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| **Recommendation ITU-R BT.2074-1**  **(12/2017)** |
| **Service configuration, media transport protocol, and signalling information for MMT-based broadcasting systems** |
| **BT Series**  **Broadcasting service**  **(television)** |

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| **Series** | Title |
| **BO** | Satellite delivery |
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| **BS** | Broadcasting service (sound) |
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| **P** | Radiowave propagation |
| **RA** | Radio astronomy |
| **RS** | Remote sensing systems |
| **S** | Fixed-satellite service |
| **SA** | Space applications and meteorology |
| **SF** | Frequency sharing and coordination between fixed-satellite and fixed service systems |
| **SM** | Spectrum management |
| **SNG** | Satellite news gathering |
| **TF** | Time signals and frequency standards emissions |
| **V** | Vocabulary and related subjects |

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| ***Note***: *This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.* |

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RECOMMENDATION ITU-R BT.2074-1

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

(2015-2017)

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 – 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. Figure 1 shows the protocol stack of MMT-based broadcasting systems.

FIGURE 1

Protocol stack of MMT-based broadcasting systems



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 Fig. 3, 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]](#footnote-1) video is encoded, two streams can be generated: one is a sub-bitstream for 60-Hz[[2]](#footnote-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.

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

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



Attachment 1   
to Annex 2  
(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 7, 8 and 9 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 7

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 8

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 decoderʼs 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. | |
| TABLE 8 (*end*) | | | | |
| Table name | | Table\_id assignment | | Description |
| MH-event information table | | 0x8B – 0x9B | | Conveys information related to TV programmes such as programme name, broadcast date and time, and explanations of them. |
| 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 broadcasterʼs 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 9

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. | |
| TABLE 9 (*continued*) | | | | |
| Descriptor name | Descriptor\_tag value assignment | | Description | |
| Scramble descriptor | 0x8005 | | Identifies the scrambling sub-system. | |
| 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 programmeʼs 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 broadcasterʼs name. | |
| MH-Service descriptor | 0x8019 | | Provides descriptions of the programme channel and its companyʼs 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 9 (*continued*) | | | | | |
| 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. | |
| TABLE 9 (*end*) | | | | | |
| Descriptor name | | Descriptor\_tag value assignment | | Description | |
| MH-Download protection descriptor | | 0x8033 | | Provides location of download management or download control messages. | |
| Application service descriptor | | 0x8034 | | Provides information on applications related to services. | |
| MPU node descriptor | | 0x8035 | | Provides label of directory to which this MPU belongs. | |
| Presentation unit structure descriptor | | 0x8036 | | Provides list of MPUs for presentation units. | |
| MH-Hierarchy descriptor | | 0x8037 | | Provides information on video components coded with scalable video coding. | |
| Content copy control descriptor | | 0x8038 | | Provides copy control information for services. | |
| Content usage control descriptor | | 0x8039 | | Provides copy control information for programmes. | |
| MH-External application control descriptor | | 0x803A | | Identifies permission of external applications to broadcast resources. | |
| MH-Playback application descriptor | | 0x803B | | Provides information on applications related to recorded content. | |
| MH-Simple playback application location descriptor | | 0x803C | | Provides information on link of applications related to recorded content. | |
| MH-Application expiration descriptor | | 0x803D | | Provides expiration date and time of applications. | |
| Related broadcaster descriptor | | 0x803E | | Provides broadcaster identification for sharing NVRAM. | |
| Multimedia service information descriptor | | 0x803F | | Provides detailed information on each piece of content for multimedia services. | |
| Emergency news descriptor | | 0x8040 | | Signals that emergency news is broadcasted. | |
| MH-CA contract information descriptor | | 0x8041 | | Provides contract information to decide whether end user is able to watch programmes. | |
| MH-CA service descriptor | | 0x8042 | | Provides broadcaster group identification and message control. | |
| MH-Linkage descriptor | | 0xF000 | | Provides links to additional information. | |
| MH-Short event descriptor | | 0xF001 | | Provides short descriptions for events. | |
| MH-Extended event descriptor | | 0xF002 | | Provides detailed descriptions for events. | |
| Event message descriptor | | 0xF003 | | Provides information for event messages. | |

# 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 10.

TABLE 10

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 11.

TABLE 11

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 |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Also includes 120/1.001 Hz. [↑](#footnote-ref-1)
2. Also includes 60/1.001 Hz. [↑](#footnote-ref-2)