



VIDEO SERVICES FORUM

# **Video Services Forum (VSF) Technical Recommendation TR-10-0**

Internet Protocol Media Experience (IPMX):  
Document Organization



December 17, 2024

This work is licensed under the Creative Commons Attribution-NoDerivatives 4.0 International License. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nd/4.0/>

or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.



[www.videoservicesforum.org](http://www.videoservicesforum.org)

---

### **INTELLECTUAL PROPERTY RIGHTS**

RECIPIENTS OF THIS DOCUMENT ARE REQUESTED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT CLAIMS OR OTHER INTELLECTUAL PROPERTY RIGHTS OF WHICH THEY MAY BE AWARE THAT MIGHT BE INFRINGED BY ANY IMPLEMENTATION OF THE RECOMMENDATION SET FORTH IN THIS DOCUMENT, AND TO PROVIDE SUPPORTING DOCUMENTATION.

THIS RECOMMENDATION IS BEING OFFERED WITHOUT ANY WARRANTY WHATSOEVER, AND IN PARTICULAR, ANY WARRANTY OF NONINFRINGEMENT IS EXPRESSLY DISCLAIMED. ANY USE OF THIS RECOMMENDATION SHALL BE MADE ENTIRELY AT THE IMPLEMENTER'S OWN RISK, AND NEITHER THE FORUM, NOR ANY OF ITS MEMBERS OR SUBMITTERS, SHALL HAVE ANY LIABILITY WHATSOEVER TO ANY IMPLEMENTER OR THIRD PARTY FOR ANY DAMAGES OF ANY NATURE WHATSOEVER, DIRECTLY OR INDIRECTLY, ARISING FROM THE USE OF THIS RECOMMENDATION.

### **LIMITATION OF LIABILITY**

VSF SHALL NOT BE LIABLE FOR ANY AND ALL DAMAGES, DIRECT OR INDIRECT, ARISING FROM OR RELATING TO ANY USE OF THE CONTENTS CONTAINED HEREIN, INCLUDING WITHOUT LIMITATION ANY AND ALL INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING DAMAGES FOR LOSS OF BUSINESS, LOSS OF PROFITS, LITIGATION, OR THE LIKE), WHETHER BASED UPON BREACH OF CONTRACT, BREACH OF WARRANTY, TORT (INCLUDING NEGLIGENCE), PRODUCT LIABILITY OR OTHERWISE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE FOREGOING NEGATION OF DAMAGES IS A FUNDAMENTAL ELEMENT OF THE USE OF THE CONTENTS HEREOF, AND THESE CONTENTS WOULD NOT BE PUBLISHED BY VSF WITHOUT SUCH LIMITATIONS.



## **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 and as such the VSF TR-10 suite of Technical Recommendations is a set of differences between SMPTE ST 2110 and IPMX.

The VSF TR-10-0 document describes the organization of the various Technical Recommendation documents that form the TR-10 specification.

## Table of Contents

1	Introduction (Informative) .....	4
2	Contributors .....	4
3	About the Video Services Forum.....	4
4	TR-10 General Organization.....	5
	TR-10-1 IPMX System Timing and Definitions.....	5
	TR-10-2 IPMX Uncompressed Active Video.....	5
	TR-10-3 IPMX PCM Digital Audio .....	5
	TR-10-4 IPMX SMPTE ST 291-1 Ancillary Data.....	5
	TR-10-5 IPMX HDCP Key Exchange Protocol .....	6
	TR-10-6 IPMX Forward Error Correction (FEC).....	6
	TR-10-8 IPMX NMOS Requirements .....	6
	TR-10-10 HDMI InfoFrame Packet Transport .....	6
	TR-10-11 IPMX Constant Bit-Rate Compressed Video.....	6
	TR-10-12 IPMX AES3 Transparent Transport.....	6

## 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 document describes the various documents that form the IPMX TR-10 Technical Recommendations.

**This document is informative and contains no normative provisions.**

## 2 Contributors

The following individuals participated in the Video Services Forum IPMX working group that developed this Technical Recommendation.

Aaron Doughten (Sencore)	Charles Buyschaert (Intopix)	Jean-Baptiste Lorent (IntoPIX)	Phil Nguyen (Nextera)
Alain Bouchard (Matrox)	Chris Lapp (Cisco)	Jed Deame (Nextera Video)	Prinyar Boon (Phabrix)
Albert Faust (Arista)	Clark Williams (Christie Digital)	JJ Eynon (CNN)	Raul Diaz (Intel)
Andre Testa (Matrox)	Daniel BOUQUET (Analogway)	John Belstner (Intel)	Raymond Hermans (Adeas)
Andreas Hildebrand (ALC NetworX)	Danny Pierini (Matrox)	John Dale (Media Links)	Robert Welch (Arista)
Andrew Starks (Macnica)	David Chiappini (Matrox)	John Fletcher (BBC)	Ron Stites (Macnica)
Antoine Hermans (Adeas)	David Mitchinson (Appear TV)	Karl Johnson (Christie Digital)	Tadahiro Watanabe (Macnica)
Arnaud Germain (Intopix)	Gerard Phillips (Arista)	Karl Paulsen (Diversified)	Teiji Kubota (Macnica)
Ben Cope (Intel)	Greg Schlechter (Intel)	Marc Levy (Macnica)	Thomas True (NVIDIA)
Brad Gilmer (VSF)	Greg Stigall (Warner Media)	Mike Boucke (AJA)	Tim Bruylants (intopix)
Bob Ruhl (VSF)	Jack Douglass (PacketStorm)	Paulo Francisco (Evertz)	Wes Simpson (LearnIPvideo)
Cassidy Phillips (Imagine)	Jean Lapierre (Matrox)	Peter Brightwell (BBC)	

## 3 About the Video Services Forum

The Video Services Forum, Inc. ([www.videoservicesforum.org](http://www.videoservicesforum.org)) is an international association dedicated to video transport technologies, interoperability, quality metrics and education. The VSF is composed of service providers, users and manufacturers. The organization's activities include:

- 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.

The VSF is an association incorporated under the Not For Profit Corporation Law of the State of New York. Membership is open to businesses, public sector organizations and individuals worldwide. For more information on the Video Services Forum or this document, please call +1 929-279-1995 or e-mail [opsmgr@videoservicesforum.org](mailto:opsmgr@videoservicesforum.org).

## **4 TR-10 General Organization**

The transport protocol portion of IPMX is based on SMPTE ST 2110. The TR-10 Technical Recommendations that cover the transport protocol, outline the differences between the SMPTE ST 2110 Standard and VSF TR-10. TR-10 adds requirements related to the mandated use of AMWA NMOS for IPMX.

### **TR-10-1 IPMX System Timing and Definitions**

This Technical Recommendation corresponds to the SMPTE ST 2110-10 document and describes the System Timing used in IPMX. It also defines basic terms used in the IPMX TR-10 family of recommendations. Some of the subject covered in this document include how IPMX supports asynchronous media sources, the IPMX traffic shaping model, and how IPMX supports networks where PTP is present and in network where PTP is not present.

### **TR-10-2 IPMX Uncompressed Active Video**

This Technical Recommendation corresponds to the SMPTE ST 2110-20 document and describes the transport of uncompressed active video using RTP protocol in IPMX. It documents the differences between TR-10-2 and SMPTE ST 2110-20. Some of the subject covered in this document include the payload format, Media Clock, RTP Clock, RTP Timestamps and the IPMX Info Block definition for uncompressed active video.

### **TR-10-3 IPMX PCM Digital Audio**

This Technical Recommendation corresponds to the SMPTE ST 2110-30 document and describes the transport of PCM digital audio using RTP protocol in IPMX. It documents the differences between TR-10-3 and SMPTE ST 2110-30. Some of the subject covered in this document include the payload format, sample rate, Media Clock, RTP Clock, RTP Timestamps and the IPMX Info Block definition for PCM digital audio.

### **TR-10-4 IPMX SMPTE ST 291-1 Ancillary Data**

This Technical Recommendation corresponds to the SMPTE ST 2110-40 document and describes the transport of SMPTE ST 291-1 ancillary data using RTP protocol in IPMX. It

documents the differences between TR-10-4 and SMPTE ST 2110-40. Some of the subject covered in this document include Media Clock, RTP Clock, RTP Timestamps and the IPMX Info Block definition for SMPTE ST 291-1 ancillary data.

### **TR-10-5 IPMX HDCP Key Exchange Protocol**

This document describes interoperability requirements for devices implementing the “High-bandwidth Digital Content Protection System: Direct Adaptation Amendment, Revision 2.3, May 19, 2021” amendment of the “High-bandwidth Digital Content Protection System: Interface Independent Adaptation, Revision 2.3, May 02, 2018” specification.

### **TR-10-6 IPMX Forward Error Correction (FEC)**

This document describes a Forward Error Correction profile of SMPTE ST 2022-5 for use with IPMX.

### **TR-10-7 IPMX NMOS Requirements**

This Technical Recommendation documents the transport of IPMX RTP streams for any compressed video that does not generate a constant number of bytes per frame as required by TR-10-11. It documents the differences between TR-10-7 and SMPTE ST 2110-22. Some of the subjects covered in this document include payload format, Media Clock, RTP Clock, RTP Timestamps and the IPMX Info Block definition for TR-10-7 compressed video transport.

### **TR-10-8 IPMX NMOS Requirements**

This Technical Recommendation documents the minimum requirements for IPMX Devices with respect to AMWA NMOS support. It documents the requirements and some implementation details related to the AMWA NMOS suite of specifications that concern devices that implement the IPMX TR-10 suites of Technical Recommendations.

### **TR-10-10 HDMI InfoFrame Packet Transport**

This Technical Recommendation documents the transport of HDMI InfoFrame using RTP protocol in IPMX.

### **TR-10-11 IPMX Constant Bit-Rate Compressed Video**

This Technical Recommendation corresponds to the SMPTE ST 2110-22 document and describes the transport of constant bit-rate compressed video using RTP protocol in IPMX. It documents the differences between TR-10-11 and SMPTE ST 2110-22. Some of the subject covered in this document include payload format, Media Clock, RTP Clock, RTP Timestamps and the IPMX Info Block definition for constant bit-rate compressed video.

### **TR-10-12 IPMX AES3 Transparent Transport**

This Technical Recommendation corresponds to the SMPTE ST 2110-31 document and describes the transparent transport of AES3 audio using RTP protocol in IPMX. It documents the differences between TR-10-3 and SMPTE ST 2110-31. Some of the subject covered in this

document include the RTP encapsulation, Media Clock, RTP Clock, RTP Timestamps and the IPMX Info Block definition for AES3 audio.

### **TR-10-13 IPMX Privacy Encryption Protocol (PEP)**

This Technical Recommendation describes a method generating keying material for encrypting, decrypting and authenticating media content over multicast and unicast networks. It is designed to support multiple types of transport protocol adaptations. The default adaptation defined in this document describes privacy encryption of media streams having an RTP payload format.

### **TR-10-14 IPMX USB**

This technical recommendation defines the transport layer technologies for IPMX USB-over-IP networks.

## **5 TR-10 Media Info Block Type**

IPMX Senders send RTCP Sender Reports as outlined in TR-10-1. These RTCP Sender Reports include an IPMX Info Block extension and sometimes a Media Info Block. The Media Info Block contains a Media Info Block type identifier that identifies the type of Media Info Block used.

The following table shows the currently allocated values for Media Info Block type and in which TR-10 specification where each one is defined.

<b>Media Info Block type</b>	<b>Specification where defined</b>
0x0001	TR-10-2
0x0002	TR-10-3
0x0003	TR-10-11
0x0004	TR-10-12
0x0005	TR-10-7

Table 1 – Media Info Block type allocation