Video Services Forum (VSF)
Technical Recommendation TR-10-10

Internet Protocol Media Experience (IPMX): HDMI InfoFrame Packet Transport

October 7, 2024

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Executive Summary

Internet Protocol Media Experience (IPMX) was created to foster the adoption of open standards-based protocols for interoperability over IP in the media and entertainment and professional audio/video industries. IPMX is based on the SMPTE ST 2110 standard.

This Technical Recommendation documents the transport of HDMI InfoFrame using RTP protocol in IPMX based on SMPTE ST 2110-41.

Table of Contents

1 Introduction (Informative)

IPMX, which stands for IP Media Experience, is based on two families of specifications. The SMPTE ST 2110 Professional Media Over Managed IP Networks suite of standards for the transport of video, audio, and ancillary/control signals over IP networks, and the NMOS REST APIs from AMWA, which provide discovery, connection management, and control.

IPMX is an accessible, open standard that meets the needs of professional and consumer video and audio users in a wide variety of contexts while giving manufacturers and developers what they need to build low-latency, interoperable, IP based audiovisual products or applications.

This Technical Recommendation (TR) covers the transport of ANSI/CTA-861 InfoFrame over an IP network using an RTP stream in an IPMX system.

1.1 Contributors

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1.2 About the Video Services Forum

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- providing forums to identify issues involving the development, engineering, installation, testing and maintenance of audio and video services;
- exchanging non-proprietary information to promote the development of video transport service technology and to foster resolution of issues common to the video services industry;
- identification of video services applications and educational services utilizing video transport services;
- promoting interoperability and encouraging technical standards for national and international standards bodies.

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Normative text describes elements of the design that are indispensable or contain the conformance language keywords: "shall," "should," or "may."

Informative text is potentially helpful to the user but not indispensable and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except the Introduction and any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed to conform to the document and from which no deviation is permitted.

The keywords "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

- SMPTE ST 2110-41:2024 Fast Metadata Framework
- HDMI 1.4b: High-Definition Multimedia Interface Specification Version 1.4b
- HDMI 2.1a: High-Definition Multimedia Interface Specification Version 2.1a
- ANSI/CEA-861-H: A DTV Profile for Uncompressed High Speed Digital Interfaces

4 Definitions

For the purposes of this Technical Recommendation, the terms, and definitions of VSF TR-10-1, SMPTE ST 2110-41 and the following apply.

InfoFrame Block	HDMI InfoFrame data transported through the mechanism defined in this TR.
Information Frame Packet	A packet formatted according to this TR, containing zero or more Information Frame Packages.
Information Frame Package	Data Item Package that contains zero or more InfoFrame Blocks and having a Data Item Type value of 0x100100.

5 General Provision

IPMX Devices that transport HDMI InfoFrame packets over an IP network shall be compliant to SMPTE ST 2110-41 subject to the constraints in this Technical Recommendation.

Note: This Technical Recommendation is targeting IPMX Senders with a baseband input that supports InfoFrames and that needs to send an InfoFrame stream corresponding to a IPMX media stream.

IPMX sender compliant to TR-10-10 shall use the same destination IP address as their corresponding media stream and a UDP destination port that corresponds to +3 from the UDP destination port used by the media stream.

A single TR-10-10 RTP stream shall be used for all Information Frame Packet corresponding to the same media stream.

6 RTP Timestamps

The RTP Clock rate and RTP Timestamp requirements for streams compliant with this TR shall match that of the IPMX Video Sender stream it is associated with.

Note: In ANSI/CTA-861 video and audio InfoFrame are sent once per frame or field of video.

7 RTP Payload Format

The Data Item Type shall be set to 0x100100 by IPMX Senders that are compliant to this TR.

IPMX Receivers that are compliant to this TR shall support Data Item Type 0x100100. Other Data Item Types may also be present in the stream, Data Item Type not supported by compliant IPMX Receivers shall be ignored.

Note: This provision enables the transport of other Data Item Types in the same RTP stream. It is not in the scope of this TR to define those other Data Item Packages.

Note: The value for Data Item Type of 0x100100 was allocated for HDMI InfoFrame use by VSF from the allocated pool provided by SMPTE and is registered in the SMPTE ST2110-41 Administrative Register.

The K bit shall be 0.

Data Item Contents shall be as defined in the Data Item Payload section below.

8 SDP Signaling

IPMX Senders compliant to this TR shall include the following session attribute in the SDP object of the associated IPMX media stream. The format of this attribute is as follows:

```
a=infoframe:<port> SSN=ST2110-41:2024;DIT=100100
```

Where port = UDP destination port number used for the TR-10-10 stream. This port number shall be equal to the UDP destination port number of the associated media stream +3.

For example, when the associated media stream UDP destination port is 5400 the following attribute is included in the media stream SDP object:

```
a=infoframe:5403 SSN=ST2110-41:2024;DIT=100100
```

9 Sender Schedule

All IPMX Senders compliant with this TR shall send at least one Information Frame Packet once per frame if the video is progressive, or once per field if the video is interlaced. Multiple Information Frame Packets may be associated with the same video frame or field.

The RTP timestamp in the Information Frame Packet shall match the timestamp used for the corresponding frame or field of the associated IPMX media stream.

Each Information Frame Packet shall be sent before the first video media packet of its associated frame or field and after the last video information packet of the previous frame or field.

10 NMOS IS-05

An IPMX Sender compliant to this TR shall extend the NMOS IS-05 Sender transport parameters with an "ext_infoframe_enabled" boolean attribute.

The "ext_infoframe_enabled" shall be set to true to indicate that the IPMX Sender produces an infoframe stream.

The "ext_infoframe_enabled" shall be set to false to indicate that the IPMX Sender does not produce an infoframe stream.

When the "ext_infoframe_enabled" attribute is not present in an IPMX Sender transport parameters, it indicates that an infoframe stream is not supported by the Sender.

11 IPMX InfoFrame Receiver

An IPMX Receiver compliant to this TR may ignore any InfoFrame Block that it is unable to process.

An IPMX Receiver compliant to this TR shall not expect that all types of InfoFrame Blocks will be present in every frame or field.

InfoFrames shall be assumed to be effective for the associated frame or field of video with the corresponding Timestamp.

12 Data Item Payload format

Figure 1 below shows the format of the Data Item Payload format for the HDMI InfoFrame used in this TR.

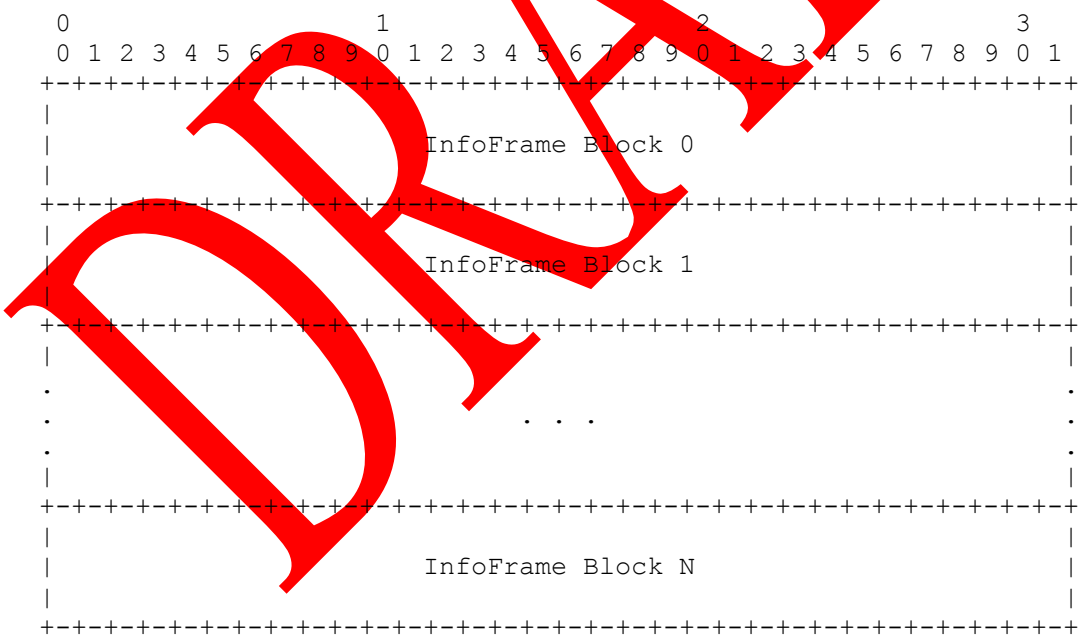

Figure 1 – HDMI InfoFrame Data Item Payload format

The Data Item Payload is composed of one or more InfoFrame Blocks. InfoFrame Blocks are defined in following section. Each InfoFrame Block shall be composed of one or more Dwords.

If there is no InfoFrame to convey, the data Item Payload shall have one Null InfoFrame Block.

13 InfoFrame Block

Figure 2 below shows the format of an InfoFrame Block when Info_Type is between 0x00 and 0x7F. InfoFrame Blocks in this range are 32 bytes. The InfoType is the value of HB0. The definition of HB0 through HB2 and PB0 through PB27 are defined in the HDMI specification. The Rsvd field shall be 0.

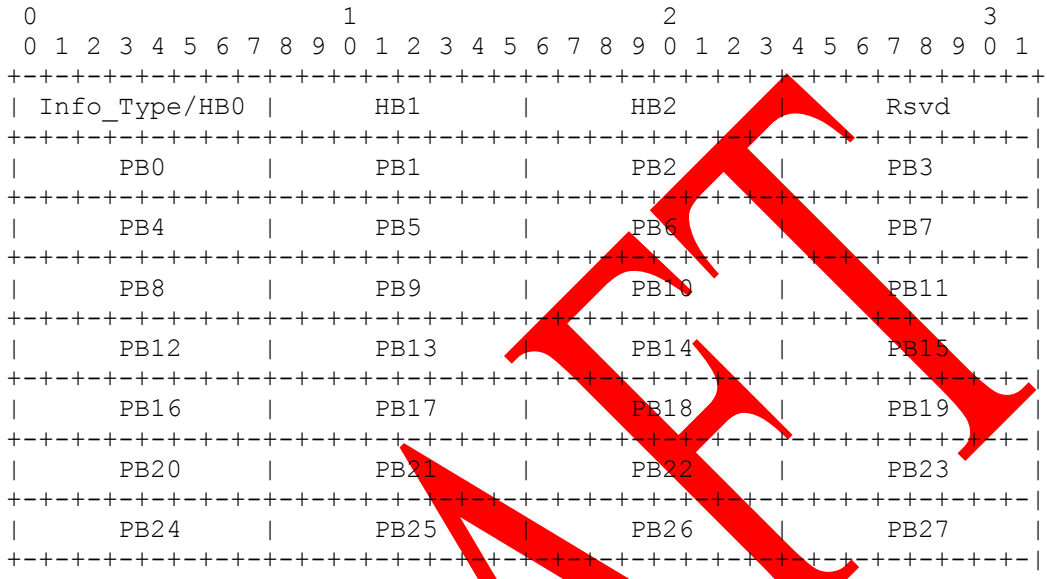

Figure 2 – InfoFrame Block for Info_Type 0x00 to 0x7F

Figure 3 below shows the format of an InfoFrame Block when Info_Type is between 0x80 and 0x8F. InfoFrame Blocks in this range have a variable number of Dwords.

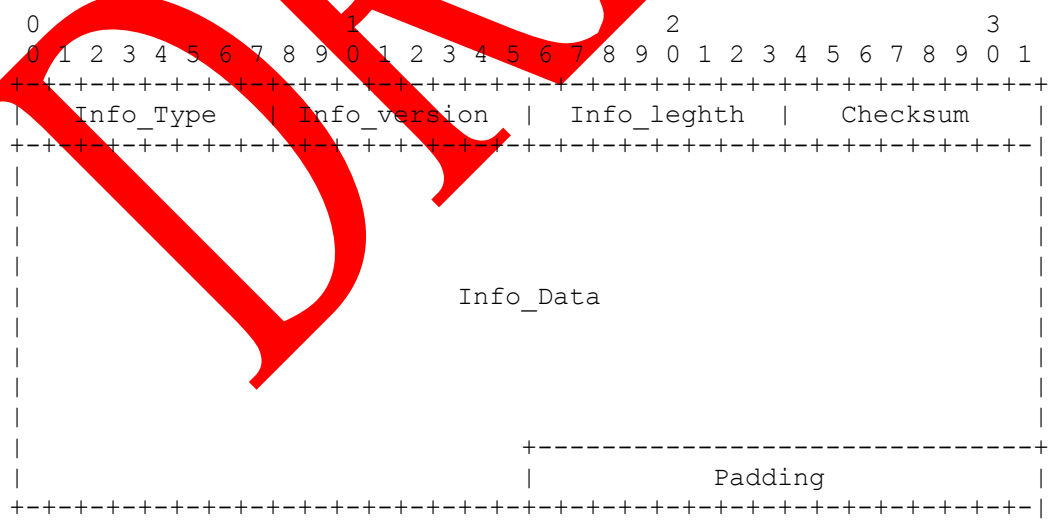

Figure 3 – InfoFrame Block for Info_Type 0x80 to 0xFF

Info_type: 8 bits

The Info_type field of the InfoFrame Block shall indicate the type of data conveyed by this InfoFrame Block. Info_type between 0x00 and 0x7F shall be defined in one of the HDMI specification. Info_type between 0x80 and 0x9F shall be as defined in the CEA-861 specification where bits 6-0 of the Info_type represents the Info Frame Type Code and bit 7 is 1. Info_type between 0xA0 and 0xFF are reserved for future use.

Info_version: 8 bits
The Info_version field of the InfoFrame Block shall indicate the version of the Info_type for this InfoFrame Block. For InfoFrame Block defined by the CEA-861 specification, CEA-861 defines the value to use for Info_version.

Info_length: 8 bits
The Info_length shall indicate the number of bytes (N) of the Info_Data field.

Info_Data: N * 8 bits
The Info_Data is the payload data of this InfoFrame Block. For InfoFrame Block defined by the CEA-861 specification, CEA-861 defines the value to use for Info_Data.

Padding: M * 8 bits
Padding is data added to the InfoFrame Block such that the InfoFrame Block is a multiple of 32 bits.

14 Null InfoFrame Block

A Null InfoFrame Block is a 32 bytes InfoFrame Block where Info_type is 0 and all bytes of the InfoFrame Block are 0.

15 Appendix A (Informative)

Table 1 below contains a list of the InfoFrame Block types from HDMI 1.4b and 2.1a specifications.

Info_type	Description	1.4b		2.1a	
		Video	Audio	Video	Audio
0x03	General Control	X	X	X	X
0x04	ACP Packet		X		X
0x05	ISRC1 Packet		X		X
0x06	ISRC2 Packet		X		X
0x0A	Gamut Metadata Packet	X		X	
0x0D	Audio Metadata Packet				X
0x7F	Extended Metadata Packet			X	
0x7F	Extended Metadata Packet			X	
0x81	Vendor-Specific InfoFrame	X		X	

0x82	AVI InfoFrame	X		X	
0x83	Source Product Descriptor InfoFrame	X		X	
0x84	Audio InfoFrame		X		X
0x87	Dynamic Range and Mastering InfoFrame			X	

Table 1 – HDMI Control and InfoFrame packets

Note: There exist other InfoFrame Block types such as NTSC vertical blanking interval information.

Note: Audio Clock Regeneration InfoFrame Block has been removed from the list since the IPMX receiver needs to generate its own Audio Clock Regeneration InfoFrame.