

TV-Anytime Metadata Application for DMB MAF

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Abstract

Digital Multimedia Broadcasting (DMB) Multimedia Application Format (MAF) [3] specify how to combine the variety of DMB contents with associated information for a presentation in a well-defined format that facilitates interchange, management, editing, and presentation of the DMB contents. The current metadata specification for DMB MAF [3] is based on TV-Anytime metadata tools. In this paper, we overview the general application scenarios of DMB MAF and then explore the TV-Anytime metadata tools and usage examples proposed for DMB MAF.

1. Introduction

Digital Multimedia Broadcasting (DMB) is the first global mobile TV service based on a digital radio transmission system. DMB provides people with crystal-clear video, theatre-quality audio, and other data services on the move via in-vehicle terminals or hand-held gadgets like mobile phones so that it makes possible the information acquisition and consumption anywhere. [1]

Due to the availability of multiple DMB broadcasting services, the DMB users have many mobile TV programs available on their terminals and they may want to watch their preferred DMB program contents. However, it is not easy for users to consume the DMB programs at their convenient time. Therefore, it is required that the DMB program contents could be stored and play backed at anytime. The stored DMB contents are also expected to be exchanged between different DMB terminals. Thus, a standardized DMB file format needs to be specified to guarantee the interoperability across the DMB terminals from different vendors. [2]

DMB Multimedia Application Format (MAF) [3] specify how to combine the variety of DMB contents with associated information for a presentation in a well-defined format that facilitates interchange, management, editing, and presentation of the DMB contents. A DMB MAF content is composed of native DMB contents and auxiliary informations such as associated metadata and governance informations. The constituents of DMB MAF are summarized in Figure 1.

The current metadata specification for DMB MAF [3] is based on TV-Anytime metadata tools. In this paper, we overview the general application scenarios of DMB MAF and then explore the TV-Anytime metadata tools and usage examples proposed for DMB MAF. For file format and governance issues of DMB MAF, refer [8] and [9], respectively.

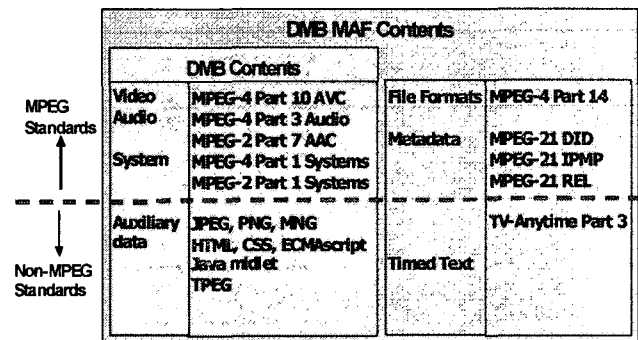


Figure 1. The Constituents of DMB MAF

2. DMB MAF Applications

In this section, we overview the general application scenarios of DMB MAF: storage of broadcasting contents, IP media services, interchange between terminals, and user-creative contents.

• Storage of Broadcasting Contents

In the DMB services, DMB-HE (Head End) broadcasts the digital contents through satellite or terrestrial DMB network. A user can watch the live contents through a DMB player and can store them in a unified form (DMB MAF file) for a next-time usage. He can also search and select some scheduled contents using EPG metadata and make a reservation for recording on a local or remote storage. In addition to the main audio-visual contents, various contents can be acquired through DMB data services such as BWS (broadcasting website), MOT slide show, and TTI (traffic and travel information), or can be signaled by metadata describing the locator (e.g. URI (uniform resource identifier)) of the contents. A user can not only consume the additional contents, he can also select and store them in a packaged form for a next-time usage.

• IP Media Services

DMB MAF contents can also be stored to and/or acquired from a network storage such as a PDR (personal digital recorder), an NDR (network digital recorder), or a DMB Portal. For example, a user can search and select some DMB contents on a DMB Portal, record them on network storage, and watches them through Internet streaming or just download them for next-time usage. Note that not only on the DMB-receivable terminals, DMB MAF can be created and played on DMB terminals without RF-module through the IP media services and/or removable storage media.

- Interchange between Terminals

DMB MAF contents can be stored to and interchanged through a remote storage or a removable storage media. For example, a user can transfer and consume DMB MAF contents between the DMB MAF terminals through a CD, an USB drive, or a memory card. Partial and whole items contained in a DMB MAF content can be exported.

- User-Creative contents

If they are interpretable on DMB terminals, a user can freely add his own contents or data to an existing DMB MAF content. For example, he can add an image, verbal or textual comments, secondary audio or video, or graphical annotation, and can make some of them spatially and temporally synchronized with the existing contents. A user can also add his usage history and bookmark for next-time usage. For example, if information describing which contents/items/segments are already watched is stored with the contents, he can start to consume the contents from the point of last consumption at any time. More over, if bookmark information is stored with the contents, he can selectively consume the contents by just navigating his favorite bookmarked items or segments. The marked items or segments over multiple DMB MAF contents can be gathered and reformatted to a new MAF and can be shared to other users. For example, sports highlight content can be easily generated by this mechanism.

3. Metadata Tools for DMB MAF

We adopt TV-Anytime metadata specifications [4][5][6][7] as the metadata tools for DMB MAF. With these metadata specifications, the metadata requirements for the DMB MAF application scenarios can be easily satisfied.

TV-Anytime metadata are sub-divided into two categories: Phase 1 metadata schema [4] and Phase 2 metadata schemas [5][6]. The Phase 1 metadata schema has the root element of TVAMainType and defines mainly about program and user descriptions. The Phase 2 metadata schemas has the root element of ExtendedTVAMainType and extends the Phase 1 schema for including various content types and consumption conditions. The structure of the TV-Anytime schemas is briefly summarized in Figure 2.

TV-Anytime metadata can not only describe a broadcast program but also describe various kind of additional resources. Thus, DMB MAF terminals can obtain the additional resources from service providers or a third party through content referencing [7], so that a user can enjoy a recorded broadcast with its related metadata and media resources such as webpage, jpeg images, Java midlet, etc. The TV-Anytime metadata tools adopted for DMB MAF are summarized in Table 1 and 2. Note that DMB MAF is intended to exploit virtually all the TV-Anytime metadata tools

and applications.

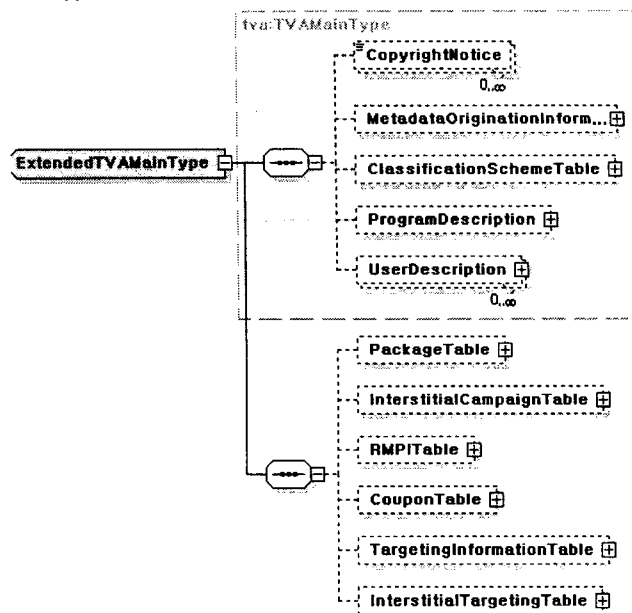


Figure 2. The Structure of TV-Anytime Metadata Schema

Table 1. TV-Anytime Phase 1 Metadata Tools

Tool	Description of tool
Classification schemes [4]	Sets of controlled terminology - These comprise simple- and multi-level, multi-axis labels that can be applied to a particular piece of content such as its genre or atmosphere.
Content description metadata [4]	Information defining, describing and detailing content items - such as a programme's synopsis.
CRID (Content Referencing ID) [7]	A location independent identifier used to identify content or groups of content - Additionally it is used as the key to associate metadata with the content or group of content.
Instance description metadata [4]	Information that defines a particular occurrence of a multimedia element - such as a programme's location in a schedule.
Segmentation metadata [4]	Information that describes elements of a whole piece of content in a way that allows it to be broken up - such as indexing stories in a news programme by subject thereby allowing only preferred stories to be viewed.
Usage history metadata [4]	Information generated in a device that describes the actions by a consumer while interacting with that device.
User preference metadata [4]	Information that describes a user's profile - which has either been entered by themselves or generated by their device such as the consumer's demographic data.

Table 2. TV-Anytime Phase 2 Metadata Tools

Tool	Description of tool
Packaging [5]	Framework for the association of disparate elements of content that are intended to be consumed as a whole.
Targeting [5]	Information that allows the matching and delivery of relevant content based on a consumers profile.
Interstitials [6]	Framework for the replacement of interstitials during playback depending on specific criteria.
E-Flyer/Coupon [5]	Way of attaching pricing and discount information to content.
Terminal capabilities [5]	Description of the capabilities of an end user terminal that enables appropriate content to be captured and consumed.
New content types [5]	Information describing and detailing content types other than audio and video such as stills, text, games and applications.
Educational metadata [5]	Information describing and detailing content types that relate to educational content.
Data broadcast [5]	Description of non-AV content.

4. Metadata Usage Examples for DMB MAF

● EPG Metadata

Major application area of DMB MAF is for storage of mobile broadcasting contents. Mobile broadcasting contents and EPG metadata for a user to search and select them could be stored in a DMB MAF file for a next-time usage. The elements and definitions of metadata for EPG are shown in Table 3.

The following xml instance shows an example of ProgramInformation and PurchaseInformation. In this example, 849th Englishcafe program is included in the genre of "education/language study" and can be watched free when a user watch advertisements inserted at the program.

```
<ProgramInformation fragmentId="" programId="crid://www.ebs.co.kr/englishcafe 849">
  <BasicDescription xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:type="tva2:ExtendedContentDescriptionType">
    <Title>Englishcafe 849</Title>
    <MediaTitle>
      <mpeg7:TitleImage>
        <mpeg7:MediaUri>http://192.168.1.108:8080/smrttv/package/englishcafe_849.png</mpeg7:MediaUri>
      </mpeg7:TitleImage>
    </MediaTitle>
    <Synopsis>I can't stop sneezing</Synopsis>
    <Keyword>Danyeol Moon</Keyword>
    <Keyword>Englishcafe</Keyword>
    <Genre href="urn:tva:metadata:cs:ProgramGenreCS:2006:9.3">
      <Name>Education/Language study</Name>
    </Genre>
    <ParentalGuidance>
      <mpeg7:MinimumAge>12</mpeg7:MinimumAge>
    </ParentalGuidance>
    <Language>kr</Language>
    <PurchaseList>
      <PurchaseItem>
        <Price currency="WON">1000</Price>
        <Description>Original price on a supplementary package for englishcafe 849</Description>
      </PurchaseItem>
      <PurchaseItem xsi:type="tva2:ExtendedPurchaseItemType">
        <Price currency="WON">0</Price>
        <Description>Discounted price watching advertisement at englishcafe 849</Description>
        <tva2:RequiredCoupon requiredNumber="1" couponId="Coupon-A"/>
      </PurchaseItem>
    </PurchaseList>
    <tva2:ContentProperties>
      <tva2:ContentType href="urn:tva:metadata:extended:cs:ExtendedContentTypeCS:2006:2">
        <Name>Video</Name>
      </tva2:ContentType>
    </tva2:ContentProperties>
  </BasicDescription>
  <MemberOf xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:type="MemberOfType" crid="crid://www.ebs.co.kr/englishcafe"/>
</ProgramInformation>
```

Table 3. TV-Anytime Metadata for EPG Applications

Metadata	Definition
ProgramInformation	General information about a piece of content that does not change regardless of how the content is published or broadcasted. For example, title, synopsis, actor and actress, etc.
GroupInformation	The programme group entity simply represents a grouping of programmes. A number of different types of group have been identified, such as series, show and programme concept. Programme group can be treated as a program, therefore it is identified using a unique CRID.
Schedule	Provide a mechanism to group a number of consecutive events together, which span a given time period on a single service.

OnDemandProgram	Describe instances (or "publication event") that can be acquired on demand. StartOfAvailability, EndOfAvailability, etc. are indicated.
ServiceInformation	Describe a service provider to provide contents. Name, owner, logo, etc. of a service provider are presented.
PurchaseInformation	Describes an item with its associated pricing and conditions of availability information like the number of plays in duration, as well as an access to a pricing server.

● Usage History Metadata

A user can add his or her usage history to the DMB MAF file for next-time usage. That is, if information describing which contents are already watched is stored with the contents, he can start to consume the contents from the point of last consumption at any time. For this purpose, usage history metadata of TV-Anytime is used. Usage history metadata describes audiovisual content consumption history of a user as a list of actions performed over an observation period. The following xml instance shows an example of usage history metadata. At this example, "User1" consumed the content identified by the ID, "crd://www.ebs.co.kr/englishcafe 849" for 15 minutes from the start of the contents.

```
<UserDescription>
  <UsageHistory>
    <mpeg7:UserIdentifier>
      <mpeg7:Name>User1</mpeg7:Name>
    </mpeg7:UserIdentifier>
    <mpeg7:UserActionHistory>
      <mpeg7:ObservationPeriod>
        <mpeg7:TimePoint>2006-06-04T20:11:12</mpeg7:TimePoint>
        <mpeg7:Duration>PT32M7S</mpeg7:Duration>
      </mpeg7:ObservationPeriod>
      <mpeg7:UserActionList>
        <mpeg7:ActionType>
          <mpeg7:Name>Playback</mpeg7:Name>
        </mpeg7:ActionType>
        <mpeg7:UserAction>
          <mpeg7:ActionTime>
            <mpeg7:MediaTime>
              <mpeg7:MediaTimePoint>T00:00:00</mpeg7:MediaTimePoint>
              <mpeg7:MediaDuration>PT15M</mpeg7:MediaDuration>
            </mpeg7:MediaTime>
          </mpeg7:ActionTime>
          <mpeg7:ProgramIdentifier>crd://www.ebs.co.kr/englishcafe 849</mpeg7:ProgramIdentifier>
        </mpeg7:UserAction>
      </mpeg7:UserActionList>
    </mpeg7:UserActionHistory>
  </UsageHistory>
</UserDescription>
```

● Coupons Metadata

Coupons metadata provides the way to signal the existence of coupon, to explain the coupon, and to signal the method to retrieve the coupon. DMB MAF users may store the coupons with the associated contents and may retrieve and use them at any time.

● Segment Metadata

As previously mentioned, a user can also add his bookmark for next-time usage. That is, if bookmark information is stored with the contents, he can selectively consume the contents by just navigating his favourite items or segments. (A segment is a continuous portion of a piece of content.) For this purpose, segmentation metadata of TV-Anytime is used. Segmentation metadata also make it possible to repurpose programs to generate a video highlight, bookmark, or virtual program. The following xml

instance shows an example of segmentation metadata which describes a segment group of bookmarks type.

```
<SegmentGroupInformation topLevel="false" ordered="false" groupId="segroupid://TOC 4 1">
  <ProgramRef crid="crid://www.ebs.co.kr/englishcafe 849"/>
  <GroupType xsi:type="SegmentGroupType" value="bookmarks"/>
  <Description>
    <Title>Tell me anything </Title>
    <Synopsis>[Today's subject] I can't stop sneezing</Synopsis>
    <Keyword>Today's expression</Keyword>
  </Description>
  <Segments refList="SID 0 6604 8102 SID 0 8103 17409"/>
  <KeyFrameLocator>
    <MediaRelIncrTimePoint mediaTimeUnit="PT1001N30000F">6604</MediaRelIncrTimePoint>
  </KeyFrameLocator>
</SegmentGroupInformation>
```

● Package Metadata

In addition to audio-visual contents, various DMB contents can be acquired through DMB data channel or IP-based DMB services. Each can be consumed by itself or can be consumed together to provide more enriched consumer experiences. TV-Anytime defines Package metadata to describe characteristics and composition of such contents collections. Some examples of packaged contents include: multi-angle service of a broadcasting content, photo album service, linguistic educational content service which may consist of main video and additional contents such as today's expression, scripts of one's native and foreign language, textual data for structure and vocabulary, and dictionary, etc.

The following xml instance shows an example of Package metadata. At this example, a movie about the world best jazz signer, "Ray Charles" and its scripts are used as materials for English Study.

```
<Item item id="AVPlayer">
  <Component>
    <Resource crid="crid://www.etri.re.kr/package/englishcafe 849 Package/Videoplayer" imi="imi:PC"/>
  </Component>
  <Component>
    <Resource crid="crid://www.etri.re.kr/package/englishcafe 849 Package/movie Ray Charles"/>
    <Anchor anchor id="Sentence1">
      <TemporalLocation>
        <tva:TimePoint>T00:00:09</tva:TimePoint>
        <tva:Duration>PT8S</tva:Duration>
      </TemporalLocation>
    </Anchor>
  </Component>
</Item>
<Item item id="Inform">
  <Item>
    <Condition require="ShowScript"/>
  </Item>
  <Item>
    <Descriptor>
      <ObjectDescription>
        <Description>I can't stop wanting you</Description>
      </ObjectDescription>
    </Descriptor>
    <Descriptor>
      <Condition require="ShowTranslation"/>
      <ObjectDescription>
        <Description>I cannot stop wanting you</Description>
      </ObjectDescription>
    </Descriptor>
    <Component>
      <Condition require="Sentence1"/>
      <Resource crid="crid://www.etri.re.kr/package/englishcafe 849 Package/highlighted"/>
    </Component>
  </Item>
</Item>
</Item>
```

● Targeting Metadata

Targeting metadata provides information for automatic matching and delivering of relevant content to profiled consumers. Targeted substitution can be based on user profile, usage history, etc. A DMB portal may use user preferences and other attributes to selectively recommend or present a DMB MAF content to the targeted user. Also, an intelligent agent in the DMB MAF terminal may use user preferences and other attributes to selectively acquire and record DMB contents.

● Interstitials Metadata

Interstitial replacement at playback time based on a number of criteria should be possible for personalized advertisement applications. The criteria can be explicitly declared using the Interstitials metadata schema. With the Interstitials metadata, DMB MAF consumers can automatically replace the interstitials in main AV with their preferable ones at storing time or at later time.

5. Concluding Remarks

As explored in this paper, TV-Anytime metadata is a key element of DMB MAF in the sense that it provides all the descriptive schema for the DMB MAF resources and that it enables the various kind of applications defined for DMB MAF to be possible.

However, due to the limited bandwidth and storage capacity of current mobile broadcasting environment, some profiling and usage restrictions on TV-Anytime metadata should be studied in detail.

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