

A study on the transmission method for the DMB filecasting service

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Abstract— the DMB filecasting service is able to provide peoples with crystal-clear video and theatre-quality audio as well as downloadable richmedia services such as personalized and interactive multimedia service on the move via in-vehicle terminals or hand-held gadgets like mobile phones. In this paper, we explain about the DMB filecasting service and propose the transmission method of signalling information and DMB contents for the DMB filecasting service.

Keywords— DMB filecasting, DMB-AF, DMB ECG, AT-DMB

I. INTRODUCTION

In Korea, the terrestrial DMB (Digital Multimedia broadcasting) has supported us with a simple audio-visual service as well as various additional data service such as BWS (Broadcast Web Site), slideshow and TPEG (Transport Protocol Experts Group). But DMB market has required advanced DMB data services more with benefit recently. So that, with the start of new trial AT-DMB (Advanced Terrestrial DMB) service, we propose DMB filecasting service conception which has come out as a new growth power of the future DMB industry and market.

The purpose of the DMB filecasting service is to provide people with multimedia data based on DMB AF (Application Format) through DMB service channels. Most peoples want to store their favourite DMB contents anytime and anywhere on their preferred device. And many of them also want to share the contents with other people. In addition, content and service providers also want to serve various 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.

First of all, we explain about the DMB filecasting service including service scenarios and examples. And then we propose a transmission method of DMB contents based on DMB AF and signalling information through DMB data channels without DMB ECG (Electronic Content Guide) information. Finally, we describe a specification activity status of the worldDMB and TTA (Telecommunications Technology Association), and future works[1][2][3].

II. FILECASTING SERVICE

The DMB filecasting service is a non-real-time downloadable data service such as personalized, interactive,

and bidirectional multimedia service with/without DMB ECG information. On the environment of the DMB filecasting service, DMB contents based on DMB-AF are able to be stored and distributed. In addition, various multimedia data services are able to support easily by additional definition of DMB-AF components without modification and extension of DMB transmission specification.

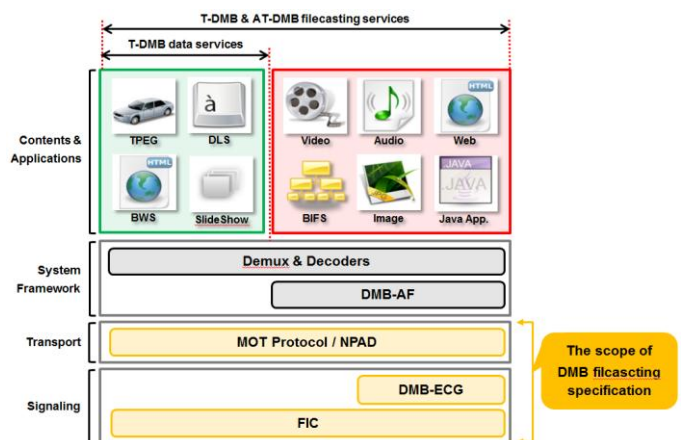


Figure 1. The scope of DMB filecasting service specification

As shown in Figure 1, the scope of the DMB filecasting service specification contains only transmission and signalling specification in consideration of a backward compatibility with the existing DMB device.



Figure 2. Examples of DMB filecasting service

As shown Figure 2, the DMB filecasting service technology is able to provide peoples with various DMB richmedia services such as navigation information auto-update services, segmented content play back services, e-commerce services, and personalized education services out of simple and free the DMB data services until now.

Finally, we try to explain three main service scenarios to help understand the above-mentioned DMB filecasting service.

A. Scheduling download scenario

While a user is watching a DMB broadcasting program, the user browses through a list of available short-time media files. The user chooses the 'Weekly Sport Review' and the 'Film Review' media files. The user arrives home after daily commute and place the DMB handset into the cradle for charging. The device knows what times those media files are delivered over the DMB network, and on what channel, so at 07:30 in the morning the device wakes up and downloads those files. When the user next turns on the device, it alerts the user. The user then has the choice to consume the content at that time or at a later time. All downloads can be accessed from the 'MyDownloads' menu of the device.

B. Partial re-download scenario

A user has previously chosen to download the 'Weekly Sport Review'. The device is downloading this media file at the scheduled time. Part-way through downloading, the user wishes to watch a live broadcasting program on a different channel. The device can no longer download the media file at the time that it was expecting to. The media file is also broadcast at an alternative time. The device caches the partly downloaded file, and at the alternative time switches on and downloads the remainder of the file. Once this has been downloaded completely, the media file list is presented to the user.

C. Periodic update scenario

During the day a user chooses to receive the hourly 'News Update' and, assuming the device is within the reception area, from then on the device will download the 'News Update' in the background, and offer the latest version to the user.

III. DMB APPLICATION FILE FORMAT

DMB AF specification, based on MPEG-4 Part 12 ISO Base Media File Format, 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[4].

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[4].

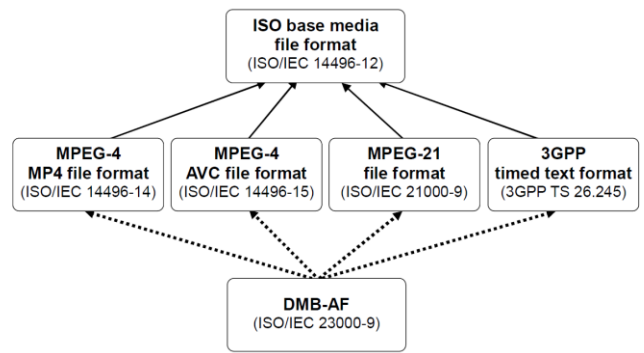


Figure 3. Relation to other file formats

As shown in Table 1, the boxes are based on a restricted set of boxes from the ISO base media file format and the MP4 file format. The mandatory boxes, which shall be exist in DMB-AF file if the higher level box exist, are marked with an asterisk(*). Note that support for all the structural boxes in above table is required for all the brands defined in DMB-AF specification[4].

Unless specifically mentioned in this specification, the requirements of ISO base media file format, MP4 file format, AVC file format, and MPEG-21 file format apply for the listed boxes in table 1[4].

TABLE 1. BOX TYPES AND STRUCTURE FOR DMB-AF 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
*			std	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
			inf	item information
			crd	mapping table between CRID and item or track (a 'uuid' box)
			xml	XML container
			bxml	binary XML container

A. File Structure

Figure 4 shows 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. 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 depositing the content in the mdat box[1].

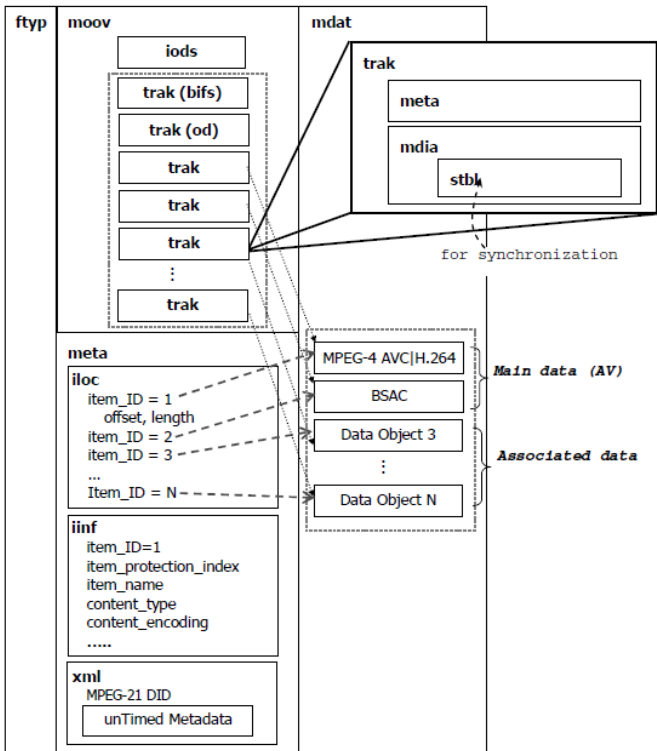


Figure 4. A file structure based on DMB-AF

B. Brands

These brands are set in the file type box (ftyp box). In the file type box, two kinds of brands can be indicated. The first one is the major_brand that identifies the specification of the best use for the file. The second one 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[1].

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'.

TABLE 2. 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	-	-	-	-	-
'da0b'		R	-	-	-	-	-	O	O	O	O	-	-	O
'da1a'		-	R	-	-	-	-	-	O	-	-	-	-	-
'da1b'		-	R	-	-	-	-	-	O	O	O	O	-	O
'da2a'		-	-	R	-	-	-	O	O	O	-	-	-	-
'da2b'		-	-	R	-	-	-	O	O	O	O	O	O	O
'da3a'		-	-	-	R	-	-	-	O	-	-	-	-	-
'da3b'		-	-	-	R	O	-	-	O	O	O	O	-	O

TABLE 3. 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	MP4onMP2	DID	TVA	REL	IPMP
'dv1a'	O	R	-	-	O	O	-	R	-	-	-	-
'dv1b'	O	R	-	-	O	O	O	R	O	O	O	O
'dv2a'	O	-	R	-	O	O	-	R	-	-	-	-
'dv2b'	O	-	R	-	O	O	O	R	O	O	O	O
'dv3a'	O	-	-	R	O	O	-	R	-	-	-	-
'dv3b'	O	-	-	R	O	O	O	R	O	O	O	O

As shown in Table 3, the TS 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 existed in the same file.

TABLE 4. 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.

As shown in Table 2-4, there is not a definition of brand for only DMB data service because of a dependence on business models among content provider, service provider and device manufacturer. That is to say, it is advantage that various multimedia data services are able to support easily by an additional definition of brand without modification and extension of DMB transmission specification.

IV. TRANSMISSION & SIGNALLING

There are three methods to transfer signalling information and download DMB contents for filecasting service on a receiver. The most ideal method is to use DMB ECG metadata to define and transfer signalling information such as filecasting channel information, program title, and genre. But it is impossible to download filecasting data and applications if the receiver cannot parse the DMB ECG metadata.

In the case without DMB ECG information, we think that it is best useful method is to use the UserApplicationType field of FIG 0/13 for selection and download of contents base on DMB-AF.

A. Signalling

The UserApplicationType value of FIG 0/13 has been not defined yet because of filecasting standardization is ongoing in the worldDMB and TTA.

The brand that identifies the specification of the play must be described in the user application data field. If several brands are described including the compatible brands, the major_brand and the minor_version are described firstly and then the compatible_brands must be sorted in ascending order in the user application data field as shown in figure 5[5][6].

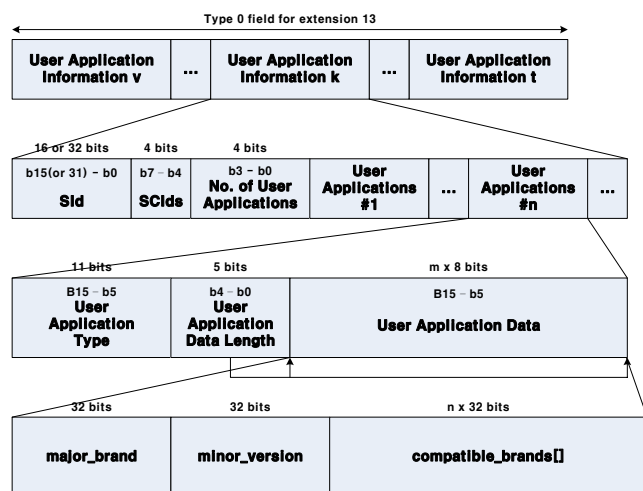


Figure 5. A structure of type 0 field for extension 13(FIG 0/13)

If brand which a receiver cannot consume, that filecasting channel name must not display in channel view or the tool to download and play filecasting contents must be supported.

B. Transmission

MOT directory mode is the method for transporting filecasting channel[7][8][9][10].

To maintain backwards compatibility with existing DMB ECG-enabled receivers, the MOT directory within the ECG channel shall not be compressed. The MOT directory within the filecasting channel can be compressed. It is a requirement of this specification that receivers shall decode a compressed MOT directory.

Additionally, for both channel types the header information within the MOT directory shall be sorted in ascending order of the ContentName, signalled by the SortedHeaderInformation that is MOT directory extension parameter as detailed within the MOT specification.

Further information about setting MOT parameters for the filecasting channel is described within TABLE 5[7].

For any carousels containing filecasting objects, the data rate for MOT transported in packet mode is limited to a maximum of 256 kbps. For packet mode transport, the overall size of the subchannel including the filecast channel is limited to a maximum of 384 kbps[7].

The media files are broadcast as MOT objects within the filecasting channel. They are referenced from the MOT directory. The MOT directory is also used as a means of

transporting the broadcast information that is required by the basic filecasting receiver.

The scope of the MOT directory is set by the service provider, but it is recommended that it includes all media files that are currently being broadcast and planned to be broadcast within that MOT carousel for several days into the future. This is due to the reason that a basic filecast receiver will only be able to decode and display listings information from the MOT directory, and not the ECG. Providing information within the MOT directory only on the currently transmitted files will restrict the selection choice of media files for users of these receivers[8][9][10].

The following extensions and restrictions apply for the filecast channel:

- The MOT directory must be re-broadcast at a minimum repetition rate of 60 seconds.
- Compression of the MOT directory is permitted (as defined within the MOT specification).
- As a minimum, the MOT directory shall list the file or files currently in the MOT carousel. It may also list files that are planned to be broadcast, for a service provider-defined period of time into the future.
- The directory entries of the MOT directory shall be sorted in ascending order of the ContentName parameter at the service provider side, using the SortedHeaderInformation parameter (as specified within the MOT specification)
- The MOT directory shall have a maximum uncompressed size of 16 Kbytes (16,384 bytes).

MOT parameters that are to be applied to individual MOT objects are carried within the MOT header information of each directory entry in the MOT directory[8][9][10].

1) MOT Core

The ContentsType and the ContnetSubType parameters of MOT header core are set on "000000" and "00000000". It is recognized as a MIME type of 'application/octet-stream'.

2) MOT Extension

As shown in Table 5, we do not explain the PermitOutdatedVersions parameter, the Expiration parameter, the ContentName parameter, the CompressionType parameter, the UniqueBodyVersion parameter and the CAInfo parameter in this paper because those parameters are exactly same as defined in MOT specification[8][9][10].

The ContentName parameter is consists of the filename and the extension of file. A filename must be same that a broadcasting program title described in ECG information and unique in a MOT data carousel. And an extension of file must be described as 'dmb'.

The AvailabilityStart parameter describes the date & time from which the media file is transmitted on this filecast channel. If the AvailabilityStart has a value in the future then this parameter indicates that the media file (and updates to the media file in the case of periodic update) is not part of the current carousel. It informs the receiver when the next broadcast of a media file will begin, to enable a receiver to tune in to the filecast channel at the appropriate time. If the

AvailabilityStart has a value in the past or is omitted then it indicates that the media file (and updates to the media file in the case of periodic update) is in the current carousel of media files being broadcast[7].

The use of The ContentDescription parameter for each MOT object is mandatory. It contains a description for the media file. It has a maximum length of 128 characters or a maximum of 512 bytes. The character set used shall be ISO/IEC 10646 (UTF-8 encoding). The ContentDescription is presented to the user for basic filecast receivers, and is used by those receivers instead of the programme <Title> and <ShortTitle> elements contained within the ECG information for that media file[1][2][7].

The use of the ContentCategory parameter for each MOT object is optional. It contains information about the category or categories for this media file. It has a maximum length of 64 characters or a maximum of 256 bytes. The character set used shall be ISO/IEC 10646 (UTF-8 encoding). The ContentCategory is used by basic filecast receivers for categorising media files[7].

If this parameter is used, the values for the ContentCategory shall match exactly the <Genre> elements used within the ECG information for that media file[1][2].

If the media file contains content that is related to one or more audio-visual services, then the ParentService parameter indicates the parent audio-visual service. It uses locator information defined by the DMB ECG specification[1][2].

TABLE 5. PARAMETERS OF MOT HEADER EXTENSION

Parameter	Parameter Id	Specified in	Usage mandatory for service provider	Usage mandatory for receiver	Occurrence
PermitOutdatedVersions	0x01	MOT	No (if a suitable value is set with the DefaultPermitOutdatedVersions parameter)	Yes	Single
Expiration	0x09	MOT	No (if a suitable value is set with the DefaultExpiration parameter)	Yes	Single
ContentName	0x0C	MOT	Yes	Yes	Single
CompressionType	0x11	MOT	No (but the parameter shall be used for all objects compressed on MOT transport level)	Yes	Single
UniqueBodyVersion	0x0D	MOT	Yes	Yes	Single
CAInfo	0x23	MOT	No (but the parameter shall be used for all objects encrypted on MOT level)	Yes (non CA capable receivers shall discard encrypted objects)	Single
ContentDescription	0x25	FILECAST	Yes	Yes, for Basic Filecasting receivers	Single
ContentCategory	0x26	FILECAST	No	Yes, for Basic Filecasting receivers	Multiple
ParentService	0x27	FILECAST	No (but the parameter shall be used for all objects that link to an audio service on that multiplex)	Yes, for Basic Filecasting receivers	Multiple
AvailabilityStart	0x28	FILECAST	No (but the parameter shall be used for all media files that are listed within the Directory, but which are not contained within the currently broadcast carousel).	Yes	Single

V. CONCLUSIONS

Recently, the consumption and distribution of value-add DMB services have been required with appearance of AT (Advanced Terrestrial)-DMB. So that the most DMB service providers, DMB content providers and terminal manufacturers have recognized that the DMB filecasting service is powerful business model to overcome the difficult market situation.

We explained about the DMB filecasting service including service scenarios and examples, and those feature and advantages simply. And then we propose a transmission

method of DMB contents based on DMB AF and signalling information through DMB data channels without DMB ECG information in this paper.

The DMB filecasting standardization focused on an audio service mainly has been ongoing for finishing standardization on the worldDMB by the end of 2010. But the domestic standardization is just started on TTA in the year 2010.

In future, it is necessary to discuss how to transfer huge amounts of DMB contents through DMB filecasting channel and how to error recovery for efficient data download on MOT protocol level. And a study on new business model for the DMB filecasting service is needed in the conversion broadcasting environment.

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