

SMPTE STANDARD



Open Binding of Content Identifiers
(OBID)

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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 its Standards Operations Manual. This SMPTE Engineering Document was prepared by Technology Committee 24TB.

Intellectual Property

SMPTE draws attention to the fact that it is claimed that compliance with this Standard may involve the use of one or more patents or other intellectual property rights (collectively, "IPR"). The Society takes no position concerning the evidence, validity, or scope of this IPR.

Each holder of claimed IPR has assured the Society that it is willing to License all IPR it owns, and any third party IPR it has the right to sublicense, that is essential to the implementation of this Standard to those (Members and non-Members alike) desiring to implement this Standard under reasonable terms and conditions, demonstrably free of discrimination. Each holder of claimed IPR has filed a statement to such effect with SMPTE. Information may be obtained from the Director, Standards & Engineering at SMPTE Headquarters.

Attention is also drawn to the possibility that elements of this Standard may be subject to IPR other than those identified above. The Society shall not be responsible for identifying any or all such IPR.

Introduction

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

This document specifies a means of binding content identifiers (Ad-ID and EIDR) to audiovisual content in such a way that it survives processing encountered on the way to the viewer, allowing the content to be accurately identified, regardless of how it got to the viewer.

Scope

This document describes a method of binding content identifiers to media, utilizing audio watermarking, allowing the content to be identified both electronically and acoustically.

1. 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 clause 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; then formal languages; then figures; and then any other language forms.

2. Normative References

The following documents, in whole or in part, as referenced in this document, contain specific provisions that are to be followed strictly in order to implement a provision of this Standard.

SMPTE RP 2092-1:2015 - SMPTE Recommended Practice - Advertising Digital Identifier (Ad-ID®) Representations

SMPTE RP 2079:2017 - SMPTE Recommended Practice - Digital Object Identifier (DOI) Name and Entertainment ID Registry (EIDR) Identifier Representations

3. Terms and Definitions

With respect to definition of terms, abbreviations, and units, the practice of the Institute of Electrical and Electronics Engineers (IEEE) as outlined in the Institute's Doc. SI 10 shall be used. Where an abbreviation is not covered by IEEE practice or industry practice differs from IEEE practice, the abbreviation in question will be described in this document.

For the purposes of this document, the following terms and definitions apply.

3.1 Ad-ID

industry standard identifier for advertising content

3.2 acoustic path

transmission of sound from a loudspeaker through the air to a microphone.

3.3 audio signal

single channel (monophonic) of audio

3.4 audio program

set of audio signals that are intended to be rendered simultaneously

Note to entry: for example, a stereophonic audio program or 5.1 multichannel audio program

3.5 audio watermark

data that is embedded in an audio stream in such a way that it can be extracted by a watermark decoder

3.6 EIDR

Entertainment Industry Data Registry.

Note to entry: Industry standard identifier for program content

3.7 embed

modify the audio signal by adding the audio watermark

3.8 embedder

tool that is able to embed the audio watermark in the audio signal

3.9 decoder

tool that is able to detect and extract an audio watermark embedded in a marked audio signal

3.10 symbol

representation of binary information in the audio watermark

3.11 marked audio

audio that has an audio watermark embedded in it

3.12 OBID

content identifier bound to media using the audio watermarking process defined in this standard

3.13 packet

sequence of contiguous symbols that contains independently recoverable information data

3.14 linear PCM

Pulse Code Modulation audio that has not been bit rate reduced

3.15 synchronization symbol

specific symbol that defines the start of a packet

3.16 whitening

linear transformation that transforms a vector of random variables with a known covariance matrix into a set of new variables whose covariance is the identity matrix, meaning that they are uncorrelated and each have variance 1. The transformation is called "whitening" because it changes the input vector into a white noise vector.

4. System Overview (Informative)

Audio watermarking is a signal processing technology that enables the embedding of digital data information into the audio signal itself. It implements audio processing solutions that are resilient to most types of audio distribution systems including lossy bitrate compression systems.

Figure 1: Audio watermark system architecture shows a block diagram illustrating the basic audio watermarking process. The original unmarked audio signal is sent to the watermark embedder system. This system performs signal processing to embed the watermark data into the audio signal itself. The audio signal at the embedder

Figure 1: Audio watermark system architecture

output carries the watermark information and can be distributed through traditional broadcast and/or storage systems. Common distribution platforms include, but are not limited to, terrestrial broadcast, cable/satellite networks, IP networks, mobile networks as well as ad hoc distribution in consumer applications that access either file-based or streaming content. At the audio receiver and/or rendering system, the watermark data present in the audio signal can be recovered by the watermark decoder.

File-based watermarking applications are usually storage applications where the desire is to identify content as opposed to distribution. Some examples of these applications include identification of syndicated programming, identification of network content, identification of a cable network program episodes, identification of a commercial, VOD, etc. The content usually resides on storage medium on a server in the highest quality format possible. A software application either on the server or on a remote networked computer processes the audio from the files on the server. The original content may or may not be copied, depending upon whether the desire is to keep an unwatermarked original for possible future versions. Most file-based watermarking happens through a media asset management system or a transcoder system. Additionally, several systems are cloud based, which makes content available anywhere on the web globally. File based watermarking is advantageous in the fact that it can happen faster than realtime. Typically, a one-hour asset can be watermarked in less than a minute, depending upon the system used and the complexity of the asset (i.e. multiple languages, etc).

The audio watermark is embedded in the linear PCM audio before its distribution. Thus, this embedding should be performed before any bit rate reduction.

The audio watermark data is decoded from the linear PCM audio. If audio is received in another format, it shall be decoded to PCM audio prior to audio watermark decoding.

The audio watermarking system is also designed to support watermark decoding on acoustically-captured audio signals.

An example application is the use of a mobile device such as a smartphone to detect watermarked information in an audio signal reproduced through a TV set or loudspeakers in a living room.

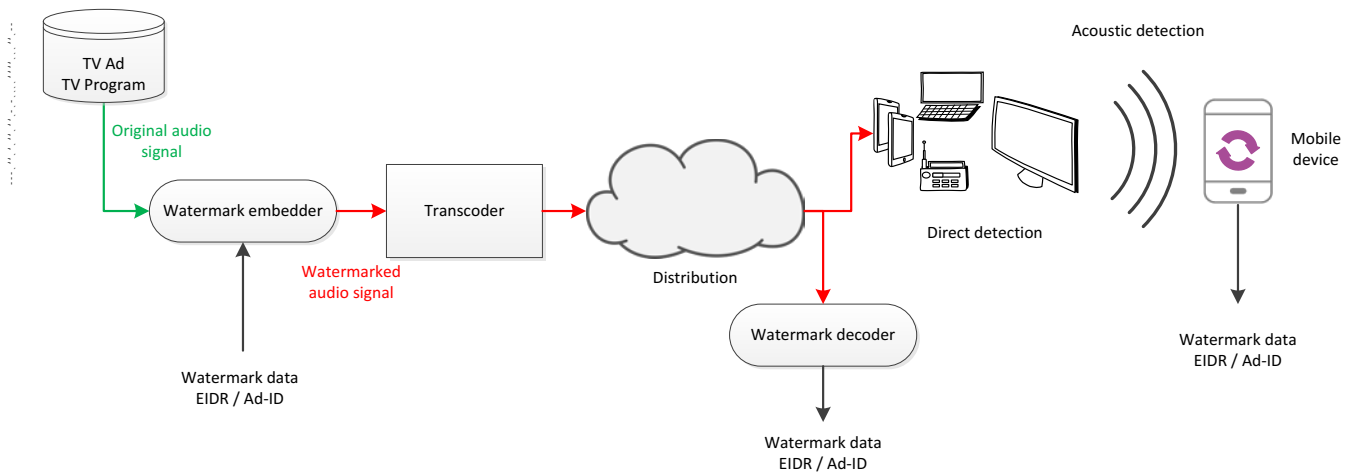


Figure 1: Audio watermark system architecture

When the audio program contains more than one mono audio channel, the same symbol shall be watermarked at the same time on all audio channels. This principle insures that the watermarking information is recovered at the audio receiving side even if a channel downmix is performed between audio channels. This also insures coherent watermarking information between channels at audio rendering, which is mandatory to decode the watermarking through the acoustic path.

Different content identifiers could be used for each language track in a multi-language transmission, enabling separate measurement of the viewership of the content by language.