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

## Part 4: MMT reference software

*Technologies de l'information — Codage à haute efficacité et livraison des medias dans des environnements hétérogènes —*

*Partie 4: Logiciel de référence pour le transport des médias MPEG (MMT)*



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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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# Foreword

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

A list of all parts in the ISO/IEC 23008 series can be found on the ISO website.

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# Introduction

The MMT reference and conformance software is defined as part of the MPEG-H standard in this document. This document outlines the MMT reference and conformance software and describes how it is used for conformance testing. It also collects a list of MMT features that need to be verified as part of conformance testing.

The attachment, available at https://standards.iso.org/iso-iec/23008/-4/ed-1/en, contains the updated reference software source code implementing the MPEG media transport: MMT.tar.gz.

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

# Part 4:
# MMT reference software

## 1 Scope

This document provides the reference software for MMT and its description.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions given in ISO/IEC 23008-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

## 4 General

The reference and conformance software operates according to Figure 1. It takes as input the MPUs, generic files and signalling messages that are to be transmitted. The MMTP sender then generates the MMTP flow as a multiplex of MMTP packets from the different sources and uses BSD sockets to send them to a pre-configured destination IP address and port number using MMTP over UDP. The MMTP receiver de-multiplexes the MMTP flow based on the *packet_id* and the *mode* and passes the packets to the corresponding reconstruction module. The reconstruction module extracts the payload and reconstructs the resource (i.e. the MPU, the generic file, or the signalling message).

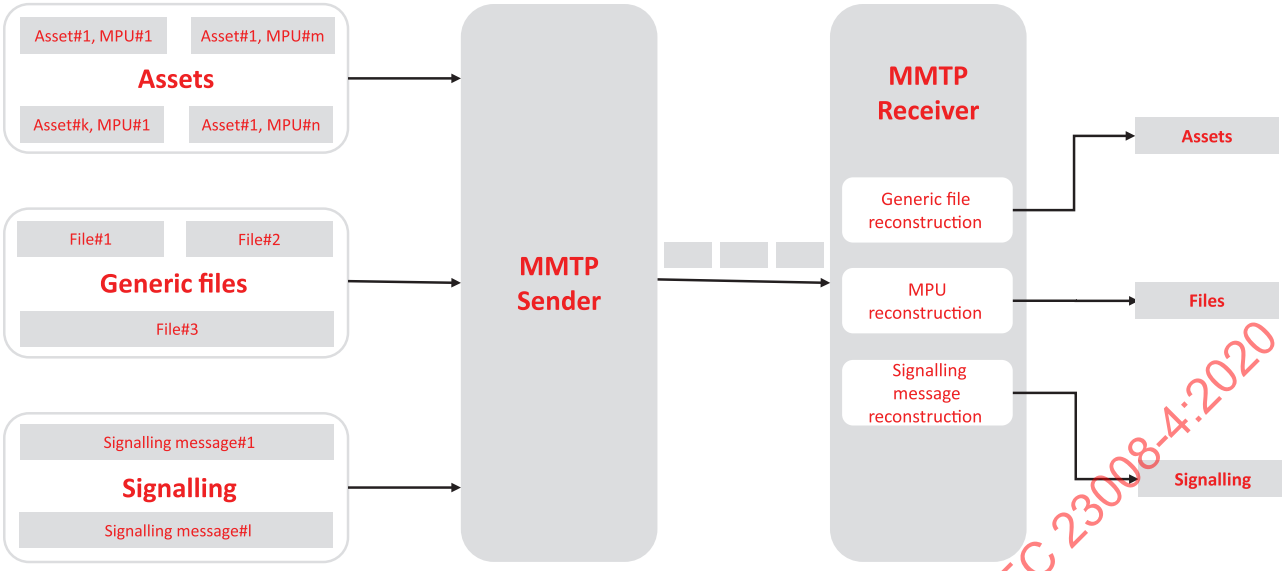


**Figure 1 — Operation of reference and conformance software**

Figures 2 and 3 depict the structure and class diagram of the reference and conformance software. The yellow, orange and green boxes indicate classes, general or binary files (MPU, generic, configuration, and packet dump), and XML files respectively.

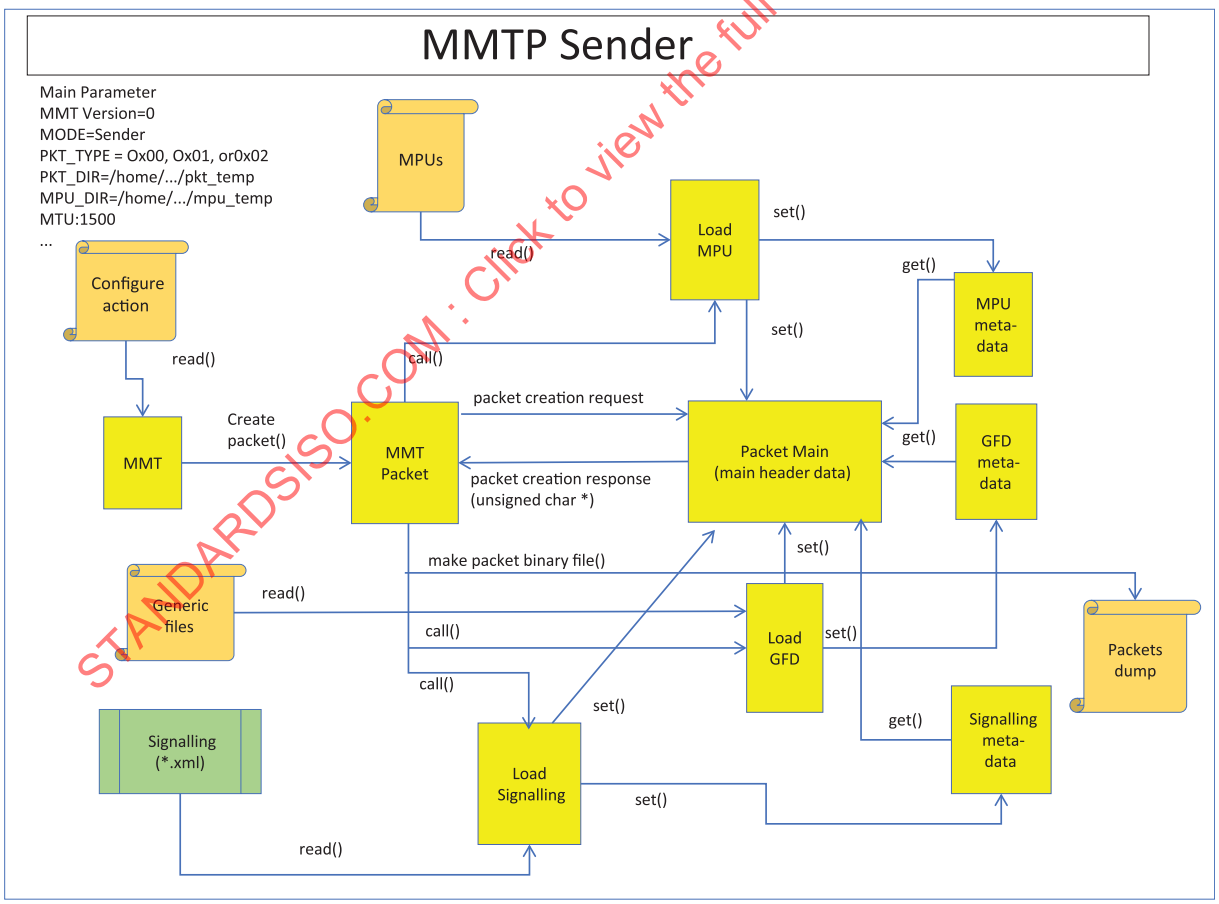


**Figure 2 — Class diagram of MMTP sender**

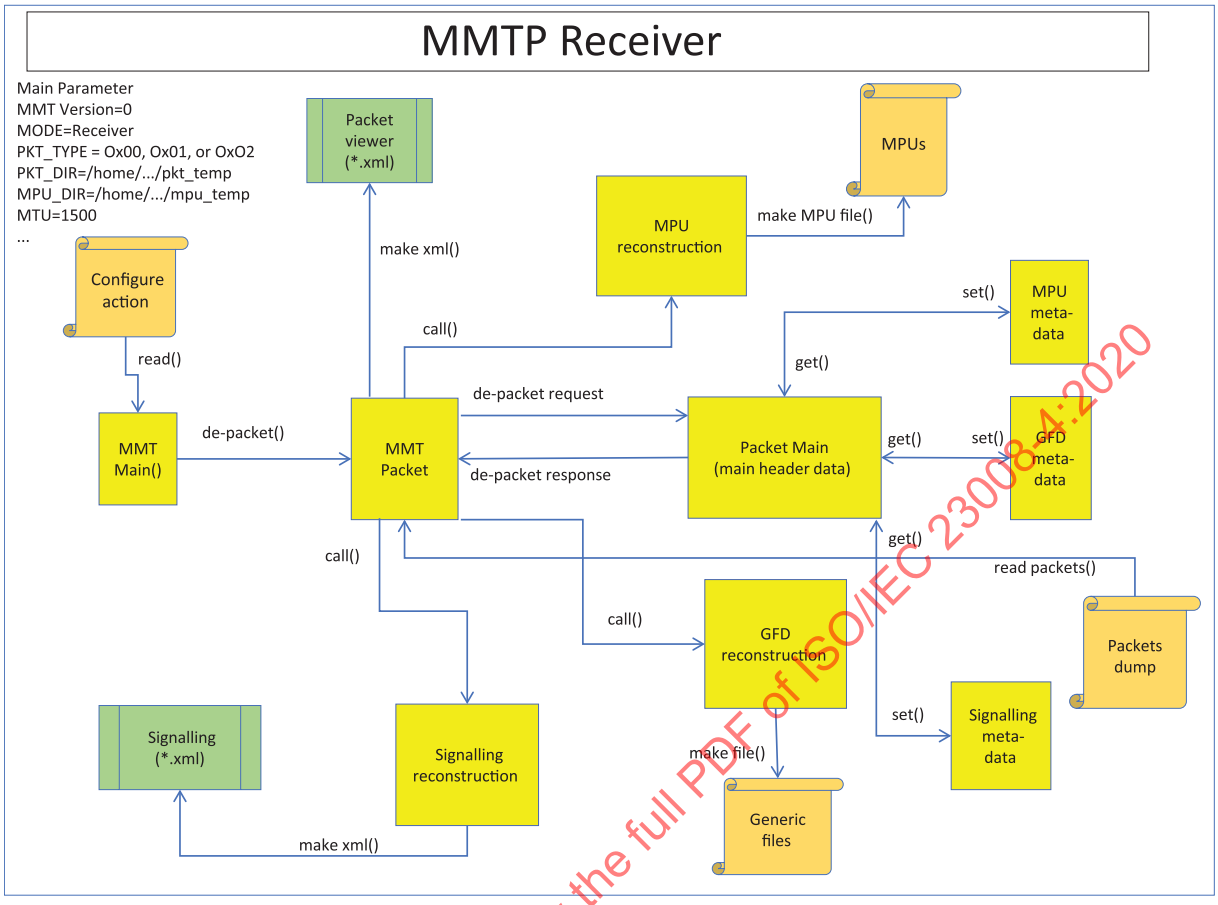


**Figure 3 — Class diagram of MMTP receiver**

The MMTP reference software works on both the sender and receiver side with a configuration (Demon 0: sender and 1: receiver). The MMTP sender has three functions: loading files (MPUs, generic, and signalling files) from pre-configured directories, the creation of MMT packets, and storing packets. The receiver side also has several functions: loading packets, de-packetizing, and the reconstruction of files. The MMT, MMT packet, packet main, MPU metadata, GFD metadata and signalling metadata classes are used on both the sender and receiver side. The loading module with load MPU, load GFD, and load signalling class are used only on the sender side and the related reconstruction classes are used only on the receiver side.

— MMT: MMT is a main class. MMT reads a configuration file (MMT_config) and distinguishes MMTP as sender and receiver mode. If the mode is sender, the MMT reads all files from the sender directories that are pre-configured in certain locations to load MPUs, generic, and signalling files and starts a packetizing process for each file. The MMT calls a MMT packet class for the creation of packets. On the other hand, if the mode is receiver, the MMT calls a de-packetization function.

— MMT packet: The main function of MMT packet is packetization and de-packetization. In sender mode, the MMT packet distinguishes packet types (such as 0x00: MPU, 0x01:GFD, 0x02:Signalling), calls loaders for each mode and calls the packet main class to manipulate header information. If the mode is receiver, it calls the de-packetization module and reconstruction module for each mode.

— Packet Main (main header data): The MMTP main packet header is defined except the payload data fields. The Packet Main calls MPU metadata, GFD metadata, and signalling metadata to store meta information for each mode.

— MPU metadata: The MMTP payload header for MPU mode is defined and creates the MPU packet and de-packet.

— GFD metadata: The MMTP payload header for GFD mode is defined and creates the GFD packet and de-packet.

— Signalling metadata: MMTP payload header for signalling mode is defined and creates the signalling packet and de-packet.

— Load MPU: Parsing and storing functions for MPU or ISOBMFF standards. Reads binary MPU files or ffmpeg files and loads box information (ftyp, moov, moof, samples, etc) at the matching variables.

— Load GFD: Parsing and storing functions for any generic files. Reads those files and loads information at the variables.

— Load signalling: Parsing and storing functions for any signalling files. Reads signalling files and loads information at the variables.

— MPU reconstruction: Reconstructs MPU files. After receiving each packet and payload data, this is called to append them to the right place.

— GFD reconstruction: Reconstructs generic files. After receiving each packet and payload data, this is called to append them to the right place.

— Signalling reconstruction: Reconstruct signalling as either an xml file or binary file. After receiving each packet and payload data, this is called to append them to the right place.

Support for live streaming is made possible through constant monitoring of the input folders for newly created media files.

In the MMT Sender, the structure of the HRBM message, and a signalling message creator for the HRBM message to set the message field value according to message structure, are added. The signalling message generator then generates a binary-formatted signalling message. The binary signalling message is then packetized using the message header and MMTP packet header. In the MMTP Receiver, after the signalling message reconstruction, the signalling message parser can parse the message and retrieve the message field values for consumption. (See Figure 4.) The de-jitter buffer is set based on the HRBM's max_buffer_size and packets are moved the into the de-capsulation buffer at time packet sending time + fixed_end_to_end_delay.

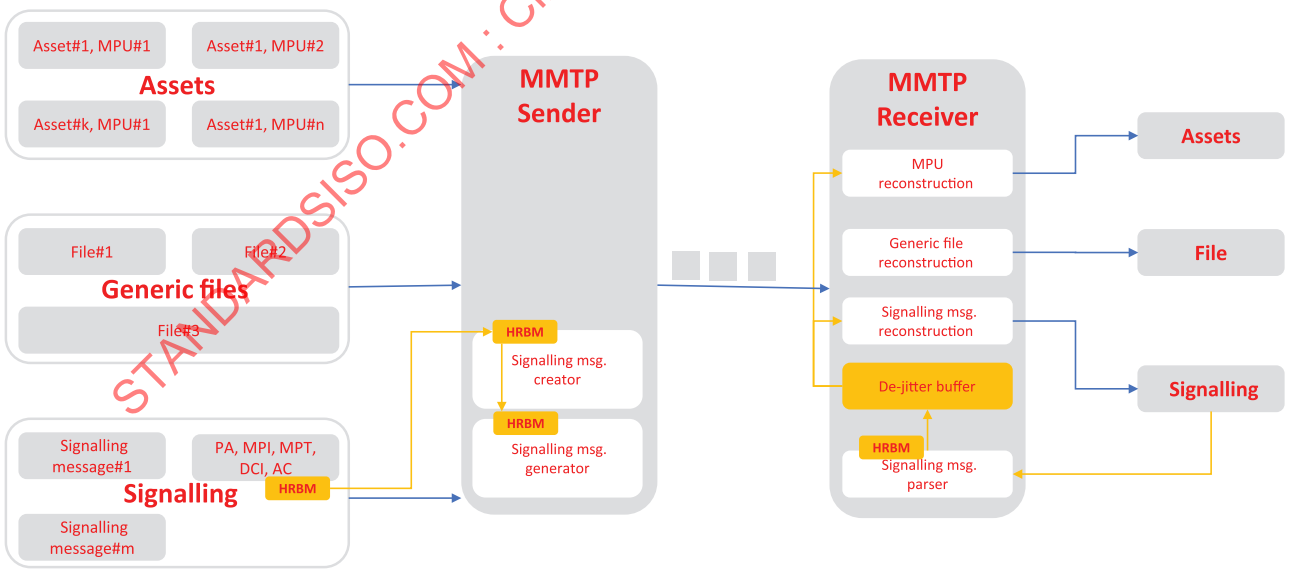


**Figure 4 — Proposal on reference software**

The HRBM message has the following fields as defined in ISO/IEC 23008-1:

— `message_id` – indicates the identifier of the HRBM message. The length of this field is 16 bits.

— `version` – indicates the version of HRBM messages. An MMT receiving can use this field to check the version of the received HRBM message. The length of this field is 8 bits.

— `length` – indicates the length of HRBM messages in bytes, counting from the first byte of the next field to the last byte of the HRBM message. The value '0' is not valid for this field. The length of this field is 16 bits.

— `max_buffer_size` – provides information for the required maximum buffer size in bytes of MMT Assets. The length of this field is 32 bits.

— `fixed_end_to_end_delay` – provides information for `fixed_end_to_end_delay` between the sending entity and the receiving entity in millisecond. The length of this field is 32 bits.

— `max_transmission_delay` – provides information for the max transmission delay between sending entity and receiving entity in millisecond. The length of this field is 32 bits.

The following source files have been updated as follows:

**HRBMMessage.h**: Defines the structure of the HRBM message and provides the public method to create the HRBM message, generates the HRBM message buffer and parses the HRBM message.

**HRBMMessage.cpp**: Implements the method to create the HRBM message, generates the HRBM message buffer and parses the HRBM message.