

SMPTE STANDARD

Transport of High Bit Rate Media Signals over IP Networks (HBRMT)



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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Operations Manual.

SMPTE ST 2022-6 was prepared by Technology Committee 32NF.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

IP-based networks have become increasingly important for delivery of media content such as SMPTE ST 259, SMPTE ST 292-1 and SMPTE ST 424 streams. However, existing transport protocols do not fully meet the user requirements. This standard describes a transport protocol which can be used for the real time transport of video/audio over IP networks. In this standard, it is specified that the entire payload of the serial digital interface signal including all VANC and HANC is encapsulated as one stream. The payload packing into RTP datagrams is designed to allow implementers to conveniently employ error concealment in the case where no FEC is utilized, or in the case that errors extend beyond what the FEC is capable of correcting. The acronym HBRMT (High Bit Rate Media Transport) has developed a modicum of support in the industry in reference to the technique standardized in this document.

This standard is intended for real-time audio/video applications such as contribution, primary distribution, and digital cinema. This standard is designed to be applied to television transport for broadcast production and is not intended for emission purposes. Typically a connection will be set up and torn down as a managed configuration of transmitting and receiving equipment. A connection may be unicast or multicast. Support of RFC 4566 Session Description Protocol (SDP) or RFC 3550 Real Time Control Protocol (RTCP) are not required for equipment supporting this standard but could be utilized at the implementers discretion.

The method described herein has been in the process of standardization for several years. The informal name "High Bit-Rate Media Transport" and the acronym "HBRMT" have been associated with the work throughout that time. The mention of HBRMT in the title of this document references that heritage.

This standard makes provision for, and specifies relevant parameter limits of an optional FEC mechanism. Details of the FEC implementation are defined in a separate standard document.

1 Scope

This standard defines a unidirectional IP-based protocol for the transport of real-time video, audio, and ancillary signals. In particular this standard defines a method for the encapsulation of the payloads of a variety of existing SMPTE serial digital video standards.

The term High Bit Rate is used herein to distinguish from other Media-over-IP applications in which compressed signals are transported. The uncompressed signals in this document are at rates of 270 Mbits/sec and higher.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that 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, 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 in order 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

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 259:2008) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 259M-2008). Documents with the same root number (e.g. 259) and publication year (e.g. 2008) are functionally identical.

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

IETF RFC 3550, RTP: A Transport Protocol for Real-Time Applications

Recommendation ITU-R BT.656-5, Interface for Digital Video Signals in 525-Line and 625-Line Television Systems Operating at the 4:2:2 Level of Recommendation ITU-R BT.601

SMPTE ST 259:2008, Television — SDTV Digital Signal/Data — Serial Digital Interface

SMPTE ST 292-1:2012, 1.5 Gb/s Signal/Data Serial Interface

SMPTE ST 425-1:2011, Source Image Format and Ancillary Data Mapping for the 3 Gb/s Serial Interface

SMPTE ST 2022-1:2007, Forward Error Correction for Real-Time Video/Audio Transport Over IP Networks

SMPTE ST 2022-5:2012, Forward Error Correction for High Bit Rate Media Transport Over IP Networks

4 Acronyms

D: Number of Rows in an FEC Matrix

DiffServ: Differentiated Services (see IETF RFC 2474)

FEC: Forward Error Correction

HBRMT: High Bit Rate Media Transport

IP: Internet Protocol (see IETF STD05)

L: (Length) Number of Columns in an FEC Matrix

MTU: Maximum Transmission Unit

RSVP: Resource Reservation Protocol (see IETF RFC 2205)

RTP: Real Time Protocol (see IETF RFC 3550)

SDI: Serial Digital Interface

SSRC: Synchronization Source List

TOS: Type Of Service

TS: Timestamp

UDP: User Datagram Protocol (see IETF STD06)

UTC: Coordinated Universal Time

XOR: Exclusive OR

5 Definitions

5.1

Block Aligned FEC Operation

Block Aligned FEC Operation is a correction scheme using a two dimensional matrix where the Media Datagrams are a contiguous group of $L \times D$ datagrams. The Media Datagrams are protected as follows. Level A protection is achieved by L FEC Datagrams derived from each column for the FEC Matrix. Optional level B protection is achieved by D FEC Datagrams derived from each row for the FEC Matrix. Level A FEC stream shall protect all media packets exactly once. Optional Level B FEC stream shall protect all media packets exactly once.

5.2

FEC Datagram

An FEC Datagram is an RTP Datagram consisting of an RTP Header and an FEC Payload. The FEC Payload is composed of an FEC Header and the FEC Payload. The FEC Datagrams are formatted according to the rules specified in SMPTE ST 2022-5.

5.3

FEC Header

The FEC Header is the header information contained in an FEC Datagram.

5.4

FEC Matrix

An FEC Matrix is a set of Media Datagrams ordered in a matrix with L columns and D rows. The datagrams are entered into the matrix to fill each row sequentially with incremented RTP sequence numbers.

5.5

FEC Payload

The FEC Payload is the payload of an FEC Datagram.

5.6

High Bit Rate

At the time of development of this Standard, High Bit Rate commonly refers to transmission rates higher than 270 Mb/s (SDI, HD SDI, 3G), although the techniques specified herein may have continued utility at higher rates (e.g. 40 Gb/s, 100 Gb/s) as technology allows.

5.7

IP Stream

An individual flow of media and / or FEC datagrams on an IP network which includes all necessary components of the video signal including video, embedded audio, and embedded ancillary data signals.

5.8

Media Datagram

A Media Datagram is an RTP Datagram consisting of an RTP header and the media data payload. The media data payload is composed of a Payload Header and a Media Payload.

5.9

Media Payload

The Media Payload is the raw data (including video, audio, and ancillary data) that are transmitted from the sender. The Payload Header and the Media Payload are placed inside of a Media Datagram.

5.10

Non Block-Aligned FEC Operation

A Non Block-Aligned FEC Operation is a correction scheme similar to a Block-Aligned FEC Operation, but performed over non-contiguous Media Datagrams. In a Non Block-aligned FEC Operation the FEC columns are offset from each other to facilitate Traffic Shaping and/or lower Latency. The FEC rows of a Non Block-Aligned FEC Operation cover contiguous Media Datagrams.