SMPTE STANDARD

Data Encoding Protocol Using Key-Length-Value

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Approved
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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 30MR - Metadata and Registers.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. 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.

1 Scope

This standard defines a byte-level data encoding protocol for representing data items and data groups. This protocol defines a data structure which is independent of the application or transportation method used.

The standard defines a Key-Length-Value (KLV) triplet as a data interchange protocol for data items or data groups where the Key identifies the data, the Length specifies the length of the data and the Value is the data itself. The KLV protocol provides a common interchange point for all compliant applications irrespective of the method of implementation or transport.

The standard also provides methods for combining associated KLV triplets in data sets where the set of KLV triplets is itself coded with KLV data coding protocol. Such sets can be coded in either full form (Universal Sets) or in one of four increasingly bit-efficient forms (Global Sets, Local Sets, Variable Length Packs and Defined Length Packs). The standard provides a definition of each of these data constructs.

The standard also describes implications of KLV coding including the use of a SMPTE Universal Label as a value within a KLV coding triplet or whose meaning is entirely conveyed by the SMPTE UL itself. The two kinds of usage for such standalone SMPTE Universal Labels are a) as a value in a K L V construct and b) as a Key that has no Length and no Value. This standard defines where SMPTE ULs can be used for each kind of construct.

The standard also defines the use of KLV coding to provide a means to carry information that is registered with a non-SMPTE external agency.

The encoding byte range (length of the payload) specified in this document can accommodate unusually large volumes of data. Consequently, a specific application of KLV encoding might require only a limited operating data range and those details be defined in a relevant application document.

This revision is intended to yield identical encodings to previous revisions of ST 336 given identical dictionaries.

Section 4 provides a glossary of terms used in this standard.

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.

2.1 Conforming Implementations

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.

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 ST 298:2009 Universal Labels for Unique Identification of Digital Data.

ISO/IEC 8825-1:2008 |ITU-T X.690:2008, Information Technology – ASN.1 Encoding Rules – Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER), and Distinguished Encoding Rules (DER): BER Paragraphs 8.1.3.4 and 8.1.3.5 for Length, 8.19 for Object Identifier Coding.

4 Terms and Definitions

ASN
Abstract Syntax Notation (see ISO/IEC 8825-1 (ITU-T X.690)).

Basic Encoding Rules (BER)
ISO standard encoding for various constructs in ASN.1. Includes the encoding of Object Identifiers, and also of Length fields. The length bytes of the KLV packet conform to the Basic Encoding Rules (BER) for either the short form or long form encoding specified in ISO/IEC 8825-1, Pars. 8.1.3.4 and 8.1.3.5.

Big-Endian
Multi-octet (multi-byte) data entity that has the most significant octet (byte) first in time or leftmost in diagrams.

Byte
Widely used alternative for the term ‘octet’ (see Octet, below).

CER
Canonical Encoding Rules (see ISO/IEC 8825-1 (ITU-T X.690)).

Container
Generic name for a data object which provides a framework to ‘contain’ different kinds of information. The term is commonly applied to multimedia where audio, video, data essence and metadata are formed into a single data object.

Control Data
Item of data that is used to provide a control function for essence data or metadata.

Data Group
Collection of data items.

Data Item
Data entity in this standard. The term ‘item’ is widely used in other documents and can have a different meaning. A data item is not a group in this standard.

Data Type
(see definition of Type below).

DER
Distinguished Encoding Rules (see ISO/IEC 8825-1 (ITU-T X.690)).

Dictionary
Register that provides for the semantic interpretation of the data items within the register.

Essence
Abstract term that describes any data or signal necessary to represent any single type of visual, aural or other sensory experience independent of the method of coding. Also identified by the SMPTE/EBU “Task Force for Harmonized Standards for the Exchange of Program Material as Bitstreams” (TFHS) as Video, Audio, and/or Data information. Essence can also be Graphics, Telemetry, Photographs, Haptic / Tactile or other information.

ISAN
International Standard Audiovisual Number.

Key
16-byte SMPTE administered Universal Label used for KLV coding of data.

KLV
Key-Length-Value; data format defined by this standard.

Metadata
Generally referred to as “data about data” or “data describing other data”. Metadata is information that is considered ancillary to or otherwise directly complementary to the essence. Also any information considered useful or of value when associated with the essence.

Metadata Dictionary
Standard database of approved Metadata Items including definitions and allowed formats.

Metadata Item
Broad term for a unit of metadata.

Object Identifier (OID)
First byte in the UL that identifies it as a UL — abbreviated OID. Always “06” in hexadecimal (hex) notation (0x06).

Octet
Data word comprising 8 binary digits.

Primitive Encoding
In ASN.1 notation, a definite-length encoding method that applies to simple encoding types and types derived from simple types by implicit tagging. It requires that the length of sub-identifiers be known in advance.

Register
Information store or database that is maintained by a registry.

Registry
Information system for registering data.

SMPTE Administered UL (abbreviated to UL in this standard)
UL that is administered by SMPTE in accordance with SMPTE ST 298. All SMPTE administered ULs are 16 bytes in length.

SMPTE Label
SMPTE UL that is self identifying. (See Section 9).