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(05/2015)

Service configuration, media transport protocol, and signalling information for MMT-based broadcasting systems

BT Series

Broadcasting service (television)

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RECOMMENDATION ITU-R BT.2074-0

Service configuration, media transport protocol, and signalling information for MMT-based broadcasting systems

(2015)

Scope

This Recommendation defines the service configuration, media transport protocol, and signalling information required for broadcasting systems using ISO/IEC 23008-1 (MPEG Media Transport). It specifies the constraints to ISO/IEC 23008-1 for MMT-based broadcasting systems.

Keywords: transport, MMT, multiplexing, IP-based broadcasting, hybrid delivery, UHDTV

The ITU Radiocommunication Assembly,

considering

a) that multimedia services consist of various media components such as audio, video, closed captions, and other data;

b) that various media components for multimedia services may be delivered in broadcasting channels and broadband networks;

c) that multimedia services have also been introduced in broadband networks where IP packets are used;

d) that an IP-friendly media transport protocol is desirable for multimedia broadcasting systems to enable harmonization of broadcasting and broadband;

e) that synchronized presentation of various media components over various delivery channels is required for multimedia broadcasting applications;

f) that efficient and reliable transport of various media components is required over broadcasting channels;

g) that ISO/IEC 23008-1 "MPEG Media Transport (MMT)" specifies an encapsulation format of media components, delivery protocol, and signalling information for various applications including broadcasting applications;

h) that a common MMT protocol packet syntax has been specified in ISO/IEC 23008-1;

i) that practical implementation of broadcasting systems may require certain constraints on ISO/IEC 23008-1;

j) that it is desirable for such constraints to be in common with MMT-based broadcasting systems for development and deployment of systems including receiver terminals,

recommends

1 that broadcasting systems using MPEG Media Transport as per ISO/IEC 23008-1 should be designed on the basis of the system structure and service configuration described in Annex 1;

2 that the broadcasting systems using MPEG Media Transport should comply with the media transport protocol and signalling information described in Annex 2.

Note 1 – Attachment 1 shows additional signalling information specified in ARIB systems.

References

Normative references

– ISO/IEC 23008-1:2014: Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 1: MPEG media transport (MMT).

Informative references

– Recommendation ITU-T H.222.0 | ISO/IEC 13818-1:2013: Information technology – Generic coding of moving pictures and associated audio information: Systems.

– IETF RFC 768: User Datagram Protocol, Aug. 1980.

– IETF RFC 791: Internet Protocol, Sep. 1981.

– IETF RFC 2460: Internet Protocol, Version 6 (IPv6) Specification, Dec. 1998.

– IETF RFC 5905: Network Time Protocol Version 4: Protocol and Algorithms Specification, June 2010.

– Recommendation ITU-R BT.1869-0 (2010) – Multiplexing scheme for variable-length packets in digital multimedia broadcasting systems.

– Recommendation ITU-T H.265 | ISO/IEC 23008-2 (2013) – Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 2: High efficiency video coding.

Abbreviations

AAC	Advanced audio coding
AIT	Application information table
AL-FEC	Application layer forward error correction
ALS	Audio lossless coding
AMT	Address map table
BIT	Broadcaster information table
CA	Conditional access
CAS	Conditional access system
CDT	Common data table
CRI	Clock relation information
DCI	Device capability information
DCM	Download control message
DMM	Download management message
ECM	Entitlement control message
EIT	Event information table
EMM	Entitlement management message
EPG	Electronic programme guide
GFD	Generic file delivery
GOP	Group of pictures
HEVC	High efficiency video coding

HRBM	Hypothetical receiver buffer model
IP	Internet Protocol
IRAP	Intra random access point
LAOS	Low overhead audio stream
LATM	Low overhead audio transport multiplex
LCT	Layout configuration table
LDT	Linked description table
MFU	Media fragment unit
MMT	MPEG media transport
MMTP	MMT protocol
MPI	MMT presentation information
MPT	MMT package table
MPU	Media processing unit
NIT	Network information table
NPT	Normal play time
NTP	Network time protocol
PA	Package access
PLT	Package list table
SDT	Service description table
SDTT	Software download trigger table
TLV	Type length value
UDP	User datagram protocol

Annex 1

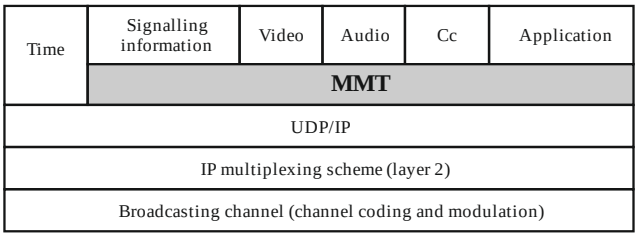
System structure and service configuration

1 System structure

This section describes the general structure of MMT-based broadcasting systems. Fig. 1 shows the protocol stack of MMT-based broadcasting systems.

FIGURE 1

Protocol stack of MMT-based broadcasting systems



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In these systems, media components, such as video, audio, and closed captions (cc), constituting a TV programme are encapsulated into media fragment units (MFUs)/media processing units (MPUs). They are carried as MMT protocol (MMTP) payloads of MMTP packets and delivered in IP packets. Data applications that are related to a TV programme are also encapsulated into MFUs/MPUs, carried in MMTP packets, and delivered in IP packets.

IP packets generated like this are multiplexed over broadcasting channels with an IP multiplexing scheme, also referred to as a layer 2 (L2) protocol, e.g. the TLV multiplexing scheme described in Recommendation ITU-R BT.1869.

The systems also have MMT signalling information (MMT-SI). MMT-SI is signalling information on the structure of a TV programme and associated information on TV services like the electronic programme guide (EPG). MMT-SI is carried in MMTP packets and delivered in IP packets.

In order to provide Coordinated Universal Time (UTC) in broadcasting systems for receiver terminals to synchronize with broadcast station, time information is also delivered in IP packets.

2 Service configuration

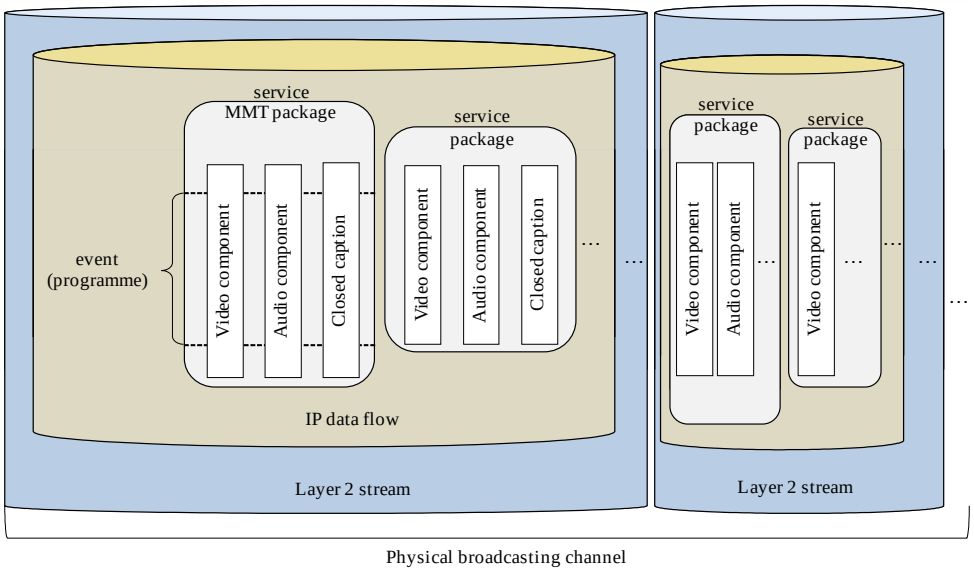
2.1 Services in a broadcasting channel

ISO/IEC 23008-1 specifies the MMT package as a logical structure of content. The MMT package includes presentation information and associated Assets that constitute content.

A broadcasting service is generally a series of TV programmes. In MMT-based broadcasting systems, one MMT package corresponds to one broadcasting service. The relationship between the broadcasting service and the MMT package is shown in Fig. 2. As shown in the figure, one TV programme is distinguished from the rest of the service by its start and end times and corresponds to one event.

FIGURE 2

Relationship between a broadcasting service and MMT package in a broadcasting channel



In ISO/IEC 23008-1, an Asset is defined as a media component. An Asset is equivalent to a series of MPUs. In MMT-based broadcasting systems, one TV programme is an MMT package including one or more Assets and signalling information. A package access (PA) Message is an MMT-SI, and the MMT package table (MPT) carried in the PA message identifies Assets constituting the TV programme.

Multiple MMT packages can be delivered in one IP data flow, as shown in Fig. 2. Here, an IP data flow is defined as a sequence of IP packets of which the source IP address, destination IP address, protocol, source port number, and destination port number are the same combination. There may be other IP data flows carrying content for download services or extended services in addition to IP data flows carrying MMT packages.

Multiple IP data flows might be multiplexed into one layer 2 stream. The layer 2 stream includes signalling information for demultiplexing IP packets from broadcasting signals.

2.2 Services in broadcasting channels and broadband networks

ISO/IEC 23008-1 has been developed to support delivery of media data over heterogeneous networks including broadcasting channels and broadband networks. In the MMT specifications, broadcasting channels and broadband networks can be treated in the same way for delivery of content. Figure 3 shows a service configuration using both broadcasting channels and broadband networks.

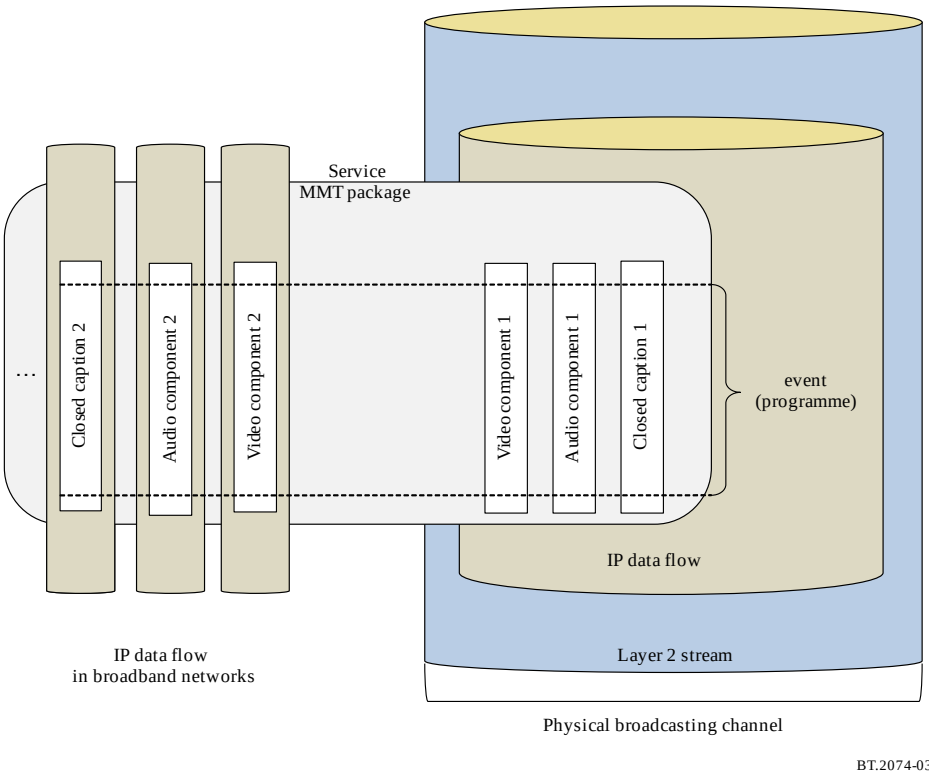
In the figure, video component 1, audio component 1, and closed caption 1 are delivered on broadcasting channels. In addition to these components, video component 2, audio component 2, and closed caption 2 are delivered on broadband networks.

In the broadcasting channels, the three components are multiplexed into one IP data flow and delivered in one layer 2 stream, since all transmitted information is delivered to all receiver terminals. On the other hand, in the broadband networks, components are delivered as a separate IP data flow, since each component is delivered to the receiver terminal requesting it.

In MMT-based broadcasting systems, media components delivered in different channels can easily be included in one MMT package. MMT-based broadcasting systems support hybrid delivery of multimedia content.

FIGURE 3

Service configuration over both broadcasting channels and broadband networks



Annex 2

Media transport protocol and signalling information

1 Media transport protocol

1.1 Introduction

MMT-based broadcasting systems use the syntax and semantics of the MMTP payload and MMTP packet specified in ISO/IEC 23008-1. The extensions described below are intended for broadcast applications.

1.2 Header extension of MMTP packets

ISO/IEC 23008-1 specifies a header extension in the MMTP packet. The header extension has three fields: extension_type, extension_length, and header_extension_value. Although the header extension can be used for various purposes, it contains only one piece of information. The multi-type header extension described below enables it to contain multiple pieces of information.

header_extension_value – When the extension_type field is set to 0x0000, this field has the structure shown in Table 1.

TABLE 1

Structure of multi-type header extension

Syntax	No. of bits	Mnemonic
Header_extension_value {		
for (i=0; i<N; i++) {		
hdr_ext_end_flag	1	bslbf
hdr_ext_type	15	uimsbf
hdr_ext_length	16	uimsbf
for (j=0; j<M; j++) {		
hdr_ext_byte	8	bslbf
}		
}		
}		

hdr_ext_end_flag – When this flag is set to "1", this multi-type header extension is the end of the header extension. When this flag is set to "0", this multi-type header extension is not the end of the header extension.

hdr_ext_type – This field specifies the type of multi-type header extension.

hdr_ext_length – This field specifies the number of bytes of the following hdr_ext_byte field.

hdr_ext_byte – This field provides information on multi-type header extension.

2 Encapsulation of multimedia data

2.1 Introduction

In order to improve the interoperability of MMT-based broadcasting systems, the following constraints apply to carriage of multimedia data in MMTP packets.

2.2 Encapsulation of video data

2.2.1 MFU format for HEVC stream

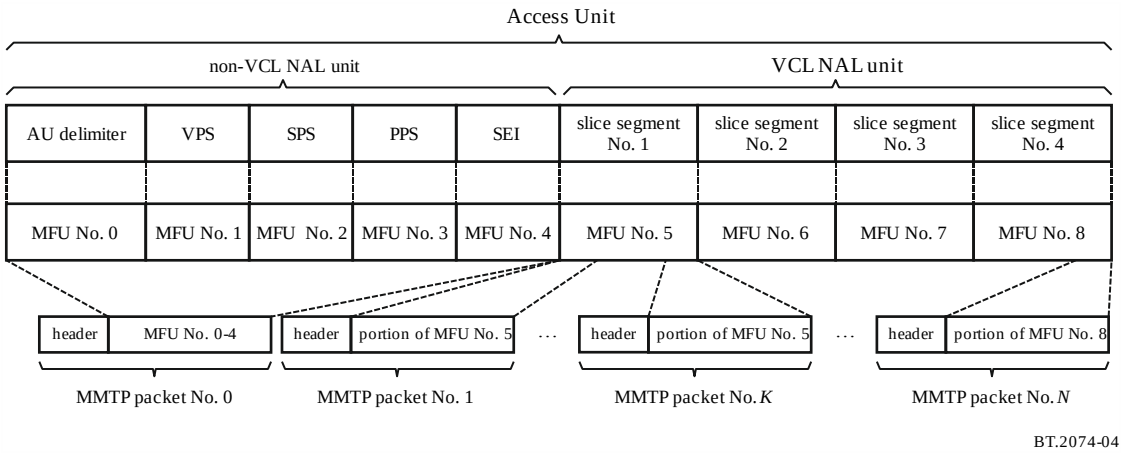
When a high efficiency video coding (HEVC) stream is carried in the MMT protocol, input to the MMT process is a sequence of network abstraction layer (NAL) units. A NAL unit is encapsulated into an MFU when an HEVC stream is carried in the MMT protocol.

If an HEVC encoder generates the byte stream format specified in Recommendation ITU-T H.265 | ISO/IEC 23008-2 Annex B, one start code prefix (0x000001) followed by one NAL unit is replaced with 32-bit length information of the NAL unit (unsigned integer format). Namely, the NAL unit together with the length information are encapsulated into one MFU.

Figure 4 shows an overview of generating MMTP packets and MFUs from a sequence of NAL units output from an HEVC encoder.

FIGURE 4

Overview of packetization of NAL units of HEVC streams



The duration of video MPU greatly influences the channel change time at the receiver terminal, since the video stream is decoded and presented at the receiver terminal on a per MPU basis. In order to reduce the channel change time, the MPU of an HEVC stream is constructed in intra random access point (IRAP) intervals.

2.2.2 Encapsulation of HEVC bitstream subsets

HEVC supports temporal sub-layer coding. One example is that when 120-Hz[1] video is encoded, two streams can be generated: one is a sub-bitstream for 60-Hz[2] video; the other is a bitstream subset for 120-Hz video. At the receiver terminal, 60-Hz video can be decoded from the sub-bitstream, and 120-Hz video can be decoded from both the sub-bitstream and the bitstream subset. The same process can be used for 100-Hz video.

Figure 5 shows an overview of encapsulation of HEVC bitstream subsets. Note that this figure shows display order frame sequence. When an MMT package is made up of various media components, the sub-bitstream and the bitstream subset are encapsulated into separate Assets. In Fig. 5, the sub-bitstream is encapsulated into Asset 1 and the bitstream subset is encapsulated into Asset 2. Since they are separate Assets, the access units of Asset 1 and Asset 2 are carried in MMTP packets that have different packet IDs.

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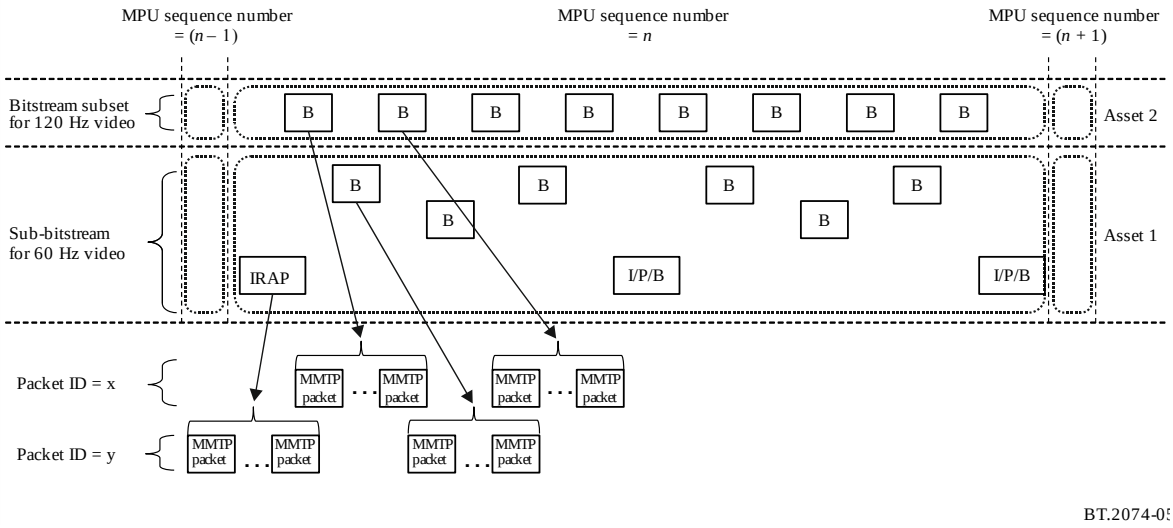
1 Also includes 120/1.001 Hz.

2 Also includes 60/1.001 Hz.

FIGURE 5

Overview of encapsulation of HEVC sub-bitstream and bitstream subset for temporal sub-layer coding



The sequence number of an MPU that the access units of the bitstream subset belong to is identical to the sequence number of an MPU that the access units of the sub-bitstream belong to in the same time period. Assigning the same sequence number to both MPUs enables receiver terminals to easily identify the MPUs that include the corresponding access units in the same GOP.

In the example shown in Fig. 5, the decoding of Asset 2 depends on Asset 1. A Dependency Descriptor stating that Asset 2 depends on Asset 1 is inserted in the asset_descriptors_byte field of the MP Table. In addition to the Dependency Descriptor, an MPU Timestamp Descriptor and MPU Extended Timestamp Descriptor are inserted in the asset_descriptors_byte fields of both Asset 1 and Asset 2.

2.3 Encapsulation of audio data

2.3.1 MFU format for MPEG-4 AAC and MPEG-4 ALS

When an MPEG-4 advanced audio coding (AAC) stream or MPEG-4 audio lossless coding (ALS) stream is carried in the MMT protocol, input to the MMT process is in the form of either a LATM/LOAS stream or a data stream.

The low overhead audio transport multiplex (LATM) includes an audio channel configuration and provides multiplexing functions for audio data. The low overhead audio stream (LOAS) provides synchronization for audio data. When an audio encoder generates a LATM/LOAS stream, one AudioMuxElement () specified in ISO/IEC 14496-3 is encapsulated into one MFU.

When an audio encoder generates a data stream, a Raw Data Stream is encapsulated into one MFU.

3 Signalling information

3.1 Introduction

There are three kinds of MMT-signalling information: Message, Table, and Descriptor. Some of the signalling information specified in ISO/IEC 23008-1 is not used in broadcasting systems. This section summarizes the signalling information for broadcasting systems.

3.2 MMT signalling information Messages

3.2.1 List of MMT-signalling information Messages

Table 2 shows the list of Messages.

TABLE 2

List of Messages

Message name	Message_id assignment	Description	Specified in ISO/IEC 23008-1	Use in broadcas-ting systems
PA message	0x0000	Is the entry point of MMT-signalling information. Conveys one or more tables.	X	X
Media presentation information (MPI) message	0x0001 – 0x000F	Conveys a presentation information document.	X	
MPT message	0x0010 – 0x001F	Conveys a whole or a subset of an MP table	X	
Clock relation information (CRI) message	0x0200	Conveys clock related information to be used for mapping between the NTP timestamp and MPEG-2 STC.	X	
Device capability information (DCI) message	0x0201	Conveys information on required device capabilities for the package consumption.	X	
Application layer-forward error correction (AL-FEC) message	0x0202	Conveys configuration information of an AL-FEC scheme to be used to protect Asset.	X	
Hypothetical receiver buffer model (HRBM) message	0x0203	Conveys information on end-to-end transmission delay and memory requirement to a receiving terminal.	X	
M2section Message	0x8000	Conveys the MPEG-2 Section-format Table. Tables and descriptors in MPEG-2 TS based conventional broadcasting systems can be reused by this message.		X

3.2.2 Detailed specifications of messages

3.2.2.1 PA message

The syntax and semantics of the PA message are specified in ISO/IEC 23008-1.

3.2.2.2 M2section message

Table 3 shows the syntax of the M2section message.

TABLE 3

Syntax of M2section message

Syntax	No. of bits	Mnemonic
M2section_Message () {		
message_id	16	uimsbf
version	8	uimsbf
length	16	uimsbf
table_id	8	uimsbf
section_syntax_indicator	1	bslbf
'1'	1	bslbf
'11'	2	bslbf
section_length	12	uimsbf
table_id_extension	16	uimsbf
'11'	2	bslbf
version_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
for(i=0; i<N; i++) {		
signalling_data_byte	8	bslbf
}		
CRC_32	32	rpchof
}		

The semantics of each field of the M2section message are as follows:

table_id – This field identifies the table to which the section belongs.

section_syntax_indicator – This field determines whether a normal or extension format is used. This field is always set to "1" to indicate the extension format.

section_length – This field identifies the number of data bytes following this field.

table_id_extension – This is a field extending the table identifier.

version_number – This field contains the table version number.

current_next_indicator – This field contains "1" when the table is currently used and "0" when the table cannot be used at present, but can be used next.

section_number – This field contains the number of the first section comprising the table.

last_section_number – This field contains the number of the last section comprising the table.
CRC_32 – This field complies with Recommendation ITU-T.

3.3 MMT signalling information Tables

3.3.1 List of MMT-signalling information Tables

Table 4 shows the list of Tables.

TABLE 4

List of Tables

Table name	Table_id assignment	Description	Specified in ISO/IEC 23008-1	Use in broadcasting systems
PA table	0x00	Provides information on all other signalling tables.	X	
MPI table	0x01 – 0x0F	Provides a presentation information document.	X	
MP table	0x20	Provides configuration information on the MMT package, such as lists and locations of Assets.	X	X
CRI table	0x21	Provides a CRI descriptor.	X	
DCI table	0x22	Provides information on the required device capabilities for consumption of the package.	X	
Package list table	0x80	Provides the IP data flow and packet id of the PA message for the MMT package as a broadcasting service. Also provides a list of IP data flows of other IP services.		X

3.3.2 Detailed specifications of tables

3.3.2.1 MMT package table

The syntax and semantics of the MMT package table are specified in ISO/IEC 23008-1.

3.3.2.2 Package list table

Table 5 shows the syntax of the package list table.

TABLE 5

Syntax of package list table

Syntax	No. of bits	Mnemonic
Package_List_Table () {		
table_id	8	uimsbf
version	8	uimsbf
length	16	uimsbf
num_of_package	8	uimsbf
for (i=0; i<N; i++) {		
MMT_package_id_length	8	uimsbf
for (j=0; j<M; j++) {		
MMT_package_id_byte	8	bslbf
}		
MMT_general_location_info ()		
}		
num_of_ip_delivery	8	uimsbf
for (i=0; i<N; i++) {		
transport_file_id	32	uimsbf
location_type	8	uimsbf
if (location_type == 0x01) {		
ipv4_src_addr	32	uimsbf
ipv4_dst_addr	32	uimsbf
dst_port	16	uimsbf
}		
if (location_type == 0x02) {		
ipv6_src_addr	128	uimsbf
ipv6_dst_addr	128	uimsbf
dst_port	16	uimsbf
}		
if (location_type == 0x05) {		
URL_length	8	uimsbf
for (j=0; j<M; j++) {		
URL_byte	8	char

TABLE 5 (*end*)

Syntax	No. of bits	Mnemonic

}
}
descriptor_loop_length
for (j=0; j<M; j++) {
descriptor ()
}
}
}
	16	uimsbf

The semantics of each field of the package list table are as follows:

num_of_package – This field identifies the number of Packages whose locations are described in this Table.

MMT_package_id_length – This field specifies the number of bytes of the following MMT_package_id_byte field.

MMT_package_id_byte – This field identifies the MMT package ID.

MMT_general_location_info – This field indicates the location information carrying the PA Message of the identified MMT package.

num_of_ip_delivery – This field specifies the number of IP flows whose locations are described in this Table.

transport_file_id – This field specifies the identification of a file object.

location_type – This field specifies the type of location information. When this field is set to 0x01, the location is an IPv4 data flow. When this field is set to 0x02, the location is an IPv6 data flow. When this field is set to 0x05, the location is a URL.

ipv4_src_addr – This field specifies an IPv4 source address. The IPv4 address is fragmented into four fields of 8 bits, where the first byte of this field contains the most significant byte of the IPv4 source address.

ipv4_dst_addr – This field specifies an IPv4 destination address. The IPv4 address is fragmented into four fields of 8 bits, where the first byte of this field contains the most significant byte of the IPv4 destination address.

dst_port – This field specifies the destination port number of an IP data flow.

ipv6_src_addr – This field specifies an IPv6 source address. The IPv6 address is fragmented into eight fields of 16 bits, where the first byte of this field contains the most significant byte of the IPv6 source address.

ipv6_dst_addr – This field specifies an IPv6 destination address. The IPv6 address is fragmented into eight fields of 16 bits, where the first byte of this field contains the most significant byte of the IPv6 destination address.

URL_length – This field specifies the number of bytes of the following URL_byte field.

URL_byte – This field specifies the URL.

descriptor_loop_length – This field represents the number of bytes in all descriptors immediately after this field.

3.4 MMT signalling information descriptors

3.4.1 List of MMT-signalling information descriptors

Table 6 shows the list of descriptors.

TABLE 6

List of descriptors

Descriptor name	Descriptor_tag value assignment	Description	Specified in ISO/IEC 23008-1	Use in broadcasting systems
CRI descriptor	0x0000	Provides the relationship between the NTP timestamp and the MPEG-2 STC for synchronization.	X	
MPU timestamp descriptor	0x0001	Provides presentation time of MPU.	X	X
Dependency descriptor	0x0002	Provides Asset identifications that depend on other Assets.	X	X
Generic file delivery table (GFDT) descriptor	0x0003	Provides one or more CodePoints describing the association of a specific object and object delivery properties.	X	

3.4.2 Detailed specifications of descriptors

3.4.2.1 MPU timestamp descriptor

The syntax and semantics of the MPU timestamp descriptor are specified in ISO/IEC 23008-1.

3.4.2.2 Dependency descriptor

The syntax and semantics of the dependency descriptor are specified in ISO/IEC 23008-1.

3.5 Packet identification

ISO/IEC 23008-1 does not specify a fixed value for MMTP packet. However, it is beneficial that certain fixed values are used to identify MMTP packets so that a receiver terminal can easily recognize the information carried by the MMTP packet.

4 Start-up procedure of broadcasting service

Figure 6 shows the start-up procedure of a receiver terminal from the moment a user presses a channel change button to the moment the new TV programme begins to be shown on screen. Pressing the channel change button corresponds to identifying the service_id of the desired TV programme.

The first procedure is initiated in the IP multiplexing layer. In the case of the TLV multiplexing scheme, the receiver terminal parses the address map table (AMT) to associate the service_id with the IP data flow. Then, it parses the TLV-network information table (NIT) to acquire the physical channel information, such as the channel frequency carrying the IP data flow. On the basis of the acquired information, it tunes in to the broadcasting channel and receives the desired IP data flow.

After receiving the IP data flow, the second procedure in the MMT layer is initiated. The received IP packets carry the MMTP packets. To retrieve the PA message, the receiver terminal seeks MMTP packets whose packet_id=0. It parses the received PA message and gets the MP table in the PA message.

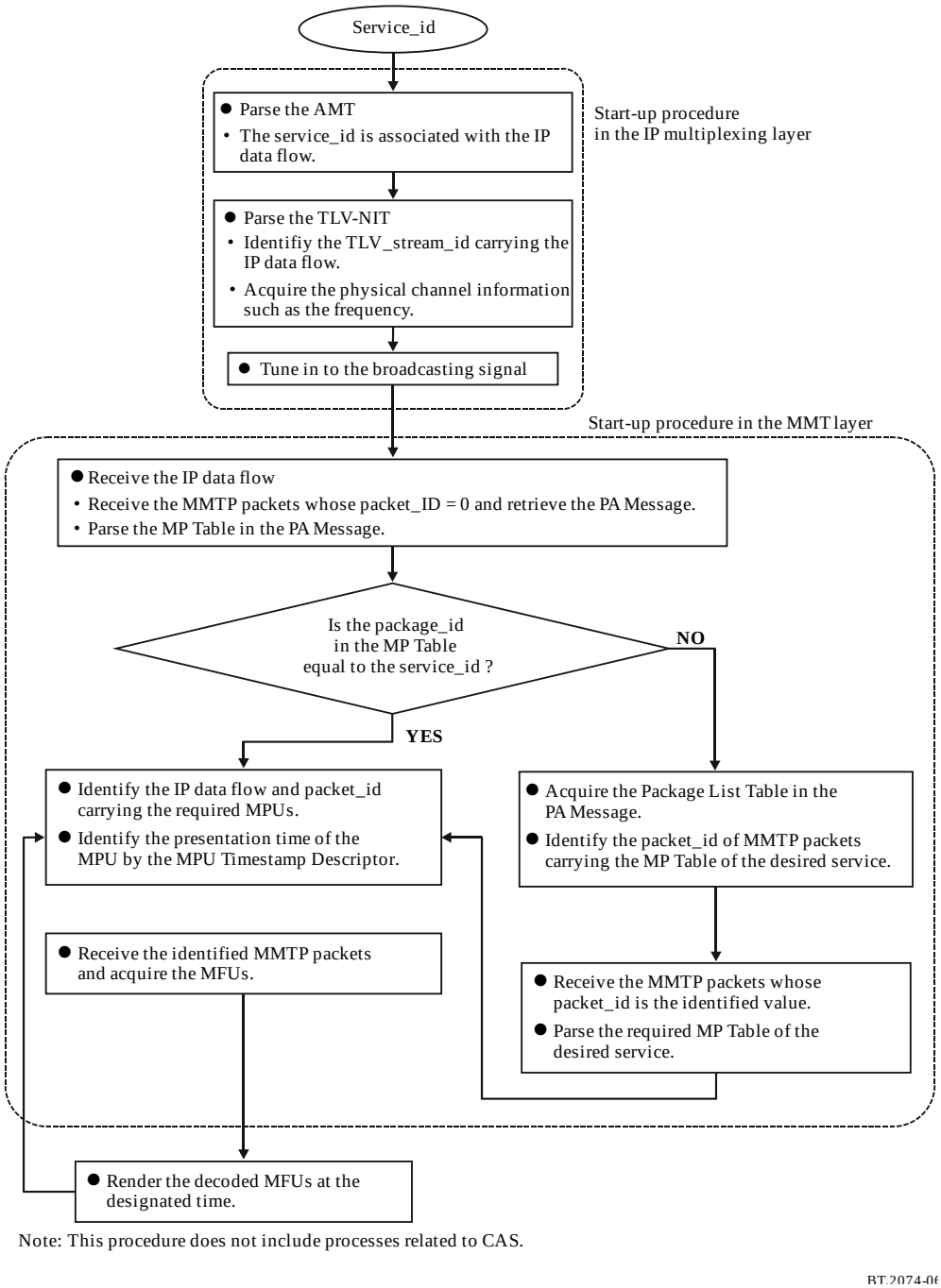
In MMT-based broadcasting systems, multiple services might be multiplexed into one IP data flow, as shown in Fig. 2 of Annex 1. Therefore, the receiver terminal checks whether the package_id of the acquired MP Table is equal to the desired service_id or not. If the package_id of the MP table is not equal to the desired service_id, the receiver terminal acquires the package list table from the PA message. Then, from the package list table, it identifies the packet_id of the MMTP packets carrying the MP table of the desired service.

From the MP table, the receiver terminal identifies the IP data flow and packet_id of MMTP packets carrying the required MPUs in the desired TV programme. It also identifies the presentation time of the MPU by referring to the MPU timestamp descriptor included in the MP table.

Then, the receiver terminal receives the identified MMTP packets carrying media components in the form of MFUs. The MFUs are decoded and rendered at the designated time. The user watches the desired TV programme at this time.

FIGURE 6

Start-up procedure of broadcasting service



Note: This procedure does not include processes related to CAS.

BT.2074-06

Attachment 1 (informative)

ARIB signalling information

1 Additional signalling information

Additional signalling information is specified by ARIB in its specification STD-B60 “MMT-based media transport scheme in digital broadcasting systems”. Tables A1-1, A1-2, and A1-3 list the messages, tables, and descriptors, respectively.

MPEG-2 TS based conventional broadcasting systems have used numerous tables and descriptors. Some of them are reused in MMT-based broadcasting systems. This signalling information has "MH-" at the beginning of its name.

TABLE A1-1

List of Messages additionally specified by ARIB

Message name	Message_id assignment	Description
Conditional access (CA) message	0x8001	Conveys information on conditional access.
M2short section message	0x8002	Conveys MPEG-2 short Section-format table.
Data transmission message	0x8003	Conveys one or more tables related to data transmission.

TABLE A1-2

List of Tables additionally specified by ARIB

Table name	Table_id assignment	Description
Layout configuration table	0x81	Assigns layout information for displaying Assets.
Entitlement control message	0x82 – 0x83	Conveys common information consisting TV programme information (related to TV programmes, descrambling keys, etc.) and control information (instructions on compulsory on/off of the decoder's descramble function).
Entitlement management message	0x84 – 0x85	Conveys individual information including contract information for each subscriber and work keys to decrypt common information.
MH-conditional access table	0x86	Conveys one or more descriptors related to conditional access.
Download control message	0x87 – 0x88	Conveys information related to descrambling keys to descramble channel encryption for download.
Download management message	0x89 – 0x8A	Conveys information related to download keys to decrypt DCM.
MH-event information table	0x8B – 0x9B	Conveys information related to TV programmes such as programme name, broadcast date and time, and explanations of them.

TABLE A1-2 (*end*)

Table name	Table_id assignment	Description
MH-application information table	0x9C	Conveys dynamic control information and additional information for executing applications.
MH-broadcaster information table	0x9D	Presents information on broadcasters in the network.
MH-software download trigger table	0x9E	Conveys announcement information about downloads, such as the service id, schedule information, and target receiver terminals.
MH-service description table	0x9F – 0xA0	Conveys information related to the programme channel, such as the channel name and broadcaster's name.
MH-time offset table	0xA1	Indicates the current date and time and provides the time difference between the current time and indicating time for humans.
MH-common data table	0xA2	Conveys data that are commonly required for receiver terminals and stored in non-volatile memory, such as company logos.
Data directory management table	0xA3	Provides directory information on files constituting applications.
Data asset management table	0xA4	Provides the MPU configuration of the Asset and the version of the MPU.
Data content configuration table	0xA5	Provides configuration information on files that are used as data content.
Event message table	0xA6	Provides information related to event messages.

TABLE A1-3

List of Descriptors additionally specified by ARIB

Descriptor name	Descriptor _tag value assignment	Description
Asset group descriptor	0x8000	Provides the group and priority within a group of Assets.
Event package descriptor	0x8001	Provides a description on the relationship of events and the MMT packages.
Background colour descriptor	0x8002	Provides background colour information on the layout configuration.
MPU presentation region descriptor	0x8003	Provides information on the position of displaying the MPU.
Access control descriptor	0x8004	Identifies the conditional access method.
Scramble descriptor	0x8005	Identifies the scrambling sub-system.

TABLE A1-3 (*continued*)

Descriptor name	Descriptor _tag value assignment	Description
Message authentication method descriptor	0x8006	Identifies the message authentication method.
MH-emergency information descriptor	0x8007	Provides information on and functions for emergency alarm signals.
MH-MPEG-4 audio descriptor	0x8008	Provides basic information for identifying the coding parameters of MPEG-4 audio streams.
MH-MPEG-4 audio extension descriptor	0x8009	Provides additional information for identifying the profile and level of MPEG-4 audio streams.
MH-HEVC video descriptor	0x800A	Provides information for identifying the coding parameters of HEVC video streams.
MH-linkage descriptor	0x800B	Provides a description of the relationship with other programme channels.
MH-Event group descriptor	0x800C	Provides a description of grouping information for multiple events.
MH-Service list descriptor	0x800D	Provides a description of programme channels and a list of their types.
MH-Short event descriptor	0x800E	Provides the name and a brief explanation of the TV programme.
MH-Extended event descriptor	0x800F	Provides detailed information about the TV programme.
Video component descriptor	0x8010	Provides parameters and explanations of video signals.
MH-Stream identifier descriptor	0x8011	Identifies individual programme element signals of the TV programme.
MH-Content descriptor	0x8012	Provides a description of the TV programme's genre.
MH-Parental rating descriptor	0x8013	Provides information on the permitted minimum audience age.
MH-Audio component descriptor	0x8014	Provides parameters and explanations of audio signals.
MH-Target region descriptor	0x8015	Provides target region information.
MH-Series descriptor	0x8016	Provides series information for multiple events.
MH-SI Parameter descriptor	0x8017	Provides transmission parameters of signalling information, e.g. the retransmission period.
MH-Broadcaster name descriptor	0x8018	Provides the broadcaster's name.
MH-Service descriptor	0x8019	Provides descriptions of the programme channel and its company's name.
IP Data flow descriptor	0x801A	Provides information on IP data flows in the broadcasting services.
MH-CA Start-up descriptor	0x801B	Provides information on the start-up of CA programs having conditional access functions.

TABLE A1-3 (*end*)

Descriptor name	Descriptor _tag value assignment	Description
MH-Type descriptor	0x801C	Provides type of files in data transmission.
MH-Info descriptor	0x801D	Provides information related to MPU or item.
MH-Expire descriptor	0x801E	Provides expiry information.
MH-Compression type descriptor	0x801F	Provides the compression type and bytes of an item before compression.
MH-Data component descriptor	0x8020	Identifies the coding scheme of data.
UTC-NPT Reference descriptor	0x8021	Provides the relationship between NPT and UTC.
Event message descriptor	0x8022	Provides general information related to event messages.
MH-Local time offset descriptor	0x8023	Provides the current local time and indicates whether daylight-savings time is observed.
MH-Component group descriptor	0x8024	Provides a description of grouping information for multiple components.
MH-Logo transmission descriptor	0x8025	Provides characters consisting of simple logos and references to CDT-format logos.
MPU Extended timestamp descriptor	0x8026	Provides a decoding timestamp for access units in the MPU.
MPU Download content descriptor	0x8027	Provides property information on the download content delivered in the MPU.
MH-Network download content descriptor	0x8028	Provides property information on the download content delivered in broadband networks.
MH-Application descriptor	0x8029	Provides a description of an application.
MH-Transport protocol descriptor	0x802A	Provides transmission protocol and location information on applications that depend on transmission protocols.
MH-Simple application location descriptor	0x802B	Provides detailed location information on applications.
MH-Application permission descriptor	0x802C	Provides descriptions of the application boundary and permission information.
MH-Autostart priority descriptor	0x802D	Provides priority information for launch of applications.
MH-Cache control info descriptor	0x802E	Provides cache control information for caching resources constituting applications.
MH-Randomized latency descriptor	0x802F	Provides latency information for application control.
Linked PU descriptor	0x8030	Provides information on linked presentation units.
Locked cache descriptor	0x8031	Provides file information that is cached and locked.
Unlocked cache descriptor	0x8032	Provides file information that is un-cached and unlocked.

2 Header extension of MMTP packets

When the extension_type field is set to 0x0000, hdr_ext_type field specifies the type of multi-type header extension. The value of hdr_ext_type is specified in Table A1-4.

TABLE A1-4

hdr_ext_type values

Value	Description
0x0000	Reserved for future use
0x0001	Reserved for ARIB STD-B61 (scrambling information)
0x0002	Reserved for ARIB STD-B60 (download_id)
0x0003 – 0x7FFF	Reserved for future use

3 Packet identification assignment

The fixed values are assigned to recognize the information carried by the MMTP packet. These values are listed in Table A1-5.

TABLE A1-5

Packet ID assignments

Value	Description
0x0000	PA Message
0x0001	Reserved for CA Message
0x0002	AL-FEC Message
0x0003 – 0x00FF	Reserved for future use
0x0100 – 0x7FFF	Reserved for private use
0x8000	Reserved for M2section Message carrying MH-EIT
0x8001	Reserved for M2section Message carrying MH-AIT
0x8002	Reserved for M2section Message carrying MH-BIT
0x8003	Reserved for M2section Message carrying MH-SDTT
0x8004	Reserved for M2section Message carrying MH-SDT
0x8005	Reserved for M2short Section Message carrying MH-TOT
0x8006	Reserved for M2section Message carrying MH-CDT
0x8007	Reserved for Data Transmission Message
0x8008 – 0xEFFF	Reserved for private use
0xF000 – 0xFFFF	Reserved for private use