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Information technology — High efficiency coding and media delivery in heterogeneous environments —

Part 1: MPEG media transport (MMT)

Technologies de l'information — Codage à haute efficacité et livraison des medias dans des environnements hétérogènes —
Partie 1: Transport des médias MPEG

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Foreword

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

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ISO/IEC 23008-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 23008 consists of the following parts, under the general title *Information technology — High efficiency coding and media delivery in heterogeneous environments*:

— *Part 1: MPEG media transport (MMT)*

— *Part 2: High efficiency video coding (HEVC)*

— *Part 5: HEVC Conformance testing and reference software*

— *Part 8: Conformance Specification for HEVC*

— *Part 10: MPEG Media Transport Forward Error Correction (FEC) codes*

— *Part 11: MPEG Media Transport Composition Information (CI)*

Introduction

This part of ISO/IEC 23008 specifies the MPEG Media Transport (MMT) technologies for the transport and delivery of coded media data for multimedia services over heterogeneous packet-switched networks including Internet Protocol (IP) networks and digital broadcasting networks. In this specification, “coded media data” includes both timed audiovisual media data, and non-timed data.

MMT is designed under the assumption that the coded media data will be delivered over a packet-switched delivery network. Several characteristics of such delivery environment, such as non-constant end-to-end delay of each packet from the sending entity to the receiving entity, have been taken into consideration.

For efficient and effective delivery and consumption of coded media data over packet-switched delivery networks, this specification provides the following elements:

— the logical model to construct contents composed of components from various sources, for example components of mash-up applications;

— the formats to convey information about the coded media data, to enable delivery layer processing, such as packetization;

— the packetization method and the structure of the packet to deliver media content over packet-switched networks supporting media and coding independent hybrid delivery over multiple channels;

— the format of the signalling messages to manage delivery and consumption of media content.

Information technology — High efficiency coding and media delivery in heterogeneous environments —

Part 1: MPEG media transport (MMT)

1 Scope

This part of ISO/IEC 23008 specifies MPEG Media Transport (MMT) technologies, which include a single encapsulation format, delivery protocols and signalling messages for transport and delivery of multimedia data over heterogeneous packet-switched networks for multimedia services. Types of packet-switched networks supported by this specification include bidirectional networks such as IP (Internet Protocol) networks and unidirectional networks such as digital broadcast networks (which may or may not use the IP).

The technologies specified by this specification belong to one of three functional areas of MMT: Media Processing Unit (MPU) format, signalling messages and delivery protocol.

Media Processing Unit format specifies the `mpuf` branded ISO Based Media File Format encapsulating both timed and non-timed media contents. The MPU format is a self-contained ISOBMFF structure enabling independent consumption of media data, which hides codec specific details from the delivery function.

Signalling functional area specifies the formats of signalling messages carrying information for managing media content delivery and consumption, e.g. specific media locations and delivery configuration of media contents.

Delivery functional area specifies the payload formats that is independent of media and codec types, which allows fragmentation and aggregation of contents encapsulated as specified by this specification for delivery using packet-switched oriented transport protocols. The delivery functional area also provides an application layer transport protocol that allows for advanced delivery of media contents.

2 Normative references

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

ISO/IEC 14496-12, *Information technology — Coding of audio-visual objects — Part 12: ISO base media file format* (technically identical to ISO/IEC 15444-12)

IETF RFC 1738, *Uniform Resource Locators (URL)*, December 1994.

IETF RFC 2141, *URN Syntax*, May 1997.

IETF RFC 3406, *Uniform Resource Names (URN) Namespace Definition Mechanisms*, October 2002.

IETF RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*, January 2005.

IETF RFC 4122, *A Universally Unique Identifier (UUID) URN Namespace*, July 2005.

W3C XML *Extensible Markup Language (XML) Version 1.0*, W3C Recommendation 26, Nov 2008.

3 Terms, definitions, symbols and abbreviated terms

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

3.1 Terms and definitions

3.1.1
access unit
AU
smallest media data entity to which timing information can be attributed

3.1.2
asset
any multimedia data entity that is associated with a unique identifier and that is used for building a multimedia presentation

3.1.3
dependent asset
asset for which one or more other assets are necessary for decoding of the contained media content

3.1.4
encoding symbol
unit of data generated by the encoding process

3.1.5
encoding symbol block
set of encoding symbols

3.1.6
FEC code
algorithm for encoding data such that the encoded data flow is resilient to data loss

3.1.7
FEC encoded flow
logical set of flows that consists of an FEC source flow and one or more associated FEC repair flows

3.1.8
FEC payload ID
identifier that identifies the contents of a MMTP packet with respect to the MMT FEC scheme

3.1.9
FEC repair flow
data flow carrying repair symbols to protect an FEC source flow

3.1.10
FEC repair packet
MMTP packet along with repair FEC payload identifier to deliver one or more repair symbols of a repair symbol block

3.1.11
FEC source flow
flow of MMTP packets protected by an MMT FEC scheme

3.1.12
FEC source packet
MMTP packet along with source FEC payload identifier

3.1.13
Media Fragment Unit
MFU
fragment of a media processing unit

3.1.14
Media Processing Unit
MPU
generic container for independently decodable timed or non-timed data that is media codec agnostic

3.1.15
MMT entity
software and/or hardware implementation that is compliant to a profile of MMT

3.1.16
MMT FEC scheme
forward error correction procedure that defines the additional protocol aspects required to use an FEC scheme in MMT

3.1.17
MMT protocol
MMTP
application layer transport protocol for delivering MMTP payload over IP networks

3.1.18
MMT receiving entity
MMT entity that receives and consumes media data

3.1.19
MMT sending entity
MMT entity that sends media data to one or more MMT receiving entities

3.1.20
MMTP packet
formatted unit of the media data to be delivered using the MMT protocol

3.1.21
MMTP packet flow
sequence of MMTP packets with same MMT sending entity and MMT receiving entity

3.1.22
MMTP payload
formatted unit of media data to carry Packages and/or signalling messages using either the MMT protocol or an Internet application layer transport protocols (e.g. RTP)

3.1.23
MMTP session
single MMTP transport flow that is used for certain period of time

3.1.24
MMTP transport flow
series of MMTP packet flow delivered to the same destination

3.1.25
non-timed data
media data that do not have inherent timeline for the decoding and/or presenting of its media content

3.1.26
package
logical collection of media data, delivered using MMT

3.1.27
repair FEC payload ID
FEC payload ID for repair packets

3.1.28
repair packet block
segmented set of FEC repair flow which can be used to recover lost source packets

3.1.29
repair symbol
encoding symbol that contains redundancy information for error correction

3.1.30
repair symbol block
set of repair symbols which can be used to recover lost source symbols

3.1.31
source FEC payload ID
FEC payload ID for source packets.

3.1.32
source packet block
segmented set of FEC source flow that is to be protected as a single block

3.1.33
source symbol
unit of data to be encoded by an FEC encoding process

3.1.34
source symbol block
set of source symbols generated from a single source packet block

3.1.35
timed data
any data that has inherent timeline information for the decoding and/or presentation of its media contents

3.2 Symbols and abbreviated terms

For the purpose of this document, the symbols and abbreviated terms given in the following apply:

AU	access unit
AL-FEC	application layer forward error correction
AVC	advanced video coding
CRI	clock relation information
DCI	device capability information

GFD	generic file delivery
HRBM	hypothetical receiver buffer model
HTTP	hypertext transfer protocol
ISOBMFF	ISO base media file format
LA-FEC	layer aware forward error correction
MPI	media presentation information
MFU	media fragment unit
MMT	MPEG media transport
MMTP	MMT protocol
MP	MMT package
MPU	media processing unit
MTU	maximum transmission unit
MVC	multi-view video coding
NTP	network time protocol
PA	package access
PID	packet identifier
PTP	precision time protocol
RAP	random access point
RTP	real-time protocol
SDP	session description protocol
SVC	scalable video coding
TCP	transmission control protocol
TS	transport stream
UDP	user datagram protocol
URI	uniform resource identifier
URL	uniform resource locator
URN	uniform resource name
UUID	universally unique identifier
UTC	coordinated universal time
XML	extensible mark-up language

3.3 Conventions

The following conventions apply in this document:

— The Big Endian number representation scheme is used.

4 Overview

This specification defines a set of tools to enable advanced media transport and delivery services. The tools spread over three different functional areas: Media Processing Unit (MPU) format, delivery and signalling. Even though the tools are designed to be efficiently used together, they may also be used independently regardless of the use of tools from the other functional areas.

The Media Processing Unit (MPU) functional area defines the logical structure of media content, the Package, and the format of the data units to be processed by an MMT entity and their instantiation with ISO Base Media File Format as specified in ISO/IEC 14496-12. The Package specifies the components comprising the media content and the relationship among them to provide necessary information for advanced delivery. The format of data units in this specification is defined to encapsulate the encoded media data for either storage or delivery, and to allow for easy conversion between data to be stored and data to be delivered. (see clause 6)

The delivery functional area defines an application layer transport protocol and a payload format. The application layer transport protocol defined in this specification provides enhanced features for delivery of multimedia data when compared to conventional application layer transport protocols, e.g. multiplexing and support of mixed use of streaming and download delivery in a single packet flow. (see sub-clause 8.2) The payload format is defined to enable the carriage of encoded media data which is agnostic to media types and encoding methods. (see sub-clause 8.3)

The signalling functional area defines formats of signalling messages to manage delivery and consumption of media data. Signalling messages for consumption management are used to signal the structure of the Package (see sub-clause 9.3) and signalling messages for delivery management are used to signal the structure of the payload format and protocol configuration. (see sub-clause 9.4)

A multimedia service may use any subset of the tools defined in this specification according to its specific needs. Furthermore, interfaces between protocols and standards defined by this specification and those defined in other specifications can also be defined and used Figure 1illustrates the different functions and their relationships to existing protocols and standards.

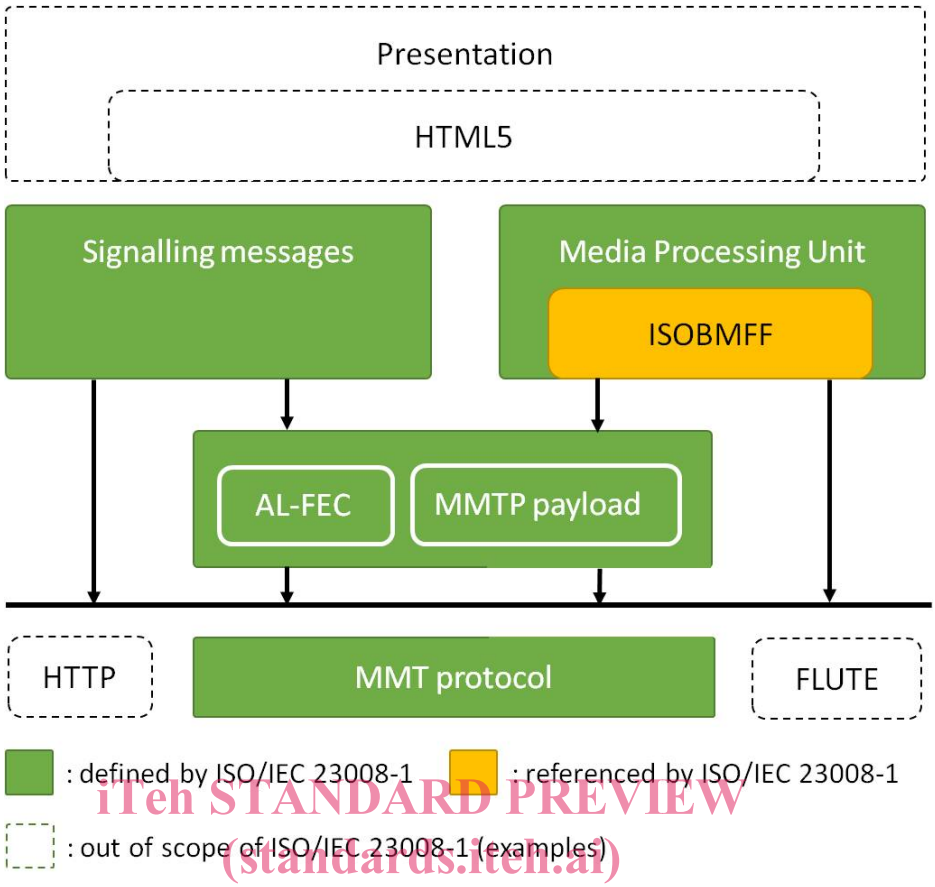

Figure 1 — MMT functional areas, tools and interfaces

Figure 2 depicts the end-to-end architecture for this specification. The MMT sending entity is responsible for sending the Packages to the MMT receiving entity as MMTP packet flows. The sending entity may be required to gather contents from content providers based on the presentation information of the Package that are provided by a Package provider.

A Package provider and Content providers may be co-located. Media content is provided as an Asset that is segmented into a series of encapsulated MMT Processing Units that forms a MMTP packet flow.

The MMTP packet flow of such content is generated by using the associated transport characteristics information. Signalling messages may be used to manage the delivery and the consumption of Packages.

This specification defines the interfaces between the MMT sending entity and the MMT receiving entity as well as their operations. The MMT sending entity shall conform to the sender operations as defined in clause 8.

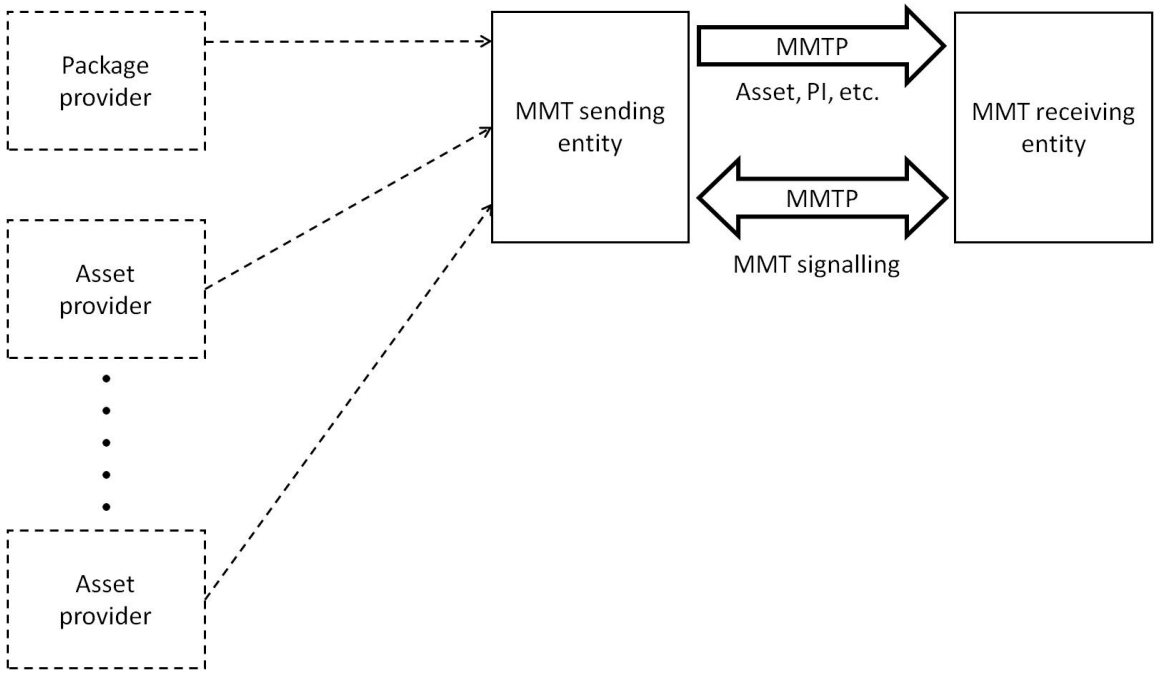

Figure 2 — End-to-end Architecture of MMT

An MMT receiving entity operates at one or more MMT functional areas. An exemplary MMT receiving entity architecture is shown in Figure 3.

The MMT protocol (MMTP) is used to receive and de-multiplex the streamed media based on the `packet_id` and the payload type. The de-capsulation procedure depends on the type of payload that is carried and is processed separately and thus is not shown here.

The presentation engine layer is responsible for setting up the multimedia scene and referencing the content that is received using the MMT protocol.

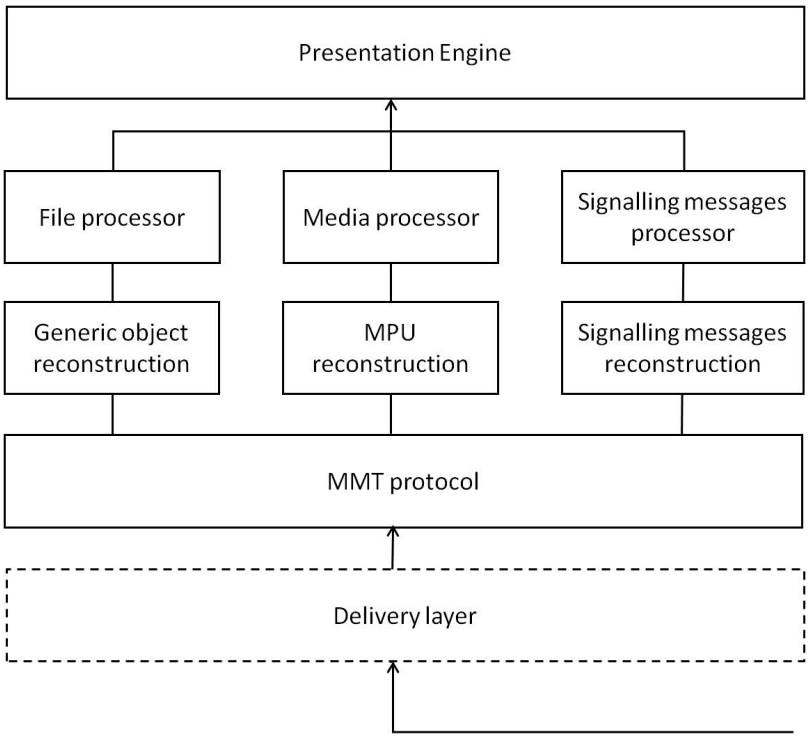

Figure 3 — Example of MMT receiving entity

5 MMT Data Model

5.1 Introduction

This clause introduces the logical data model assumed for the operation of the MMT protocol. The MMT protocol provides both streaming delivery and download delivery of coded media data. For streaming delivery, MMT protocol assumes the specific data model including MPUs, Assets, and Package. MMT protocol preserves the data model during the delivery by indicating the structural relationships among MPU, Asset, and Package using signalling messages.

The collection of the encoded media data and its related metadata builds a Package. The Package may be delivered from one or more MMT sending entities to the MMT receiving entities. Each piece of encoded media data of a Package, such as a piece of audio or video content, constitutes an Asset.

An Asset is associated with an identifier which may be agnostic to its actual physical location or service provider that is offering it, so that an Asset can be globally uniquely identified. Assets with different identifiers shall not be interchangeable. For example, two different Assets may carry two different encodings of the same content but they are not interchangeable.

MMT does not specify a particular identification mechanism but allows the usage of URIs or UUIDs for this purpose. Each Asset has its own timeline which may be of different duration than that of the whole presentation created by the Package.

Each MPU constitutes a non-overlapping piece of an Asset, i.e. 2(two) consecutive MPUs of the same Asset shall not contain the same media samples. Each MPU may be consumed independently by the presentation engine of the MMT receiving entity.