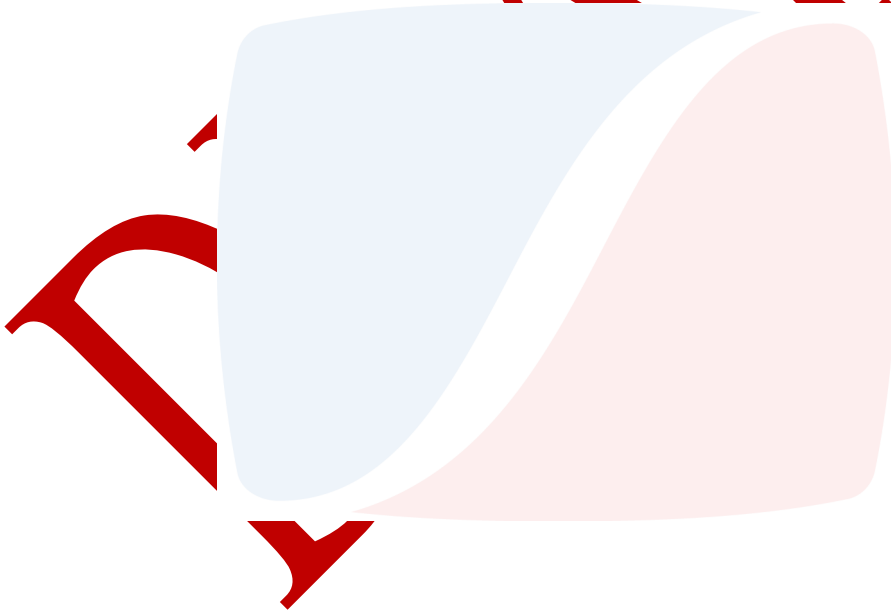




VIDEO SERVICES FORUM

# **Video Services Forum (VSF) Technical Recommendation TR-10-7**

## **Internet Protocol Media Experience (IPMX): Compressed Video**



November 22, 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.



<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THE FOREGOING NEGATION OF DAMAGES IS A FUNDAMENTAL ELEMENT OF THE USE OF THE CONTENTS HEREOF, AND THESE CONTENTS WOULD NOT BE PUBLISHED BY VSF WITHOUT SUCH LIMITATIONS.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 (M&E) and professional audio/video industries. IPMX is based on the SMPTE ST 2110 and as such the VSF TR-10 suite of Technical Recommendations is built as set of differences between SMPTE ST 2110 and IPMX.

Since some constant bit rate compression methodology only guarantees a constant number of bytes over a longer period than one frame; TR-10-11 cannot be used for video compressed using such compression methods. 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. 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.

**DRAFT**

## Table of Contents

Table of Contents .....	4
1 Introduction (Informative) .....	5
2 Contributors .....	5
3 About the Video Services Forum.....	5
4 Conformance Notation.....	6
5 Normative References.....	7
6 Definitions.....	7
7 General Provisions .....	7
8 Payload Format .....	8
9 Media Clock, RTP Clock, and RTP Timestamps.....	8
10 Transmission Traffic Shape Models .....	8
11 Session Description Protocol (SDP).....	8
12 IPMX Info Block for Compressed Video.....	9

**DRAFT**

## 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 IPMX transport of compressed video that does not generate a constant number of bytes per frame. Other parts of the TR-10 family of Technical Recommendations describe IPMX individual media essence types, along with their requirements, and defines other aspects of the IPMX system.

## 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 Conformance Notation

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.

## 5 Normative References

- SMPTE ST 2110-22:2022 Professional Media Over Managed IP Networks: Constant Bit-Rate Compressed Video
- SMPTE ST 2110-10:2022 Professional Media over Managed IP Networks: System Timing and Definitions
- VSF TR-10-1 Internet Protocol Media Experience (IPMX): System Timing and Definitions

## 6 Definitions

For the purposes of this document, the terms, and definitions of VSF TR-10-1 apply.

## 7 General Provisions

All Compressed Video IPMX Senders and Receivers compliant with this TR shall comply with the following specifications:

Compressed Video IPMX Senders and Receivers shall comply with the provisions of VSF TR-10-1 System Timing and Definitions, subject to the additional constraints in this document.

IPMX network interface requirements shall be in accordance with the provisions of SMPTE ST 2110-10 section 6, subject to the additional constraints in this document.

All IPMX Media streams shall have a UDP destination port value that is even, and that is greater than 1024.

All IPMX Media streams should have a UDP destination port value that is greater than 5000.

Note: The interested reader can refer to RFC 3551 section 8 for a description of the selection of the above port number range.

The UDP size of each RTP packet shall not exceed the Standard UDP Size Limit as specified in SMPTE ST 2110-10.

To ensure interoperability, separate TR-10 documents define the profiles and implementation details for each compressed video format that uses TR-10-7 as an RTP transport mechanism.

## 8 Payload Format

The payload format of TR-10-7 media streams shall be according to SMPTE ST-2110-22 section 6.

## 9 Media Clock, RTP Clock, and RTP Timestamps

The Media Clock and RTP Clock shall comply with the provisions of VSF TR-10-1 for an IPMX Video Sender.

The Media Clock and RTP Clock rate for streams compliant with this TR shall be 90 kHz.

All RTP packets which are part of the same progressive frame shall contain the same RTP Timestamp value.

All RTP packets which are part of the same interlaced field shall contain the same RTP Timestamp value.

## 10 Transmission Traffic Shape Models

The traffic shaping and delivery timing shall be in accordance with the Network Compatibility Model for video from TR-10-1 section 8.1 (Video Transmission Traffic Shape Models).

Because of the non-constant bitrate nature of TR-10-7 streams; when computing  $C_{MAX}$ , the maximum target bitrate (  $MaxRate$  ) of the encoded media stream in units of packets per second shall be used instead of  $N_{PACKETS} / T_{FRAME}$ . For this TR the following equation shall be used to calculate  $C_{MAX}$ :

$$C_{MAX} = MAX(16, INT(MaxRate / 21600))$$

The Virtual Receiver Buffer Model from TR-10-1 section 8.1 (Video Transmission Traffic Shape Models), does not apply to this TR.

Note: Receiver buffer management is left to individual compressed transport standards to specify because requirements are likely to differ, depending on the compressed format.

## 11 Session Description Protocol (SDP)

The SDP object shall be constructed as described in ST 2110-22 section 7, subject also to the provisions of TR-10-1.

Devices conforming to this TR shall use the following table instead of table 3 from ST 2110-22 section 7.3

Syntax	Definition
--------	------------



b=<brtype>:<brvalue>	This attribute shall be as defined in RFC 4566. The <brtype> shall be AS (application specific). The <brvalue> shall be the maximum target bit rate of the encoded media stream. It shall be expressed as an integer number of kilobits per second, where kilobit means 1000 bits, rounding up if necessary. The bit rate shall include the whole of each IP packet, i.e. IP headers and payload. The bit rate shall not include layers below IP (such as Ethernet).
----------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Table 1 – Bit rate attribute

IPMX Senders shall make their SDP object available through the management programming interface of the device.

## 12 IPMX Info Block for Compressed Video

IPMX Senders shall send RTCP Sender Reports as outlined in TR-10-1. These RTCP Sender Reports shall include an IPMX Info Block extension and a Media Info Block. The Media Info Block type for compressed video shall be 0x0005.

The Media Info Block content for compressed video shall follow that of the Media Info Block for uncompressed active video as documented in TR-10-2 section 10 (IPMX Info block definition for uncompressed active video).

Other Media Info Block may be added at the end of the IPMX Info Block to further describe the media parameters related to the video compression format used in the payload.