBUCore ADM example repository. These files explore the main ADM configurations, with or without complementary embedded editorial metadata.


refers to
This → this
contains
This ◆— this
external reference
audioProgramme
audioProgrammeID: char
audioProgrammeName: char
audioProgrammeLanguage: char
audioContentIDRef: char [1..*]
typeLabel: char
<local attributes and sub-elements>
audioContent
audioContentID: char
audioContentName: char
audioContentLanguage: char
audioObjectIDRef: char [1..*]
typeLabel: char
<local attributes and sub-elements>
audioObject
audioObjectID: char
audioObjectName: char
audioObjectIDRef: char [0..*]
audioPackFormatIDRef: char [0..*]
audioTrackUIDRef: char [0..*]
startTime
duration
<local attributes and sub-elements>
audioTrackUID
sampleRate: int
bitDepth: int
audioTrackFormatIDRef: char [0..1]
audioPackFormatIDRef: char [0..1]
<local attributes and sub-elements>
Content
Format
audioPackFormat
audioPackFormatID: char
audioPackFormatName: char
audioChannelFormatIDRef [1..*]
audioPackFormatIDRef [0..*]
<local attributes and sub-elements>
audioStreamFormat
audioStreamFormatID: char
audioStreamFormatName: char
typeLabel: char
audioChannelFormatIDRef: char [0..1]
audioPackFormatIDRef: char [0..1]
audioTrackFormatIDRef: char [1..*]
<local attributes and sub-elements>
audioChannelFormat
audioChannelFormatID: char
audioChannelFormatName: char
typeLabel: char
audioBlockFormat [1...*] →
<local attributes and sub-elements>
audioTrackFormat
audioTrackFormatID: char
audioTrackFormatName: char
formatLabel: char
audioStreamFormatIDRef: char [0..1]
audioBlockFormat
audioBlockFormatID: char
rtime
duration
<local attributes and sub-elements>
BWF File

chna Chunk	TrackNum	audioTrackUID	audioTrackFormatID	audioPackFormatID
Example ->	1	ATU_00000001	AT_00010001_01	AP_00010001
	2	ATU_00000002	AT_00031001_01	AP_00031001
	2	ATU_00000003	AT_00031002_01	AP_00031002

Figure 2: Tech 3364 - Audio Definition Model

3. Implementation Guidelines / Questions & Answers

EBUCore has been developed in mind of users with different needs. EBUCore has been designed to support customisation in many ways:

- EBUCore makes an extensive use of "type" and "format" attributes that allow flexible naming of elements such as title, description, etc.
- EBUCore provides two mechanisms for extensions:
    - The schema is systematically structured around the definition of complex types. This has been done to facilitate the "redefinition" of these complex types using restrictions or extensions via the xs:redefine function. This has been preferred to the use of xs:any allowing extensions at the instance level as xs:redefine is more flexible and provides more structured data, which is important for stricter validation in particular when aggregating data from different sources who may not respect the same element ordering (unless associated with a common schema for extension).
    - A set of predefined technical attributes is provided at key format extension points in the schema. These technical attributes cover the most common datatypes and structures (such as rationals). Each technical attribute is associated with a 'type' that allows the user to implement a parameter of his choice. When applicable, the user can additionally define the format of the data associated with this parameter.

Users can extend the EBUCore schema using proprietary definitions within their own namespace, which shall not conflict with EBUCore's and shall be used within walled garden application domains.

In all cases, it is the responsibility of the user to share the definitions of its extensions with third parties within his domain of interoperability.

Reference data and controlled vocabularies identified in the specification are proposed by default but can be extended or replaced. In order to maximise interoperability in case of e.g. exchange, it is recommended that extensions or alternative reference data be duly documented, maintained and made available to other users e.g. as open permanent resources online.

The schema is built as an extension to the Simple Dublin Core.

The implementers are left with the choice of the method for implementation within their respective domains of application and interoperability.

User guidelines are now given that illustrate the flexibility of EBUCore schema for implementation.

3.1 How do I express titles of a custom type in different languages?

3.1.1 Title

The MAIN title is expressed using the title element in which dc:title is repeated in as many languages as required using the dc:element and its associated xml:lang tag. The type of the main title can be refined as fits users' needs.

The user can specify the geographical zones where the title can or cannot be used, as well as the date when it was attributed.

```
<ebucore:title startYear="2006" length="6" geographicalScope="France"
   geographicalExclusionScope="Germany" typeLabel="main title in English">
   <dc:title xml:lang="en">title0</dc:title>
</ebucore:title>
```

It is also possible to express the language used to define the type of title, or an indication of the source of the title, etc.

Note: *the same applies to other elements build around a similar structure such as description, subject, rights, etc.*

3.1.2 Alternative Title

Any other type of alternative title is expressed using alternativeTitle for which the type is defined and within which dc:title is repeated in as many languages as required using the dc:element and ist associated xml:lang tag.

There can therefore be as many alternativeTitle as required type of alternativeTitle, each one grouping its expression in one or more languages.

```
<ebucore:alternativeTitle typeLabel="secondary title" typeLanguage="en-US"
    statusLabel="working title" startDate="2014-01-20">
    <dc:title xml:lang="en">Additional secondary title</dc:title>
    <dc:title xml:lang="fr">Titre additionnel et secondaire</dc:title>
</ebucore:alternativeTitle>

<ebucore:alternativeTitle typeLabel="display title" typeLanguage="en-US"
    statusLabel="working title" startDate="2014-01-20">
    <dc:title xml:lang="en">Additional secondary title for display</dc:title>
    <dc:title xml:lang="fr">Titre additionnel et secondaire pour affichage</dc:title>
</ebucore:alternativeTitle>
```

The need has been expressed that different types might apply to the same title. Types being defined by attributes; the solution consists of repeating the title with different types.

Note: *the same applies to other elements build around a similar structure such as description, subject, rights, etc.*

3.2 What controlled vocabularies and reference data can I use?

Controlled vocabularies are mainly provided in the form of lists of terms organised as Classification Schemes (CS). These CSs are structured to allow access to terms within a predefined hierarchical vocabulary list (thesaurus). Each list is uniquely identified by its namespace (URI[1], in the form of an URN[2] or URL[3]) and 'Alias' for QNames. EBU namespaces are expressed in accordance to RFC5174[4]. A Classification Term is defined by a unique key (termID) or a Name as follows:

Example:

```
   <ClassificationScheme uri=”urn:ebu:metadata-cs:ContentGenreCS:2008”>
     <Alias>GenreCS</Alias>
     <Term termID=”3.1”>
        <Name xml:lang=”en”>NON-FICTION / INFORMATION</mpeg7:Name>
           <Term key=”3.1.1”>
              <Name xml:lang=”en”>News</mpeg7:Name>
           </Term>
           <!-etc.-->
   </ClassificationScheme>
```

[1] Unique Resource Identifier - http://tools.ietf.org/html/rfc3986

[2] Unique Resource Namespace - http://tools.ietf.org/html/rfc3986

[3] Unique Resource Locator - http://tools.ietf.org/html/rfc3986

[4] EBU Namespace - http://tools.ietf.org/html/rfc5174

It is an important implementation requirement to ensure that these resources are accessible by the metadata recipient. Classification schemes shall preferably be available as resources on the open Internet via maintained URLs. In this case URIs shall respect the following syntax:

URL#termID e.g. http://www.ebu.ch/metadata/cs/ebu_ContentGenreCS.xml#3.1

A conforming parser uses that URI to resolve the termID reference to a resource, whether physical or logical. Once the termID has been resolved, the term name can be accessed (e.g. 'News' in the above example). The resolution method is left to the appreciation of each recipient.

URIs (URLs) can be replaced by aliases to provide a more concise, application-specific way of referring to classification terms as long as a look-up table is provided describing the relationship between Aliases and URIs.

If 'GenreCS' is the alias for "http://www.ebu.ch/metadata/cs/ebu_ContentGenreCS.xml".In the above example, 'News' could be identified through "GenreCS#3.1".

EBU Classification Schemes are also published in the SKOS (Simple Knowledge Organisation System) format using RDF for use and dereferencing as linked data (https://www.ebu.ch/metadata/ontologies/skos/).

3.3 Video and Audio time point references: anything fixed?

EBUCore uses three methods to identify video and audio time point references:

- a time duration according to ISO 8601 or IETF RFC 3339
- timecodes as defined by SMPTE in specification ST 12-1:2008
- a number of edit units, which are the fraction of time calculated as the inverse of the framerate for video, or the inverse of the sample rate for audio.

Audiovisual entities generally embed the property of having a "Timeline", which comes from the fact that the AV work is conceived to be played for a defined "Duration", and all the events characteristic of the AV work itself are located on the Timeline.

The Timeline concept applies to AV 'editorial entities' as well as to the 'physical entities' incl. their 'technical parameters', which are the sources providing the AV material for actual realisations.

A typical application of the timeline mechanism is for identifying the location of a given AV-entity A which is a part (in time) of another AV-entity B.

As B has got its own duration D(B), we can say that A, with its own duration D(A), is located at point S of the Timeline of B.

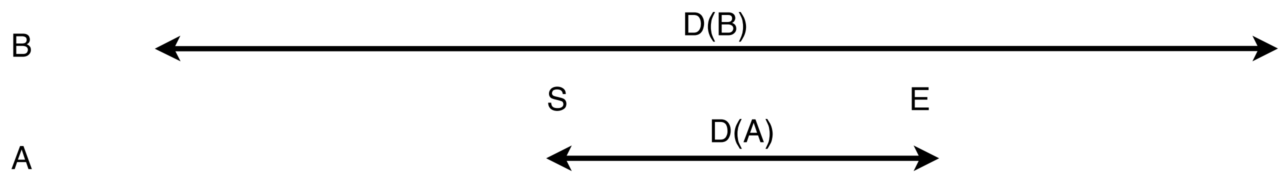


Figure 3: Illustration of a timeline

This means that if A is located on the Timeline of B, from S to E, then E=S+D(A).

In EBUCore there are two mechanisms for expressing a position on a Timeline:

- the “Elapsed Time”, which gives the time elapsed on the Timeline of the reference entity (B in the example above) from its beginning.
  - the data type for that is an ISO 8601 duration (e.g. PT1M5.0S) or IETF RFC 3339;
  - the reference point for the elapsed time is always the beginning of the reference entity.
- the “Elapsed Units” which give the same information in terms of the number of Edit Units (which are countable)
  - this is to be preferred because it ensures that Timeline markers fall on the boundary of the Edit Unit;
  - duration of the EditUnit must be known unambiguously and indicated, otherwise it is better to use the “Elapsed Time”.

The two mechanisms mentioned above can also be used to locate the position of an AV-entity on the Timeline of a material source.

However, there are contexts, in terms of the type of source, where the information in those terms is not available or it’s possibly ambiguous. For instance, identifying the position on a clip within a video-tape in terms of “Elapsed Time” or “Elapsed Units” from the “BOT (Beginning of Tape) is very difficult in practice. The BOT position itself may be not precise enough. In those cases, typically, the position on material source (e.g. the tape) is indicated by the “TimeCode”, which is a label recorded together with the EditUnit.

Although the “TimeCode” mechanism doesn’t provide any certainty about the uniqueness of the point on the Timeline (the same TimeCode might be repeated) and neither does it provide reliable information on Duration (“TimeCode” is not constrained to be continuous), this is the way on which legacy production systems rely for editing and for saving EDLs (Editing Decision Lists).

This is the reason why EBUCore also supports the indication of TimeCodes for all the cases where the Timeline positioning deals with material sources.

However, it is recommended to also provide, if available, the information in terms of elapsed time or edit units (required in IMF).

Alternatively, a user may use the user defined time and duration formats to express time and duration as a number of seconds and fractions of seconds. Other user defined formats can be used.

The pattern used for timecode respects recommendation SMPTE ST 12-1-2008 and supports the use of drop-frame or non-drop-frame timecodes:

```
(([0-1][0-9])|([2][0-3])):[0-5][0-9]:[0-5][0-9](([.,])|([:;]))[0-9]{2,5}
```

3.4 *What is the 'part' element? How can I use it?*

The 'Part' element was originally introduced to identify 'editorial' segments of content within a media resource. Following work done within the EBU on acquisition metadata, the definition of the 'part' element has been extended to allow any form of partitioned description, editorial or technical metadata, optionally bound to a specific timeline.

Some implementers also use part to sort metadata per category e.g. one or more parts for descriptive metadata, one part for video technical metadata, another for audio technical metadata, etc. This is absolutely in conformance with the EBUCore schema.

The EBU work on the Class Conceptual Data Model (CCDM), EBU Tech 3351, has allowed extending the use of 'part' to a business object made of one or more components. For example, EBUCore can be used to describe a series or season, each part describing an episode of that series or season.

The 'part' element is extremely versatile. §§ 3.4.1 and 3.4.5 illustrate some of these possible implementations. But the use of the 'part' element is not limited to these examples.

An EBUCore XML instance can contains a mix of 'part' elements of different nature, editorial technical or else. It is just a matter for the implementer to figure a coherent identification and name convention to help parsing these elements.

3.4.1 How can I define editorial 'parts' of a media resource?

There are many different editorial reasons why 'parts' (or e.g. segments, sequences, scenes) could be identified within a timeline. For example, content can be split into a set of purposefully constructed sequences designed to facilitate user navigation (e.g. like DVD chapters). 'Parts' can also be identified when a particular actor appears (e.g. as the result of face recognition processing or using user labelling). It can also be used to identify, for example, news items (internal, affairs, news report, weather report…) within a news programme.

Two mechanisms allow such 'parts' to be identified and described in EBUCore.

The first solution consists of using the 'part' element, which provides a description of 'parts' (and parts of parts of parts…) within one metadata instance.

The second solution consists of using the 'hasPart' or 'hasTrackPart' relations pointing to objects being described on their own with separate EBUCore metadata XML files/instances for each 'part'. This will be the approach followed when using the EBU Core RDF ontology, linking data.

3.4.2 How can I use the 'part' element for dynamic (technical) metadata?

In order to describe the changing value of a technical attribute over time, all that is needed is to identify that the 'Part' element is used for this purpose through an appropriate 'formatId' or 'formatName'. Time segments are defined by sub-parts. The 'format' element contains the value of the technical attribute associated to a 'start', 'end' and/or 'duration' time points.

Example - Camera parameter evolution associated to a timeline

```
<ebucore:part partId="CameraMetadata">
  <ebucore:part partId="part_CameraMetadata_1">
  <!-- FIRST TIME SEGMENT WITH A PARTICULAR SET OF CAMERA SETTINGS -->
     <ebucore:format>
        <ebucore:start>
           <ebucore:editUnitNumber editRate="60" factorDenominator="1001"
           factorNumerator="1000">200</ebucore:editUnitNumber>
        </ebucore:start>
        <ebucore:duration>
           <ebucore:editUnitNumber editRate="60" factorDenominator="1001"
           factorNumerator="1000">800</ebucore:editUnitNumber>
        </ebucore:duration>
        <ebucore:technicalAttributeString typeLabel="AutoExposureMode"
        typeDefinition="a value from RP224" formatLabel="Universal Label">
        06.0E.2B.34.04.01.01.0B.05.10.01.01.01.02.00.00
        </ebucore:technicalAttributeString>
        <ebucore:technicalAttributeUInt16 typeLabel="ISOSpeed"
typeDefinition="ISO12232">
        800</ebucore:technicalAttributeUInt16>
    </ebucore:format>
  </ebucore:part>
  <ebucore:part  partId="part_CameraMetadata_2">
  <!-- SECOND TIME SEGMENT WITH A DIFFERENT SET OF CAMERA SETTINGS -->
    <ebucore:format>
          <ebucore:start>
            <ebucore:editUnitNumber editRate="60" factorDenominator="1001"
            factorNumerator="1000">1000</ebucore:editUnitNumber>
          </ebucore:start>
          <ebucore:duration>
            <ebucore:editUnitNumber editRate="60" factorDenominator="1001"
            factorNumerator="1000">630</ebucore:editUnitNumber>
          </ebucore:duration>
          <ebucore:technicalAttributeString typeLabel="AutoExposureMode"
          typeDefinition="a value from RP224" formatLabel="Universal Label">
          06.0E.2B.34.04.01.01.0B.05.10.01.01.01.02.00.00
          </ebucore:technicalAttributeString>
          <ebucore:technicalAttributeUInt16 typeLabel="ISOSpeed"
typeDefinition="ISO12232">
          1600</ebucore:technicalAttributeUInt16>
      </ebucore:format>
   </ebucore:part>
</ebucore:part>
```

Important Note: EBUCore now offers an alternative solution specifically designed for highly dynamic metadata. See § 3.25.

3.4.3 How can I use parts to describe (programme) groups?

EBUCore fully supports the description of groups and collections using the appropriate relations such as isMemberOf or isEpisodeOf.

Similar mechanisms can be used to identify different parts composing a media resource using e.g. hasPart. However, it is also possible to use the "part" element as syntactically represented in the following XML snippet:

Example: description of a series with seasons and episodes

```
<ebuCoreMain xmlns....>
    <coreMetadata>
        <!-- Describe here a series with series title, description, cast, etc.-->
        <!-- define the type / objectType as "series"
        <part partId="season1" partName="season a" typeLabel="Season">
            <!-- describe here the elements characterising a season -->
            <part partId="e1" partName="episode 1" typeLabel="Episode">
                <!-- describe here the episode with title, description, cast incl.
e.g.
         guests, etc. -->
            </part>
            <part partId="e2" partName="episode 2" typeLabel="Episode">
                <!-- describe here the episode with title, description, cast incl.
e.g.
         guests, etc. -->
            </part>
            <!-- Etc.-->
        </part>
        <!-- Etc.-->
    </coreMetadata>
</ebuCoreMain>
```

3.4.4 Distributed storage of media resources: where and in which format?

As shown below, there are two built-in mechanisms to describe where are different instantiations of the same editorial objects, possibly in different formats or using different type of storage.

A third option would consist of defining a new relation such as "isInstantiatedBy" establishing the relation between the editorial object described in an EBUCore instances with instantiations described by their own EBUCore instances.

Option 1 ***- Repeating the format element***

```
<ebuCoreMain xmlns=…>
    <coreMetadata>
        <!-- Describe here the editorial objects possibly with associated editorial
        parts,
        etc.-->
        <!-- Define the type/objectType e.g. as a programme -->
        <format formatId="instance1" formatName="instantiation 1">
            <!-- describe here the format and location of this instantiation -->
            <locator>xxxx</locator>
        </format>
        <format formatId="instance2" formatName="instantiation 2">
            <!-- describe here the format and location of this instantiation -->
            <locator>xxxx</locator>
        </format>
 <!-- Etc. -->
    </coreMetadata>
</ebuCoreMain>
```

Option 2 ***- Using different 'part' element for each format***

```
<ebuCoreMain xmlns=…>
  <coreMetadata>
      <!-- Describe the editorial objects possibly with associated editorial parts,
      etc.-->
      <!-- Define the type/objectType e.g. as a programme -->
      <part partId="instance1" partName="instantiation 1">
          <format>
              <!-- describe here the format and location of this instantiation -->
              <locator>xxxx</locator>
          </format>
          <!-- describe here the format and location of this instantiation -->
      </part>
      <part partId="instance2" partName="instantiation 2">
          <format>
              <!-- describe here the format and location of this instantiation -->
              <locator>yyyy</locator>
          </format>
      </part>
      <!-- Etc.-->
  </coreMetadata>
</ebuCoreMain>
```

3.4.5 *Can I use the 'part' element to fragment my data?*

Yes. As an example, some implementers use the part element to clearly separate technical format metadata:

```
<ebuCoreMain xmlns=….>
  <coreMetadata>
      <!-- Optionally describe here the editorial object, not required if the xml
      document only describes an specific instantiation -->
      <format>
          <!-- provide here file and container information -->
          <fileName>filename</fileName>
          <locator>xxxxx</locator>
      </format>
      <part partId="id23" partName="audio format information">
          <format>
              <audioFormatExtended>
                  <!-- describe here the audio format -->

              </audioFormatExtended>
          </format>
      </part>
      <part partId="id34" partName="video format information">
          <format>
              <videoFormat>
                  <!-- describe here the video format -->
              </videoFormat>
          </format>
      </part>
      <!-- Etc.-->
  </coreMetadata>
</ebuCoreMain>
```

This approach can apply in a variety of contexts left to the appreciation of the implementer.

3.4.6 *Can I use the 'part' element to localise props and artefacts?*

The elements artefact, props, costume, food allow identifying which of these objects can be seen in a scene/part. It is also possible to link an object to a person/actor/contributor appearing in the scene/part.

3.4.7 *Can I use the 'part' element to localise agents/contributors?*

Each part can be associated with agents/contributors with a variety of roles.

3.4.8 *Can I use the 'part' element to localise text?*

The textLine element allows associating text to a scene and agent in a given order and language. The source of the text can also be specified (e.g. speech to text).

3.5 *How can I describe versions of programmes?*

There can be many reasons why a programme is declared to be a version of a particular source (e.g. a shorter version, a different language, with or without captioning, but also available on different mediums such as a file, a tape, a disk).

The best approach to identify versions is to use relations such as hasVersion or hasSource. The relation links two instances and their respective descriptions highlighting differences such as given above as examples.

EBUCore provide a rich set of predefined relations. Users can also define their own relation as shown below:

```
<relation typeLabel="my relation"
          typeDefinition="my type of relation in a few words"
          note="relation for this purpose">
          <dc:relation>isConnectedTo</dc:relation>
</relation>
```

3.6 How can I use my own technical attributes?

The following example illustrates how to use the technical attribute patterns within EBUCore. The average bitrate can be expressed as:

a) Example of a user defined technicalAttributeString

```
<ebucore:technicalAttributeString typeLabel="averageBitrate" typeDefinition="the
average bitrate" formatLabel="integer">123456789</ebucore:technicalAttributeString>
```

b) Example of a user defined a technicalAttributeLong

```
<ebucore:technicalAttributeLong typeLabel="myCustomTechnicalParameter">123456789
</ebucore:technicalAttributeLong>
```

The choice is left to the implementer within his domain of interoperability. Some implementations use only the technicalAttributeString, which allows defining/replacing all simple datatypes with only one structure. It can also be used for more complex datatypes such as the technicalAttributeRational structure by defining a template in the format attribute, etc.

Some pre-defined technical attributes may be replaced by user defined attributes if required by the format of the data available to the implementer.

The metadata extraction application "mediaInfo" exports data as EBUCore. When technical attributes are not specifically defined, mediaInfo uses technical attributes to export technical metadata.

3.7 How do I apply loudness?

Documents EBU Tech 3343 and EBU R 128 establish a predictable and well-defined method of measuring the loudness level for news, sports, drama, music, film, promotions, adverts etc. throughout the broadcast chain and thereby help professionals to create robust specifications for ingest, production, play-out and distribution to a multitude of platforms. EBU R 128 is based entirely on open standards and aims to harmonise the way we produce and measure audio internationally.

The audioFormatExtended element specifies precisely how and where to apply loudness.

3.8 How can I tag content in EBUCore?

It is now common to 'tag' content. Tags can be issued by professionals like content creators or content providers, or by users.

In EBUCore, tags are defined as 'subjects' of typeLabel="tag" issued by 'attributors' (persons or organisations).

3.9 How can I differentiate locators?

The locator attribute in format now has a type attribute to specify what the locator is being used for. A locator can point to an object of typeLabel "resource", "thumbnail", "landing page", etc.

Relations can also be used to point to related external objects.

3.10 How can I associate a format and rights to a publication event?

The publicationHistory lists the publication events of a media resource. This allows indicating, when, where, in which format and under which rights the media resource has been published.

The format attribute now has an associated formatId attribute of type ID, which can be referenced to from the publication event formatIdRef attribute. This allows indicating which format is being used for a particular publication.

The same applies to rights using the rightsID and associated rightsIDREFS.

3.11 When do I use labels and/or links in type/format/status?

Several EBUCore elements and attributes propose to define their value through a "label" and/ or a "link". Links can be used to define a relationship in the sense of linked data. A typical case of linked data consists of pointing to classification scheme term via its identifier.

However, when available, the corresponding term of value should also be provided as a 'label' to facilitate mapping.

3.12 Can I provide e.g. a display or print name in contactDetails?

A display or print name can easily be implemented as follows:

```
<contactDetails>
   <name typeLabel="Display name">
     Mr. Best Guest for display
   </name>
   <name typeLabel="Print name">
     Mr. Best Guest for print
   </name>
</contactDetails>
```

3.13 Can I provide contactDetails for a group or ensemble?

For groups, ballets or similar non individual formation, you can use contactDetails with typeLabel="music group, orchestra dancing team, ballet team or e.g. individual" (real person by default, but can be fictitious). Then use "name" to provide the name of the group, orchestra, dancing team, ballet team or individual.

You can use the other more structured way for detailing names for persons either real or fictitious (there are web resources describing the bio and life of fictitious characters). Then you can now use a link to web resource with related information, which can be of any type optionally specified.

Another option would be to use organisationDetails in the same way for groups and then use contactDetails for members of the group.

3.14 Are there examples of implementation of the new audio model?

Examples of implementation of the new EBU extended audio model implemented in the EBUCore schema through the audioFormatExtended element can be found in Annex C and in the audio model specification Tech.3364.

EBU Tech 3364 provides more details on the audio model, including examples on its mapping to BWF and MXF.

The extended audio model is built around a set of relations. These relations are clearly identified using a naming convention by which elements or attributes contains 'ID', 'IDREF', 'IDREFS'. In XML, IDREF and IDREFS pair with ID to establish a relation. This can be implemented in two ways:

- XML Schema define datatypes for ID, IDREF and IDREFS. If these datatypes are used, relations must be established within the same metadata instance file, which can be seen as a design restriction but provides strong validation support.
- EBUCore doesn't use ID, IDREF and IDREFS datatypes but anyURI. This allows establishing relations across metadata instance files (e.g. allowing to separate a content description from the structural description of the audio model components, or to constitute external libraries of audio configurations). Of course, this requires that an implementer pays particular attention to the pairing of URIs, which is facilitated by the naming convention used for related elements and attributes in the EBUCore schema.

3.15 How can I extend a schedule beyond midnight?

It is common practice that a day schedule starts for example at around 6 O'clock in the morning and finishes at around the same time on the following day. The following XML snippet shows how it should be done instantiating the EBUCore schema.

```
<publicationEvent>
    <publicationDate>2014-03-12</ns2:publicationDate>
    <publicationTime>01:00:00</ns2:publicationTime>
    <scheduleDate>2014-03-11</ns2:scheduleDate>
    <publicationService…
</publicationEvent>
```

In this example, a programme is broadcast a 1 O'clock in the morning on 12th March 2014, but this publication event belongs to the schedule of 11th March 2014.

3.16 targetAudience, audienceLevel and audienceRating?

Originally, targetAudience has been the common placeholder for audience rating and audience level as defined also by MPEG-7 and TV-Anytime. However, for the sake of harmonisation with North-American best practice, the audienceLevel element has been added as a sub-element of ebucore:type. It is recommended to use targetAudience or audienceLevel to identify age and population groups.

The element audienceRating has also been added for the sake of harmonisation. It shall be used to define an audience appropriate to the programme. The EBU Classification Scheme for audience rating has been deprecated. For ratings the EBU now recommends the use of
http://www.movielabs.com/md/ratings/v2.0/html/Summary.html .

3.17 When should I use rating?

Rating can be used to rate content (e.g. 'like' or 'not like' or using custom scales). Rating can be provided by users or organisations.

3.18 How do I provide annotation along a timeline?

There are two options:

- Use a part element with a timestamp and a description of type annotation with an attributor.

- Populate the new textLine element with a part or associated to a timestamp. In this implementation, timed text can be specifically associated to a scene, a timestamp and/or a person/character. See § 3.27.

3.19 How do I map MXF video and audio tracks to EBUCore?

The following is an example of technical metadata extracted from a UK DPP AS-11 MXF file and converted into EBUCore using mediaInfo (https://mediaarea.net/fr/MediaInfo).

```
<ebucore:coreMetadata>
   <ebucore:title typeLabel="PROGRAMME TITLE">
      <dc:title>Programme Title - Post Watershed Version</dc:title>
   </ebucore:title>
   <ebucore:alternativeTitle typeLabel="SERIES TITLE">
      <dc:title>Series Title</dc:title>
   </ebucore:alternativeTitle>
   <ebucore:alternativeTitle typeLabel="EPISODE TITLE NUMBER">
      <dc:title>Episode Title / Number</dc:title>
   </ebucore:alternativeTitle>
   <ebucore:description typeLabel="SYNOPSIS">
      <dc:description>DPP test material</dc:description>
   </ebucore:description>
   <ebucore:description typeLabel="PRODUCT PLACEMENT">
      <dc:description>false</dc:description>
   </ebucore:description>
   <ebucore:contributor>
      <ebucore:contactDetails>
         <ebucore:details>
            <ebucore:emailAddress>xxx.yyy@bbc.co.uk</ebucore:emailAddress>
            <ebucore:telephoneNumber>0208 008 4566</ebucore:telephoneNumber>
         </ebucore:details>
      </ebucore:contactDetails>
      <ebucore:role typeLabel="contact"/>
   </ebucore:contributor>
   <ebucore:contributor>
      <ebucore:organisationDetails>
         <ebucore:organisationName>BBC R&D</ebucore:organisationName>
      </ebucore:organisationDetails>
      <ebucore:role typeLabel="originator"/>
   </ebucore:contributor>
   <ebucore:date>
```

```
      <ebucore:copyrighted startYear="2013"/>
   </ebucore:date>
   <ebucore:type>
      <ebucore:genre typeDefinition="Test Material"/>
   </ebucore:type>
   <ebucore:format>
      <ebucore:videoFormat videoFormatName="AVC">
         <ebucore:width unit="pixel">1920</ebucore:width>
         <ebucore:height unit="pixel">1080</ebucore:height>
         <ebucore:frameRate factorNumerator="25000"
         factorDenominator="1000">25</ebucore:frameRate>
         ebucore:aspectRatio typeLabel="display">
            <ebucore:factorNumerator>16</ebucore:factorNumerator>
            <ebucore:factorDenominator>9</ebucore:factorDenominator>
         </ebucore:aspectRatio>
         <ebucore:videoEncoding typeLabel="High 4:2:2 Intra@L4.1"/>
         <ebucore:codec>
            <ebucore:codecIdentifier>
               <dc:identifier>0D01030102106001-
               0401020201323102</dc:identifier>
            </ebucore:codecIdentifier>
         </ebucore:codec>
         <ebucore:bitRate>113664000</ebucore:bitRate>
         <ebucore:scanningFormat>interlaced</ebucore:scanningFormat>
         <ebucore:scanningOrder>top</ebucore:scanningOrder>
         <ebucore:videoTrack trackId="1001" trackName="V1"/>
         <ebucore:technicalAttributeString
         typeLabel="ActiveFormatDescription">5</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="Standard">Component</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="ColorSpace">YUV</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="ChromaSubsampling">4:2:2</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="colour_primaries">BT.709</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="transfer_characteristics">BT.709
         </ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString typeLabel="matrix_coefficients">BT.709
         </ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="colour_range">Full</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeInteger
         typeLabel="StreamSize">11700924815</ebucore:technicalAttributeInteger>
         <ebucore:technicalAttributeInteger
         typeLabel="BitDepth">10</ebucore:technicalAttributeInteger>
         <ebucore:technicalAttributeBoolean
         typeLabel="CABAC">false</ebucore:technicalAttributeBoolean>
         <ebucore:technicalAttributeBoolean
         typeLabel="MBAFF">true</ebucore:technicalAttributeBoolean>
         <ebucore:comment typeLabel="VideoComments">RP 2027 AVC-Intra compatible
         encoded</ebucore:comment>
      </ebucore:videoFormat>
      <ebucore:audioFormat audioFormatName="PCM">
         <ebucore:audioEncoding typeLabel="PCM"/>
         <ebucore:codec>
            <ebucore:codecIdentifier>
               <dc:identifier>0D01030102060100</dc:identifier>
            </ebucore:codecIdentifier>
         </ebucore:codec>
         <ebucore:audioTrackConfiguration typeLabel="EBU R 123: 16c"/>
         <ebucore:samplingRate>48000</ebucore:samplingRate>
         <ebucore:sampleSize>24</ebucore:sampleSize>
         <ebucore:bitRate>1152000</ebucore:bitRate>
         <ebucore:bitRateMode>constant</ebucore:bitRateMode>
         <ebucore:audioTrack trackId="2001" trackName="A1"/>
         <ebucore:channels>1</ebucore:channels>
         <ebucore:technicalAttributeString typeLabel="ChannelPositions">
         Front: L</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString typeLabel="ChannelLayout">L
         </ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="Endianness">Little</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString typeLabel="Wrapping">Frame (BWF)
         </ebucore:technicalAttributeString>
         <ebucore:technicalAttributeInteger
         typeLabel="StreamSize">118431360</ebucore:technicalAttributeInteger>
      </ebucore:audioFormat>
      <!—-other audio channel formats-->
      <ebucore:containerFormat containerFormatName="MXF">
         <ebucore:containerEncoding formatLabel="MXF"/>
         <ebucore:technicalAttributeString typeLabel="AS11ShimName">UK DPP HD
         </ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString typeLabel="AS11ShimVersion">1.1
         </ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString typeLabel="FormatProfile">OP-1a
         </ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString typeLabel="FormatSettings">Closed /
         Complete</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString
         typeLabel="WrittingApplication">
         BBC bmx 0.1.2.0.2</ebucore:technicalAttributeString>
         <ebucore:technicalAttributeString typeLabel="WrittingLibrary">BBC bmx
         0.1.2.0.2</ebucore:technicalAttributeString>
      </ebucore:containerFormat>
      <ebucore:signingFormat signingPresenceFlag="false"/>
      <ebucore:dataFormat>
         <ebucore:captioningFormat captioningPresenceFlag="false"
         closed="true"/>
      </ebucore:dataFormat>
      <ebucore:dataFormat>
         <ebucore:captioningFormat captioningPresenceFlag="false"
         closed="false"/>
      </ebucore:dataFormat>
      <ebucore:timecodeFormat timecodeFormatName="MXF TC">
         <ebucore:timecodeStart typeLabel="Material">
            <ebucore:timecode>09:59:30:00</ebucore:timecode>
         </ebucore:timecodeStart>
         <ebucore:timecodeTrack trackId="901" trackName="MXF_TC"/>
         <ebucore:technicalAttributeBoolean typeLabel="Stripped">
         true</ebucore:technicalAttributeBoolean>
      </ebucore:timecodeFormat>
      <ebucore:timecodeFormat timecodeFormatName="MXF TC">
         <ebucore:timecodeStart typeLabel="Source">
            <ebucore:timecode>09:59:30:00</ebucore:timecode>
         </ebucore:timecodeStart>
         <ebucore:timecodeTrack trackId="901" trackName="MXF_TC"/>
```

```
         <ebucore:technicalAttributeBoolean typeLabel="Stripped">
            true</ebucore:technicalAttributeBoolean>
      </ebucore:timecodeFormat>
      <ebucore:metadataFormat metadataFormatName="AS-11 Core">
         <ebucore:metadataTrack trackName="AS-11 Core" trackId="3001"/>
      </ebucore:metadataFormat>
      <ebucore:metadataFormat metadataFormatName="AS_11_Segmentation">
         <ebucore:metadataTrack trackName="AS_11_Segmentation"
         trackId="3002"/>
      </ebucore:metadataFormat>
      <ebucore:metadataFormat metadataFormatName="AS_11_UKDPP">
         <ebucore:metadataTrack trackName="AS_11_UKDPP" trackId="3101"/>
      </ebucore:metadataFormat>
      <ebucore:start typeLabel="LineUpStart">
         <ebucore:timecode>09:59:30:00</ebucore:timecode>
      </ebucore:start>
      <ebucore:start typeLabel="IdentClockStart">
         <ebucore:timecode>09:59:50:00</ebucore:timecode>
      </ebucore:start>
      <ebucore:duration>
         <ebucore:normalPlayTime>PT13M42.440S</ebucore:normalPlayTime>
      </ebucore:duration>
      <ebucore:duration typeLabel="TotalProgrammeDuration">
         <ebucore:timecode>09:59:50:00</ebucore:timecode>
      </ebucore:duration>
      <ebucore:fileSize>13597677029</ebucore:fileSize>
      <ebucore:fileName>AS11_DPP_HD_EXAMPLE_1.mxf</ebucore:fileName>
      <ebucore:locator>E:\MediaInfoLib_CrashTest\Nominal\Multiple\MXF\AS-
      11\AS11_DPP_HD_EXAMPLE_1.mxf</ebucore:locator>
      <ebucore:technicalAttributeString typeLabel="AudioLoudnessStandard">EBU
      R 128</ebucore:technicalAttributeString>
      <ebucore:technicalAttributeInteger typeLabel="OverallBitRate">
      132266690</ebucore:technicalAttributeInteger>
      <ebucore:dateCreated startDate="2014-02-18" startTime="14:28:14Z"/>
   </ebucore:format>
   <ebucore:identifier typeLabel="PRODUCTION NUMBER">
      <dc:identifier>DRAZ855R/01</dc:identifier>
   </ebucore:identifier>
   <ebucore:language typeLabel="PrimaryAudioLanguage">
      <dc:language>eng</dc:language>
   </ebucore:language>
   <ebucore:language typeLabel="ProgrammeTextLanguage">
      <dc:language>eng</dc:language>
   </ebucore:language>
   <ebucore:part partNumber="1" partTotalNumber="1">
      <ebucore:partStartTime>
         <ebucore:timecode>10:00:00:00</ebucore:timecode>
      </ebucore:partStartTime>
      <ebucore:partDuration>
         <ebucore:timecode>00:13:06:00</ebucore:timecode>
      </ebucore:partDuration>
   </ebucore:part>
</ebucore:coreMetadata>
```

3.20 How do I map MPEG video and audio tracks to EBUCore?

The following is an example of technical metadata extracted from an MPEG transport stream (TS) file and converted into EBUCore using mediaInfo (https://mediaarea.net/fr/MediaInfo).

```
<ebucore:format>
  <ebucore:videoFormat videoFormatName="MPEG Video" videoFormatVersionId="Version 2">
     <ebucore:width unit="pixel">720</ebucore:width>
     <ebucore:height unit="pixel">576</ebucore:height>
     <ebucore:framerate factorNumerator="25000"
     factorDenominator="1000">25</ebucore:frameRate>
        <ebucore:aspectRatio typeLabel="display">
           <ebucore:factorNumerator>4</ebucore:factorNumerator>
           <ebucore:factorDenominator>3</ebucore:factorDenominator>
        </ebucore:aspectRatio>
        <ebucore:videoEncoding typeLabel="MPEG-2 Video Main Profile @ Main Level"/>
     <ebucore:codec>
        <ebucore:codecIdentifier>
           <dc:identifier>2</dc:identifier>
        </ebucore:codecIdentifier>
     </ebucore:codec>
     <ebucore:bitRate>3614266</ebucore:bitRate>
     <ebucore:bitRateMax>15000000</ebucore:bitRateMax>
     <ebucore:scanningFormat>interlaced</ebucore:scanningFormat>
     <ebucore:scanningOrder>top</ebucore:scanningOrder>
     <ebucore:videoTrack trackId="120"/>
  </ebucore:videoFormat>
  <ebucore:audioFormat audioFormatName="MPEG Audio" audioFormatVersionId="Version 1">
  <ebucore:audioEncoding typeLabel="MPEG-1 Audio Layer II"
  typeLink="http://www.ebu.ch/metadata/cs/ebu_AudioCompressionCodeCS.xml#7.2"/>
     <ebucore:codec>
        <ebucore:codecIdentifier>
           <dc:identifier>4</dc:identifier>
        </ebucore:codecIdentifier>
     </ebucore:codec>
   <ebucore:samplingRate>48000</ebucore:samplingRate>
   <ebucore:bitRate>256000</ebucore:bitRate>
   <ebucore:bitRateMode>constant</ebucore:bitRateMode>
   <ebucore:audioTrack trackId="130" trackLanguage="fr"/>
   <ebucore:channels>2</ebucore:channels>
</ebucore:audioFormat>
<ebucore:audioFormat audioFormatName="AC-3">
   <ebucore:audioEncoding typeLabel="AC3"/>
     <ebucore:codec>
        <ebucore:codecIdentifier>
           <dc:identifier>6</dc:identifier>
        </ebucore:codecIdentifier>
     </ebucore:codec>
   </ebucore:audioEncoding>
          <ebucore:audioTrackConfiguration typeLabel=">Front: L C R, Side: L R "/>
          <ebucore:samplingRate>48000</ebucore:samplingRate>
          <ebucore:sampleSize>16</ebucore:sampleSize>
          <ebucore:bitRate>384000</ebucore:bitRate>
          <ebucore:bitRateMode>constant</ebucore:bitRateMode>
          <ebucore:audioTrack trackId="131" trackLanguage="fr"/>
          <ebucore:channels>5</ebucore:channels>
   </ebucore:audioFormat>
  <!—other audio channels and associated formats→

   <ebucore:containerFormat formatLabel="MPEG-TS"/>
   <ebucore:dataFormat dataFormatName="Teletext" dataTrackId="140-100">
     <ebucore:subtitlingFormat subtitlingFormatName="Teletext" trackId="140-
     100" language="fr"/>
   </ebucore:dataFormat>
   <ebucore:dataFormat dataFormatName="Teletext Subtitle" dataTrackId="140-888">
     <ebucore:subtitlingFormat subtitlingFormatName="Teletext Subtitle"
     trackId="140-888" language="fr"/>
   </ebucore:dataFormat>
   <ebucore:dataFormat dataFormatName="DVB Subtitle" dataTrackId="150">
     <ebucore:subtitlingFormat subtitlingFormatName="DVB Subtitle"
     trackId="150" language="fr"/>
   </ebucore:dataFormat>
   <ebucore:duration>
     <ebucore:normalPlayTime>PT34.171S</ebucore:normalPlayTime>
   </ebucore:duration>
   <ebucore:fileSize>19188488</ebucore:fileSize>
   <ebucore:fileName>E:\MediaInfo_EbuCore_File1.ts</ebucore:fileName>
</ebucore:format>
```

3.21 How do I implement EIDR or ISAN in EBUCore?

As defined in collaboration with EIDR, this is the recommended means of encoding EIDR identifiers into EBUCore metadata instances:

```
<ebucore:identifier typeLabel="EIDR"
   typeLink="http://www.ebu.ch/metadata/cs/ebu_IdentifierTypeCodeCS.xml#3.11">
   <dc:identifier>10.5240/7791-8534-2C23-9030-8610-5</dc:identifier>
</ebucore:identifier>
```

Term 3.11 points to the EBU Classification Scheme for identifiers containing the following information:

```
<Term termID="3.11">
  <Name xml:lang="en">EIDR</Name>
  <Definition xml:lang="en">
    Canonical Representation of an Entertainment Identifier Registry
   (EIDR) Identifier, a universal unique identifier for movie and television assets.
  </Definition>
  <Reference>Section 2.2 of EIDR: ID FORMAT</Reference>
  <ChangeComment>Clarified that the Canonical Representation is used.</ChangeComment>
  <ChangeVersionDate>2015-05-05</ChangeVersionDate>
  <ValidityFlag>1</ValidityFlag>
  <Link xml:lang="en">
    <URL>http://eidr.org/documents/EIDR_ID_Format_v1.2.pdf</URL>
    <LinkName>EIDR: ID FORMAT</LinkName>
  </Link>
</Term>
```

Note: A similar approach can be followed to encode ISAN or other identifiers into EBUCore metadata instances.

3.22 How to define a checksum for insertion in BWF chunks?

As defined in collaboration with "The Music Producers Guild" this is how it is recommended to represent checksums in an EBUCore snippet for insertion in BWF metadata chunks.

```
<format>
  <hash>
   <hashValue>
     d131dd02c5e6eec4 693d9a0698aff95c 2fcab58712467eab 4004583eb8fb7f89
     55ad340609f4b302 83e488832571415a 085125e8f7cdc99f d91dbdf280373c5b
     d8823e3156348f5b ae6dacd436c919c6 dd53e2b487da03fd 02396306d248cda0
     e99f33420f577ee8 ce54b67080a80d1e c69821bcb6a88393 96f9652b6ff72a70
   </hashValue>
   </hashFunction typeLabel="MD5" typeLink="http://dbpedia.org/page/MD5">
  </hash>
</format>
```

3.23 How do I map EBUCore XML to EBUCore RDF?

The EBUCore schema inherently addresses the classes and properties that can be found in EBUCore RDF.

An EBUCore description is about content e.g. a programme, a group of programmes. Several of these types of programmes are predefined in the ontology as subclasses of the EditorialObject. Descriptive metadata such as e.g. title or description are associated with the EditorialObject.

Each EditorialObject is instantiated into MediaResources and Essences. This corresponds to what is described in the format element of the EBUCore schema, including all technical properties. The EBUCore schema allows describing the different formats in which content is available, which would correspond to different MediaResources.

Many other classes are mapped directly from the schema into the ontology, e.g. persons/contacts, organisations, events, locations, props, emotions, etc.

In order to facilitate future mappings, it is recommended to associate identifiers as early in the process as possible and when applicable to formats/@formatId, entities/@entityId, locations/@locationId, events/@eventId, etc. This will be useful when defining URIs to identify instances of classes in RDF.

More examples of mappings of actual data to EBUCore RDF can be found in **Annex B**.

3.24 How do I use correction factors – frame rate, timecode…?

The following complex types of the EBUCore schema contain factorNumerator and factorDenominator attributes allowing an alternative representation of rational values:

- aspectRatioType
- rationalType (frameRate, technicalAttributeRational)
- editUnitNumberTypetimecodeType

This is how the correction factors should be used.

3.24.1 aspectRatioType

An aspect ratio can be expressed as float, e.g. 1.7777. It can also be expressed as the "16 by 9" ratio. The EBUCore schema supports the use of a technicalAttributeFloat (1.777) or a technicalAttributeString in which this ratio can be expressed in many possible ways, e.g. “16 by 9”, “16:9”, “16/9”.

Alternatively, the aspectRatioType defines the ratio by its numerator and denominator; factorNumerator=”16” and factorDenominator =”9”.

3.24.2 rationalType

In this case the rational value in an integer, which can be weighed by a factorNumerator and factorDenominator.

Examples of possible framerate expressions:

- framerate=60 with factorNumerator =1000 and factorDenominator =1001

Other possible examples but not recommended:

- framerate=1 with factorNumerator =60000 and factorDenominator =1001

3.24.3 EditUnitNumbertype

In this case, the integer expressed a number of Edit Units. The value of each Edit Unit is based on the framerate for video (e.g. 60 Hz) or sampleRate (48000 Hz) for audio, so called EditRate in the EditUnitNumberType, which is weighed by a factorNumerator and factorDenominator.

3.24.4 timecodeType

In order to be able accurately convert timecode into real time, timecode should be annotated with an edit rate and drop frame attributes. For example, a timecode of 01:00:00;00 at 29.97 frames per second dropframe should be represented as follows:

```
<timecodeStart editRate="30" factorNumerator="1000" factorDenominator="1001"
dropframe="true">
  01:00:00;00
</timecode>
```

Note that while dropframe *should* always be denoted by a ‘;’ in between the seconds and frames field, this is not always done in practice, so it is better to make it explicit, i.e. setting the timecode/@dropframe attribute to 'true'.

A timecode of 01:00:00:00 at 25 frames per second can be represented as follows:

```
<timecodeStart editRate="25">
   01:00:00:00
</timecode>
```

3.25 Can I represent highly dynamic metadata?

Highly Dynamic metadata is typically acquisition technical metadata that can potentially change frame after frame. However, the following solution applies to any form of highly dynamic metadata.

EBUCore supports two alternative formats for highly dynamic acquisition technical metadata instantiating the acquisitionData element:

- representation of each technical parameter, which value varies along a line of time segments.
- representation of time segments during which each available parameter value is provided.

Dynamic technical metadata can for example be extracted using the mediaInfo application (open source, licence free, https://mediaarea.net/fr/MediaInfo/Download/Source).

Best practice is to generate separate EBUCore files for dynamic metadata. For technical dynamic metadata, the structure of the XML instance would be:

ebuCoreMain/coreMetadata/format/acquisitionData

3.26 Can I track props, costumes and other artefacts in production?

EBUCore now allows to identify and list props, costumes and other artefacts down to a scene or timestamp and establish relations to e.g. persons/characters using these items. A relation to a person/character can be done simple through the entityId.

3.27 Can I represent timed text from various sources?

TextLine is a new element that allows to link text to parts/segments/scenes or a timestamp. Text can be referenced from various sources such as subtitling, speech to text, text extraction, etc. Text can also be associated to a Person/Character in the scene. A relation to a person/character can be done simple through the entityId. This comes in complement to other sources of timed text such as W3C TTML or EBU-TT.

3.28 Can I track emotions and actions?

EBUCore now allows to identify emotions and actions in scenes and associated persons/characters. A relation to a person/character can be done simple through the entityId. A precise timestamp can be used to locate emotions and actions.

3.29 Where can I use EBUCore metadata in IMF?

As defined in the specification SMPTE ST 2067-1 2017, "The IMF is a file-based framework for the exchange and processing of multiple content versions (airline edits, special edition, languages…) of the same high-quality finished work (feature, episode, trailer, advertisement, etc.) destined for distribution channels worldwide. Specialization of the IMF Framework designed to meet the requirements of specific domains is achieved through the definition of IMF Applications."

Metadata is essential in IMF:

- to describe the essences which are referred to in an IMF package
- to identify the essences and other files in the package
- to define the compositions.
- Figure 4 shows the main metadata components and links in an IMF package.

EBUCore can be used under its namespace to provide descriptive metadata in the CPL ExtendedProperties. The recommendation is to use the ExtendedProperties to provide limited and simple descriptive metadata.

For richer descriptive metadata, the best approach consists of providing a sidecar metadata file. EBUCore documents can used in a sidecar file.

Finally, it is important to be able to use timed data. Here too, EBUCore can be used to define metadata along a timeline. In order to benefit from pre-existing tools, best practice consists of embedding this file in an MXF file referenced to in the CPL.

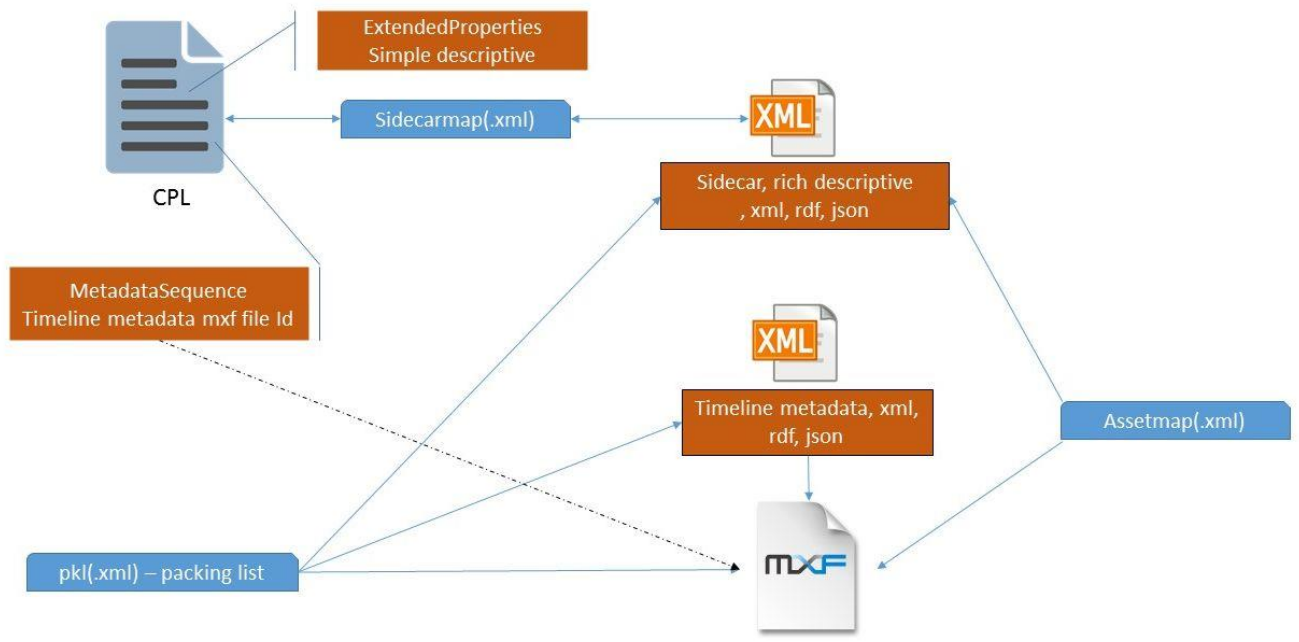


Figure 4: Metadata options in an IMF package

This has been successfully implemented using EBUCore XML and RDF instances.

3.30 HDR range metadata in EBUCore

An HDR range can be specified using the format/hdrMetadata element.

The HDR range is defined for a given picture size defined by its width and height.

An active area is also defined to which the masteredColorVolume applies. "*Master Display Color Volumes*" metadata is defined in SMPTE-2086. It is used to describe the capabilities of the display used to master content. SMPTE ST.2086 metadata includes CIE (x,y) chromaticity coordinates for RGB primaries, White Point, and min/max luminance of the mastering display.is defined (RGB and white point primary chromaticity).

This metadata has been designed to provide a specific EBUCore manifest to be used as metadata sidecar in IMF (see § 3.29).

3.31 Why EBUCore "pretty RDF/XML"?

The EBUCore RDF files accessible from the download zone (§ 6 of this document) are formatted as "pretty RDF/XML". This provides the best canonical RDF representation of the EBUCore ontology.

Why? Because tools like Protégé and TopBraid generate their own representation when exporting an ontology. This is also a potential problem when importing ontologies issued from other tools.

Pretty RDF/XML is generated online: http://rdf-translator.appspot.com/.

3.32 How do I manage multi-range properties in EBUCore RDF?

In real life, metadata usually comes from heterogeneous sources as either structured metadata or e.g. simple text. In order to maximise the aggregation of such data into semantic databses, being able to express a property as a Literal (basic values that are not IRIs) or an IRI is a typical requirement in RDF modelling.

3.32.1 Option 1: create 2 distinct properties, each with a different name and a specific range

The first solution consists of generating multiple properties with the same purpose but with different ranges, for instance "hasContributor" with an IRI as a range, and "contributor" with a string as a range, to identify a Contributor.

These can additionally be typed as object and data properties in OWL models.

3.32.2 Use only one property with multiple ranges

This is the choice that has been made in the current version of EBUCore RDF.
Several EBUCore RDF properties have multiple ranges, typically:

- an IRI to point to an instance of a specific resource belonging to the model
- a URI/IRI to point to an external resource
- a literal, e.g. a string, to provide a value.

The form of the RDF/XML should change depending on the type of range. For example:

```
<ebucore:isContributor rdf:resource="dummyNamespace/person#ID1234"/>
```
or
```
<ebucore:isContributor>John Doe</ebucore:isContributor>
```

3.33 How can I map EBUCore metadata to FRBR and METS?

3.33.1 FRBR (Functional Requirements for Bibliographical records)

https://www.ifla.org/files/assets/cataloguing/isbd/OtherDocumentation/resource-wemi.pdf

FRBR comprises groups of entities:

- Group 1 entities are work, expression, manifestation, and item (WEMI). They represent the products of intellectual or artistic endeavour.
    - *Resource: An entity, tangible or intangible, that comprises intellectual and/or artistic content and is conceived, produced and/or issued as a unit, forming the basis of a single bibliographic description.*
    - *Work: A distinct intellectual or artistic creation.*
    - *Expression: The intellectual or artistic realization of a work in the form of alpha-numeric, musical, or choreographic notation, sound, image, object, movement, etc., or any combination of such forms.*
    - *Manifestation: The physical embodiment of an expression of a work.*
    - *Item: A single exemplar of a manifestation.*
- Group 2 entities are person, family and corporate body, responsible for the custodianship of Group 1's intellectual or artistic endeavour.
- Group 3 entities are subjects of Group 1 or Group 2's intellectual endeavour, and include concepts, objects, events, places.

The current EBUCore mapping focuses on work, manifestation, item and the associated resources:

- A work is an EBUCore XML document with the descriptive metadata.
- A manifestation is an EBUCore XML document describing a publicationEvent.

- An item is an EBUCore XML document describing the resource used by the publicationEvent in a specific format.

3.33.2 METS (Metadata Encoding and Transmission Standard)

The METS schema is a standard for encoding descriptive, administrative, and structural metadata regarding objects within a digital library. It has become relevant to develop an EBUCore mapping to METS as digital libraries growingly extend their scope to manage audio-visual content.

A METS metadata file containing the FRBR elements mapped to EBUCore mentioned in § 3.33.1 could look like the following XML snippet. A Work is described with descriptive metadata. This Work is made available as a manifestation, i.e. a publicationEvent and the corresponding resource/Item (descriptive and technical metadata). The files and links to the corresponding Item/PublicationEvent/Item being are managed through the structMaps.

```
<?xml version="1.0" encoding="UTF-8"?>
<mets:mets>
    <!-- WORK - descriptive medadata -->
    <mets:dmdSec ID="DMDLOG_0000">
        <mets:mdWrap MDTYPE="OTHER" OTHERMDTYPE="urn:ebu:metadata-schema:ebucore">
            <mets:xmlData>
                <ebucore:ebuCoreMain>
                    ....
                </ebucore:ebuCoreMain>
            </mets:xmlData>
        </mets:mdWrap>
    </mets:dmdSec>
    <!-- the MANIFESTATION - PublicationEvent -->
    <mets:dmdSec ID="DMDLOG_0001">
        <mets:mdWrap MDTYPE="OTHER" OTHERMDTYPE="urn:ebu:metadata-schema:ebucore">
            <mets:xmlData>
                <ebucore:ebuCoreMain>
                    ...
                </ebucore:ebuCoreMain>
            </mets:xmlData>
        </mets:mdWrap>
    </mets:dmdSec>
    <!-- The ITEM and instance descriptive metadata of the object used for the
    PublicationEvent -->
    <mets:dmdSec ID="DMDLOG_0002">
        <mets:mdWrap MDTYPE="OTHER" OTHERMDTYPE="urn:ebu:metadata-schema:ebucore">
            <mets:xmlData>
                <ebucore:ebuCoreMain>
                    ...
                </ebucore:ebuCoreMain>
            </mets:xmlData>
        </mets:mdWrap>
    </mets:dmdSec>
    <!-- ITEM Technical Metadata -->
    <mets:amdSec ID="AMD_DATAOBJECT">
        <mets:techMD ID="AMD_0000">
            <mets:mdWrap MDTYPE="OTHER" OTHERMDTYPE="urn:ebu:metadata-
            schema:ebucore">
                <mets:xmlData>
                    <ebucore:ebuCoreMain>
                        ...e.g. mediainfo extracted technical metadata...
                    </ebucore:ebuCoreMain>
                </mets:xmlData>
            </mets:mdWrap>
        </mets:techMD>
    </mets:amdSec>
    <!-- the following structMaps are specific to METS to manage the different
    file resources -->
    <mets:structMap TYPE="xxx">
    </mets:structMap>
    <mets:structMap TYPE="yyy">
    </mets:structMap>
</mets:mets>
```

Each object corresponding to an EBUCore instance metadata document, this open new powerful perspectives on how to describe e.g. a publication event or an item with its own specific descriptive metadata and format/language information.

3.34 How do I use bidirectional/antisymmetric properties in EBUCore RDF?

The EBUCore schema contains a significant set of antisymmetric properties like “hasPart and isPartOf” or “hasMember and isMemberOf”. This reflects best practice when defining such properties to instantiate relations in XML instances.

There is no particular recommendation on the use cases where such properties should be used and how they should be used. The decision is left to the implementer.

In RDF, centred around relations, the definition of bidirectional properties is not systematic. The best guideline is to optimise the model to facilitate queries fitting the business requirements. For example, some use cases have shown that relations like “hasEpisode and isEpisodeOf” ease the definitions of relations between Assets. This helps defining efficient SPARQL queries. However, as SPARQL now allows queries on the inverse of properties (i.e. on the domain or range of a property), it is not required to systematically use explicit antisymmetric properties. The decision is again left to the implementer who can design the ontology to optimize queries for specific use cases as they see fit.

3.35 How do I manage collections of different types in EBUCore RDF?

It is easy to create all sorts of Collections using EBUCore RDF by:

- Instantiating a Collection class
- The type of Collection using the assetType property, a multi-range property accepting URIs (e.g. to a term in a SKOS vocabulary, or strings
- A Collection inherits all properties associated with an Asset: title, description, contributors, publication events, etc.

3.36 More questions?

The guidelines and questions presented in this specification address queries received from a variety of EBUCore implementers. EBUCore can sustain more scenarios.

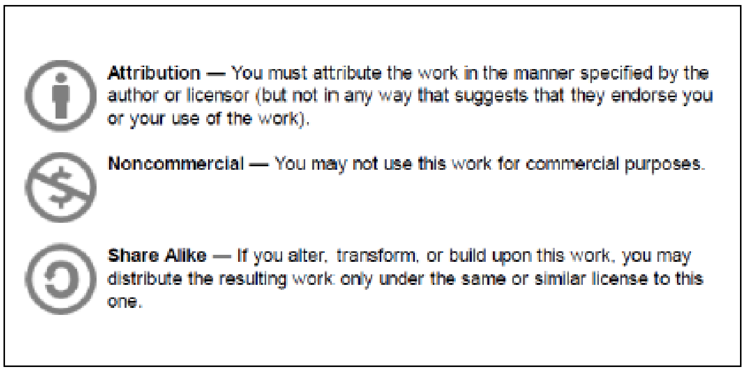
If you have additional questions on how to use EBUCore, please forward your queries to metadata@ebu.ch. You will receive personalised advice and answers will enrich this section of the EBUCore specification, with your permission.

4. Compliance

EBUCore doesn't pretend to cover everyone's needs in detail. EBUCore is an open framework allowing each user to adapt it as needed!

EBUCore is governed by Creative Commons' Attribution-NonCommercial-ShareAlike3.0 Unported(CC BY-NC-SA 3.0).

You are free: *to Share*—to copy, distribute and transmit the work *to Remix*—to adapt the work incl. under your own namespace under the following conditions:



Attribution — You must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work).

Noncommercial — You may not use this work for commercial purposes.

Share Alike — If you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

Non-commercial: EBUCore can be adapted and integrated into commercial products but shall not be subject to a specific financial license.

EBUCore is flexible and adaptable in nature. For example, thanks to the extended nature of the 'Part' element, description can be implemented in different ways.

Each implementer will define best practice, incl. additional compliance rules specific to its implementation and own domain of interoperability.

5. Maintenance

The EBU Core Metadata Set is maintained by the EBU and suggestions for corrections or additions can be made by mailing to (metadata@ebu.ch).

Contributions will be subject to peer review by the metadata experts participating in EBU metadata Strategic Programmes and projects (http://tech.ebu.ch/groups/mim).

6. Download Zone

Filename	Type	Contents
http://www.ebu.ch/metadata/schemas/EBUCore/ebucore.xsd	XML Schema	ebucore.xsd
https://www.ebu.ch/metadata/schemas/EBUCore/documentation/ebucore.html	HTML documentation	Navigate through the online documentation starting from the ebuCoreMain element.
https://www.ebu.ch/metadata/cs/ https://www.ebu.ch/metadata/cs/EBU_cs_p.zip	EBU Classification Schemes	Periodically updated list of EBU Classification Schemes in XML
https://www.ebu.ch/metadata/ontologies/ebucore/ (documentation) https://www.ebu.ch/metadata/ontologies/ebucore/ebucore.rdf (ontology)	RDF Schema	ebucore.rdf
https://www.ebu.ch/metadata/ontologies/skos/ https://www.ebu.ch/metadata/ontologies/skos/EBU_cs_skos_p.zip	EBU SKOS Classification Schemes	Periodically updated list of EBU Classification Schemes in RDF

7. Useful links

AES (http://www.aes.org)

Dublin Core (http://dublincore.org)

EBU Metadata (http://tech.ebu.ch/metadata/)

EBU Loudness (http://tech.ebu.ch/docs/tech/tech3343.pdf)

EBU BWF (http://tech.ebu.ch/docs/tech/tech3285.pdf)

EBU ADM (http://tech.ebu.ch/docs/tech/tech3364.pdf)
EUScreen (http://www.euscreen.eu)
FIMS (http://fims.tv)
IOC - International Olympic Committee (http://www.olympic.org/uk/sports/)
W3C SKOS (http://www.w3.org/2004/02/skos/)

ISO (http://www.iso.org)
ISO 4217 - Currency codes:
https://en.wikipedia.org/wiki/ISO_4217
ISO 3166-1 - Country codes (English):
https://en.wikipedia.org/wiki/ISO_3166-1
ISO 639 - Language codes : http://www.loc.gov/standards/iso639-2/

ITU

ITU R BS.2076-1 (ADM)
https://www.itu.int/dms_pubrec/itu-r/rec/bs/R-REC-BS.2076-1-201706-I!!PDF-E.pdf

IETF
RFC 3339 (Date and time on the Internet): http://tools.ietf.org/html/rfc3339
RFC5174 (EBU namespace): http://tools.ietf.org/html/rfc5174

IANA MIME Type: http://www.iana.org/assignments/media-types/
Thesaurus of Geographic Names: http://www.getty.edu/research/tools/vocabulary/tgn/index.html

Mediainfo https://mediaarea.net/fr/MediaInfo/Download/Source

8. Bibliography

- EBU Technical Information I36-2003 – Metadata Implementation considerations for Broadcasters
- EBU Tech 3293-2001 – Core Metadata Set for Radio Archives
- EBU Tech 3295 – P-META Metadata Library
- EBU Tech 3343 - Practical guidelines for Production and Implementation of EBU R 128
- EBU Tech 3351 - Class Conceptual Data Model
- EBU Tech 3364 - Audio Definition Model (ADM)
- ITU-R BS.2076-0 – Audio Definition Model (ADM)

Annex A: EBUCore Metadata Set Schema

The EBUCore Metadata schema is used to generate compliant EBUCore Metadata instances formed of an ebuCoreMain document.

The ebuCoreMain document contains several attributes required to contribute to OAI (Open Archive Initiative) for metadata harvesting. These attributes include the name of the schema (in case the schema location urn would not be present), the version of the schema used to generate the document, the date and time of last modification of the document and a unique identifier associated to the document. The name of the contributing archive is given by the metadata provider’s organisation name or ID.

Resource related information is provided by instantiating the coreMetadata element.

The reference schema is available from the download links in § 6 (Download Zone) of this document.

Annex B: EBUCore and Semantic Web

The EBUCore RDF schema (so called EBUCore ontology) is a semantic alternative to the EBUCore XML schema. The EBUCore ontology has been designed to provide a core set of classes and properties derived from EBUCore. Other EBU ontologies, like the EBU Class Conceptual Data Model (Tech 3351 - CCDM), extend the EBUCore ontology.

The business object and resource names have been selected to offer maximum harmonisation with other related ontologies. The hierarchy of the EBUCore RDF class model reflects the audiovisual objects that can be met in audiovisual production. The ontology offers all the properties defined in EBUCore XML schema still providing additional expressivity.

The EBUCore RDF ontology can be accessed from the following locations as permanent dereferencable resources. The server has been setup to allow client requests for XML/RDF or HTML content with a priority to the documentation.

- http://www.ebu.ch/metadata/ontologies/ebucore/ links to the online documentation.
- http://www.ebu.ch/metadata/ontologies/ebucore/ebucore.rdf links to the ontology.

More information on server setups can be found at the following address (Best Practice Recipes for Publishing RDF Vocabularies). The EBU server has been setup following Recipe 3 with a default to the html documentation. The direct link to the ontology is provided in the download zone.

http://www.w3.org/TR/swbp-vocab-pub/

The EBUCore ontology has been designed to use "cool URIs" with "hash namespaces".

Important Notes:

- The EBUCore ontology is now mostly RDF, which allows to instantiate properties with resources or literals. This approach offers great interoperability with various communities.
- SubClasses inherit properties from upper classes;
- Custom classes and properties can be added under a contextual namespace;
- Ids are intrinsic properties of classes (defined by their URIs) but additional identifiers can also be provided;
- Types, formats, status (see the attribute groups in the XML schema) shall be implemented through the definition of sub-classes (e.g. manufacturer would be defined as a sub-class of organisation if the defined as such in the organisation typeGroup attributes);
- Terms that can be derived from Classification Schemes, such as Genre or Role, shall be treated as Classes. If expressed in SKOS, such Classes are sub-classes of the SKOS Concept Class. If a term identifier (e.g. a SKOS Concept) is not available, additional properties associated to the Class can be used through a blank node. The EBUCore imports the SKOS ontology. In this implementation, e.g. Genre is declared as a subclass of skos:Concept.

The EBUCore RDF ontology is referenced as a Linked Open Vocabulary (Linked Open Vocabulary) (http://lov.okfn.org/dataset/lov/vocabs/ebucore) and also as RDF-Vocab for Ruby developers (https://github.com/ruby-rdf/rdf-vocab).

The MeMAD use case

MeMAD is a European project (https://memad.eu/) proposing innovative methods for accessing and using audiovisual content as well as enhancing digital storytelling. The project selected EBUCore RDF as its data model and contributed to the enhancement of the ontology. The following figures, courtesy of the project, brilliantly illustrate the implementation of EBUCore describing content from YLE and INA with the collaboration Radio-France and France Télévisions.

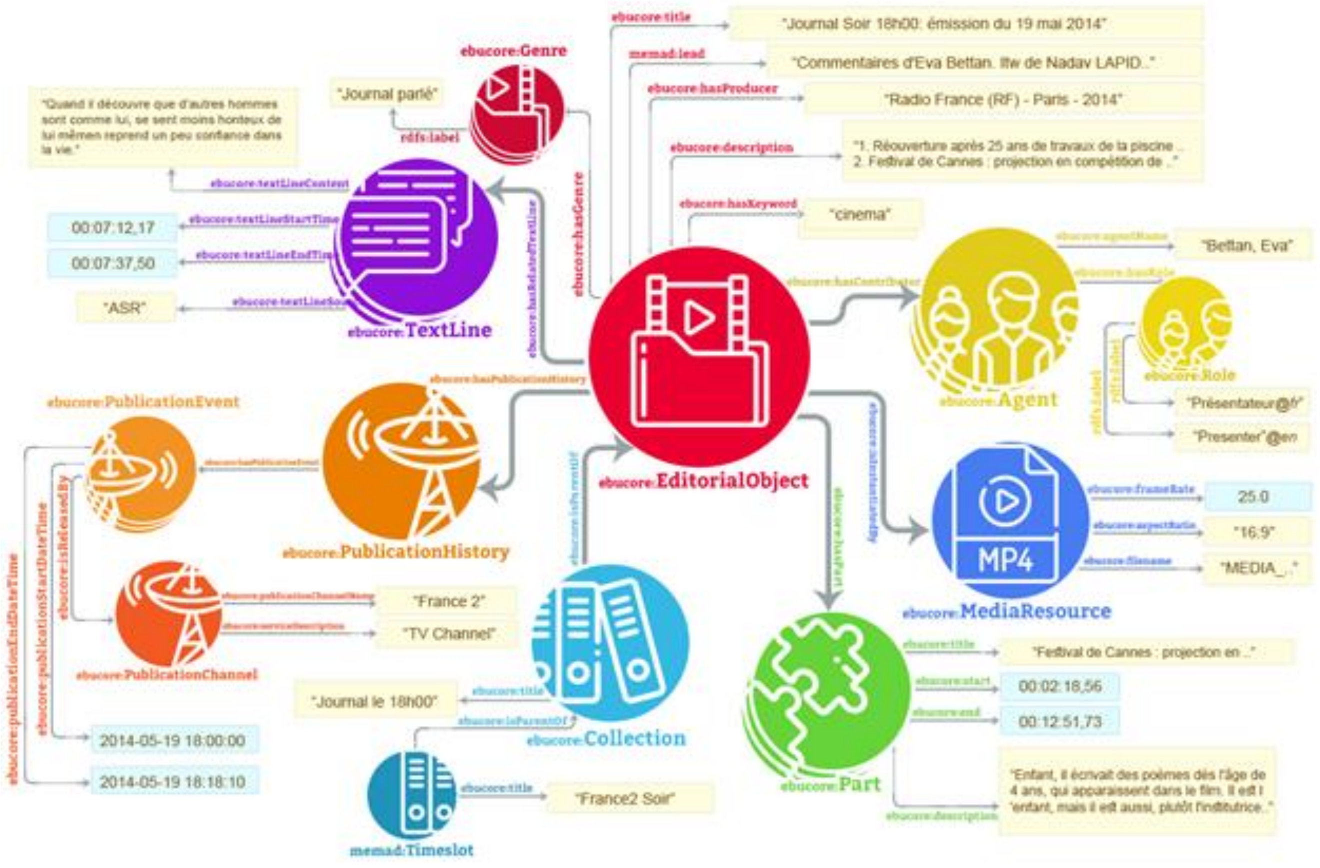


Figure B1: Instantiation of the EBUCore editorial object – France Télévisions

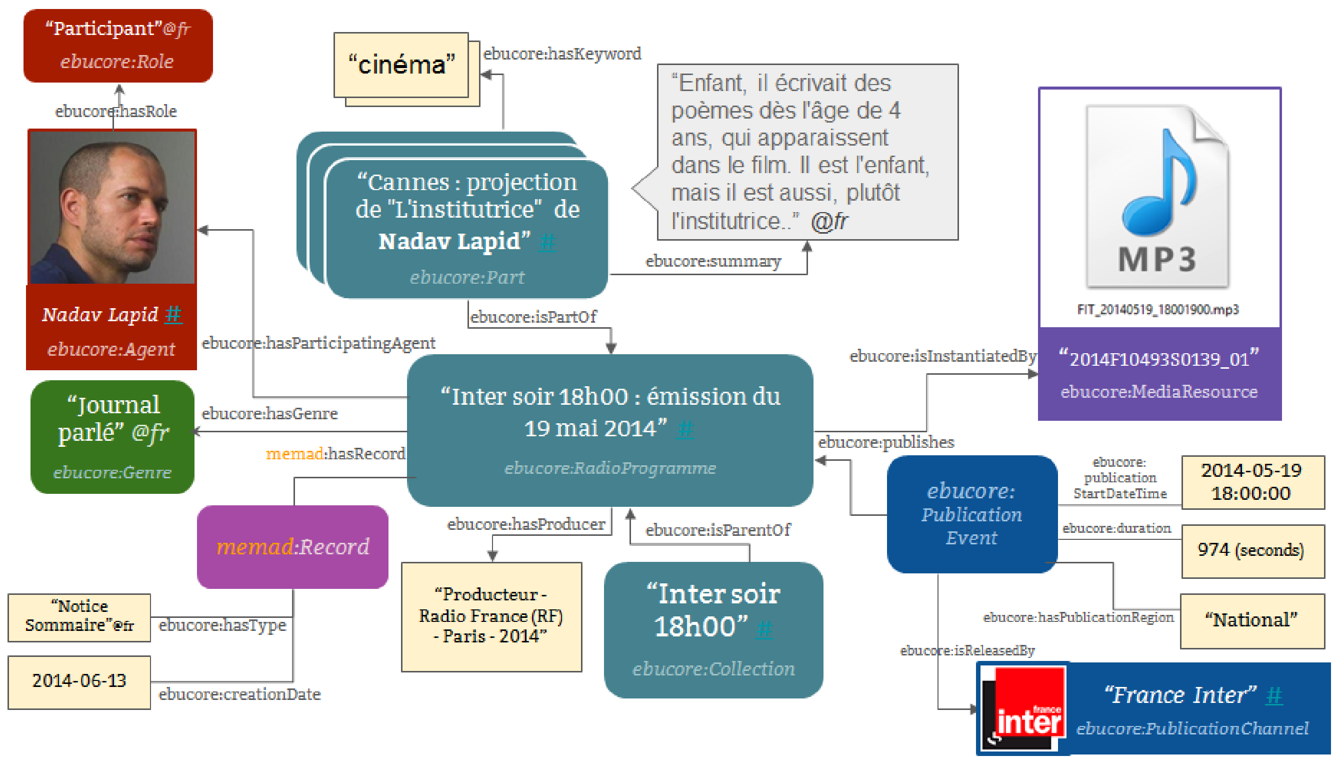


Figure B2: Description of a France Inter programme and publication event

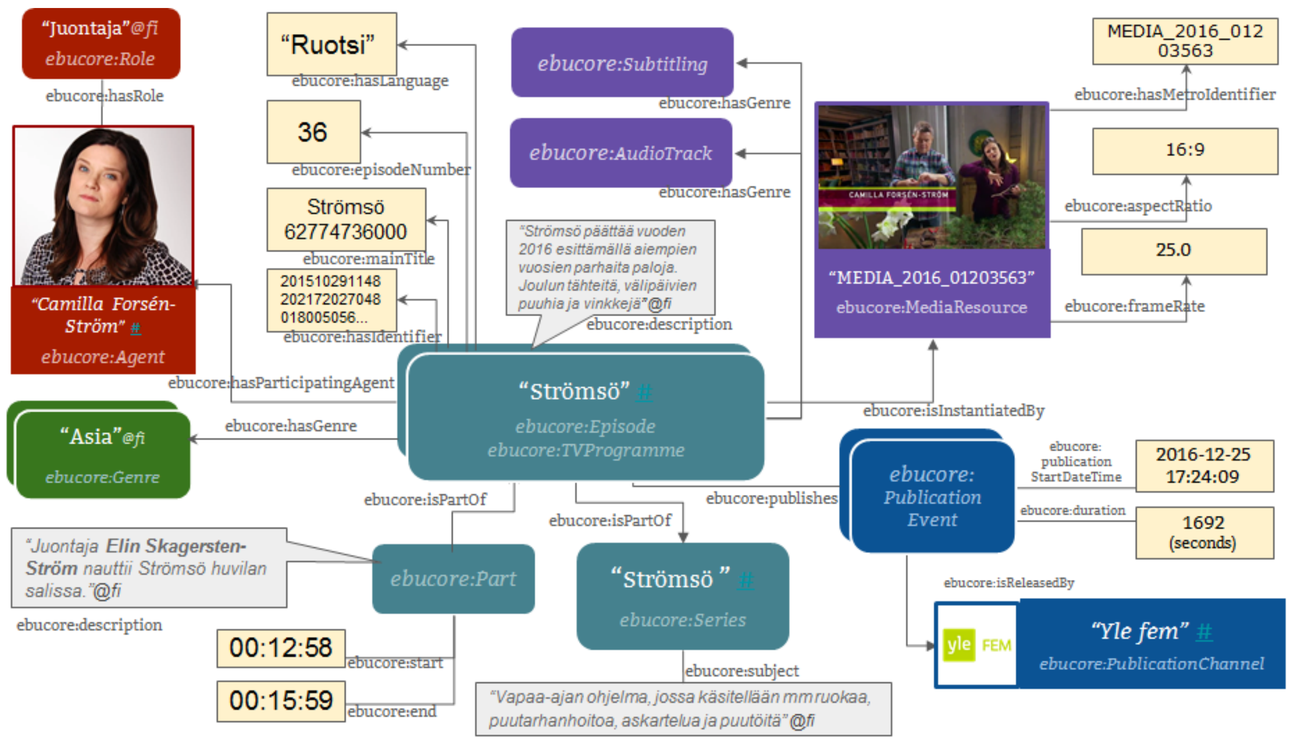


Figure B3: Description of a programme and publication event from YLE

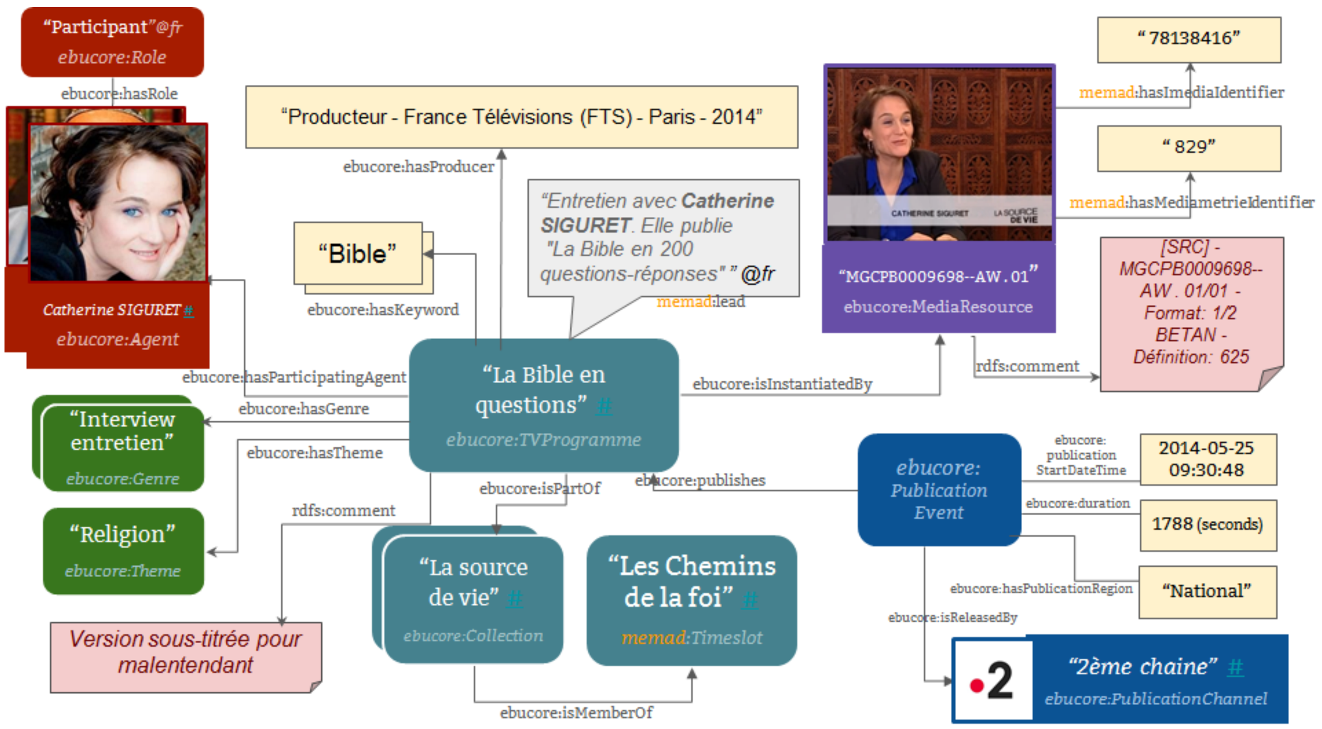


Figure B4: Description of a programme and publication event from France Télévisions

Annex C: Applying EBU Tech 3364's data model in EBUCore

Several example files are available from the EBUCore ADM example repository. These files explore the main ADM configurations, with or without complementary embedded editorial metadata.

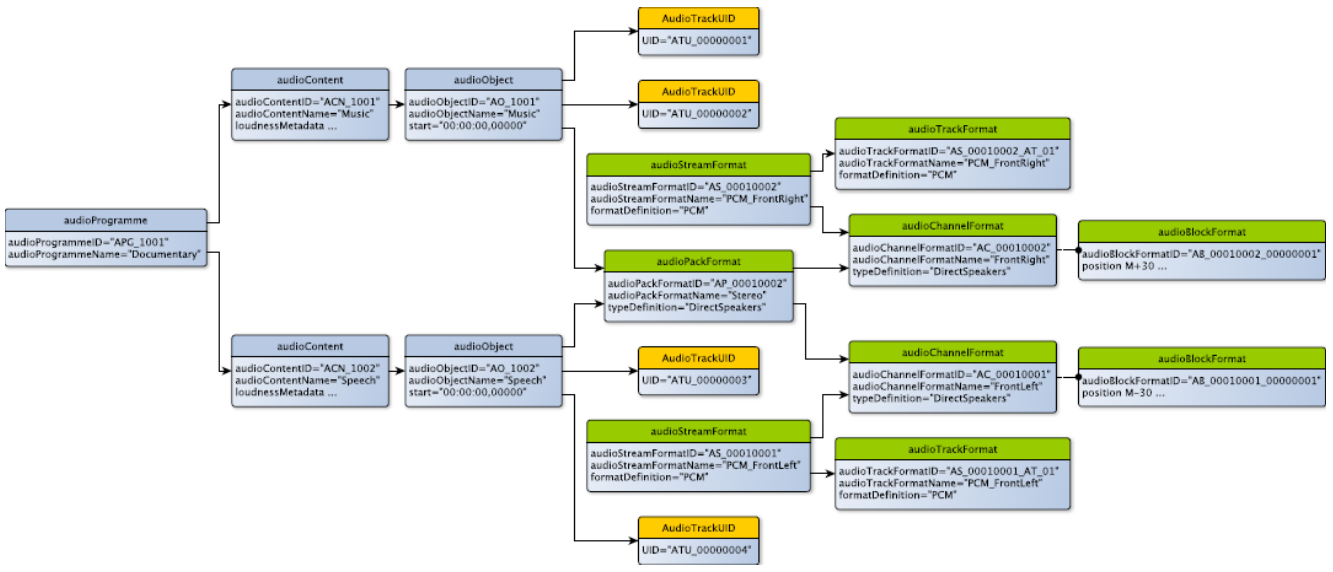
C.1 *Channel based example (extract from Tech 3364)*

The most common use of audio is still channel-based, where tracks within a file each represent a static audio channel. This example demonstrates how to define two tracks, streams and channels; and a pack for stereo. The track and stream definitions are for PCM audio. Two objects are defined, both stereo, but containing different content so there are 4 tracks used. This example uses a programme called 'Documentary' containing 'Music' and 'Speech' each defined as separate stereo objects.

The format-related elements in this example represent a tiny subset of the standard reference set of definitions. In practice, this XML code would be part of the standard reference file and would not have to be included in the BWF file. All that would be required is a <*chna*> chunk with the references to the audioTrackFormats and audioPackFormats and any extra XML required for audioObject, audioContent and audioProgramme.

Table C.1: Summary of model elements

Element	ID	Name	Description
audioTrackFormat	AT_00010001_01	PCM_FrontLeft	Defines track as PCM
audioTrackFormat	AT_00010002_01	PCM_FrontRight	Defines track as PCM
audioStreamFormat	AS_00010001	PCM_FrontLeft	Defines stream as PCM
audioStreamFormat	AS_00010002	PCM_FrontRight	Defines stream as PCM
audioChannelFormat & audioBlockFormat	AC_00010001 AB_00010001_00000001	FrontLeft	Describes channel as front left with a position and speaker reference
audioChannelFormat & audioBlockFormat	AC_00010002 AB_00010002_00000001	FrontRight	Describes channel as front right with a position and speaker reference
audioPackFormat	AP_00010002	Stereo	Defines a stereo pack referring to two channels.


audioProgramme
audioProgrammeID="APG_1001"
audioProgrammeName="Documentary"
audioContent
audioContentID="ACN_1001"
audioContentName="Music"
loudnessMetadata ...
audioObject
audioObjectID="AO_1001"
audioObjectName="Music"
start="00:00:00,00000"
audioContent
audioContentID="ACN_1002"
audioContentName="Speech"
loudnessMetadata ...
audioObject
audioObjectID="AO_1002"
audioObjectName="Speech"
start="00:00:00,00000"
AudioTrackUID
UID="ATU_00000001"
AudioTrackUID
UID="ATU_00000002"
AudioTrackUID
UID="ATU_00000003"
AudioTrackUID
UID="ATU_00000004"
audioStreamFormat
audioStreamFormatID="AS_00010002"
audioStreamFormatName="PCM_FrontRight"
formatDefinition="PCM"
audioStreamFormat
audioStreamFormatID="AS_00010001"
audioStreamFormatName="PCM_FrontLeft"
formatDefinition="PCM"
audioPackFormat
audioPackFormatID="AP_00010002"
audioPackFormatName="Stereo"
typeDefinition="DirectSpeakers"
audioTrackFormat
audioTrackFormatID="AS_00010002_AT_01"
audioTrackFormatName="PCM_FrontRight"
formatDefinition="PCM"
audioTrackFormat
audioTrackFormatID="AS_00010001_AT_01"
audioTrackFormatName="PCM_FrontLeft"
formatDefinition="PCM"
audioChannelFormat
audioChannelFormatID="AC_00010002"
audioChannelFormatName="FrontRight"
typeDefinition="DirectSpeakers"
audioChannelFormat
audioChannelFormatID="AC_00010001"
audioChannelFormatName="FrontLeft"
typeDefinition="DirectSpeakers"
audioBlockFormat
audioBlockFormatID="AB_00010002_00000001"
position M+30 ...
audioBlockFormat
audioBlockFormatID="AB_00010001_00000001"
position M-30 ...

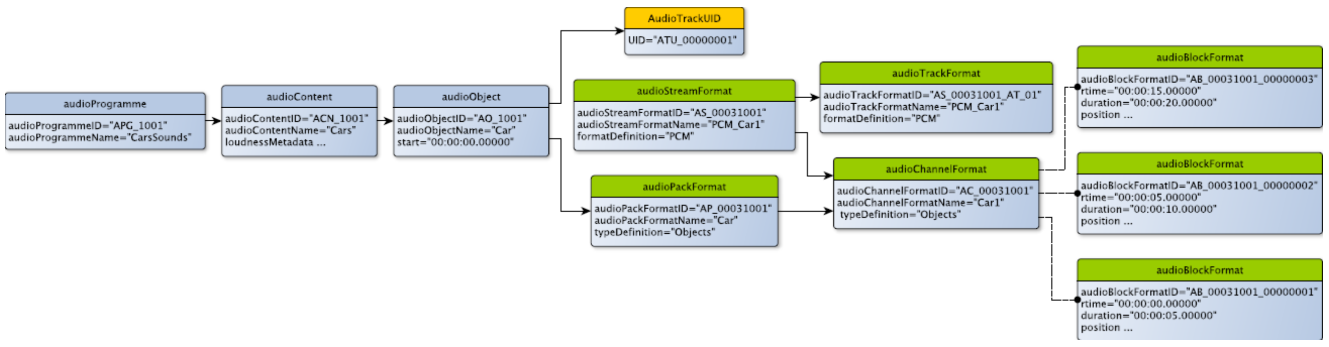
```
<?xml version="1.0" encoding="UTF-8"?>
<ebuCoreMain xmlns="urn:ebu:metadata-schema:ebucore"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:dc="http://purl.org/dc/elements/1.1/">
 <coreMetadata>

  <format>

   <audioFormatExtended>

    <!-- audio programme -->
    <audioProgramme audioProgrammeID="APG_1001" audioProgrammeName="Documentary">
     <audioContentIDRef>ACN_1001</audioContentIDRef>
     <audioContentIDRef>ACN_1002</audioContentIDRef>
    </audioProgramme>

    <!-- audio content -->
    <audioContent audioContentID="ACN_1001" audioContentName="Music">
     <audioObjectIDRef>AO_1001</audioObjectIDRef>
     <loudnessMetadata>
      <integratedLoudness>-28.0</integratedLoudness>
     </loudnessMetadata>
    </audioContent>

    <audioContent audioContentID="ACN_1002" audioContentName="Speech">
     <audioObjectIDRef>AO_1002</audioObjectIDRef>
     <loudnessMetadata>
      <integratedLoudness>-23.0</integratedLoudness>
     </loudnessMetadata>
    </audioContent>

    <!-- audio object -->
    <audioObject audioObjectID="AO_1001" audioObjectName="Music"
start="00:00:00,00000">
     <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
     <audioTrackUIDRef>ATU_00000001</audioTrackUIDRef>
     <audioTrackUIDRef>ATU_00000002</audioTrackUIDRef>
    </audioObject>
    <audioObject audioObjectID="AO_1002" audioObjectName="Speech"
start="00:00:00,00000">
     <audioPackFormatIDRef>AP_00010002</audioPackFormatIDRef>
     <audioTrackUIDRef>ATU_00000003</audioTrackUIDRef>
     <audioTrackUIDRef>ATU_00000004</audioTrackUIDRef>
    </audioObject>

    <!-- audio pack -->
    <audioPackFormat audioPackFormatID="AP_00010002" audioPackFormatName="Stereo"
     typeDefinition="DirectSpeakers">
     <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
     <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
    </audioPackFormat>

   <!-- audio channel -->
   <audioChannelFormat audioChannelFormatID="AC_00010001"
audioChannelFormatName="FrontLeft"
            typeLabel="0001" typeDefinition="DirectSpeakers">
            <audioBlockFormat audioBlockFormatID="AB_00010001_00000001">
                  <speakerLabel>M+30</speakerLabel>
                  <position coordinate="azimuth">30.0</position>
                  <position coordinate="elevation">0.0</position>
                   <position coordinate="distance">1.0</position>
             </audioBlockFormat>
   </audioChannelFormat>

   <audioChannelFormat audioChannelFormatID="AC_00010002"
audioChannelFormatName="FrontRight"
           typeLabel="0001" typeDefinition="DirectSpeakers">
           <audioBlockFormat audioBlockFormatID="AB_00010002_00000001">
                     <speakerLabel>M-30</speakerLabel>
                     <position coordinate="azimuth">-30.0</position>
                     <position coordinate="elevation">0.0</position>
                     <position coordinate="distance">1.0</position>
            </audioBlockFormat>
   </audioChannelFormat>

    <!-- audio stream -->
    <audioStreamFormat audioStreamFormatID="AS_00010001"
audioStreamFormatName="PCM_FrontLeft"
     formatLabel="0001" formatDefinition="PCM">
     <audioChannelFormatIDRef>AC_00010001</audioChannelFormatIDRef>
     <audioTrackFormatIDRef>AS_00010001_AT_01</audioTrackFormatIDRef>
    </audioStreamFormat>

    <audioStreamFormat audioStreamFormatID="AS_00010002"
audioStreamFormatName="PCM_FrontRight"
     formatLabel="0001" formatDefinition="PCM">
     <audioChannelFormatIDRef>AC_00010002</audioChannelFormatIDRef>
     <audioTrackFormatIDRef>AS_00010002_AT_01</audioTrackFormatIDRef>
    </audioStreamFormat>

    <!-- audio track format-->
    <audioTrackFormat audioTrackFormatID="AS_00010001_AT_01"
audioTrackFormatName="PCM_FrontLeft"
     formatLabel="0001" formatDefinition="PCM">
     <audioStreamFormatIDRef>AS_00010001</audioStreamFormatIDRef>
    </audioTrackFormat>

    <audioTrackFormat audioTrackFormatID="AS_00010002_AT_01"
audioTrackFormatName="PCM_FrontRight"
     formatLabel="0001" formatDefinition="PCM">
     <audioStreamFormatIDRef>AS_00010002</audioStreamFormatIDRef>
    </audioTrackFormat>

    <!-- audio track -->
    <audioTrackUID UID="ATU_00000001"/>
    <audioTrackUID UID="ATU_00000002"/>
    <audioTrackUID UID="ATU_00000003"/>
    <audioTrackUID UID="ATU_00000004"/>
   </audioFormatExtended>
  </format>
 </coreMetadata>
</ebuCoreMain>
```

C.2 Object based example (extract from Tech 3364)

To demonstrate how the ADM can be used in object-based audio here is a simple example using a single object. This example uses multiple audioBlockFormats within an audioChannelFormat to describe the dynamic properties of an object called “Car”. The audioBlockFormats uses the start and duration attributes to frame the time dependent metadata, thus allowing the object’s position to move in space.

Table C.2: Summary of model elements

Element	ID	Name	Description
audioTrackFormat	AT_00031001_01	PCM_Car1	Defines track as PCM
audioStreamFormat	AS_00031001	PCM_Car1	Defines stream as PCM
audioChannelFormat & audioBlockFormat	AC_00031001 AB_00031001_00000001 AB_00031001_00000002 AB_00031001_00000003	Car1	Describes channel as an object type containing 3 blocks with different positional metadata in each.
audioPackFormat	AP_00031001	Car	Defines a pack referring to one channel.
audioObject	AO_1001	Car	Object for ‘Car, stereo format
audioContent	ACN_1001	Cars	‘Cars’ content
audioProgramme	APG_1001	CarsSounds	Programme ‘CarsSounds’ containing ‘Cars’ content


AudioTrackUID
UID="ATU_00000001"
audioProgramme
audioProgrammeID="APG_1001"
audioProgrammeName="CarsSounds"
audioContent
audioContentID="ACN_1001"
audioContentName="Cars"
loudnessMetadata ...
audioObject
audioObjectID="AO_1001"
audioObjectName="Car"
start="00:00:00.00000"
audioStreamFormat
audioStreamFormatID="AS_00031001"
audioStreamFormatName="PCM_Car1"
formatDefinition="PCM"
audioPackFormat
audioPackFormatID="AP_00031001"
audioPackFormatName="Car"
typeDefinition="Objects"
audioTrackFormat
audioTrackFormatID="AS_00031001_AT_01"
audioTrackFormatName="PCM_Car1"
formatDefinition="PCM"
audioChannelFormat
audioChannelFormatID="AC_00031001"
audioChannelFormatName="Car1"
typeDefinition="Objects"
audioBlockFormat
audioBlockFormatID="AB_00031001_00000003"
rtime="00:00:15.00000"
duration="00:00:20.00000"
position ...
audioBlockFormat
audioBlockFormatID="AB_00031001_00000002"
rtime="00:00:05.00000"
duration="00:00:10.00000"
position ...
audioBlockFormat
audioBlockFormatID="AB_00031001_00000001"
rtime="00:00:00.00000"
duration="00:00:05.00000"
position ...

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ebuCoreMain xmlns="urn:ebu:metadata-schema:ebucore"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:dc=”http://purl.org/dc/elements/1.1/” version=”1.8”>

 <coreMetadata>

  <format>

   <audioFormatExtended>

    <!-- audio programme -->
    <audioProgramme audioProgrammeID="APG_1001" audioProgrammeName="CarsSounds">
     <audioContentIDRef>ACN_1001</audioContentIDRef>
    </audioProgramme>

    <!-- audio content -->
    <audioContent audioContentID="ACN_1001" audioContentName="Cars">
     <audioObjectIDRef>AO_1001</audioObjectIDRef>
     <loudnessMetadata>
```

```
      <integratedLoudness>-23.0</integratedLoudness>
   </loudnessMetadata>
    </audioContent>

    <!-- audio object -->
    <audioObject audioObjectID="AO_1001" audioObjectName="Car"
start="00:00:00.00000">
     <audioPackFormatIDRef>AP_00031001</audioPackFormatIDRef>
     <audioTrackUIDRef>ATU_00000001</audioTrackUIDRef>
    </audioObject>

    <!-- audio pack -->
    <audioPackFormat audioPackFormatID="AP_00031001" audioPackFormatName="Car"
typeLabel="0003"     typeDefinition="Objects">
     <audioChannelFormatIDRef>AC_00031001</audioChannelFormatIDRef>
    </audioPackFormat>

    <!-- audio channel -->
    <audioChannelFormat audioChannelFormatID="AC_00031001"
audioChannelFormatName="Car1" typeLabel="0003"     typeDefinition="Objects">
     <audioBlockFormat audioBlockFormatID="AB_00031001_00000001"
rtime="00:00:00.00000"         duration="00:00:05.00000">
      <position coordinate="azimuth">-22.5</position>
      <position coordinate="elevation">5.0</position>
      <position coordinate="distance">1.0</position>
     </audioBlockFormat>

     <audioBlockFormat audioBlockFormatID="AB_00031001_00000002"
rtime="00:00:05.00000"         duration="00:00:10.00000">
      <position coordinate="azimuth">-24.5</position>
      <position coordinate="elevation">6.0</position>
      <position coordinate="distance">0.9</position>
     </audioBlockFormat>

     <audioBlockFormat audioBlockFormatID="AB_00031001_00000003"
rtime="00:00:15.00000"         duration="00:00:20.00000">
      <position coordinate="azimuth">-26.5</position>
      <position coordinate="elevation">7.0</position>
      <position coordinate="distance">0.8</position>
     </audioBlockFormat>
    </audioChannelFormat>

    <!-- audio stream -->
    <audioStreamFormat audioStreamFormatID="AS_00031001"
audioStreamFormatName="PCM_Car1" formatLabel="0001" formatDefinition="PCM">
     <audioChannelFormatIDRef>AC_00031001</audioChannelFormatIDRef>
     <audioTrackFormatIDRef>AS_00031001_AT_01</audioTrackFormatIDRef>
    </audioStreamFormat>

    <!-- audio track format-->
    <audioTrackFormat audioTrackFormatID="AS_00031001_AT_01"
audioTrackFormatName="PCM_Car1" formatLabel="0001"
      formatDefinition="PCM">
     <audioStreamFormatIDRef>AS_00031001</audioStreamFormatIDRef>
    </audioTrackFormat>

    <!-- audio track -->
    <audioTrackUID UID="ATU_00000001"/>
   </audioFormatExtended>
  </format>
 </coreMetadata>
```

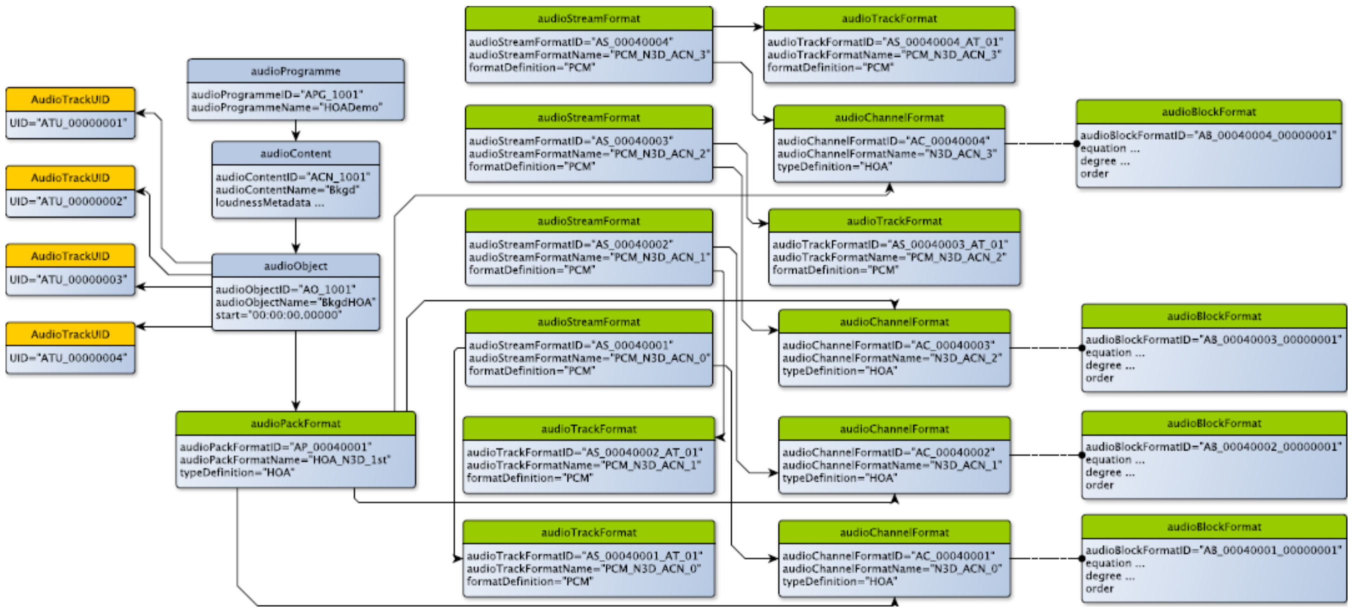
```
</ebuCoreMain>
```

C.3 *Scene-based example (extract from Tech 3364)*

The other main type of audio is scene-based where the audio channels are representing Ambisonic/HOA components. Their use is very similar to that of the channel-based approach with the main difference being the parameters used within audioBlockFormat. This example shows a simple 1st order Ambisonic (using the N3D method) configuration using 4 channels mapped onto 4 tracks. Like the channel-based approach, the format elements would be defined in a standard reference file so in practice would not need to be included in the BWF file itself.

Table C.3: Summary of model elements

Element	ID	Name	Description
audioTrackFormat	AT_00040001_01	PCM_N3D_ACN_0	Defines track as PCM
audioTrackFormat	AT_00040002_01	PCM_N3D_ACN_1	Defines track as PCM
audioTrackFormat	AT_00040003_01	PCM_N3D_ACN_2	Defines track as PCM
audioTrackFormat	AT_00040004_01	PCM_N3D_ACN_3	Defines track as PCM
audioStreamFormat	AS_00040001	PCM_N3D_ACN_0	Defines stream as PCM
audioStreamFormat	AS_00040002	PCM_N3D_ACN_1	Defines stream as PCM
audioStreamFormat	AS_00040003	PCM_N3D_ACN_2	Defines stream as PCM
audioStreamFormat	AS_00040004	PCM_N3D_ACN_3	Defines stream as PCM
audioChannelFormat & audioBlockFormat	AC_00040001 AB_00040001_00000001	N3D_ACN_0	Describes channel as ACN0 HOA component
audioChannelFormat & audioBlockFormat	AC_00040002 AB_00040002_00000001	N3D_ACN_1	Describes channel as ACN1 HOA component
audioChannelFormat & audioBlockFormat	AC_00040003 AB_00040003_00000001	N3D_ACN_2	Describes channel as ACN2 HOA component
audioChannelFormat & audioBlockFormat	AC_00040004 AB_00040004_00000001	N3D_ACN_3	Describes channel as ACN3 HOA component
audioPackFormat	AP_00040001	HOA_N3D_1st	Defines a 1st order HOA pack referring to four ACN channels.


AudioTrackUID
UID="ATU_00000001"
AudioTrackUID
UID="ATU_00000002"
AudioTrackUID
UID="ATU_00000003"
AudioTrackUID
UID="ATU_00000004"
audioProgramme
audioProgrammeID="APG_1001" audioProgrammeName="HOADemo"
audioContent
audioContentID="ACN_1001" audioContentName="Bkgd" loudnessMetadata ...
audioObject
audioObjectID="AO_1001" audioObjectName="BkgdHOA" start="00:00:00.00000"
audioPackFormat
audioPackFormatID="AP_00040001" audioPackFormatName="HOA_N3D_1st" typeDefinition="HOA"
audioStreamFormat
audioStreamFormatID="AS_00040004" audioStreamFormatName="PCM_N3D_ACN_3" formatDefinition="PCM"
audioStreamFormat
audioStreamFormatID="AS_00040003" audioStreamFormatName="PCM_N3D_ACN_2" formatDefinition="PCM"
audioStreamFormat
audioStreamFormatID="AS_00040002" audioStreamFormatName="PCM_N3D_ACN_1" formatDefinition="PCM"
audioStreamFormat
audioStreamFormatID="AS_00040001" audioStreamFormatName="PCM_N3D_ACN_0" formatDefinition="PCM"
audioTrackFormat
audioTrackFormatID="AS_00040004_AT_01" audioTrackFormatName="PCM_N3D_ACN_3" formatDefinition="PCM"
audioTrackFormat
audioTrackFormatID="AS_00040003_AT_01" audioTrackFormatName="PCM_N3D_ACN_2" formatDefinition="PCM"
audioTrackFormat
audioTrackFormatID="AS_00040002_AT_01" audioTrackFormatName="PCM_N3D_ACN_1" formatDefinition="PCM"
audioTrackFormat
audioTrackFormatID="AS_00040001_AT_01" audioTrackFormatName="PCM_N3D_ACN_0" formatDefinition="PCM"
audioChannelFormat
audioChannelFormatID="AC_00040004" audioChannelFormatName="N3D_ACN_3" typeDefinition="HOA"
audioChannelFormat
audioChannelFormatID="AC_00040003" audioChannelFormatName="N3D_ACN_2" typeDefinition="HOA"
audioChannelFormat
audioChannelFormatID="AC_00040002" audioChannelFormatName="N3D_ACN_1" typeDefinition="HOA"
audioChannelFormat
audioChannelFormatID="AC_00040001" audioChannelFormatName="N3D_ACN_0" typeDefinition="HOA"
audioBlockFormat
audioBlockFormatID="AB_00040004_00000001" equation ... degree ... order
audioBlockFormat
audioBlockFormatID="AB_00040003_00000001" equation ... degree ... order
audioBlockFormat
audioBlockFormatID="AB_00040002_00000001" equation ... degree ... order
audioBlockFormat
audioBlockFormatID="AB_00040001_00000001" equation ... degree ... order

```
<?xml version="1.0" encoding="UTF-8"?>
<ebuCoreMain xmlns="urn:ebu:metadata-schema:ebucore"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:dc="http://purl.org/dc/elements/1.1/">
 <coreMetadata>

  <format>

   <audioFormatExtended>

    <!-- audio programme -->
    <audioProgramme audioProgrammeID="APG_1001" audioProgrammeName="HOADemo">
     <audioContentIDRef>ACN_1001</audioContentIDRef>
    </audioProgramme>

    <!-- audio content -->
    <audioContent audioContentID="ACN_1001" audioContentName="Background">
     <audioObjectIDRef>AO_1001</audioObjectIDRef>
    </audioContent>

    <!-- audio object -->
    <audioObject audioObjectID="AO_1001" audioObjectName="BackgroundHOA">
     <audioPackFormatIDRef>AP_00040001</audioPackFormatIDRef>
     <audioTrackUIDRef>ATU_00000001</audioTrackUIDRef>
     <audioTrackUIDRef>ATU_00000002</audioTrackUIDRef>
     <audioTrackUIDRef>ATU_00000003</audioTrackUIDRef>
     <audioTrackUIDRef>ATU_00000004</audioTrackUIDRef>
    </audioObject>

    <!-- audio pack -->
    <audioPackFormat audioPackFormatID="AP_00040001"
audioPackFormatName="HOA_N3D_1st" typeLabel="0004"     typeDefinition="HOA">
     <audioChannelFormatIDRef>AC_00040001</audioChannelFormatIDRef>
     <audioChannelFormatIDRef>AC_00040002</audioChannelFormatIDRef>
     <audioChannelFormatIDRef>AC_00040003</audioChannelFormatIDRef>
     <audioChannelFormatIDRef>AC_00040004</audioChannelFormatIDRef>
    </audioPackFormat>

    <!-- audio channel -->
    <audioChannelFormat audioChannelFormatID="AC_00040001"
audioChannelFormatName="N3D_ACN_0"     typeDefinition="HOA">
     <audioBlockFormat audioBlockFormatID="AB_00040001_00000001">
      <equation>1</equation>
      <degree>0</degree>
      <order>0</order>
     </audioBlockFormat>
    </audioChannelFormat>
    <audioChannelFormat audioChannelFormatID="AC_00040002"
audioChannelFormatName="N3D_ACN_1"     typeDefinition="HOA">
     <audioBlockFormat audioBlockFormatID="AB_00040002_00000001">
      <equation>sqrt(3)*cos(E)</equation>
      <degree>1</degree>
      <order>-1</order>
     </audioBlockFormat>
    </audioChannelFormat>
    <audioChannelFormat audioChannelFormatID="AC_00040003"
audioChannelFormatName="N3D_ACN_2"     typeDefinition="HOA">
     <audioBlockFormat audioBlockFormatID="AB_00040003_00000001">
```

```
      <equation>sqrt(3)*sin(E)</equation>
      <degree>1</degree>
      <order>0</order>
     </audioBlockFormat>
    </audioChannelFormat>
    <audioChannelFormat audioChannelFormatID="AC_00040004"
audioChannelFormatName="N3D_ACN_3"     typeDefinition="HOA">
     <audioBlockFormat audioBlockFormatID="AB_00040004_00000001">
      <equation>sqrt(3)*cos(E)*cos(A)</equation>
      <degree>1</degree>
      <order>1</order>
     </audioBlockFormat>
    </audioChannelFormat>

    <!-- audio stream -->
    <audioStreamFormat audioStreamFormatID="AS_00040001"
audioStreamFormatName="PCM_N3D_ACN_0"     formatLabel="0001" formatDefinition="PCM">
     <audioChannelFormatIDRef>AC_00040001</audioChannelFormatIDRef>
     <audioTrackFormatIDRef>AS_00040001_AT_01</audioTrackFormatIDRef>
    </audioStreamFormat>

    <audioStreamFormat audioStreamFormatID="AS_00040002"
audioStreamFormatName="PCM_N3D_ACN_1"     formatLabel="0001" formatDefinition="PCM">
     <audioChannelFormatIDRef>AC_00040002</audioChannelFormatIDRef>
     <audioTrackFormatIDRef>AS_00040002_AT_01</audioTrackFormatIDRef>
    </audioStreamFormat>

    <audioStreamFormat audioStreamFormatID="AS_00040003"
audioStreamFormatName="PCM_N3D_ACN_2"     formatLabel="0001" formatDefinition="PCM">
     <audioChannelFormatIDRef>AC_00040003</audioChannelFormatIDRef>
     <audioTrackFormatIDRef>AS_00040003_AT_01</audioTrackFormatIDRef>
    </audioStreamFormat>

    <audioStreamFormat audioStreamFormatID="AS_00040004"
audioStreamFormatName="PCM_N3D_ACN_3"     formatLabel="0001" formatDefinition="PCM">
     <audioChannelFormatIDRef>AC_00040004</audioChannelFormatIDRef>
     <audioTrackFormatIDRef>AS_00040004_AT_01</audioTrackFormatIDRef>
    </audioStreamFormat>

    <!-- audio track format-->
    <audioTrackFormat audioTrackFormatID="AS_00040001_AT_01"
audioTrackFormatName="PCM_N3D_ACN_0"     formatLabel="0001" formatDefinition="PCM">
     <audioStreamFormatIDRef>AS_00040001</audioStreamFormatIDRef>
    </audioTrackFormat>

    <audioTrackFormat audioTrackFormatID="AS_00040002_AT_01"
audioTrackFormatName="PCM_N3D_ACN_1"     formatLabel="0001" formatDefinition="PCM">
     <audioStreamFormatIDRef>AS_00040002</audioStreamFormatIDRef>
    </audioTrackFormat>

    <audioTrackFormat audioTrackFormatID="AS_00040003_AT_01"
audioTrackFormatName="PCM_N3D_ACN_2"     formatLabel="0001" formatDefinition="PCM">
     <audioStreamFormatIDRef>AS_00040003</audioStreamFormatIDRef>
    </audioTrackFormat>

    <audioTrackFormat audioTrackFormatID="AS_00040004_AT_01"
audioTrackFormatName="PCM_N3D_ACN_3"     formatLabel="0001" formatDefinition="PCM">
     <audioStreamFormatIDRef>AS_00040004</audioStreamFormatIDRef>
    </audioTrackFormat>

    <!-- audio track -->
    <audioTrackUID UID="ATU_00000001"/>
    <audioTrackUID UID="ATU_00000002"/>
    <audioTrackUID UID="ATU_00000003"/>
    <audioTrackUID UID="ATU_00000004"/>

   </audioFormatExtended>

  </format>
 </coreMetadata>
</ebuCoreMain>
```

Annex D: JSON as an EBUCore representation format

D.1 Introduction

JSON is one of many alternative representation formats for data.

EBUCore is defined by an XML schema but EBUCore metadata instances can easily be converted to JSON using tools like XMLSpy, Oxygen or else.

This allows developers who prefer JSON to use EBUCore.

EBUCore JSON should be compatible with all libraries commonly found for a large variety of development software stacks.

D.2 MediaInfo

MediaInfo is an open-source (BSD-style license) software application which extracts and displays the most relevant technical and tag data from video and audio files. This metadata can be exported as EBUCore XML or JSON. More information can be found at https://mediaarea.net/en/MediaInfo.

D.3 Example

```
{"ebucore:ebuCoreMain": {
   "version": 1.9,
   "xmlns:dc": "http://purl.org/dc/elements/1.1/",
   "xmlns:ebucore": "urn:ebu:metadata-schema:ebuCore",
   "xmlns:xalan": "http://xml.apache.org/xalan",
   "ebucore:coreMetadata": {
      "ebucore:title": {"dc:title": "Eurovision Song Contest 1987"},
      "ebucore:alternativeTitle": [
         {
            "typeLabel": "Event Type",
            "dc:title": "ESC"
         },
         {
            "typeLabel": "Event Subtype",
            "dc:title": "final"
         }
      ],
      "ebucore:description": [
         {
            "typeLabel": "Body",
            "dc:description": "<p>Belgium had the  honour ..... <\/p>"
         },
         {
            "typeLabel": "Preface",
            "dc:description": "<p>Belgian superstar Viktor Laszlo ....<\/p>"
         },
         {
            "typeLabel": "Voting Procedure",
            "dc:description": "Each national jury awarded 1 to 8, 10 and 12 points"
         }
      ],
      "ebucore:contributor": [
         {
            "ebucore:contactDetails": {"ebucore:name": "Viktor Laszlo"},
            "ebucore:role": {"typeLabel": "Presenter"}
         }
      ],
      "ebucore:date": {"dc:date": "1987-05-09 00:00:00"},
      "ebucore:identifier": {"dc:identifier": 303},
      "ebucore:coverage": {"ebucore:spatial": {"ebucore:location": [
         {
            "typeLabel": "Venue",
            "ebucore:name": "Palais de Centenaire"
         },
         {
            "typeLabel": "Host City",
            "ebucore:name": "Brussels"
         },
         {
            "typeLabel": "HostCountry",
            "ebucore:region": {"ebucore:country": {"typeLabel": 12}}
         }
      ]}},
      "ebucore:part": [
         {
            "partId": 20694,
            "partNumber": 1,
            "ebucore:title": {"dc:title": "Mitt Liv"},
            "ebucore:description": [
               {
                  "typeLabel": "Total Number of Points",
                  "dc:description": 65
               }
            ],
            "ebucore:contributor": [
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