

SMPTE STANDARD

Unidirectional Transport of Variable Bit Rate MPEG-2 Transport Streams on IP Networks



Page 1 of 16 pages

Table of Contents	Page
Foreword	2
Intellectual Property	2
Introduction.....	2
1 Scope	3
2 Conformance Notation	3
3 Normative References	4
4 Acronyms (Informative).....	4
5 Definitions (Normative).....	5
6 Transmission Protocols (Normative).....	5
6.1 Relationship with other SMPTE 2022 Standards.....	5
6.2 TS Packets per Media Datagram.....	6
6.3 Timing Recovery	6
6.4 FEC Operation	6
6.5 Media Datagram RTP Numbering.....	8
6.6 Session	9
7 Compliance	9
Annex A Bibliography (Informative)	12
Annex B Sending Device Options (Informative).....	13
Annex C Clock Recovery Method (Informative).....	14

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 Administrative Practices.

SMPTE ST 2022-3 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

IP-based networks have become increasingly important for delivery of compressed content which is contained within MPEG-2 Transport Streams. However, existing transport protocols do not fully meet the user requirements. This standard describes modifications to existing transport protocols which can be used for the unidirectional carriage of piecewise constant variable bit rate MPEG-2 Transport Streams over IP networks.

This standard is intended for real-time audio/video applications for contribution services over an IP network to professional broadcast equipment. The applications addressed by this standard may employ any compression scheme that is supported by the MPEG-2 Transport Stream.

This standard also provides for signal recovery from limited network errors through a forward error correction scheme.

1 Scope

This standard defines a transport protocol for the carriage of real-time piecewise constant variable bit rate (VBR) MPEG-2 Transport Streams over IP networks, either with or without Forward Error Correction for recovery from network transmission errors. A piecewise constant VBR transport stream can only vary at the PCRs of the program under consideration per ISO/IEC 13818-1:2007 § 2.4.2.2.

This standard covers the encapsulation and transmission of MPEG-2 transport streams but does not cover other processes such as MPEG-2 encoding or multiplexing. The scope of this standard is shown in Figure 1. below.

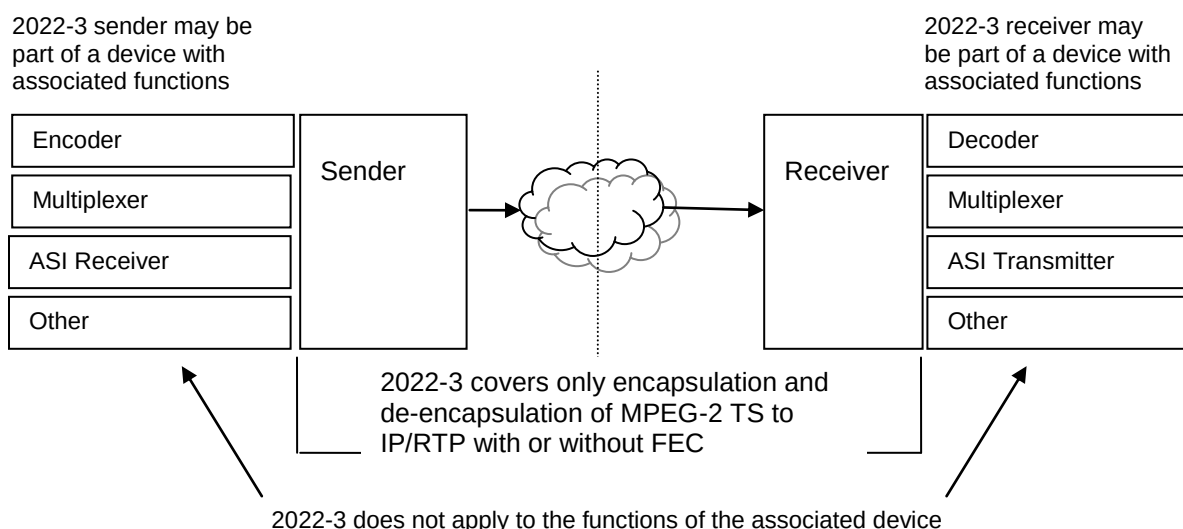


Figure 1 – SMPTE 2022-3 Scope Boundaries

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

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.

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

SMPTE 2022-2-2007, Unidirectional Transport of Constant Bit Rate MPEG-2 Transport Streams on IP Networks

ISO/IEC 13818-1:2007, ITU-T H.222.0-2006, Generic Coding of Moving Pictures and Associated Audio Information Systems

4 Acronyms (Informative)

CBR: Constant Bit Rate

D: Number of Rows in an FEC matrix

FEC: Forward Error Correction

IP: Internet Protocol (see IETF STD 05)

L: Number of Columns in an FEC matrix

PCR: Program Clock Reference

RTP: Real Time Protocol (see IETF RFC 3550)

TS: Transport Stream (see ISO/IEC 13818-1)

UDP: User Datagram Protocol (see IETF STD 06)

VBR: Variable Bit Rate

XOR: Exclusive OR

5 Definitions (Normative)

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 provided 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. The level A FEC stream shall protect all media packets exactly once. The optional level B FEC stream shall protect all media packets exactly once.

CBR Transport Stream: A MPEG-2 compliant Transport Stream constructed such that the rate of departure of packets from a sender is constant over time.

Contribution Services: Unidirectional transmission of high quality media content to a media processing facility. These services require high quality transmission such that the signal maintains sufficient quality to support further processing prior to final distribution.

Fill Datagram: An RTP Datagram consisting of a header and no payload.

FEC Matrix: 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.

Media Datagram: An RTP Datagram consisting of a header and data payload composed of an integer number of MPEG-2 TS packets

Null Packet: An MPEG-2 Transport Stream packet consisting of a PID value of 0x1FFF and an undefined payload.

Piecewise Constant: A VBR transport stream that can change rate at packets containing PCRs such that the rate of departure of packets from a sender is constant between successive PCR packets, according to ISO/IEC 13818-1 §2.4.2.2.

RTP Datagram: An RTP Packet as defined in RFC3550. A self-contained, independent entity of data carrying sufficient information to be routed from the source to the destination computer without reliance on earlier exchanges between this source and destination computer and the transporting network.

TS Packet: A MPEG-2 Transport Stream packet of 188 or 204 bytes in length. (The use of 188 and 204 byte packets are defined as class of service in SMPTE 2022-2.)

VBR Transport Stream: A MPEG-2 compliant Transport Stream such that the rate of departure of packets from a sender is not constant.

6 Transmission Protocols (Normative)

6.1 Relationship with other SMPTE 2022 Standards

This standard requires compliance with SMPTE 2022-1 and SMPTE 2022-2, with the exceptions that are defined in this standard. If a conflict occurs between this standard and either SMPTE 2022-1 or SMPTE 2022-2, this standard shall prevail.

The Payload Type field of the RTP header shall be set to 33 indicating MPEG-2 TS.