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Information technology — Multimedia application format (MPEG-A) —

Part 9: Digital Multimedia Broadcasting application format

Technologies de l'information — Format pour application multimédia (MPEG-A) —

Partie 9: Format pour application de diffusion générale multimédia numérique

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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ISO/IEC 23000-9 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 23000 consists of the following parts, under the general title *Information technology — Multimedia application format (MPEG-A)*:

— *Part 1: Purpose for multimedia application formats* [Technical Report]

— *Part 2: MPEG music player application format*

— *Part 3: MPEG photo player application format*

— *Part 4: Musical slide show application format*

— *Part 5: Media streaming application format*

— *Part 7: Open access application format*

— *Part 8: Portable video application format*

— *Part 9: Digital multimedia broadcasting application format*

— *Part 10: Video surveillance application format*

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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. DMB contents on air include audio-visual programs, interactive data, web pages, slideshows, TTI (traffic & travel information), etc.

Most users want to store their preferred DMB contents for consuming the contents at their preferred time and on their preferred device. Many of them also want to share the contents with other people. Contents providers also want to serve their DMB contents not only through broadcast but also through communication networks. Thus a standardized format needs to be specified to guarantee the interoperability of the DMB contents across various devices from different vendors.

DMB AF (Application Format) specification defines a file format that pertains to DMB (more specifically T-DMB and S-DMB) contents and services. It specifies how to combine the variety of DMB contents with associated information for a presentation in a well-defined format that facilitates storage, interchange, management, editing, and presentation of the DMB contents in protected, governed, and interoperable ways.

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Information technology — Multimedia application format (MPEG-A) —

Part 9:
Digital Multimedia Broadcasting application format

1 Scope

This part of ISO/IEC 23000 specifies a file format that pertains to both terrestrial digital multimedia broadcasting (T-DMB) and satellite digital multimedia broadcasting (S-DMB) contents and services. It integrates the existing DMB contents with appropriate additional information to facilitate storage, interchange, management, editing, and presentation of the contents in protected, governed, and interoperable ways.

This part of ISO/IEC 23000 is applicable both to storage and playback of DMB contents and to acquisition and consumption through communication networks and removable storages. Application examples of this specification include but are not limited to

— scheduled storage and time-shifted playback of DMB contents,

— file casting through DMB data channel,

— IP media service such as DMB content portal,

— rightful interchange of DMB contents between terminals, and

— user editing or creation from DMB contents.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14496-12, *Information technology — Coding of audio-visual objects (MPEG-4) — Part 12: ISO base media file format*[1)]

ISO/IEC 14496-14, *Information technology — Coding of audio-visual objects (MPEG-4) — Part 14: MP4 file format*

ISO/IEC 14496-15, *Information technology — Coding of audio-visual objects (MPEG-4) — Part 15: Advanced Video Coding (AVC) file format*

ISO/IEC 21000-2, *Information technology — Multimedia framework (MPEG-21) — Part 2: Digital Item Declaration*

1) Technically identical to ISO/IEC 15444-2.

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ISO/IEC 21000-4, *Information technology — Multimedia framework (MPEG-21) — Part 4: Intellectual Property Management and Protection Components*

ISO/IEC 21000-5, *Information technology — Multimedia framework (MPEG-21) — Part 5: Rights Expression Language*

ISO/IEC 21000-9, *Information technology — Multimedia framework (MPEG-21) — Part 9: File Format*

ETSI EN 300 401, *Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers*

ETSI TS 102 428, *Digital Audio Broadcasting (DAB); DMB video service; User Application Specification*

ETSI TS 102 822-3-1 V1.4.1:2007, *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 1: Phase 1 – Metadata schemas*

ETSI TS 102 822-3-3 V1.2.1:2007, *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 3: Metadata; Sub-part 3: Phase 2 – Extended Metadata Schema*

ETSI TS 102 822-4 V1.3.1:2007, *Broadcast and On-line Services: Search, select, and rightful use of content on personal storage systems ("TV-Anytime"); Part 4: Phase 1 – Content Referencing*

TTAS.KO-07.0027, *Standard for Satellite Digital Multimedia Broadcasting (S-DMB) Transmitter/Receiver Interface*

TTAS.KO-07.0032, *Terrestrial Digital Multimedia Broadcasting; Specification of the MOT Slide show service for Terrestrial Digital Multimedia Broadcasting (DMB) to mobile, portable and fixed receivers*

TTAS.ET_TS101498-1, *Radio Broadcasting Systems; Specification of the Broadcast Web Site Service for VHF Digital Multimedia Broadcasting (DMB) to Mobile, Portable and Fixed Receivers*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
DMB
digital multimedia broadcasting
collective term representing both terrestrial digital multimedia broadcasting (T-DMB) and satellite digital multimedia broadcasting (S-DMB)

3.2 Abbreviated terms

AAC	Advanced Audio Coding
AVC	Advanced Video Coding
AVC-FF	AVC File Format [ISO/IEC 14496-15]
BIFS	Binary Format for Scenes
BWS	Broadcast Web Site
CRID	Content Reference Identifier
CS	Classification Scheme

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DAB	Digital Audio Broadcasting [ETSI EN 300 401]
DLS	Dynamic Label Segment
DI	Digital Item
DID	Digital Item Declaration
DMB-AF	DMB Application Format [This part of ISO/IEC 23000]
DRM	Digital Right Management
ES	Elementary Stream
GOP	Group of Pictures
GUI	Graphic User Interface
HE-AAC v2	High Efficiency AAC version 2
IPMP	Intellectual Property Management and Protection
ISO-FF	ISO Base Media File Format [ISO/IEC 14496-12]
MATE	Multimedia Application Terminal Environment
MIDP	Mobile Information Device Profile
MOT	Multimedia Object Transfer
MP4-FF	MP4 File Format [ISO/IEC 14496-14]
MP21-FF	MPEG-21 File Format [ISO/IEC 21000-9]
MPEG	Moving Picture Experts Group (ISO/IEC JTC 1/SC 29/WG 11)
NPAD	Non-PAD
PAD	Program-Associated Data
PMT	Program Map Table
RAI	Random Access Indicator
REL	Rights Expression Language
SBR	Spectral Band Replication
S-DMB	Satellite Digital Multimedia Broadcasting [TTAS.KO-07.0027]
SL	Synchronization Layer
T-DMB	Terrestrial Digital Multimedia Broadcasting [ETSI TS 102 428]
TPEG	Transport Protocol Expert Group
TS	Transport Stream
TTI	Traffic and Travel Information
TVA	TV-Anytime

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4 Overview of technology

4.1 Components summary

Figure 1 shows a brief summary of the components of DMB-AF which consists of the MPEG Standards and non-MPEG Standards. The components of DMB-AF include native DMB contents which can be broadcasted on air and additional components added by this specification such as file format and metadata.

The native DMB contents include MPEG-4 AVC video, MPEG-1/2/4 audio, interactive video based on MPEG-4 BIFS, and various kind of data such as MOT slide show, Dynamic Label (DLS), Broadcast web site (BWS), Traffic and travel information (TTI) based on TPEG, and Java applications (midlet).

For this specification, ISO Base Media File Format and MP4 File Format are used for base file format structure. MPEG-21 DID is used for organizing and listing content items. TV-Anytime Metadata is used for contents and user description and is encapsulated by MPEG-21 DID. MPEG-21 REL and IPMP Components are used for protection and governance of content resources and descriptive metadata. 3GPP Timed Text Format is used when characters and glyphs rendering in timed manner is required, for example as in karaoke application.

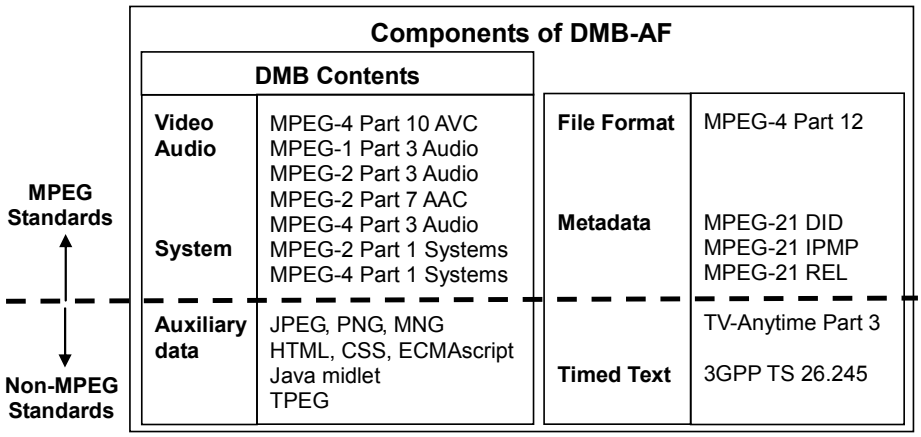


Figure 1 — Components summary for DMB-AF

4.2 File format - ISO base media file format

The ISO base media file format is a flexible, extensible format which contains timed media information in order to facilitate interchange, management, editing, and presentation of the media. The ISO base media file format is a base format for the DMB-AF file structure.

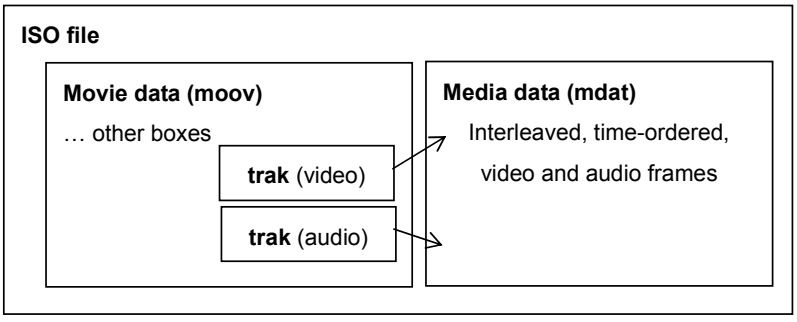


Figure 2 — ISO base media file format example

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Figure 3 shows the relations to other file formats; DMB-AF is basically derived from ISO file format and is based on MP4 file format for storing MP4 contents, AVC file format for storing AVC video and parameter sets, and MPEG-21 file format for content packaging, 3GPP timed text format for storing the 3GPP timed text.

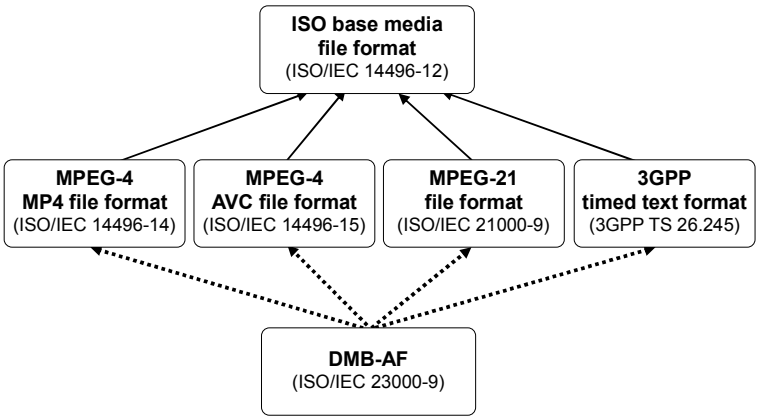


Figure 3 — Relation to other file formats

4.3 Organization of contents – MPEG-21 DID

MPEG-21 DID (ISO/IEC 21000-2) describes a set of abstract terms and concepts to form a useful model for defining Digital Items. In the MPEG-21 multimedia framework, the digital item (DI) is a fundamental unit with a standard representation, identification and metadata for the distribution, and transaction. For the declaration of the digital item in flexible and general ways, MPEG-21 DID aims to standardize the description for the definition of the digital item and provides the basic structure for content representation for the DMB content storage and distribution scenario.

4.4 Content creation and consumption description – TV Anytime Metadata

TV-Anytime (ETSI TS 102 822-1 to 822-9) is a set of specifications for the controlled delivery of multimedia content to a user's digital video recorder (DVR). It enables applications to exploit local and remote storage in consumer electronics platforms.

The TV-Anytime metadata are sub-divided into two categories: phase 1 metadata (ETSI TS 102 822-3-1) and phase 2 metadata (ETSI TS 102 822-3-3). The phase 1 metadata schema has the root element of TVAMainType and defines mainly about program and user descriptions. The phase 2 metadata schema has the root element of ExtendedTVAMainType and extends the phase 1 schema for including various content types and consumption conditions.

For describing creation and consumption information of DMB contents, DMB-AF uses a restricted subset of the TV-Anytime metadata specification. The restricted subset of TV-Anytime metadata for DMB-AF is defined in subclause 5.3 of this specification.

DMB-AF also adopts CRID (content referencing Identifier) defined in TV-Anytime Part 4 (ETSI TS 102 822-4) for identifying a specific content item independent of its location.

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4.5 Protection and governance – MPEG-21 IPMP and REL

4.5.1 Right management and protection

MPEG-21 IPMP (Intellectual Property Management and Protection) Components standard is a DRM (Digital Right Management) framework developed by MPEG for safe and easy distribution of contents between the different user terminals and the different content providers. The MPEG-21 IPMP Components standard provides the means to represent which parts of Digital Items are protected with what IPMP Tools.

For supporting governed and protected usage of DMB contents, DMB-AF adopts a restricted subset of MPEG-21 IPMP Components. The lists of the functionalities are explained in subclause 5.2 of this specification. Note that unless specifically mentioned in this specification, the requirements of MPEG-21 DID and IPMP (ISO/IEC 21000-2 and ISO/IEC 21000-4) apply for digital item declaration and protection in DMB-AF.

4.5.2 Right expression

ISO/IEC 21000-5 defines a right expression language (REL), which is designed to be domain-agnostic and comprehensive, and also very flexible and adaptive to the specific scope and requirements of applications within a particular domain. The language provides extension and profile mechanisms for these purposes.

In DMB-AF, licenses governing the use of content or parts thereof are expressed according to the dissemination and capture DAC profile of the MPEG-21 REL. The REL DAC profile is designed for usage in broadcasting applications, which can handle various use cases for DMB-AF applications. Note that the requirements of the DAC profile of MPEG-21 REL (ISO/IEC 21000-5) apply for right expression in DMB-AF.

4.6 Timed text

3GPP Timed Text format describes the normative behavior of text data for rendering. Timed text supports the characters and glyphs rendering, font support such as name, size and style, color support of text and background, text rendering position and composition, etc. By using these functionalities, various applications such as closed captioning, karaoke, dynamic highlighting and other visual annotation can be deployed in the user's terminal.

The synchronized usage of the timed text with other timed media is described in subclause 6.6.

5 Components of DMB-AF

5.1 Supported components and restrictions

In general, DMB Video Service components include audio and visual objects and associated auxiliary data, which can be carried in MPEG-2 SPTS (Single Program Transport Stream). DMB Audio Service components include audio stream and associated auxiliary data. DMB Data Service components include various kind of NPAD (Non Program-Associated-Data).

In Table 1, all the supported components of DMB-AF, except the file format, are listed with the specification reference of the respective component. Note that DMB-AF does not mandate all the syntax and semantics of the 'Specification' column of Table 1. Instead, it does mandate the component specification with some restrictions on profiles, levels, and usages, which are defined in the specification of 'Restriction' column of the table. In other words, for each component listed in Table 1, the requirements of the corresponding specification in the 'Restriction' column apply. For example, MPEG-4 AVC in T-DMB service is restricted such that Baseline Profile Level 1.3 apply with "`num_ref_frames` = 3" and "`pic_order_cnt_type` = 2" according to ETSI TS 102 428. Implementers of this specification shall carefully consult to the specifications in the 'Restriction' column for the exact restrictions made on the supported components.

For the file format components, refer to Section 6 of this specification.

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Table 1 — Supported Components of DMB-AF

Type	Component Name	Abbreviation	Specification	Restriction
Audio	MPEG Audio Layer II	MP2	ISO/IEC 11172-3 and ISO/IEC 13818-3	ETSI EN 300 401
	MPEG-4 Audio ER-BSAC	ER-BSAC	ISO/IEC 14496-3	ETSI TS 102 428
	MPEG-4 Audio HE-AAC v2	HE-AAC2	ISO/IEC 14496-3	ETSI TS 102 428
	MPEG-2 AAC LC MPEG-4 Audio SBR	AAC+SBR	ISO/IEC 13818-7 and ISO/IEC 14496-3	TTAS.KO-07.0027
Visual	MPEG-4 AVC Baseline	AVC	ISO/IEC 14496-10	T-DMB: ETSI TS 102 428 S-DMB: TTAS.KO-07.0027
Transport	MPEG-2 Systems TS MPEG-4 Systems SL	MP4on MP2	ISO/IEC 13818-1 and ISO/IEC 14496-1	ETSI TS 102 428
Data	MOT Slide Show	MOT-SLIDE	TTAS.KO-07.0032	None
	Dynamic Label Segment	DLS	ETSI EN 300 401	None
	MPEG-4 BIFS	BIFS	ISO/IEC 14496-11	ETSI TS 102 428
	JPEG Image	JPG	ISO/IEC 10918-1	TTAS.ET-TS101498-1
	PNG Image	PNG	ISO/IEC 15948 PNG Version 1.2	TTAS.ET-TS101498-1
	MNG Image	MNG	MNG(Multiple-image Network Graphics), Version 1.0, PNG Development Group	TTAS.ET-TS101498-1
	3GPP Timed Text	3GPP-TT	3GPP TS 26.245	None
	Broadcast Web Site	BWS	TTAS.ET-TS101498-1	Intermediate Profile
	TTI (Traffic and Travel Information)	TPEG	ISO/TS 18234 Part 1~6	None
	Java Application	MIDlet	Java ME MIDP	None
Metadata	MPEG-21 DID	DID	ISO/IEC 21000-2	None
	MPEG-21 IPMP Components	IPMP	ISO/IEC 21000-4	This specification (subclause 5.2)
	MPEG-21 REL	REL	ISO/IEC 21000-5	DAC Profile
	TV-Anytime Metadata	TVA	ETSI TS 102 822-3 Subpart 1 and 3 ETSI TS 102 822-4	This specification (subclause 5.3)

NOTE 1 MOT-SLIDE and BWS components can contain JPG/PNG/MNG images and that BWS can contain HTML (Hyper Text Markup Language) document, CSS (Cascading Style Sheet), and ECMA Script, etc. Unless specifically mentioned in this specification, the requirements of TTAS.KO-07.0032 apply for the MOT-SLIDE component and the requirements of TTAS.ET-TS101498-1 Intermediate Profile apply for the BWS component.

NOTE 2 JPG, PNG, and MNG images can be used in the contexts of BIFS, MOT-SLIDE, and BWS. In addition, the images can also be used as media titles or thumbnails in TVA or can independently exist as additional resource items for user. In any context, only the requirements of TTAS.ET-TS101498-1 apply for all the image components in DMB-AF.

5.2 Restrictions on MPEG-21 IPMP components

5.2.1 Introduction

The IPMP tool set for DMB-AF is a subset of MPEG-21 IPMP Components. The selection criterion on this tool set is based on the specific application domain of DMB.

- Most of the target terminals are to be hand-held DMB receivers.
- The selected IPMP tools should be useful and applicable for DMB-AF services on such devices.
- For easy implementation, some ambiguous tool elements, e.g. the elements of "`any`" type should be specifically defined.

The following subclauses specify the normative set of the required IPMP Components elements for DMB-AF.

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5.2.2 IPMP DIDL

To maintain the full capability to express the protected Digital Item, the IPMP tool set for DMB-AF shall include all the elements in the IPMP DIDL schema of MPEG-21 IPMP Components.

5.2.3 IPMP Information Descriptor

IPMP Information Descriptors in DMB-AF are composed of the subset of IPMP Information Descriptor schema in MPEG-21 IPMP Components standard. The selected elements with restrictions are as follows.

Element/Child Element	Restrictions on MPEG-21 IPMP Components
`ipmpinfo:IPMPInfoDescriptor`	As defined in 7.3 of the standard
`ipmpinfo:Tool`	Restricted to include only `ToolRef`
`ipmpinfo:RightsDescriptor`	As defined in 7.5 of the standard.
`Dsig:Signature`	As defined in 7.6 of the standard.
`ipmpinfo:Tool`	Restricted to include only a `ToolRef`, an optional `initailzationSettings`, an optional `RightDescipritor` and an optional `Signature`
`ipmpinfo:ToolRef`	As defined in 7.4.5 of the standard.
`ipmpinfo:initializationSettings`	As defined in 7.5 of the standard.
`ipmpinfo:RightsDescriptor`	As defined in 7.5 of the standard.
`dsig:Signature`	As defined in 7.6 of the standard.

The `ipmpinfo:RightsDescriptor` element is used for containing rights information that governs the IPMP information. The `ipmpinfo:RightsDescriptor` element under the `ipmpinfo:Tool` element is for each IPMP Tool. The common rights information about all tools in `ipmpinfo:IPMPInfoDescriptor` can be expressed by the `ipmpinfo:RightsDescriptor` under the `ipmpinfo:IPMPInfoDescriptor`.

Regarding encryption of resources, AES-128 CTR [32] is used as a default encryption tool in DMB-AF, meaning that DMB-AF file players compliant to the protection supporting brands of this specification shall be able to decrypt the resources encrypted by the default encryption tool. In addition, the initiation vector (IV) can be used as a value of `ipmpinfo:initializationSettingsData` for AES-128 CTR method.

5.2.4 IPMP General Information Descriptor

IPMP General Information Descriptors in DMB-AF are composed of a subset of MPEG-21 IPMP Information Descriptor schema in MPEG-21 IPMP Components and MPEG-A Media Streaming Player application format [17]. The selected elements with restrictions are tabulated as follows.

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Element/Child Element	Restrictions on MPEG-21 IPMP Components
ipmpinfo:IPMPGeneralInfoDescriptor	As defined in 8.3.1 of the standard.
Ipmpinfo:ToolList	This element is restricted to include one or many ipmpinfo:ToolDescription element(s).
ipmpinfo:LicenseCollection	As defined in 8.5 of the standard.
Dsig:Signature	As defined in 8.6 of the standard.
Ipmpinfo:ToolList	Restricted to include only ipmpinfo:ToolDescription
ipmpinfo:ToolDescription	
ipmpinfo:ToolDescription	This element is restricted to include the following child elements only: ipmpinfo:IPMPToolID, an optional ipmpinfo:Inline or ipmpinfo:Remote
ipmpinfo:IPMPToolID	As defined in 8.4.4.3 of the standard.
Ipmpinfo:Inline	As defined in 8.4.4.5 of the standard.
Ipmpinfo:Remote	As defined in 8.4.4.6 of the standard.
Ipmpinfo:ConfigurationSettings	As defined in 8.4.8.6 of the standard.
@localID	As defined in 8.4.4.1 of the standard.
ipmpinfo:ConfigurationSettings	
ipmpinfo:Configuration	Restricted to include a ipmpinfo-msx:ToolBody element [17] in order to indicate IPMP Tool Configuration.
ipmpinfo:Update	As defined in 7.4.4.7.4 of the standard.

5.2.5 IPMP Information schema

```
<?xml version="1.0"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema" xmlns:ipmpinfo="urn:mpeg:mpeg21:2004:01-IPMPINFO-NS"
xmlns:ipmpinfo-msx="urn:mpeg:mpeg21:2006:10-IPMPINFO-MSX-NS" xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-
NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS" xmlns:dsig="http://www.w3.org/2000/09/xmldsig#"
targetNamespace="urn:mpeg:mpeg21:2004:01-IPMPINFO-NS" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="0.01">
    <import namespace="http://www.w3.org/2000/09/xmldsig#"
schemaLocation="http://www.w3.org/TR/2002/REC-xmldsig-core-20020212/xmldsig-core-schema.xsd"/>
    <import namespace="urn:mpeg:mpeg21:2003:01-REL-R-NS" schemaLocation="rel-r_IS.xsd"/>
    <import namespace="urn:mpeg:mpeg21:2002:01-DII-NS" schemaLocation="dii.xsd"/>
    <element name="IPMPInfoDescriptor" type="ipmpinfo:IPMPInfoDescriptorType"/>
    <complexType name="IPMPInfoDescriptorType">
        <annotation>
            <documentation>The RightsDescriptor under this element is applied to the associated
asset</documentation>
        </annotation>
        <sequence>
            <element ref="ipmpinfo:Tool" minOccurs="0" maxOccurs="unbounded"/>
            <element ref="ipmpinfo:RightsDescriptor" minOccurs="0" maxOccurs="unbounded"/>
            <element ref="dsig:Signature" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="Tool" type="ipmpinfo:ToolType"/>
    <complexType name="ToolType">
        <complexContent>
            <restriction base="ipmpinfo:ToolType">
                <sequence>
                    <element ref="ipmpinfo:ToolRef"/>
                    <element ref="ipmpinfo:InitializationSettings" minOccurs="0"/>
                    <element ref="ipmpinfo:RightsDescriptor" minOccurs="0"/>
                    <element ref="dsig:Signature" minOccurs="0"/>
                </sequence>
                <attribute name="order" type="positiveInteger"/>
            </restriction>
        </complexContent>
    </complexType>
    <element name="ToolRef" type="ipmpinfo:ToolRef"/>
    <complexType name="ToolRef">
```

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```
        <attribute name="localidref" type="IDREF" use="required"/>
    </complexType>
    <element name="IPMPToolID" type="anyURI"/>
    <element name="Inline" type="ipmpinfo:InlineType"/>
    <complexType name="InlineType">
        <sequence>
            <element ref="ipmpinfo:Binary"/>
            <element ref="dsig:Signature" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="Binary" type="base64Binary"/>
    <element name="Remote" type="ipmpinfo:RemoteType"/>
    <complexType name="RemoteType">
        <sequence>
            <element ref="dsig:Signature" minOccurs="0"/>
        </sequence>
        <attribute name="ref" type="anyURI"/>
    </complexType>
    <element name="ConfigurationSettings" type="ipmpinfo:ConfigurationSettingsType"/>
    <complexType name="ConfigurationSettingsType" mixed="true">
        <sequence>
            <element ref="ipmpinfo:Configuration"/>
            <element ref="ipmpinfo:Update" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="Configuration" type="ipmpinfo:ConfigurationType"/>
    <complexType name="ConfigurationType" mixed="true">
    <complexContent>
        <restriction base="ipmpinfo:ConfigurationType">
        <sequence>
            <element ref="ipmpinfo-msx:ToolBody" minOccurs="0"/>
        </sequence>
        </restriction>
    </complexContent>
        <sequence>
            <any namespace="##any" processContents="lax" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="Update" type="ipmpinfo:UpdateType"/>
    <complexType name="UpdateType">
        <sequence>
            <element ref="ipmpinfo:Location" maxOccurs="unbounded"/>
            <element ref="ipmpinfo:ScheduledUpdateTime" minOccurs="0"/>
            <element ref="ipmpinfo:SupportedPlatform" minOccurs="0" maxOccurs="unbounded"/>
            <element ref="dsig:Signature" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="Location" type="ipmpinfo:RemoteType"/>
    <element name="ScheduledUpdateTime" type="ipmpinfo:ScheduledUpdateTimeType"/>
    <complexType name="ScheduledUpdateTimeType">
        <simpleContent>
            <extension base="dateTime">
                <attribute name="periodic" type="duration" use="optional"/>
            </extension>
        </simpleContent>
    </complexType>
    <element name="SupportedPlatform" type="ipmpinfo:SupportedPlatformType"/>
    <complexType name="SupportedPlatformType">
        <sequence>
            <any namespace="##any" processContents="lax" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="RightsDescriptor" type="ipmpinfo:RightsDescriptorType"/>
    <complexType name="RightsDescriptorType">
        <sequence>
            <element ref="ipmpinfo:IPMPInfoDescriptor" minOccurs="0"/>
            <choice minOccurs="0">
                <element ref="ipmpinfo:License"/>
                <element ref="ipmpinfo:LicenseReference"/>
                <element ref="ipmpinfo:LicenseService"/>
            </choice>
        </sequence>
    </complexType>
    <element name="License" type="ipmpinfo:LicenseType"/>
    <complexType name="LicenseType" mixed="true">
        <sequence>
```


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```
            <any namespace="##any" processContents="lax" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="LicenseService" type="ipmpinfo:LicenseServiceType"/>
    <complexType name="LicenseServiceType" mixed="true">
        <sequence>
            <any namespace="##any" processContents="lax" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="LicenseReference" type="ipmpinfo:LicenseReferenceType"/>
    <complexType name="LicenseReferenceType">
        <simpleContent>
            <extension base="anyURI"/>
        </simpleContent>
    </complexType>
    <element name="InitializationSettings" type="ipmpinfo:InitializationSettingsType"/>
    <complexType name="InitializationSettingsType" mixed="true">
        <sequence>
            <element ref="ipmpinfo:IPMPInfoDescriptor" minOccurs="0"/>
            <element ref="ipmpinfo:InitializationData"/>
        </sequence>
    </complexType>
    <element name="InitializationData" type="ipmpinfo:InitializationDataType"/>
    <complexType name="InitializationDataType" mixed="true">
        <sequence>
            <any namespace="##any" processContents="lax" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="IPMPGeneralInfoDescriptor" type="ipmpinfo:IPMPGeneralInfoDescriptorType"/>
    <complexType name="IPMPGeneralInfoDescriptorType">
        <sequence>
            <element ref="ipmpinfo:ToolList" minOccurs="0"/>
            <element ref="ipmpinfo:LicenseCollection" minOccurs="0"/>
            <element ref="dsig:Signature" minOccurs="0"/>
        </sequence>
    </complexType>
    <element name="ToolList" type="ipmpinfo:ToolListType"/>
    <complexType name="ToolListType">
        <complexContent>
            <restriction base="ipmpinfo:ToolListType">
                <sequence>
                    <element ref="ipmpinfo:ToolDescription" maxOccurs="unbounded"/>
                </sequence>
            </restriction>
        </complexContent>
    </complexType>
    <element name="ToolDescription" type="ipmpinfo:ToolDescriptionType"/>
    <complexType name="ToolDescriptionType">
        <complexContent>
            <restriction base="ipmpinfo:ToolDescriptionType">
                <sequence>
                    <element ref="ipmpinfo:IPMPToolID"/>
                    <choice minOccurs="0">
                        <element ref="ipmpinfo:Inline"/>
                        <element ref="ipmpinfo:Remote"/>
                    </choice>
                    <element ref="ipmpinfo:ConfigurationSettings" minOccurs="0"/>
                    <element ref="ipmpinfo:RightsDescriptor" minOccurs="0"/>
                    <element ref="dsig:Signature" minOccurs="0"/>
                </sequence>
                <attribute name="localID" type="ID" use="required"/>
            </restriction>
        </complexContent>
    </complexType>
    <element name="LicenseCollection" type="ipmpinfo:LicenseCollectionType"/>
    <complexType name="LicenseCollectionType" mixed="true">
        <sequence>
            <element ref="ipmpinfo:RightsDescriptor" maxOccurs="unbounded"/>
        </sequence>
    </complexType>
</schema>
```

--`,,```,,,,````-`-`,,`,,`,`,,`---
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5.3 Restrictions on TV-Anytime metadata

5.3.1 Introduction

DMB-AF uses a restricted subset of TV-Anytime Metadata for the rich content description and consumption. The followings are taken into considerations in order to customize the TVA metadata schema for DMB-AF applications.

- There are many elements that can be used to describe the same information. To reduce usage ambiguity of such elements, some redundant elements should be eliminated as much as possible.

- There are recursive elements such as ‘item’, which can contain ‘item’s recursively. For a simple description and devices with limited system resources, the level of recursion should be restricted to a certain level.

- Those elements which are not essential for DMB-AF applications should be optimized in regards to the required system resources and possible future usages.

5.3.2 Restricted schema elements

Figure 4 shows a high-level view of the restricted TV-Anytime metadata schema for DMB-AF.

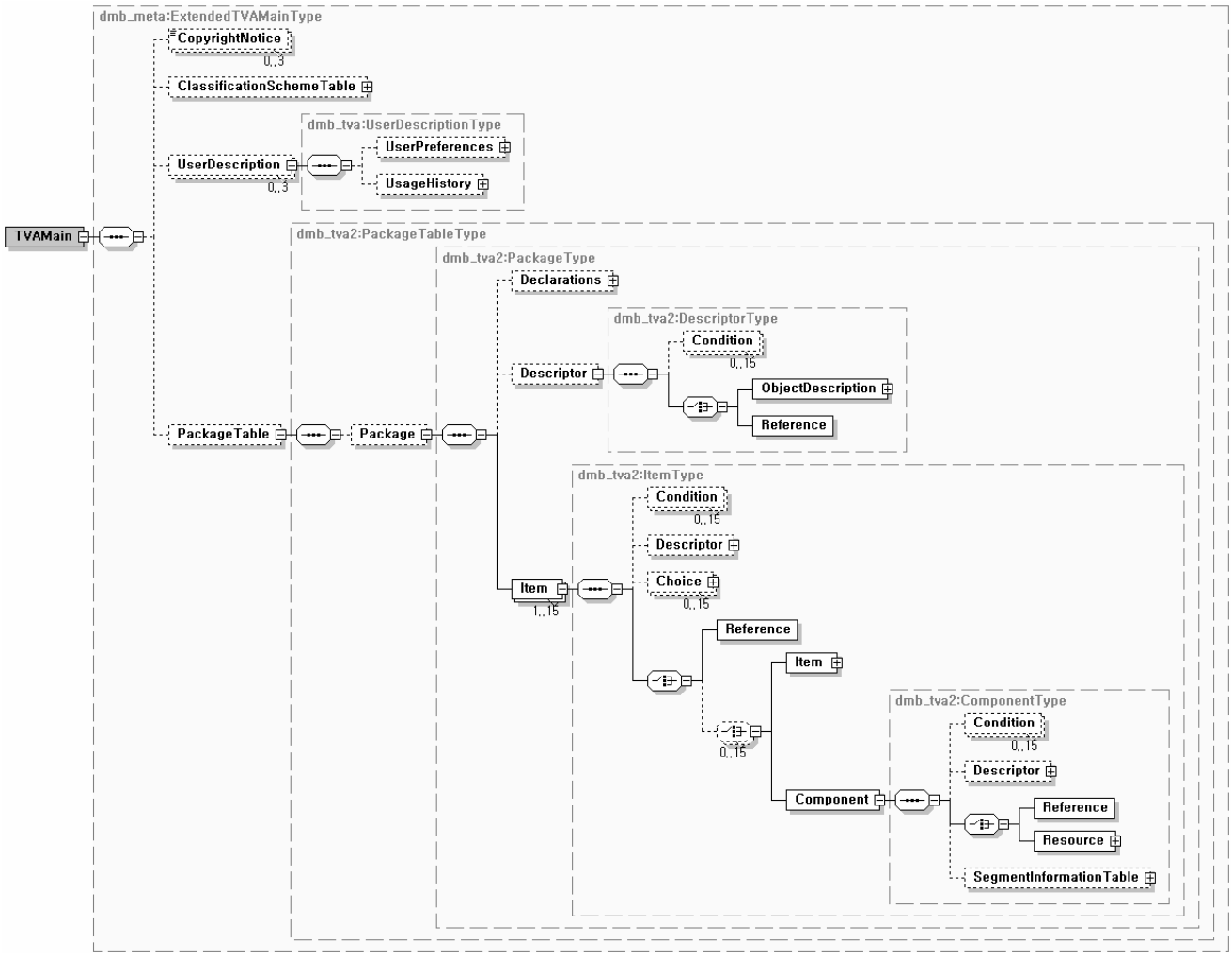


Figure 4 — Overview of the restricted set of TV-Anytime metadata

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The top-level schema of the restricted set of TV-Anytime metadata is shown in Figure 5.

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns:dmb_meta="urn:mpeg:maf:schema:dmb:metadata:2007"
xmlns:dmb_tva="urn:mpeg:maf:schema:dmb:tva:2007" xmlns:dmb_tva2="urn:mpeg:maf:schema:dmb:tva2:2007"
xmlns:dmb_mpeg7="urn:mpeg:maf:schema:dmb:mpeg7:2007" xmlns="http://www.w3.org/2001/XMLSchema"
targetNamespace="urn:mpeg:maf:schema:dmb:metadata:2007" elementFormDefault="qualified"
attributeFormDefault="unqualified">
  <annotation>
    <documentation xml:lang="en">This schema consists of datatypes that are normatively defined in
Updated proposal on TV-Anytime Metadata in ISO/IEC 23000-9 MAF for DMB (2007-10)</documentation>
  </annotation>
    <import namespace="urn:mpeg:maf:schema:dmb:tva:2007" schemaLocation="dmbmaf_tva1_3-1_v141.xsd"/>
    <import namespace="urn:mpeg:maf:schema:dmb:tva2:2007" schemaLocation="dmbmaf_tva2_3-3_v121.xsd"/>
    <import namespace="urn:mpeg:maf:schema:dmb:mpeg7:2007" schemaLocation="dmbmaf_mpeg7.xsd"/>
    <import namespace="http://www.w3.org/XML/1998/namespace" schemaLocation="xml.xsd"/>
    <annotation>
      <documentation xml:lang="en">ISO/IEC 23000-9 MAF for DMB</documentation>
    </annotation>
    <element name="TVAMain" type="dmb_meta:ExtendedTVAMainType"/>
    <complexType name="ExtendedTVAMainType">
      <sequence>
        <element name="CopyrightNotice" type="dmb_mpeg7:TextualType" minOccurs="0" maxOccurs="3"/>
        <element name="ClassificationSchemeTable" type="dmb_tva:ClassificationSchemeTableType"
minOccurs="0"/>
        <element name="UserDescription" type="dmb_tva:UserDescriptionType" minOccurs="0"
maxOccurs="3"/>
        <element name="PackageTable" type="dmb_tva2:PackageTableType" minOccurs="0"/>
      </sequence>
      <attribute ref="xml:lang" use="required"/>
      <attribute name="publisher" type="string" use="optional"/>
      <attribute name="publicationTime" type="dateTime" use="optional"/>
      <attribute name="rightsOwner" type="string" use="optional"/>
      <attribute name="originID" type="dmb_tva:TVAIDType" use="optional"/>
      <attribute name="version" type="unsignedInt" use="required"/>
    </complexType>
</schema>
```

Figure 5 — Top-level schema of the restricted set of TV-Anytime metadata

The restricted schema element types are tabulated in Table 2. In the ‘Restrictions’ column of this table, ‘TVA1’ and ‘TVA2’ mean TV-Anytime Phase 1 and Phase 2 Metadata specifications (i.e., ETSI TS 102 822-3-1 V1.4.1 and ETSI TS 102 822-3-3 V1.2.1), respectively.

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Table 2 — The restricted schema elements of TV-Anytime metadata

Index	Element/Child Element	Restrictions
1	ExtendedTVAMain	Restricted as only the elements in Index 2~5 of this table are used. In addition, xml:lang and version attributes are used as mandatory.
2	CopyrightNotice	As defined in 6.7.2 of TVA1
3	ClassificationSchemeTable	As defined in 6.7.2 of TVA1
4	UserDescription	See Index 6~8
5	PackageTable	See Index 15~16
6	UserDescription	
7	UserPreferences	See Index 9
8	UsageHistory	See Index 12~14
9	UserPreferences	Restricted as only the elements in index 10~11 of this table are used.
10	UserIdentifier	As defined in 6.5.2 of TVA1
11	FilteringAndSearchPreferences	Restricted from 6.5.2 of TVA1; Restricted only to use "CreationPreferences" element. Restricted as this element is used for describing preference for a program.
12	UsageHistory	
13	UserIdentifier	As defined in 6.5.2 of TVA1
14	UserActionHistory	Restricted not to use "ObservationPeriod" element
15	PackageTable	Restricted from 10.1 of TVA2; Restricted as xml:lang is mandatory, and copyrightNotice is optional
16	Package	See Index 17~20
17	Package	
18	Declarations	Restricted from 8.2 of TVA2; Restricted not to use “Anchor”.
19	Descriptor	See Index 38~44
20	Item	See Index 21~27
21	Item	Restricted from 8.4 of TVA2; Restricted not to use "Relation" element and "xml:lang" attribute
22	Condition	As defined in 8.3 of TVA2
23	Descriptor	See Index 38~44
24	Choice	See Index 28~31
25	Reference	As defined in 8.3 of TVA-2
26	Item	See Index 21~27
27	Component	See Index 32~37
28	Choice	Restricted form 8.4 of TVA2; Restricted as minSelections and maxSelections attribute are not used.
29	Condition	As defined in 8.3 of TVA2
30	Descriptor	See Index 38~44
31	Selection	As defined in 8.4 of TVA2
32	Component	Restricted from 8.5 of TVA2; Restricted not to use "Relation" element and xml:lang attribute. In addition, “Anchor” element is replaced with “SegmentationInformationTable”.
33	Condition	As defined in 8.3 of TVA2
34	Descriptor	See Index 38~44
35	Reference	As defined in 8.3 of TVA2
36	Resource	See Index 101~102
37	SegmentInformationTable	See Index 105~107
38	Descriptor	Restricted as xml:lang is not used
39	Condition	As defined in 8.3 of TVA2
40	ObjectDescription	See Index 42~44
41	Reference	As defined in 8.3 of TVA2
42	ObjectionDescription	As defined in 8.3 of TVA2
43	Description	As defined in 8.3 of TVA2
44	ContentDescription	See Index 45~61
45	ContentDescription	Restricted from ExtendedContentDescriptionType of TVA2; Restricted as the only elements in Index 46~61 are used.
46	Title	Restricted from 6.3.4 of TVA1; Restricted as “type” attributes are not used.
47	MediaTitle	As defined in 6.3.4 of TVA1
48	ShortTitle	As defined in 6.3.4 of TVA1
49	Synopsis	As defined in 6.3.4 of TVA1
50	Genre	Restricted from 6.3.4 of TVA1; Restricted as only “href” attribute and “Name” element are used.
51	ParentalGuidance	As defined in 6.3.4 of TVA1; Restricted as only “ParentalRating” and “MinimumAge” elements are used. Restricted not to use "ExplanatoryText" element.

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Table 2 (*continued*)

Index	Element/Child Element	Restrictions
52	Language	As defined in 6.3.4 of TVA1
53	CaptionLanguage	As defined in 6.3.4 of TVA1
54	SignLanguage	As defined in 6.3.4 of TVA1
55	CreditsList	Restricted from that defined in 6.3.4 of TVA1; Restricted as only the “role” attribute, “PersonName” and “Character” elements under “CreditsItem” are used. For both the “PersonName” and “Charater” elements, only the "xml:lang" attribute, “GivenName” and “FamilyName” elements are used.
56	RelatedMaterial	Restricted from 6.3.4 of TVA1; Restricted as “HowRelated”, “MediaLocator” and “PromotionalText” elements are only used
57	ProductionDate	As defined in 6.3.4 of TVA1
58	ProductionLocation	As defined in 6.3.4 of TVA1
59	Duration	As defined in 6.3.4 of TVA1
60	ContentProperties	See Index 62~66
61	SourceLocation	See Index 77~81
62	ContentProperties	
63	ContentType	As defined in 6.1.3 of TVA2. But the default CS used for this element (i.e., ContentTypeCS) need to be extended to describe DMB contents. Therefore, SlideShow, BWS, TTI, BIFS, Java Midlet, Timed Text are newly added to the ContentTypeCS to make dmbmaf_ContentTypeCS.
64	FileProperties	As defined in 6.1.3 of TVA2
65	ContentAttributes	See Index 67~70
66	ContextAttributes	See Index 71~76
67	ContentAttributes	
68	AudioAttributesType	As defined in 6.1.1.1 of TVA2
69	VideoAttributesType	As defined in 6.1.1.2 of TVA2
70	StillImageContentAtttibutesType	As defined in 6.1.1.3 of TVA2
71	ContextAttributes	
72	DataBroadcastingContextAttributesType	As defined in 6.1.2.1 of TVA2
73	InterstitialContextAttributesType	As defined in 6.1.2.2 of TVA2
74	EducationalContextAttributesType	As defined in 6.1.2.3 of TVA2
75	ApplicationContextAttributesType	As defined in 6.1.2.4 of TVA2
76	GameContextAttributesType	As defined in 6.1.2.5 of TVA2
77	SourceLocation	As defined in 7.1 of TVA2 (Used to describe Program Location information)
78	BroadcastEvent	See Index 82~86
79	OnDemandProgram	See Index 96~100
80	ContentIdRef	As defined in 7.1 of TVA2
81	imi	As defined in 8.5 of TVA2
82	BroadcastEvent	Restricted from 6.4.2 of TVA1; Restricted not to use “ProgramURL” and “InstanceMetadataId” elements under “ProgramLocationType”. Restricted as only the “PublishedStartTime” and “PublishedEndTime” elements under “ScheduleEventType” are used.
83	Program	As defined in 6.4.2 of TVA1
84	InstanceDescription	See Index 87~88
85	PublishedStartTime	As defined in 6.4.2 of TVA1
86	PublishedDuration	As defined in 6.4.2 of TVA1
87	InstanceDescription	Restricted as only used “PurchaseList” element
88	PurchaseList	See Index 89~90
89	PurchaseList	Restricted as only used “PurchaseItem” element
90	PurchaseItem	See Index 92~95
91	PurchaseItem	Restricted as only use the elements in Index 92~95
92	Price	As defined in 6.3.4 of TVA1
93	PricingServerURL	As defined in 6.3.4 of TVA1
94	RequiredCoupon	Restricted from 6.3 of TVA2 Only couponId and requiredNumber attribute s are used
95	RewardCoupon	Restricted from 6.3 of TVA2; “userConfirmationRequired” and “number” attribute are not used

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Table 2 (*continued*)

Index	Element/Child Element	Restrictions
96	OnDemandProgram	Restricted from 6.4.2 of TVA1; Restricted not to use "PublishedDuration", "FirstAvailability", "LastAvailability" and "ImmediateViewing" elements. Restricted not to “ProgramURL” and “InstanceMetadataId” elements under “ProgramLocationType”
97	Program	As defined in 6.4.2 of TVA1
98	InstanceDescription	See Index 87~88
99	StartOfAvailability	As defined in 6.4.2 of TVA1
100	EndOfAvailability	As defined in 6.4.2 of TVA1
101	Resource	As defined in 8.5 of TVA2
102	ResourceType	See Index 103~104
103	ResourceType	As defined in 8.5 of TVA2
104	Name	Restricted from 8.5 of TVA2; Preferred attribute is not used.
105	SegmentInformationTable	Restricted from 6.6.7 of TVA1 “metadataOriginIDRef” and “xml:lang” attributes are not used.
106	SegmentList	See Index 108~109
107	SegmentGroupList	As defined in 6.6.7 of TVA1
108	SegmentList	
109	SegmentInformation	See Index 110~115
110	SegmentInformation	Restricted from 6.6.5 of TVA1; “metadataOriginIDRef” and “xml:lang” attributes are not used.
111	ProgramRef	As defined in 6.6.5 of TVA1
112	TimeBaseReference	As defined in 6.6.5 of TVA1
113	Description	See Index 116~112
114	SegmentLocator	As defined in 6.6.5 of TVA1
115	KeyFrameLocator	As defined in 6.6.5 of TVA1
116	Description	
117	Title	See Index 46
118	Synopsis	As defined in 6.3.4 of TVA1
119	Genre	See Index 50
120	RelatedMaterial	See Index 56
121	CreditsList	See Index 55
122	RewardCoupon	See Index 123~124
123	RewardCoupon	Restricted from 6.3 of TVA2; “CouponRef” element, “userConfirmationRequired” and “number” attribute are not used
124	CouponDescription	See Index 125~129
125	CouponDescription	Restricted from 6.3 of TVA2; Restricted not to use "NonTVACouponRef", "CouponURL", "UserTargetingInformation" and "UserTargetingInformationRef"element. In addition, only couponId and acquistionMode attributes are used.
126	RequiredCoupon	Restricted from 6.3 of TVA2; Only couponId and requiredNumber attributes are used.
127	CouponValue	See Index 130~131
128	ContentTarget	See Index 132~133
129	CouponText	As defined in 6.3 of TVA2
130	CouponValue	Restricted from 6.3 of TVA2; “ReductionAmount” element and “purchaseIdRef” attribute are used only.
131	ReductionAmount	As defined in 6.3 of TVA2
132	ContentTarget	Restricted from 6.3 of TVA2; Program CRID is only used.
133	Program	As defined in 6.3 of TVA2
134	SegmentGroupList	As defined in 6.6.7 of TVA1
135	SegmentGroupInformation	See Index 136~143
136	SegmentGroupInformation	Restricted from 6.6.6 of TVA1; Restricted not to use "GroupInterval" element. metadataOriginIDRef and xml:lang are not used. Restricted as the number of keyframe equal to 1 and not to use numberOfKeyFrames attribute.
137	ProgramRef	As defined in 6.6.6 of TVA1
138	TimeBaseReference	As defined in 6.6.6 of TVA1
139	GroupType	Restricted from 6.6.6 of TVA1; GroupType is listed at SegmentGroupTypeType
140	Description	Index 116~133 are used
141	Segments	As defined in 6.6.6 of TVA1
142	Groups	As defined in 6.6.6 of TVA1
143	KeyFrameLocator	As defined in 6.6.6 of TVA1

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In addition to the restrictions in Table 2, the following restrictions on the schema elements apply:

- The recursion level of 'Item' type (index 21 of Table 2) is bounded to 2. Thus a top-level 'Item' can have sub-'Item's but the sub-'Item's shall not have any sub-'Item'. Note that since the DMB-AF file structure also support a movie-level recursion (i.e., multiple movie file structure), it is recommended to use such functionality if 'Item' depth more than 2 is needed.

- The recursion level of segment 'Groups' (index 142) is bounded to 2, meaning that a 'Groups' element can only contain such 'SegmentGroupInformation's that do not have 'Groups' element as a child.

- The recursion level of 'Term' type in 'ClassificationSchemeTable' (index 3) is bounded to 2.

- The maximum occurrence of each element is bounded to some values (1, 3, 15, 255, or 1023). The specific bound values are defined in the restricted schema.

- The maximum length of 'TextualType' string is bounded to 256.

NOTE An informative set of Classification Schemes (CSs) has been developed by TVA to provide a universally applicable default set of classification terms. In addition to – or as a total or partial replacement for – this default CSs, implementers may create and make use of other CSs to meet specific regional or other special requirements. For describing the DMB content components, the original 'ContentTypeCS' in TVA is extended for DMB-AF.

The restricted schema of the TV-Anytime metadata and the DMB content type CS are provided with this specification as an electronic attachment. Unless specifically mentioned in this specification, the syntax, semantics, and usage of the schema elements, the CS, and the CRID shall be in accordance with the associated TV-Anytime specifications (ETSI TS 102 822-3-1 V1.4.1, ETSI TS 102-822-3-3 V1.2.1, and ETSI TS 102 822-4 V1.3.1).

6 File structures

6.1 Table for boxes

The file format of DMB-AF can be represented in two kinds of structures for single movie contents and multiple movie contents. The file format structure of this specification is derived from the ISO base media file format standard.

The boxes used in this specification is based on a restricted set of boxes from the ISO base media file format and the MP4 File Format. Table 3 shows the structure of the employed boxes with their description. The mandatory boxes, which shall be exist in DMB-AF files if the higher level box exist, are marked with an asterisk (*). Note that support for all the structural boxes in Table 3 is required for all the brands defined in this specification.

Unless specifically mentioned in this specification, the requirements of ISO base media file format (ISO/IEC 14496-12), MP4 file format (ISO/IEC 14496-14), AVC file format (ISO/IEC 14496-15), and MPEG-21 file format (ISO/IEC 21000-9) apply for the listed boxes.

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Table 3 — Box types and structure for this specification

*	ftyp						*file type and compatibility*
	pdin						*progressive download information*
	moov						*container for all the metadata*
*		mvhd					*movie header, overall declarations*
		iods					*object descriptor*
*		trak					*container for an individual track or stream*
*			tkhd				*track header, overall information about the track*
			tref				*track reference container*
			edts				*edit list container for data*
				elst			*an edit list*
*			mdia				*container for the media information in a track*
*				mdhd			*media header, overall information about the media*
*				hdlr			*handler, declares the media (handler) type* *“soun” for audio data* *“vide” for video data* *“text” for timed text data* *“hint” for protocol hint track*
*				minf			*media information container*
					vmhd		*video media header, overall information (video track only)*
					smhd		*sound media header, overall information (sound track only)*
					hmhd		*hint media header, overall information (hint track only)*
					nmhd		*Null media header, overall information (some tracks only)*
*					dinf		*data information box, container*
*						dref	*data reference box, declares source(s) of media data in track*
*					stbl		*sample table box, container for the time/space map*
*						stsd	*sample descriptions (codec types, initialization etc.)*
*						stts	*(decoding) time-to-sample*
*						stsc	*sample-to-chunk, partial data-offset information*
						stsz	*sample sizes (framing)*
						stz2	*compact sample sizes (framing)*
*						stco	*chunk offset, partial data-offset information*
						co64	*64-bit chunk offset.*
						stss	*sync sample table (random access points)*
		udta					*user-data*
	mdat						*media data container*
	free						*free space*
	skip						*free space*
	meta						*metadata*
*		hdlr					*handler, declares the metadata (handler) type*
		iloc					*item location*
		iinf					*item information*
		crid					*mapping table between CRID and item or track (a ‘uuid’ box)*
		xml					*XML container*
		bxml					*binary XML container*

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6.2 File structure for a single type file

Figure 6 illustrates a single type file structure containing single movie presentation with associated data. This type of file structure mainly consists of `ftyp`, `moov` and `mdat` boxes. The `moov` box describes the presentation of the scene in which more than one `trak` box are contained. The `trak` box contains the description for one media. A media in each `trak` box can be interleaved AV, individual audio and video, BIFS, and other data service contents as shown in Table 1. The `trak` box supports time information (such as `edtl`, `stbl` box) for the synchronization with other media of other `trak` box. The `mdat` box contains the real contents which are described in the `trak` box or the `trak` box may import the content by URL without deposing the content in the `mdat` box.

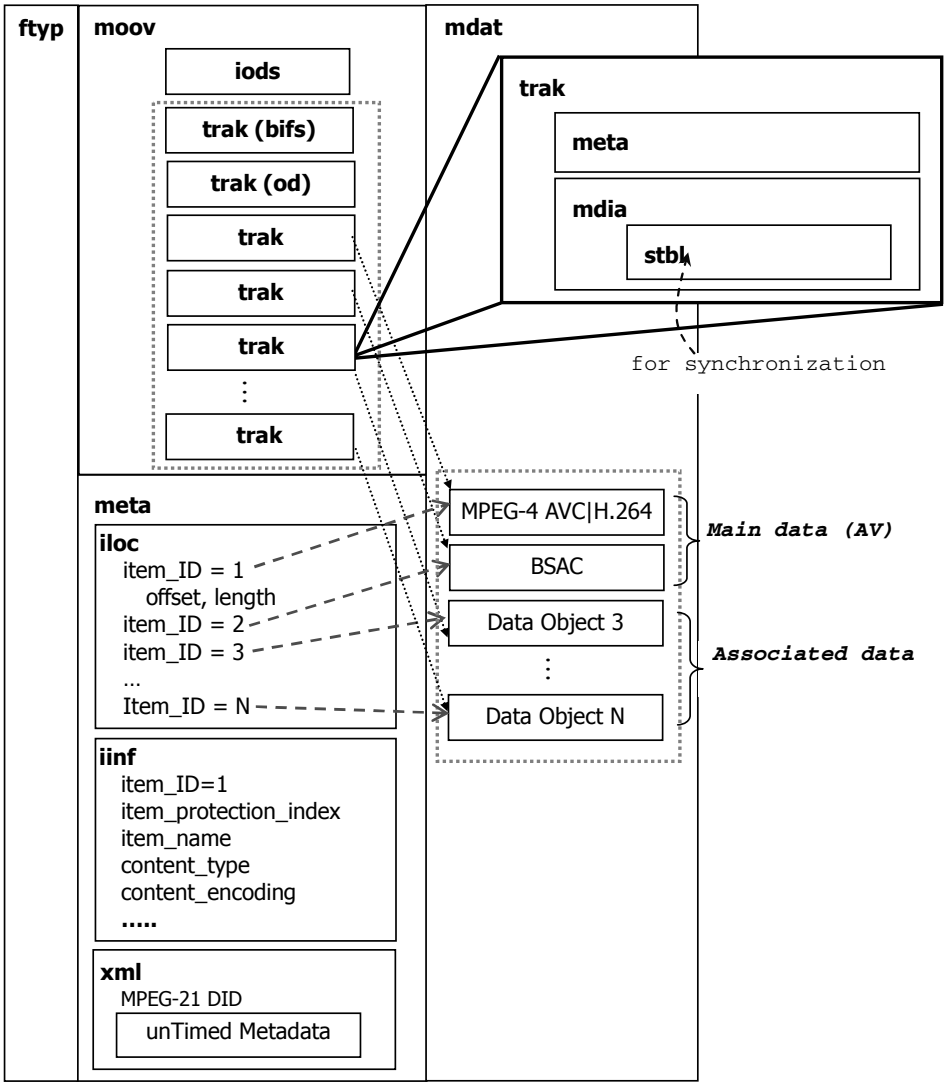


Figure 6 — Single type file structure

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- Usages of single type file structure (Informative)

Usage 1
Figure 7 shows a primitive file structure for a single type file, where BIFS and IOD/OD information is not included in the file.

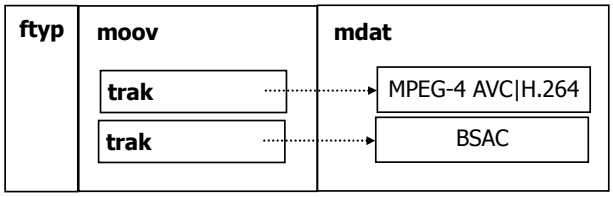


Figure 7 — A primitive file format structure

Usage 2
Figure 8 shows another primitive file structure for a single type file. In this figure, Audio and Visual streams are multiplexed in MPEG-2 TS format.

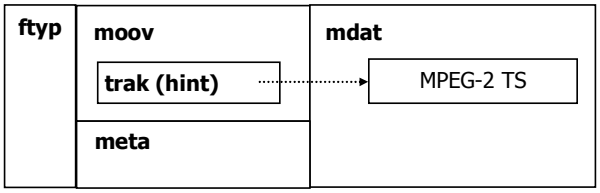


Figure 8 — A primitive file format structure for storing TS

Usage 3
Figure 9 shows another file structure for a single type file. BIFS, IOD and OD information is included with the main AV data.

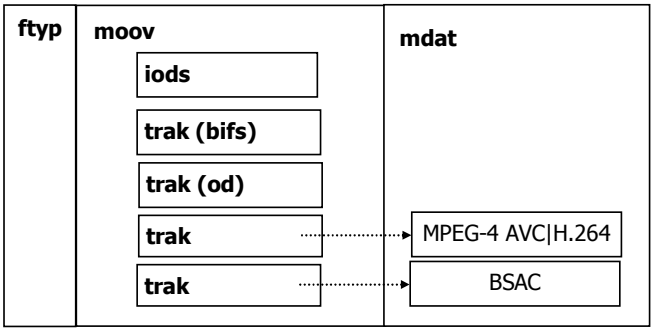


Figure 9 — A file format structure with BIFS and OD information

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File format 3 with `meta` box

Figure 10 shows a file structure for a single type file using the `meta` box. This file contains the BIFS associated non-main data such as caption, images, script, timed metadata, program code and private data. The `meta` box mainly consists of the `iloc`, `iinf`, `ipro`, `xml` boxes and etc. The `iloc` and `iinf` boxes contain the `item_ID`, `length` and `offset` for locating to an item and information such as `item_ID`, `item_protection`, `item_name`, `content_type` and `content_encoding`. The `xml` box can support the untimed text or binary data such as MPEG-21 DID, IPMP, and TV Anytime. MPEG-21 DID can support the description for items.

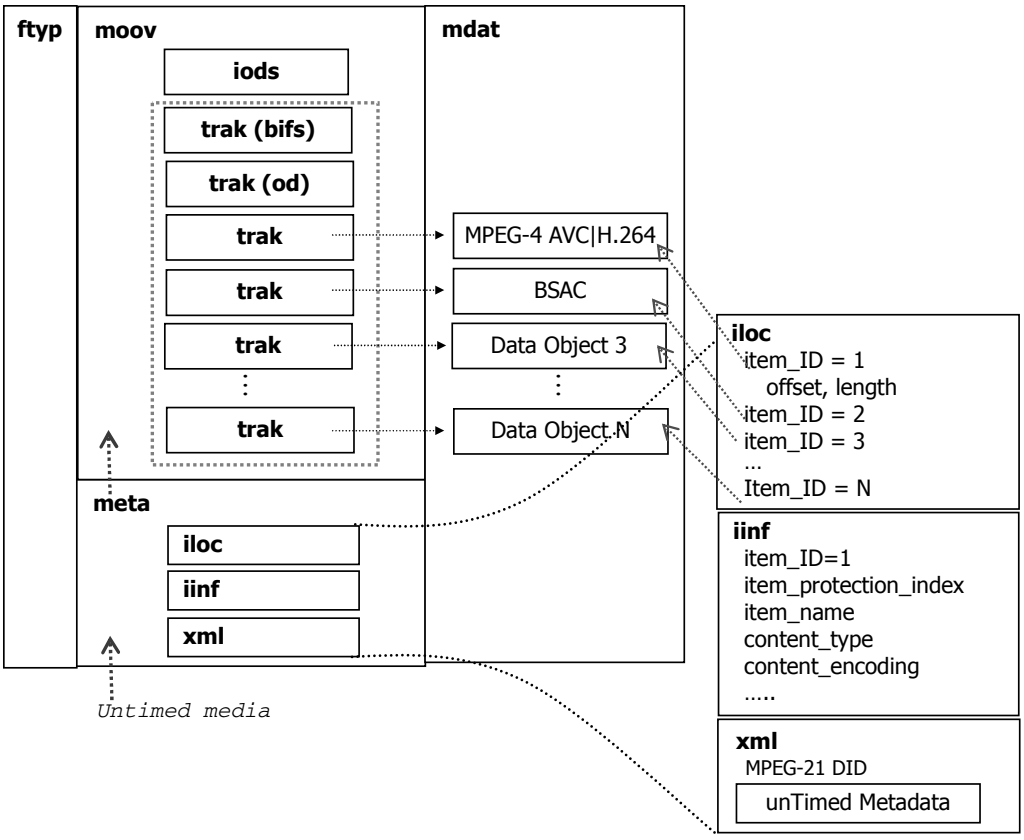


Figure 10 — A single type file structure with `meta` box

The `iloc` and `iinf` boxes describe the location and information of each item in the `mdat` box. However, the structure for items in the `iloc` and iinf boxes is flat and has limitation to describe the items in detail. In order to support the flexibility of the file format, MPEG-21 DID can be used to describe the location and information of the items as shown in Figure 10. The MPEG-21 DID metadata can be contained in the `xml` box and can contain the metadata such as IPMP, REL, and TV anytime metadata, the script and the source code in the hierarchical structure. The example of MPEG-21 DID usages can be shown in Annex A.

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6.3 File structure for a multiple type file

Figure 11 illustrates the multiple type file structure containing multiple movie presentations with associated data. There are two layers: outer file format which consists of the `ftyp`, `meta` and `mdat` boxes and inner one which consists of `moov`, `meta` and `mdat` boxes. The directory and information of the items in the outer and inner file format can be described by the `iloc` and `iinf` boxes and/or MPEG-21 DID metadata in the `meta` box. In the multiple DMB-AF contents, `item_ID`s in the outer and inner `iloc` box are called the global item id and local item id, respectively. The global item id shall indicate the hidden `moov` box and the local item id shall indicate the items in each hidden `moov` box. MPEG-21 DID in the outer `xml` box contains hierarchical item structures of all hidden `moov` boxes.

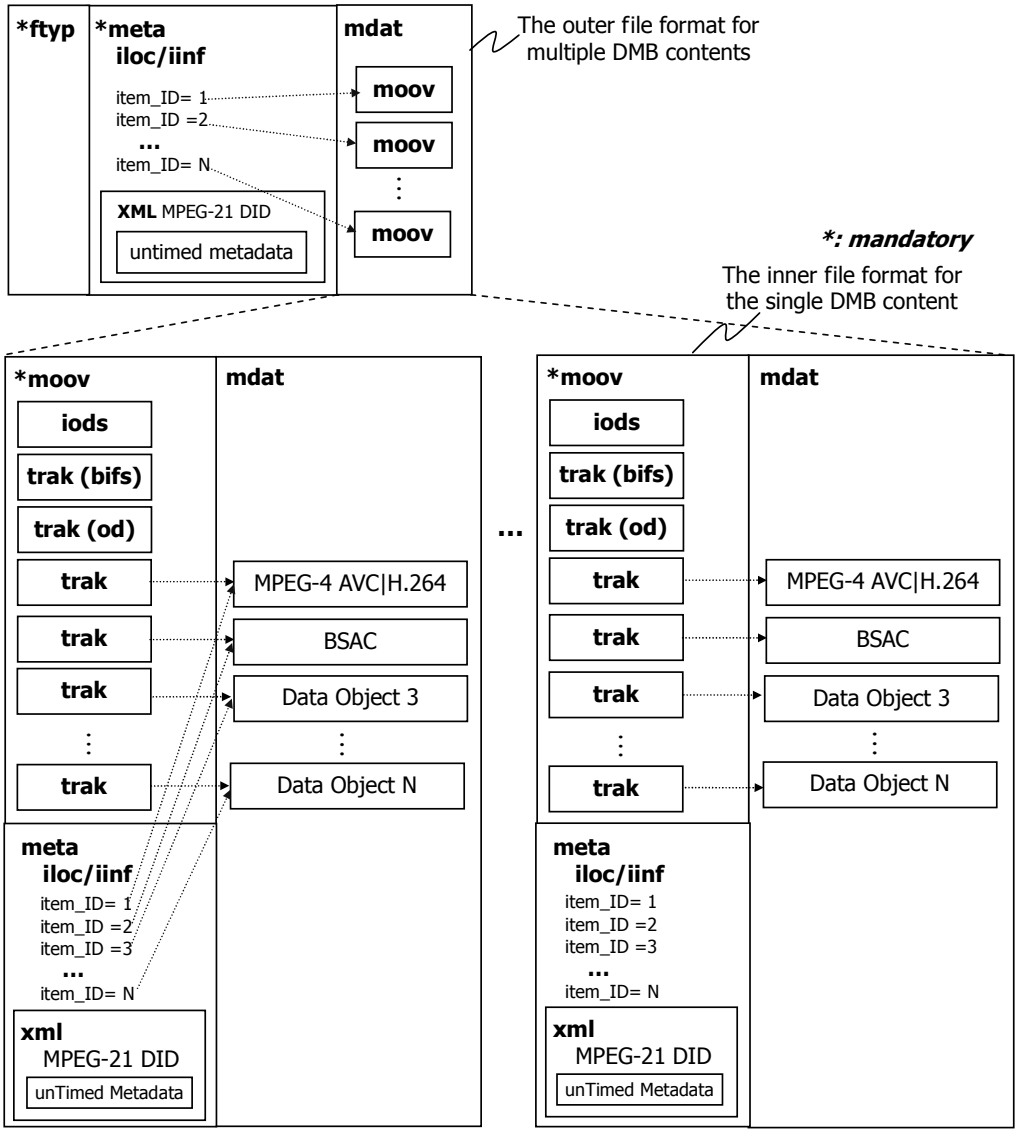


Figure 11 — Multiple type file structure

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6.4 Protected file structure

6.4.1 Signaling protection

In order to signal content protection, sample description of the `trak` box and IPMP DIDL of the `meta` box can be utilized. To indicate whether the resource in the track is protected, sample description of the `trak` box is utilized as in 6.4.1.1, and to indicate the protection mechanism including IPMP tools and Right information, the IPMP information carried in `meta` box is utilized as in 6.4.1.2.

6.4.1.1 Protection indication using sample entry code of the trak box

Through the sample description of the `trak` box, DMB Player can notice that the specified resource is protected. The four-character-code of the sample entry is replaced with a four-character-code indicating protection encapsulation: these codes vary only by media-type. For example, '`avc1`' video, '`mp4a`' audio, '`m2ts`' system, and '`tx3g`' timed text are replaced with '`encv`', '`enca`', '`encs`', and '`enct`', respectively. The entry codes for protected stream are as following:

Stream (Media) Type	Sample-Entry Code
Video	encv
Audio	enca
Text	enct
System	encs

6.4.1.2 Protection signaling using MPEG-21 IPMP Information

Through the IPMP information carried in `meta` box, the protection of the resource can be signaled. The following example is an example of the protected DID expression which can be expressed in the xml box of `meta` box. Using MPEG-21 IPMP DIDL expression, a Digital Item related to a resource track can be noticed as a protected into DMB-AF player.

```
<Item>
<Component>
   <Resource mimeType="application/mp21-ipmp">
     <ipmpdidl:item>
        <ipmpdidl:Identifier>…</ipmpdidl:Identifier>
        <ipmpdidl:Info>
            <ipmpinfo:IPMPInfoDescriptor> … </ipmpinfo:IPMPInfoDescriptor>
        </ipmpdidl:Info>
        <ipmpdidl:Contents> ref="#mp(/byte(2048, 150000))"/>
      </ipmpdidl:item>
    </Resource>
</Component>
</Item>
```

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6.4.2 Protection for a Single Type File

Figure 12 shows the single type file structure with the IPMP metadata.

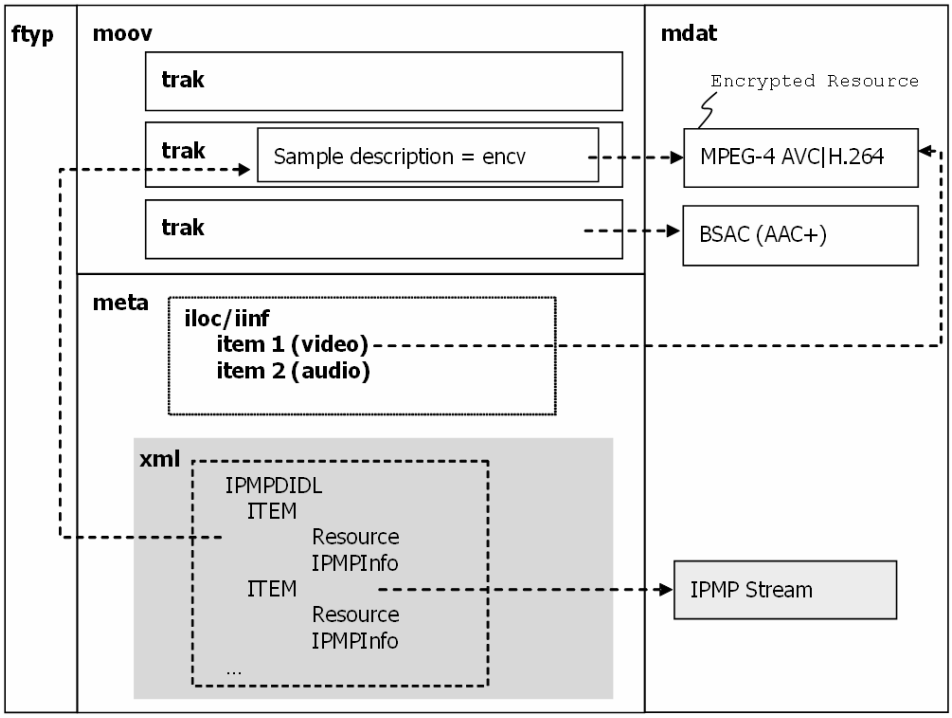


Figure 12 — Single type file structure with IPMP

For signaling to protect a video item, the sample description in the `trak` box can be used. The IPMP information is included in the `xml` box using MPEG-21 IPMP information scheme. The example of MPEG-21 IPMP usage will be shown in Annex A.

6.4.3 Protection for a Multiple File Type

Figure 13 shows the multiple type file structure with the IPMP metadata. Based on file structure for multiple type file structure in 6.3, the signaling and governance information is contained in `xml` box within `meta` box.

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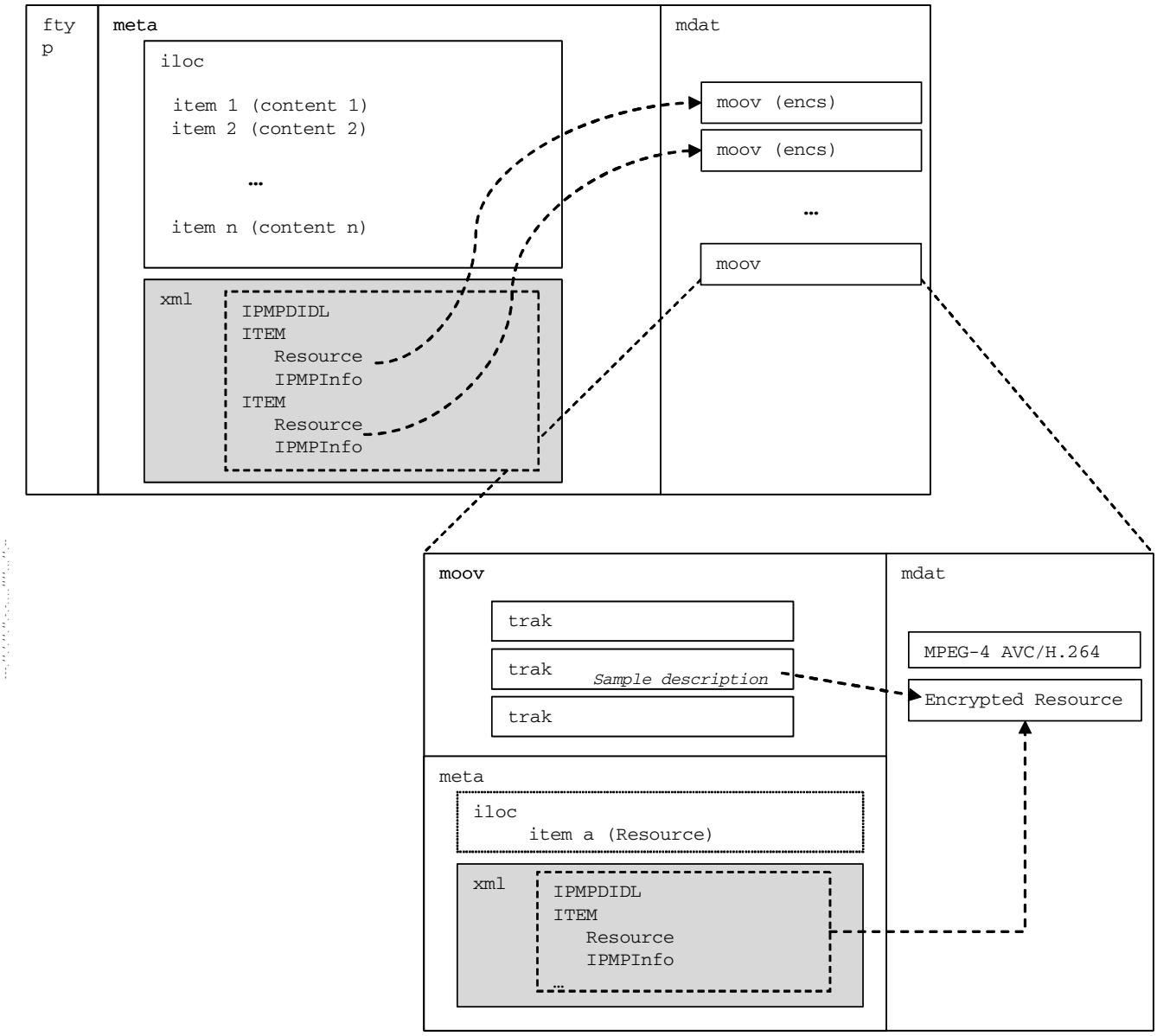


Figure 13 — Multiple type file structure with IPMP

6.5 Storage and playback of transport stream

6.5.1 Introduction

Since DMB video service contents are delivered in MPEG-2 TS (Transport Stream) format, it is required that the TS should be translated into ESs (Elementary Streams) for being stored in a DMB-AF file. However, most of the DMB receivers are hand held devices and not enough system resources may available to translate MPEG-2 TS into ESs. For DMB receivers to easily adapt to DMB-AF and to exploit the benefits of DMB-AF, a simple storage and playback method of MPEG-2 TS is defined here.

The design principle is as follows;

- DMB-AF shall be able to store MPEG-2 TS in its natural form, i.e., untouched.
- DMB-AF should be able to support random access and trick mode play on the stored MPEG-2 TS in some degree.
- If possible, no new box should be added on ISO base media file format for above functionalities. It is to make no change in ISO base media file format specification itself.

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6.5.2 File structure and track type definition

An MPEG-2 TS is stored sequentially (i.e., untouched) as a sample data. A sample can be the whole TS to be stored or a segment of it. All the sample boundaries shall be coincide with the TS packet boundaries.

A handler type of 'hint' (hint track) is used for local playback of the stored TS and the matching media information header shall be 'hmhd' (hint media header). The maxPDUsize and avgPDUsize fields in the 'hmhd' of the TS hint track shall all be equal to 188 (the TS packet size) in this case.

Normally, hint tracks are used to guide streaming servers to stream the stored media for transport protocols such as RTP and FLUTE. But here, a hint track is used for local playback or preview of already multiplexed transport streams and thus it provides a 'playback hint' for a stored transport stream rather than a 'streaming hint' for an external transport protocol. When the hint track is used for local playback in DMB-AF, the track header flags need not be 0. In addition, the playback hint track may not refer to other media tracks.

6.5.3 Sample description

An MPEG-2 TS sample entry is defined as follows. The protocol field for this sample entry shall be 'm2ts' in this case.

Syntax

```
// MPEG-2 TS Sample Entry
class M2TSSampleEntry() extends HintSampleEntry ('m2ts') {
    unsigned int(64) transporttime_offset;
    unsigned int(64) record_time;
    unsigned int(16) reserved = 0;
    unsigned int(8)  sample_type;   // one-sample TS or not
    unsigned int(8)  pmt_type;      // not stored or inlined
    unsigned int(8)  od_type;       // not stored or inlined
    if (pmt_type == 1) {            // inline
        unsigned int(16) pmt_size;  // size of PMT in bytes
        byte[pmt_size]   pmt_data;  // actual PMT section data
    }
    if (od_type == 1) {             // inline
        unsigned int(16) od_size;   // size of the OD Stream in bytes
        byte[od_size]    od_data;   // actual OD Stream data (ES)
    }
}
```

Semantics

`transporttime_offset` is an integer that specifies time offset (in the timescale indicated in the 'mdhd' box) between the transport timing and media playback timing for the stored TS. It shall be specified and shall take the PCR value corresponding to the firstly stored TS packet for this sample entry. The value 0 means 'unspecified'.

`record_time` is an integer that specifies the time of recording (in seconds since midnight, Jan. 1, 1904, in UTC time) The value 0 means 'unspecified'.

`sample_type` specifies the way how a sample maps to TS packets. It shall take the value 0 or 1:

0: the whole TS is treated as one sample. Both `pmt_type` and `od_type` shall take the value 0 for this sample type.
1: each sample corresponds to a sequence of TS packets that belong to a GOP (group of pictures). The `pmt_type` shall take the value 1 for this sample type. If the TS to be stored is from T-DMB, `od_type` shall also take the value 1.

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`pmt_type` specifies how the PMT is stored in this sample entry. It shall take the value 0 or 1:

0: the PMT data is not stored.
1: the PMT data is stored in this sample entry.

`pmt_size` gives the size (in bytes) of the PMT data stored in this sample entry.

`pmt_data` is the actual PMT data.

`od_type` specifies how the OD data is stored in this sample entry. It shall take the value 0 or 1:

0: the OD data is not stored.
1: the OD data is stored in this sample entry.

`od_size` gives the size (in bytes) of the OD data stored in this sample entry.

`od_data` is the actual OD data.

Another M2TSSampleEntry shall be instantiated if at least one of the following happens;

the version number of the PMT changes (i.e., another PMT)

the version number of ISO/IEC 14496 section containing OD stream changes (i.e., another OD)

the actual OD data is changed

a discontinuity in the system time-base happens (Note that when a system time-base discontinuity happens, `transporttime_offset` shall also be changed.)

In case `sample_type` equals to 1, a sample corresponds to TS packets having random accessible group of video or audio frames. More specifically, following rules apply;

If video exist in the TS to be stored, then TS packets corresponding to a GOP (Group of Pictures) are defined as a sample. The `random_access_indicator` inside the adaptation_field() of TS packet is used to identify the starting TS packet corresponding to a GOP; that is, a sample starts from a TS packets having `random_access_indicator`=1 and ends just before the firstly encountered another TS packet having `random_access_indicator`=1. In users' perspective, random accessibility to each GOP will be enough in most cases since GOP intervals (i.e., IDR picture transmission intervals) do not exceed two seconds in T-DMB and S-DMB.

If video does not exist in the TS to be stored, then TS packets corresponding to an audio frame are defined as a sample.

Note that '`stss`' (sync sample table) box is not used for TS hint tracks since all the samples are random-accessible regardless of the value of `sample_type`.

To randomly access and playback an '`m2ts`' sample, the PMT (Program Map Table) and OD (Object Descriptor) associated with the TS packets in the sample is needed. The PMT data is accessed by consulting to the corresponding M2TSSampleEntry of '`stsd`' box.

To randomly access and playback an '`m2ts`' sample, the PCR (Program Clock Reference) value corresponding to the first TS packet in the sample is needed to initialize the STC (System Time Clock) of the player. The PCR value for each sample is stored in the '`stts`' box, with the value of `transporttime_offset` in the corresponding M2TSSampleEntry is subtracted from the original PCR value. Accordingly, the time scale field in '`mdhd`' shall take the value equal to the time scale of PCR, making sample times in '`stts`' box expressed in this time scale. Note that for this TS hint track, '`stts`' maps transport times (with an offset) to sample numbers rather than media decoding times to sample numbers. It is much like the DMB receivers turns on and randomly access to the TS on air.

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6.5.4 Remark on chunk definition

In case `sample_type` equals to 0, a chunk shall be equal to a sample, i.e., the TS itself. In this case, the `sample_delta` in '`stts`' box for this sample gives the duration of the stored TS unless `sample_delta` equals to 0, which means "unspecified".

In case `sample_type` equals to 1, no constraints are imposed on the chunk definition. One guideline is that it is more efficient to make the number of samples in chunks the same since the size of '`stsc`' box can be minimized in this way.

6.5.5 Usage guidlines for random access

Use case 1 (Simplest): `sample_type=0`

In this case, `pmt_type=od_type=0`, and random access to the stream can be achieved as follows:

a. First, estimate the TS packet position corresponding to the wanted time point *T* (in second) using the following formula: *estimated_position* = `chunk_offset` + `avgbitrate` · *T* / 8.

b. Then, around the *estimated_position*, search and parse PMT, OD, and random access point of video (or audio if video does not exist). Not that this method needs searching overhead and may result in relatively larger time error between the wanted time point and the actually accessed time point (compared with the following method).

Use case 2: `sample_type=1`

In this case, the `pmt_type=1` and random access to the samples can be achieved as follows:

a. First, find out the sample number corresponding to the wanted time point *T* by using '`stts`' box. (In this case, time scale conversion between T and the PCR time scale shall be done.)

b. Then, follow the normal procedure for accessing the wanted sample (i.e., using the '`stsc`', '`stsz/stz2`', and '`stco/co64`' boxes according to ISO/IEC 14496-12).

c. The required PMT can be accessed from `pmt_data` of the sample entry for the wanted sample.

d. If `od_type=1`, the required OD can be accessed from `od_data` of the sample entry for the wanted sample.

6.6 Storage and playback of 3GPP time text

6.6.1 Introduction

For using the timed text with DMB contents, DMB-AF adopts 3GPP Timed Text format (3GPP TS 26.245). The timed text is stored in '`mdat`' box and treated as a track. By using the usual boxes in the sample table box, such as '`stts`', '`stsc`', '`stsz`', and '`stco`', the text samples can be synchronized with other timed media.

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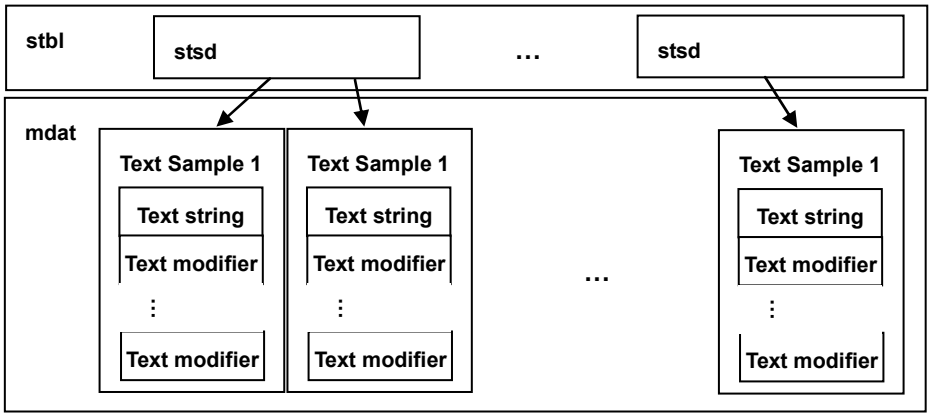


Figure 14 — Storage of timed text in DMB-AF file

6.6.2 Sample description

The sample description box ('stsd') contains sample descriptions for the text track. TextSampleEntry in 3GPP Timed Text format, which extends SampleEntry with format name of 'tx3g', is used to describe the information on the format of the timed text to be rendered. The 'tx3g' sample entry firstly specifies the manner of the text rendering (still, marquee, or scrolled), the horizontal and vertical justification of the sample, and the background color of the sample in RGB color space as well as the alpha (transparency) value. Then it also specifies the style of the text such as the inset of the text within the region of the text, the font color, font style, and font size.

6.6.3 Sample format

3GPP Timed Text Format also specifies the manner of storing the text sample inside the media data container box ('mdat'). Each sample is composed of a string of text and followed by optional sample modifier box. Text string consists of a list of characters of the text. Text modifiers describe how the text should be rendered using different style than that specified by the sample descriptions. Since the size and location (offset) of the sample is described in the sample size box in the sample table box, the text sample do not need null termination character to signal the end of the sample.

The sample modifier boxes can be recognized by comparing the string length and the sample size. These modifier boxes, if exit, override the style described in sample description. It is possible to combine the sample modifier boxes to compose various rendering style, but two modifier boxes of the same type shall not be applied to the same character in the text sample. The examples of sample modifier boxes include Text StyleBox 'styl', TextHighlightBox 'hlit', TextKaraokeBox 'krok', TextHyperTextBox 'href', BlinkBox 'blnk', etc.

6.6.4 Usage example

Table 4 shows the use case of using three timed text samples. The first two samples belong to the same sample entry, while the last one is described in the other sample entry. Each text sample is rendered using different rendering mode. The first text sample is rendered in marquee mode, is highlighted with bluish color. The second sample also rendered in marquee mode and is blinking at certain position. The third sample is rendered in still mode and is rendered as hypertext link to certain URL.

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Table 4 — Timed text usage example

sample number	Sync. Time and Offsets (stts, stsz, stco)	Sample descriptions (tx3g sample entry)	Text sample (mdat)	
			Text string	Text modifiers
1	stts : Sample delta: 600 stsz: Size: 16 stco: Chunk offset: 18234	Rendering: marquee left to right Text style: Arial, 10, bold Text color: red: 0, green: 0, blue: 0, alpha: 0	"This is a sample"	Highlight: from character no. 1 to character no.16 Highlight color: red: 64, green: 64, blue: 192, alpha: 128
2	stts: Sample delta: 600 stsz: Size: 27 stco: Chunk offset: 18322		"This is also a sample"	Blink: from character no. 18 to character no. 27
3	stts: Sample delta: 1800 stsz: Size: 43 stco: Chunk offset: 18361	Rendering: still Text style: Serif, 12 Text color: red: 10, green: 10, blue: 200: alpha: 0	"The quick brown fox jumps over the lazy dog"	Href: from character no. 1 to character no. 43 URLLength: 20 URL: http://www.abcd.com

6.7 Relating content ID with item or track

6.7.1 Introduction

TV-Anytime standard uses CRID to uniquely identify content independently of its physical location. DMB-AF also adopts the CRID mechanism to author, manage, and provide the content description information independently of the physical location of the associated content. When content resources and the descriptive metadata are stored in the same DMB-AF file, a mechanism to relate the description and the described content inside the file is needed.

In DMB-AF, a kind of mapping table between the CRIDs inside the enclosing xml document and the associated content resources inside the file are stored in '`crid`' box. Figure 15 illustrates a content referencing example for DMB-AF.

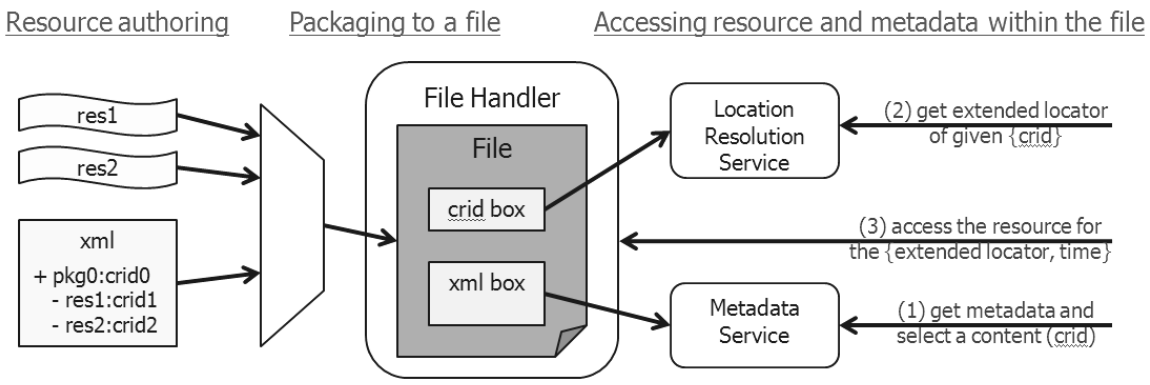


Figure 15 — Content referencing example

6.7.2 CRID box

The following is the definition of '`crid`' box, which contains mapping information between CRIDs in TVA xml document and the associated '`item_ID`'s or '`track_ID`'s.

Box Type: '`crid`'
Container: '`meta`' box
Mandatory: Yes if TV-Anytime metadata is stored in the '`xml`' or '`bxml`' box
Quantity: Exactly one

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Syntax

```
aligned(8) class CridBox extends Box ('uuid', 'crid') {
   int i;
   unsigned int(16) item_count;
   unsigned int(16) track_count;
   for (i=0; i<item_count; i++) {
       unsigned int(16) item_ID;     // item_ID associated with the CRID
       unsigned int(16) str_len;     // byte length of the CRID string
       byte[str_len] CRID_string;    // CRID string
   }
   for (i=0; i<track_count; i++) {
       unsigned int(32) track_ID;    // track_ID associated with the CRID
       unsigned int(16) str_len;     // byte length of the CRID string
       byte[str_len] CRID_string;    // CRID string
   }
}
```

Semantics

`item_count` specifies the number of {CRID : `item_ID`} pairs to be stored.

`track_count` specifies the number of {CRID : `track_ID`} pairs to be stored.

`str_len` specifies the byte length of the CRID string.

`CRID_string` is the actual CRID string to be stored.

`item_ID` is the value of item_ID associated to the paired CRID string.

`track_ID` is the value of track_ID associated to the paired CRID string.

6.7.3 Benefits and usage examples

The followings are some of the benefits in using the '`crid`' box;

TVA metadata authoring and file packaging can be separately handled.

Physical location and associated item or track can be independently updated without updating the xml.

If used with the MPEG-21 Fragment Identification schemes [16], the mechanism completes the TV-Anytime content referencing model by specifying how to reference the resources inside ISO media files.

Usage example 1
If a user requests to see some descriptive information about the media being played in a DMB-AF player, the player firstly searches the '`crid`' box for the CRID associated to the media track (or item). Then the player finds in the TVA metadata and displays the descriptions related to the CRID.

Usage example 2
Using the TVA metadata inside a DMB-AF file, the player presents the content descriptions for the included contents to a user. The user browses the metadata on the player's GUI and selects a content that he or she wants to consume. Then the player searches the '`crid`' box for the `item_ID` (or `track_ID`) associated to the CRID of the selected content.

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7 Brands identification

7.1 Introduction

In general, a brand identifies a specification or a conformance point in a specification; its presence in a file indicates both:

- that the file conforms to the specification; it includes everything required by, and nothing contrary to the specification (though there may be other material);

- that a player implementing that specification is given permission to read and interpret the file.

These brands are set in the File Type Box (`ftyp` box). In the File Type Box, two kinds of brands can be indicated. One is the `major_brand` that identifies the specification of the best use for the file. Second is the `compatible_brands`, which can identify multiple specifications to which the file complies. If more than one brand is present in the list of the `compatible_brands`, and one or more brands are supported by the player, the player shall play those aspects of the file that comply with those specifications. In this case, the player may not be able to decode unsupported media.

Since DMB-AF files can be used for various purposes, multiple brands are defined in this specification to label DMB-AF files. For instance, T-DMB in Korea uses ER-BSAC for audio coding while T-DMB in Germany uses HE-AAC v2 and S-DMB in Korea uses AAC+SBR.

The following subsections describe the defined brand identifiers for this specification according to application domains.

For the following subsections, the following legend applies;

- R (required): the component data shall exist in the file

- O (optional): the component data may or may not exist in the file

- A brand-conforming player shall support all the components marked as ‘R’ as well as ‘O’.

7.2 Audio applications

Table 5 defines brands for audio applications and the corresponding components thereof. Example services of audio brands include but not limited to: audio album with title image (JPG) and lyrics (DLS), audio with slide show (MOT-SLIDE) [22], and audio with Karaoke (3GPP-TT).

Brands starting with ‘da0’ or ‘da2’ are basically for supporting DAB audio service contents such as MP2 audio and PAD (MOT-SLIDE and DLS). MOT-SLIDE provides the user with a sequence of slides which carry information in the form of images. If exists, each slide appears on the display of player in synchronization with the associated audio. DLS provides the users with audio related text; the dynamic label may comprise up to 8 segments, each consisting of up to 16 characters and appears on the didpaly of player in synchronization with the associated audio.

Brands starting with‘da1’ and ‘da3’ are basically for supporting audio elementary stream of T-DMB (Korea) and S-DMB (Korea), respectively.

Brands ending with ‘b’ are basically for supporting content description (TVA) and protection (REL and IPMP).

Note that MP2 and HE-AAC2 audio and the associated MOT-SLIDE and DLS components shall be stored in accordance with DAB audio frame structure (ETSI EN 300 401 and ETSI TS 102 563) for the audio brands.

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Table 5 — Brands for audio applications

Components / Brands	Audio				Associated Data					Associated Metadata			
	MP2	ER-BSAC	HE-AAC2	AAC+SBR	BIFS	MOT-SLIDE	DLS	JPG /PNG /MNG	3GPP-TT	DID	TVA	REL	IPMP
'da0a'	R	-	-	-	-	O	O	O	-	-	-	-	-
'da0b'	R	-	-	-	-	O	O	O	O	O	O	O	O
'da1a'	-	R	-	-	-	-	-	O	-	-	-	-	-
'da1b'	-	R	-	-	-	-	-	O	O	O	O	O	O
'da2a'	-	-	R	-	-	O	O	O	-	-	-	-	-
'da2b'	-	-	R	-	-	O	O	O	O	O	O	O	O
'da3a'	-	-	-	R	-	-	-	O	-	-	-	-	-
'da3b'	-	-	-	R	O	-	-	O	O	O	O	O	O

7.3 Video applications

Table 6 defines brands for video applications and the corresponding components thereof. Example services of video brands include but not limited to: Visual Radio (audio with INTRA-only AVC), audio-visual program with interactivity (BIFS), and audio-visual program with closed-caption (JPG or 3GPP-TT).

Brands starting with'dv1' and 'dv3' are basically for supporting video service components of T-DMB (Korea) and S-DMB (Korea), respectively. Brands starting with 'dv2' are basically for supporting video service components of T-DMB (Europe).

Brands ending with 'b' are basically for supporting content description (TVA) and protection (REL and IPMP) as is in the audio brands.

Note that unless multiplexed into TS, the Visual and Audio components data are stored in elementary stream form for the video brands.

Table 6 — Brands for video applications

Components / Brands	Visual	Associated Audio			Associated Data			TS	Associated Metadata			
	AVC	ER-BSAC	HE-AAC2	AAC+SBR	BIFS	JPG /PNG /MNG	3GPP-TT	MP4on MP2	DID	TVA	REL	IPMP
'dv1a'	R	R	-	-	O	O	-	O*	-	-	-	-
'dv1b'	R	R	-	-	O	O	O	O*	O	O	O	O
'dv2a'	R	-	R	-	O	O	-	O*	-	-	-	-
'dv2b'	R	-	R	-	O	O	O	O*	O	O	O	O
'dv3a'	R	-	-	R	O	O	-	O*	-	-	-	-
'dv3b'	R	-	-	R	O	O	O	O*	O	O	O	O
[Remark] The component marked as 'O*' may or may not be supported by the brand-conforming players according to the following rule; if the player is DMB receivable, it shall support the component, and otherwise, the player may not support the component.												

Note that the TS (Transport Stream) can contain all the audio, visual, and data components except 3GPP-TT inside it as a multiplexed form. If TS having audio and visual components exists in a DMB-AF file, the extra audio and visual components are not necessarily required to be exist in the same file.

7.4 All-in-one applications

Table 7 defines an all-in-one brand which supports all the components of this specification.

Table 7 — Brands for all-in-one applications

Brands	Components
'dmb1'	This brand support all the components listed in Table 1 except Transport stream components. For the Transport stream components, the same rule described in the 'Remark' of Table 6 applies.

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Annex A
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MPEG-21 DID and TV-Anytime Usage Examples

A.1 MPEG-21 DID Description

As described in 6.4.2, this is an example of the MPEG-21 DID description which contains the element information and the location of the resources in a DMB-AF file, IPMP information and their metadata of each or whole resource.

Case 1: DIDL expression for a DMB-AF Content

The following example is a DIDL expression for a clear DMB-AF content with a video and audio stream. The video and audio resources refer to the position of the file structure, and the content description can be inserted within Descriptor in Digital item.

```
<?xml version="1.0" encoding="UTF-8"?>
<DIDL xmlns="urn:mpeg:mpeg21:2006:07-DIDL-NS" xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS">
<Container>
    <Item id="dmb_sample">
        <Descriptor>
            <Statement mimeType="text/plain">
                <dii:Identifier>1234</dii:Identifier>
            </Statement>
        </Descriptor>
        <Descriptor>
            <Statement mimeType="text/xml">
                <!-- DMB contents description -->
            </Statement>
        </Descriptor>
        <Component id="video01">
            <Resource mimeType="video/avc" ref="#mp(/byte(2048, 150000))"/>
        </Component>
        <Component id="audio01">
            <Resource mimeType="audio/bsac" ref="#mp(/byte(150000, 180000))"/>
        </Component>
    </Item>
</Container>
</DIDL>
```

Remark: For the ‘mp()’ pointer scheme inside the above xml sample, refer to MPEG-21 Fragment Identification [16].

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Case 2: DIDL expression for a DMB-AF Content with protection for video stream

The following example is a modified DIDL expression with protection for the Case 1 example. In this example, the video stream is protected using IPMP Tool specified by `IPMPInfoDescriptor`, and its usage rule can be expressed in license within `RightsDescriptor`. It shows how to signal that a resource is governed and which IPMP Tool is required in order to access. It also shows how to express IPMP Tool information and its update information

```
<?xml version="1.0" encoding="UTF-8"?>
<DIDL xmlns="urn:mpeg:mpeg21:2006:07-DIDL-NS" xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:ipmpdidl="urn:mpeg:mpeg21:2004:01-IPMPDIDL-NS" xmlns:ipmpinfo="urn:mpeg:mpeg21:2004:01-
IPMPINFO-NS" xmlns:ipmpinfo-msx="urn:mpeg:mpeg21:2006:07-IPMPINFOMSX-NS"
xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS" xmlns:mx="urn:mpeg:mpeg21:2003:01-REL-MX-NS"
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#" :schemaLocation="urn:mpeg:mpeg21:2002:02-DIDL-NS
didl.xsd">
<Container>
<item id="dmb_sample">
    <Descriptor>
        <Statement mimeType="text/xml">
            <!-- DMB contents description -->
        </Statement>
    </Descriptor>
   <Component id="video01">
      <Resource mimeType="application/mp21-ipmp">
       <ipmpdidl:ProtectedAsset mimeType="video/avc>
        <ipmpdidl:Identifier>
                    urn:mpegRA:mpeg21:dii:isan:006A-15FA-002B-C95F-B
               </ipmpdidl:Identifier>
            <ipmpdidl:Info>
                <ipmpinfo:IPMPInfoDescriptor>
                    <ipmpinfo:Tool>
                        <ipmpinfo:ToolBaseDescription>
    <ipmpinfo:IPMPToolID>urn:mpeg21:IPMPTool:ToolID:ABCDEF9</ipmpinfo:IPMPToolID>
                        <ipmpinfo:Remote ref="…"/>
                                <ipmpinfo:ConfigurationSettings>
        <ipmpinfo:Update>
        <ipmpinfo:Location ref="…"/>
        <ipmpinfo:ScheduledUpdateTime periodic="P1D">2005-03-07T00:00:00
                    </ipmpinfo:ScheduledUpdateTime>
        </ipmpinfo:Update>
    </ipmpinfo:ConfigurationSettings>
    </ipmpinfo:ToolBaseDescription>
                    <ipmpinfo:InitializationSettings>
                <ipmpinfo:InitializationData>... </ipmpinfo:InitializationData>
                        </ipmpinfo:InitializationSettings>
                    </ipmpinfo:Tool>
                    <ipmpinfo:RightsDescriptor>
                        <ipmpinfo:License>
                        <r:license> ... </r:license>
                        </ipmpinfo:License>
                    </ipmpinfo:RightsDescriptor>
                </ipmpinfo:IPMPInfoDescriptor>
            </ipmpdidl:Info>
            <ipmpdidl:Contents ref="#mp(/byte(2048, 150000))"/>
         </ipmpdidl:ProtectedAsset>
        </Resource>
    </Component>
    <Component id="audio01">
        <Resource mimeType="audio/bsac" ref="#mp(/byte(150000, 180000))"/>
    </Component>
</item>
</Container>
</DIDL>
```

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Case 3: DIDL expression for a DMB-AF Content with protection for video and audio stream

The following example is another DIDL expression with protection for the Case 1 example. It contains protected video and audio stream and its governance information. It shows how to signal using `IPMPGeneralInfoDescriptor` and its referring.

```
<?xml version="1.0" encoding="UTF-8"?>
<DIDL xmlns="urn:mpeg:mpeg21:2006:07-DIDL-NS" xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:ipmpdidl="urn:mpeg:mpeg21:2004:01-IPMPDIDL-NS" xmlns:ipmpinfo="urn:mpeg:mpeg21:2004:01-
IPMPINFO-NS" xmlns:ipmpinfo-msx="urn:mpeg:mpeg21:2006:07-IPMPINFOMSX-NS"
xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS" xmlns:mx="urn:mpeg:mpeg21:2003:01-REL-MX-NS"
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#" :schemaLocation="urn:mpeg:mpeg21:2002:02-DIDL-NS
didl.xsd">
<Container>
<item id="dmb_sample">
    <Descriptor>
        <Statement mimeType="text/xml">
            <!-- DMB contents description -->
        </Statement>
    </Descriptor>
    <Descriptor>
        <Statement mimeType="text/xml">
        <ipmpinfo:IPMPGeneralInfoDescriptor>
            <ipmpinfo:ToolList>
                <ipmpinfo:ToolDescription localID="TPABCDEF9">
                    <ipmpinfo:IPMPToolID>urn:ETRI:ToolPack:ToolID:ABCDEF9</ipmpinfo:IPMPToolID>
                    <ipmpinfo:Remote ref="http://www.mpeg21ToolPacks.com/ToolID:ABCDEF9"/>
                        <ipmpinfo:ConfigurationSettings>
                            <ipmpinfo:Update>
                                <ipmpinfo:Location
ref="http://www.mpeg21ToolPacks.com/ToolPackUpdate"/>
                                        <ipmpinfo:ScheduledUpdateTime periodic="P1D">2005-03-
07T00:00:00  </ipmpinfo:ScheduledUpdateTime>
                            </ipmpinfo:Update>
                    </ipmpinfo:ConfigurationSettings>
                </ipmpinfo:ToolDescription>
            </ipmpinfo:ToolList>
            <ipmpinfo:LicenseCollection>
                <ipmpinfo:RightsDescriptor>
                    <ipmpinfo:License>...    </ipmpinfo:License>
                </ipmpinfo:RightsDescriptor>
            </ipmpinfo:LicenseCollection>
        </ipmpinfo:IPMPGeneralInfoDescriptor>
        </Statement>
    </Descriptor>
        <Component id="video01">
        <Resource mimeType="application/mp21-ipmp">
         <ipmpdidl:ProtectedAsset mimeType="video/avc>
            <ipmpdidl:Identifier>urn:mpegRA:mpeg21:dii:isan:006A-15FA-002B-C95F-
B</ipmpdidl:Identifier>
            <ipmpdidl:Info>
            <ipmpinfo:IPMPInfoDescriptor>
                <ipmpinfo:Tool>
                    <ipmpinfo:ToolRef localidref="TPABCDEF9"/>
                </ipmpinfo:Tool>
                <ipmpinfo:RightsDescriptor>
                    <ipmpinfo:License>
                        <r:license licenseId="license_id012345"/>
                    </ipmpinfo:License>
                </ipmpinfo:RightsDescriptor>
            </ipmpinfo:IPMPInfoDescriptor>
            </ipmpdidl:Info>
            <ipmpdidl:Contents ref="#mp(/byte(2048, 150000))"/>
          </ipmpdidl:ProtectedAsset>
        </Resource>
    </Component>
    <Component id="audio01">
        <Resource mimeType="application/mp21-ipmp">
         <ipmpdidl:ProtectedAsset mimeType="audio/bsac>
            <ipmpdidl:Identifier>urn:mpegRA:mpeg21:dii:isan:006A-15FA-002B-C95F-
B</ipmpdidl:Identifier>
            <ipmpdidl:Info>
                <ipmpinfo:IPMPInfoDescriptor>
                    <ipmpinfo:Tool>
```

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```
    <ipmpinfo:ToolRef localidref="TPABCDEF9"/>    </ipmpinfo:Tool>
                        <ipmpinfo:RightsDescriptor>
                            <ipmpinfo:License>
                                <r:license licenseId="license_id012345">  </r:license>
                            </ipmpinfo:License>
                        </ipmpinfo:RightsDescriptor>
                    </ipmpinfo:IPMPInfoDescriptor>
                </ipmpdidl:Info>
                <ipmpdidl:Contents ref="#mp(/byte(150000, 180000))"/>
            </ipmpdidl:ProtectedAsset>
        </Resource>
    </Component>
</item>
</Container>
</DIDL>
```

A.2 Examples of TV-Anytime Metadata

A.2.1 Package Metadata

In addition to audio-visual contents, various DMB contents such as image, text, applications, slide show, web page, weather information, traffic and travel information can be acquired through IP network at DMB service. Each content can be consumed by itself or can be consumed together to provide more effective 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.

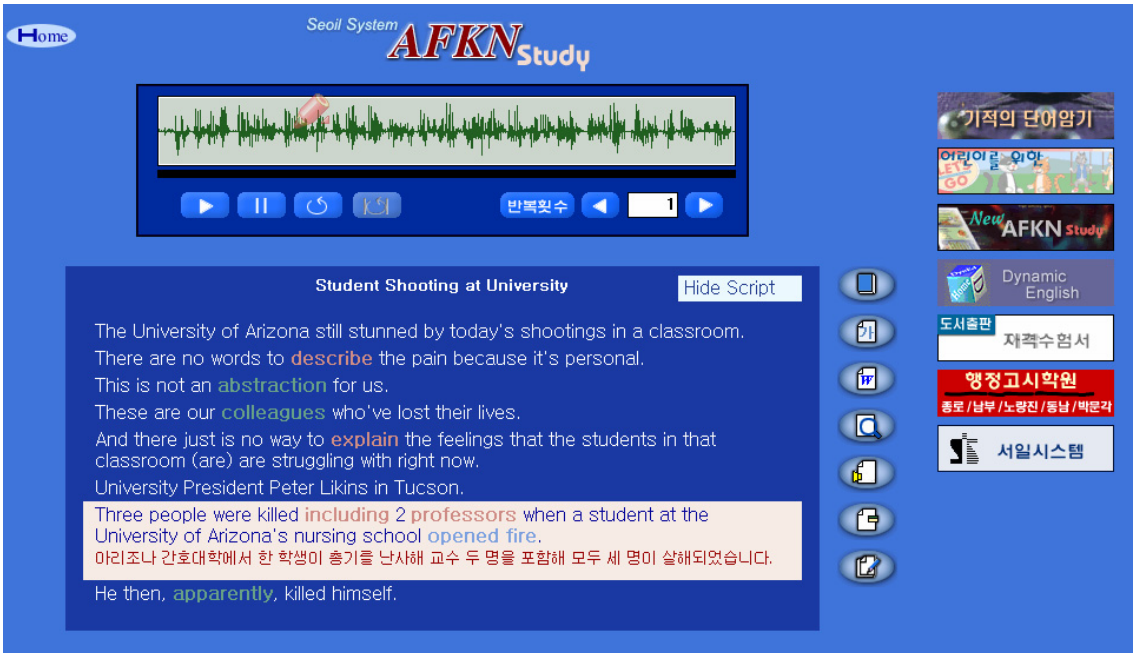


Figure A.1 — A package consumption example

Package metadata also provide a mechanism to express the options for consumption depending on usage environment (device) and user preference (user). Then the targeting service, which is defined as automatic matching and delivering relevant content to profiled consumers, could be possible. Additionally, package metadata describes synchronization (temporal) and spatial information between content to allow content to be consumed as the service provider intended. Owing to synchronization information, multi-stream experience (e.g., multi-camera sports, or alternate audio and video documentaries) can be provided with content packaging. 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.

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```
<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>
          <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>
```

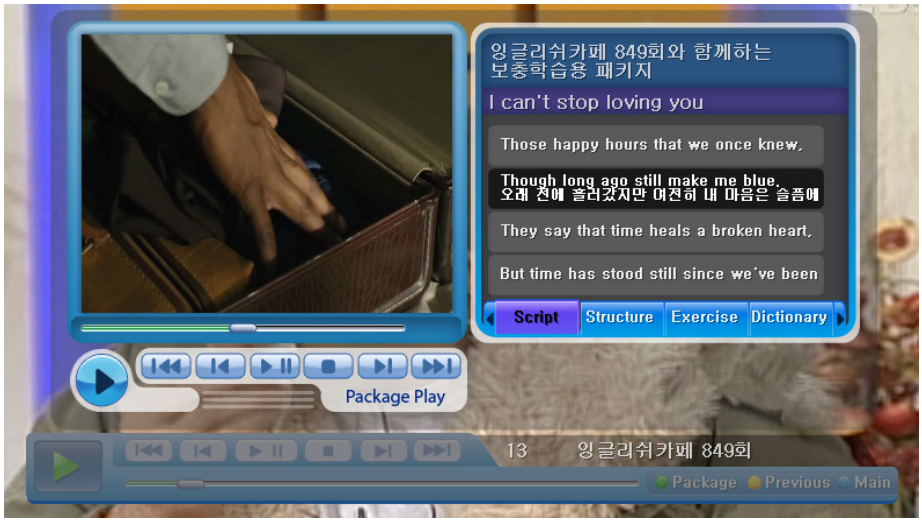


Figure A.2 — Package playback on TV

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A.2.2 Usage History Metadata

As user-creative DMB contents, a user can add his or her usage history 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, “crid://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>crid://www.ebs.co.kr/englishcafe_849
         </mpeg7:ProgramIdentifier>
       </mpeg7:UserAction>
     </mpeg7:UserActionList>
   </mpeg7:UserActionHistory>
  </UsageHistory>
</UserDescription>
```

A.2.3 Segment Metadata

As user-creative DMB contents, 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 bookmarked 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 describe a segment or groups of segments. Segment metadata make it possible to repurpose programs, for example, video highlight, bookmark, and virtual program. Fig. A.3 shows an example for virtual program which is reconstructed by a user with preference for tennis. The following xml instance shows an example of segment metadata which describes a segment group of bookmarks type.

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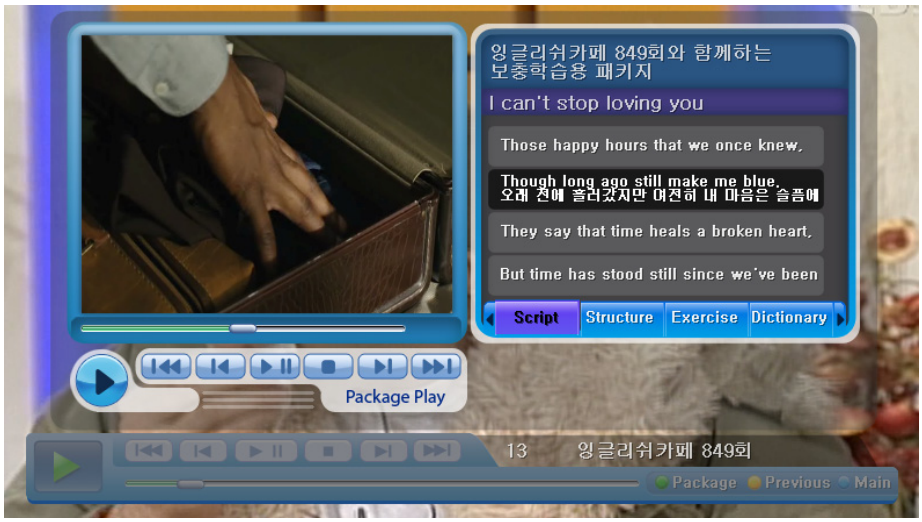


Figure A.3 — Virtual program using segment metadata

```
<SegmentGroupInformation topLevel="false" ordered="false" groupId="segroupid://TOC_4_1">
  <ProgramRef crid="crid://www.ebs.co.kr/englishcafe_849"/>
  <GroupType xsi:type="SegmentGroupTypeType" value="bookmarks"/>
  <Description>
    <Title>Tell me anyting </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>
```

A.2.4 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-AF users may store the coupons with the associated contents and may retrieve and use them at any time.



Figure A.4 — An example usage of coupons metadata

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Annex B
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User-Creative Data Usage Example

In order to offer personalized DMB content consumption, DMB-AF can wrap user-creative data such as graphics, texts, images, audio, and video in the `trak` box with the spatio-temporal representation of main DMB A/V contents. The representation is performed by a part of Core2D profile of BIFS. As shown in the table below, the user-creative data is classified into the five types and should need the representation information by BIFS. The table shows the BIFS information of the user-creative data as a form of XMT.

Type	Spatial Information	Temporal Information
Graphic	geometry, LineProperties	par
Image	geometry, translation, ES_ID	par
Video	geometry, translation, ES_ID	par
Audio	ES_ID	par
Text	geometry, translation, ES_ID	par

In the table above, each type of user-creative data has spatial and temporal information. The temporal information is described via “par” node in XMT. “LineProperties” denotes color (e.g., RGB) of “Graphic” data, and “geometry” makes the shape of visual data (In this case, line, rectangle, and ellipse are used for user-creative data.). “translation” describes the location of visual data on the screen, in other words, it enables to display the user-creative data relative to main DMB A/V content. “ES_ID” represents the index of `trak` referred by the user-creative data except “Graphic” data.

The user-creative DMB-AF content is encapsulated by two types of the file format. As shown in Fig. 18, the user-creative data is included in the `trak` and the `mdat` box which have media information and real stream of the data, respectively. However, “Graphic” can be directly expressed by only spatial and temporal information of BIFS stream. On the other hand, BIFS of remaining data types (e.g., text, image, audio, and video) should refer real streams of the embedded resources in the file format by using the `trak`. Consequently, the user-creative data (except “Graphic”) in `mdat` box can be referred via trak box of DMB-AF file format.

Bifs track describes spatio-temporal information of user-creative data. As mentioned previously, “Graphic” data has no referencing resource, so that it can be described via bifs track only. As the other types of user-creative data refer the embedded resources, trak boxes wrap media information on real streams of user-creative data. The DMB-AF file format which includes several types of user-creative data is represented as follows.

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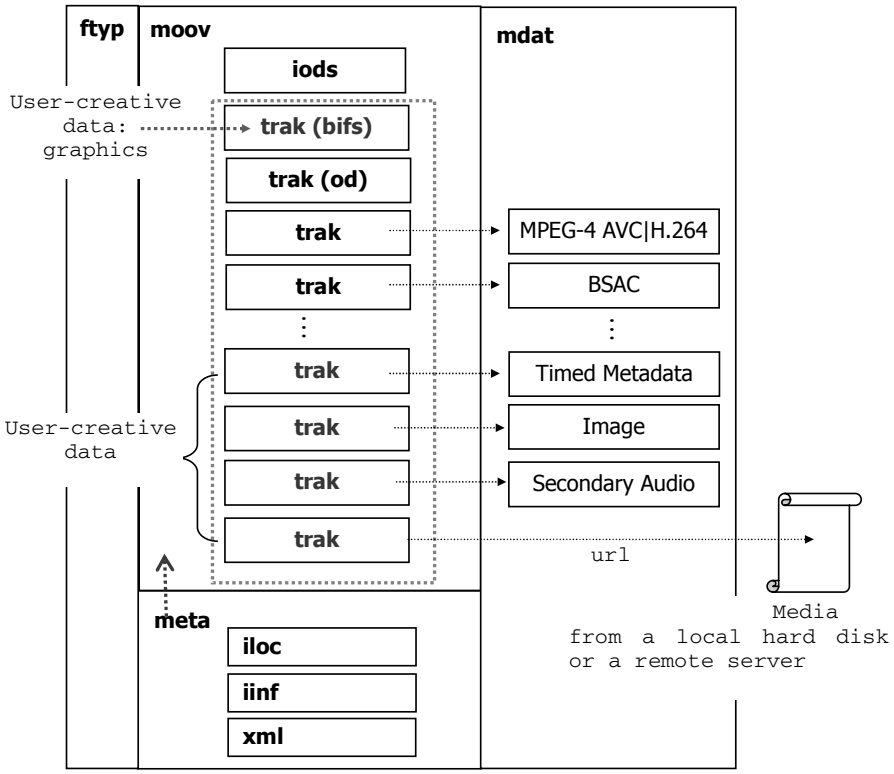


Figure B.1 — A file structure for user-creative data using the `trak` box

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Annex C
(informative)

Specifying the Player's Behavior

For the easy and convenient consumption of multiple DMB-AF contents, the DMB-AF content provider or author can define the player's behavior. The examples of the player's behavior by the DMB-AF content provider or the author as follows:

1. The DMB-AF content provider can include the single DMB-AF contents for the advertisement and they want to play it periodically or mandatory.

2. When a user plays the multiple DMB-AF contents, the player can show the single DMB-AF content list at first or play the first DMB-AF content automatically.

3. For the better communication or understanding, the author can control the single DMB-AF content in the multiple DMB-AF content file.

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Bibliography

[1] ISO/IEC 10918-1:1994, *Information technology — Digital compression and coding of continuous-tone still images: Requirements and guidelines*

[2] ISO/IEC 11172-3, *Information Technology — Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s — Part 3: Audio*

[3] ISO/IEC 13818-1, *Information technology — Generic coding of moving pictures and associated audio information — Part 1: Systems*

[4] ISO/IEC 13818-3, *Information technology — Generic coding of moving pictures and associated audio information — Part 3: Audio*

[5] ISO/IEC 13818-7, *Information technology — Generic coding of moving pictures and associated audio information — Part 7: Advanced Audio Coding (AAC)*

[6] ISO/IEC 14496-1, *Information technology — Coding of audio-visual objects — Part 1: Systems*

[7] ISO/IEC 14496-3, *Information technology — Coding of audio-visual objects — Part 3: Audio*

[8] ISO/IEC 14496-10, *Information technology — Coding of audio-visual objects — Part 10: Advanced Video Coding*

[9] ISO/IEC 14496-11, *Information technology — Coding of audiovisual objects — Part 11: Scene description and application engine*

[10] ISO/IEC 15948, *Information technology — Computer graphics and image processing — Portable Network Graphics (PNG): Functional specification*

[11] ISO/TS 18234-1, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 1: Introduction, numbering and versions*

[12] ISO/TS 18234-2, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 2: Syntax, Semantics and Framing Structure (SSF)*

[13] ISO/TS 18234-3, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 3: Service and Network Information (SNI) Application*

[14] ISO/TS 18234-4, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 4: Road Traffic Message (RTM) application*

[15] ISO/TS 18234-5, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 5: Public Transport Information (PTI) Application*

[16] ISO/TS 18234-6, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 6: Location referencing applications*

[17] ISO/IEC 21000-17, *Information technology — Multimedia framework (MPEG-21) — Part 17: Fragment Identification of MPEG Resources*

[18] ISO/IEC 23000-5, *Information technology — Multimedia application format (MPEG-A) — Part 5: Media streaming application format*

[19] ETSI TS 101 498-1, Digital Audio Broadcasting (DAB); Broadcast website Part 1

--`,,```,,,,````-`-`,,`,,`,`,,`---
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[20] ETSI TS 101 498-2, Digital Audio Broadcasting (DAB); Broadcast website Part 2

[21] ETSI TS 101 498-3, Digital Audio Broadcasting (DAB); Broadcast website Part 3

[22] ETSI TS 101 499, “Digital Audio Broadcasting (DAB);MOT Slide Show User Application Specification”

[23] ETSI TS 102 563, Digital Audio Broadcasting (DAB); Transport of Advanced Audio Coding (AAC) audio

[24] 3GPP TS 26.245, Timed text format

[25] EBU BPN 027-2, Transport Protocol Expert Group (TPEG) TPEG Specifications

[26] TTAS.KO-07.0036, Specification of the TTI Point-Of-Interest (POI) information service for Digital Multimedia Broadcasting (DMB) to Mobile, Portable and Fixed receivers

[27] TTAS.KO-07.0037, Specification of the TTI Safety Driving Information (SDI) service for Digital Multimedia Broadcasting (DMB) to Mobile, Portable and Fixed receivers

[28] TTAS.KO-07.0038, Specification of the TTI News Information (NWS) Service for Digital Multimedia Broadcasting(DMB) to Mobile, Portable and Fixed Receivers

[29] TTAS.KO-07.0047, Digital Multimedia Broadcasting (DMB) Mobile Application Terminal Environment (MATE) Standard; Terrestrial DMB

[30] TTAS.KO-07.0048, Digital Multimedia Broadcasting (DMB) Mobile Application Terminal Environment (MATE) Standard; Satellite DMB

[31] TTAS.KO-07.0049, Digital Multimedia Broadcasting (DMB) Mobile Application Terminal Environment (MATE) Standard; Common Part

[32] NIST FIPS 197, Advanced Encryption Standard (AES)
http://csrc.nist.gov/CryptoToolkit/Encryption.html#aAES

[33] Korean National Body, “Request on MAF standardization for DMB,” http://www.t-dmb.org

[34] “T-DMB White Paper,” http://www.t-dmb.org

[35] “MAFs Overview,” ISO/IEC JTC1/SC 29/WG 11 N 8942, San Jose, April, 2007

[36] MNG (Multiple-image Network Graphics), Version 1.0, PNG Development Group

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