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**Information technology — Generic  
coding of moving pictures and  
associated audio information —**

**Part 5:  
Software simulation**

**AMENDMENT 2:  
MPEG-2 IPMP reference software**

ISO/IEC TR 13818-5:1997/Amd 2:2005  
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*Technologies de l'information — Codage générique des images  
animées et des informations sonores associées —  
Partie 5: Simulation de logiciel*

*AMENDEMENT 2: Logiciel de référence MPEG-2 IPMP*

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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.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Amendment 2 to ISO/IEC TR 13818-5:1997 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

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# Information technology — Generic coding of moving pictures and associated audio information —

## Part 5: Software simulation

### AMENDMENT 2: MPEG-2 IPMP reference software

*Replace 1.1 Scope with:*

This part of ISO/IEC 13818 provides a C language software simulation of an encoder and decoder for Part 1 (systems), Part 2 (Video), Part 3 (Audio) and Part 11 (IPMP) of ISO/IEC 13818.

*Insert the following additional references to 1.2:*

ISO/IEC 13818-1:2000, *Information technology — Generic coding of moving pictures and associated audio information: Systems*

ISO/IEC 13818-11:2003, *Information technology — Generic coding of moving pictures and associated audio information — Part 11: Intellectual Property Management and Protection (IPMP) on MPEG-2 systems.*

<https://standards.iteh.ai/catalog/standards/sist/d4dbd5aa-4c19-4544-ab11-f21d4e4f01c/iso-iec-tr-13818-5-1997-amd-2-2005>

*Insert the following text as a new IPMP Modules section at the end of ISO/IEC 13818-5:*

## 6 MPEG-2 IPMP Reference Software

### 6.1 Architecture

The codes of MPEG-2 IPMP reference software are developed with C++ on Windows Platform. However, the normative parts of the reference software don't use Windows specific libraries or functions. So it is quite easy to transport the codes to other platforms as well.

The major IPMP functionalities are encapsulated in a demultiplex filter, which uses Microsoft's DirectX technology. Doing that not only gives an easy terminal implementation, which needs to deal with demultiplexing, decoding and rendering, but also brings the benefits of a clear terminal architecture. The general architecture of the software is shown in Figure 1. Based on this given architecture, a general data flow in a MPEG-2 IPMP terminal is described as below,

An input MPEG-2 Transport Stream (TS) is fed into a demultiplex filter, which decomposes the system stream into individual elementary streams. Before the TS stream is demultiplexed, the IPMP information carried inside are extracted and processed first. IPMP related actions are taken according to the processing results. For example, if the rights condition of the TS stream is not fulfilled, further processing will be terminated and user will be prompted of the rights failure. Furthermore, global initializations are also carried upon here, e.g., checking the availability the IPMP tools specified in the IPMP Tool List, retrieving the tools in case they don't exist in terminal, etc.

The TS stream is then demultiplexed into elementary streams, typically video streams and audio streams. Before elementary streams are input to their respective decoder filters, IPMP processing is involved again, if one stream has IPMP control point set before the decoder, i.e., the IPMP descriptors associated with this stream explicitly request that data in the pre-decoder buffer need to be processed first by certain IPMP Tools, which are also specified in the IPMP descriptors. For example, decryption tools are needed to transcode encrypted data back to clear data before they can be correctly processed by decoder.

After the stream data go through the decoder filter, they are input to render filter. Before the render presents the data, IPMP is involved again to check whether the data in the pre-render buffer need to be processed by some IPMP tools first. For example, watermarking tools are used to extract signatures hidden in the stream data.

At last, the render filters present the clear stream data on user's terminals.

The internal communication between tools and terminal is in the form of IPMP messages, which are normative parts of the IPMP standard. All MPEG-2 IPMP compatible terminal and tools should understand the content of an IPMP message.

Message Routers act as an agent in the IPMP terminal. It takes charge of message sending and receiving between terminal and tools. If one tool needs to send message to another tool, the message also needs to go through terminal's Message Router and redirected to its destination. However, the interfaces between Message Router and IPMP Tools are not standardized. So the implementation can vary in different platforms and applications. This software just gives a reference implementation of the Message Router and reference model how the Message Router can facilitate the message delivering between IPMP Terminal and IPMP tools. Users are not limited by the reference implementation and free to extend from it by their wills.

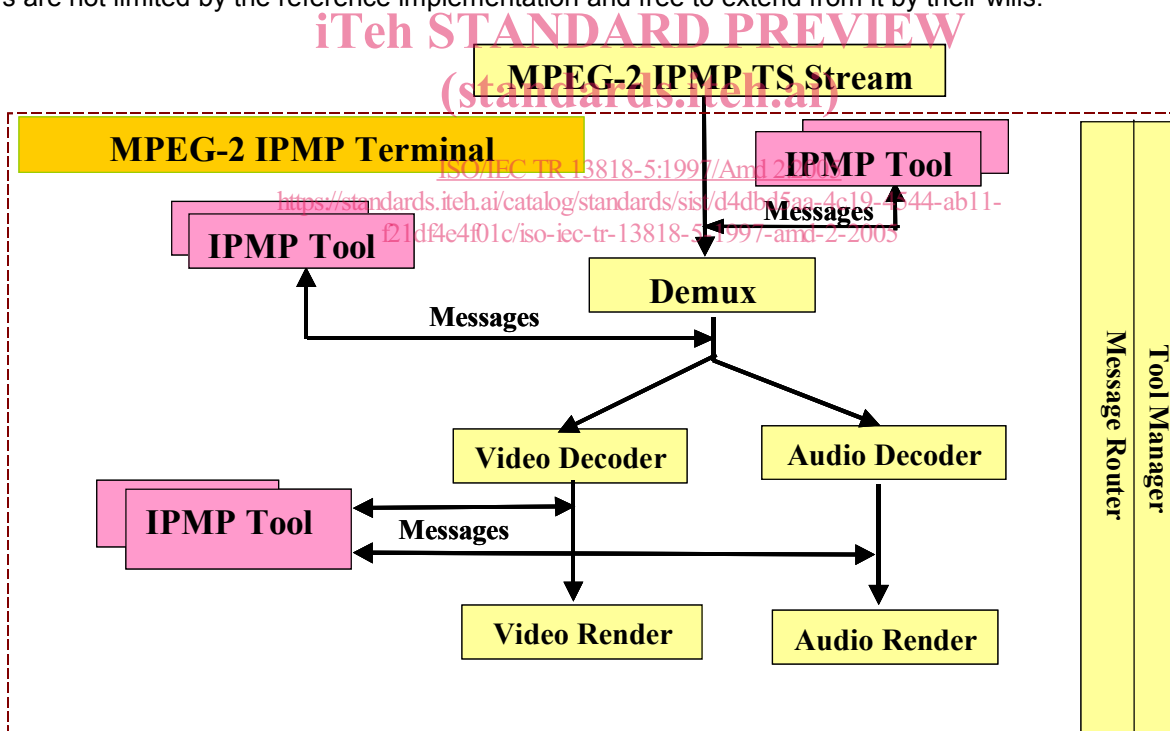


Figure AMD2-1 — MPEG-2 IPMP Terminal Architecture

Tool Manager acts as an agent to manage IPMP Tools in IPMP Terminal, e.g., loading IPMP Tool, connecting to IPMP Tool, unloading IPMP Tool, etc. Similar as Message Router, its interfaces are not standardized also. This software gives a reference implementation of the Tool Manager. Users of the software are not limited to extend its functionalities by their wills.

The following section introduces the implemented core components in details.

## 6.2 Core Components

### 6.2.1 IPMP Tool List – Normative

IPMP Tool List is carried in TS stream's PSI table. It gives the information of IPMP Tools to be used to process the given stream.

In the reference software, the modules related with IPMP Tool List are included in the demultiplex filter.

### 6.2.2 PMP Tool Container – Normative

IPMP Tool Container is carried in TS streams' PSI table. It is able to carry binary IPMP Tools. One possible scenario to use this feature is tool vendor wants to update or upgrade a updated tool with a later version.

In the reference software, the modules related with IPMP Tool Container are included in the demultiplex filter.

### 6.2.3 IPMP Rights Container - Normative

IPMP Rights Container is carried in TS streams' PSI table. It carries rights information associated with the host stream. The rights information should be extracted by the Terminal and processed by specified IPMP Tools.

In the reference software, the modules related with IPMP Rights Container are included in the demultiplex filter.

### 6.2.4 IPMP Descriptor – Normative

IPMP Descriptor is carried in TS stream's PMT table. Each descriptor is associated with an elementary stream, i.e., audio or video. Each descriptor specifies an IPMP Tool to be used to process the stream. The control point is given to tell terminal at what stage the tool to be applied.

In the reference software, the modules related with IPMP Descriptor are included in the demultiplex filter.

### 6.2.5 IPMP Messages – Normative

IPMP Messages are used to pass data and information between IPMP Terminal and IPMP Tools to facilitate IPMP processing.

There are 24 messages, listed in Table 1, defined in the MPEG-2 IPMP standard. All of them have been implemented in the reference software. They are encapsulated in an individual message library for user convenience.

**Table AMD2-1 — MPEG-2 IPMP Messages**

8-bit Tag Value	Symbolic Name
0x00	Forbidden
0x01	IPMP_OpaqueData_tag
0x02	IPMP_AudioWatermarkingInit_tag
0x03	IPMP_VideoWatermarkingInit_tag
0x04	IPMP_SelectiveDecryptionInit_tag
0x05	IPMP_KeyData_tag
0x06	IPMP_SendAudioWatermark_tag
0x07	IPMP_SendVideoWatermark_tag
0x08	IPMP_RightsData_tag
0x09	IPMP_Secure_Container_tag
0x0A	IPMP_AddToolNotificationListener_tag
0x0B	IPMP_RemoveToolNotificationListener_tag
0x0C	IPMP_InitAuthentication_tag
0x0D	IPMP_MutualAuthentication_tag
0x0E	IPMP_UserQuery_tag
0x0F	IPMP_UserQueryResponse_tag
0x10	IPMP_ToolParamCapabilitiesQuery_tag
0x11	IPMP_ToolParamCapabilitiesResponse_tag
0x12	IPMP_GetTools_tag
0x13	IPMP_GetToolsResponse_tag
0x14	IPMP_ConnectTool_tag
0x15	IPMP_DisconnectTool_tag
0x16	IPMP_NotifyToolEvent_tag
0x17	IPMP_CanProcess_tag
0x18	IPMP_TrustSecurityMetadata_tag
0x19– 0x3F	Reserved for Inter-device messages
0x40 – 0xCF	ISO Reserved
0xD0 – 0xFE	User Defined
0xFF	Forbidden

**6.2.6 IPMP Stream - Normative**

IPMP Stream carries multiple IPMP Messages, which are packed by IPMP\_StreamDataUpdate message. Multiple continuous IPMP\_StreamDataUpdate messages can be concatenated together to form IPMP stream. One usage of this stream is to carry time-variant key data, and multiplex together with video or audio elementary streams. Upon receiving IPMP\_StreamDataUpdate message, the Message Router will unpack the IPMP\_StreamDataUpdate message and extract the inside messages for further processing.

The following three messages are used to facilitate the message delivery between terminal and tools. Table AMD2-2 lists what MPEG-2 IPMP has defined.



Table AMD2-2 — MPEG-2 IPMP Facilitating Messages

8-bit Tag Value	Symbolic Name
0x00	Forbidden
0x01	IPMP_MessageFromBitstream_tag
0x02	IPMP_DescriptorFromBitstream_tag
0x03	IPMP_MessageFromTool_tag
0x04 – 0xCF	ISO Reserved
0xD0 – 0xFE	User Defined
0xFF	Forbidden

In the reference software, all above messages have been implemented in the Message library.

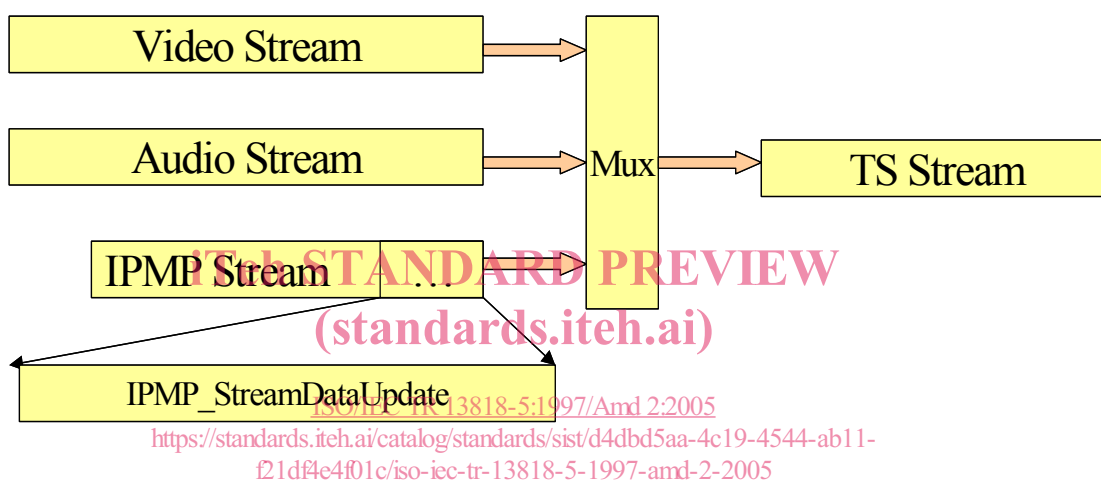


Figure AMD2-2 — IPMP Stream and other elementary streams

### 6.2.7 Message Router – Informative

Message Router manages the message delivery between Terminal and IPMP Tools. Because the practical applications could base on different platforms and have different context, the interfaces of Message Router exposed to IPMP Terminal and IPMP Tool aren't standardized. In this reference software, Class *CPSLMR* implements the major functionalities that a Message Router should have, that are receiving and delivering messages. The interfaces used by *CPSLMR* act just as reference for other users.

In the reference software, Message Router functions are encapsulated in class *CPSLMR*, which are used by the IPMP Terminal.

### 6.2.8 Tool Manager – Informative

Tool Manager manages the IPMP Tools used to process the input stream, e.g., loading the tools given in the IPMP Tool List, connecting the terminal with IPMP Tool, etc. Because the practical applications could base on different platforms and have different context, the interfaces of Tool Manager to IPMP Terminal and IPMP Tool aren't standardized. In this reference software, Class *IPMPToolManagerImp* implements the major functionalities that a Tool Manager should have. The interfaces used by *IPMPToolManagerImp* act just as reference for other users.

In the reference software, Tool Manager functions are encapsulated in class *IPMPToolManagerImp*, which are used by the IPMP Terminal.