SMPTE RECOMMENDED PRACTICE

Text-Based Metadata Carriage in MXF

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Foreword

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

SMPTE RP 2057 was prepared by Technology Committee 31FS.

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.

This document addresses a requirement for carrying text-based metadata with a specified text MIME type encoded using either Unicode UTF-8 or UTF-16 character encoding (such as XML) as it is in a MXF file without encoding each element using the KLV Packet. Text-based metadata can be encapsulated in an MXF file using the following methods as described in the rest of this introduction.

Text-based metadata can be carried using the Generic Stream Container defined in SMPTE ST 410. SMPTE ST 410 was developed to give a mechanism to carry either essence or metadata that cannot suitably be stored in the Header Metadata in a MXF file body using the Generic Stream Container. The essence is limited to 'lumpy' essence that cannot be carried by the Generic Essence Container. The metadata would be bulky text data that cannot be carried by the Header Metadata.

This document therefore specifies the mapping of text-based metadata into the Generic Stream Container along with how to identify the Generic Stream Payload. It also includes the specification of the following requirements described in SMPTE ST 410:

- Specify the format and semantics of the Payload bytes.
- Specify a Universal Label to identify each payload.
- Define the mechanism used to link from the Header Metadata to the Generic Stream Payload by use of the Generic Stream ID.
- Specify whether an index table is forbidden, optional or mandatory for the associated Generic Streams along with the format of the Index Table.

Text-based metadata can be owned by a DM Framework as defined in SMPTE ST 377-1. In this case, text-based metadata is encapsulated in the MXF Header Metadata using Descriptive Metadata Plug-In.

1 Scope

This document defines how to carry text-based metadata with a specified text MIME type encoded using either Unicode UTF-8 or UTF-16 character encoding (such as XML) in a MXF file. This standard defines two methods of text-based metadata carriage. The first method is to carry text-based metadata using the MXF Generic Stream Partition defined in SMPTE ST 410. The second method is to carry it in the MXF Header Metadata by defining a DM Framework which includes Text-based Sets.

This document specifies the Generic Stream Partition Pack for several text-based metadata formats including the KLV coding of the Generic Stream Data Element, and DM Schemes including DM Framework, Sets and Items for text-based metadata.

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 336:2007) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 336M-2007). Documents with the same root number (e.g. 336) and publication year (e.g. 2007) are functionally identical.

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

SMPTE ST 336:2007, Data Encoding Protocol Using Key-Length-Value

SMPTE ST 377-1:2009, Material Exchange Format (MXF) — File Format Specification

SMPTE ST 395:2003, Television — Metadata Groups Registry Structure

SMPTE ST 400:2004, Television — SMPTE Labels Structure

SMPTE ST 410:2008, Material Exchange Format — Generic Stream Partition

RFC5646 Tags for Identifying Languages

http://www.iana.org/assignments/media-types/text, Public Registry of Text MIME Types

ISO/IEC 10646:2003, Information Technology — Universal Multiple-Octet Coded Character Set (UCS)

XML, Extensible Markup Language (XML) 1.0, W3C Recommendation

XML, Extensible Markup Language (XML) 1.1, W3C Recommendation

4 Definition of Acronyms, Terms and Data Types

For the purposes of this document, the terms and definitions given in SMPTE ST 377-1 and SMPTE ST 410 and the following apply.

IANA: Internet Assigned Numbers Authority

MIME: Multipurpose Internet Mail Extensions

Text-based Metadata: Text data with a specified text MIME type registered in Public Registry of Text MIME Types, encoded using either Unicode UTF-8 or UTF-16 character encoding

XML: Extensible Markup Language according to versions 1.0 or 1.1 of the W3C Recommendation

5 General (Informative)

The MXF File Format specification standard, SMPTE ST 377-1, provides the Descriptive Metadata Plug-in mechanism to carry additional Descriptive Metadata elements in the MXF Header Metadata. This document defines the DM Scheme including DM Framework, Sets and Items for Text-based Metadata with a specified text MIME type encoded using either Unicode UTF-8 or UTF-16 character encoding. The Text-based Metadata may include Descriptive metadata or Application metadata.

The Text-based Metadata is referenced from DM Tracks. The DM Tracks may be static, timeline or dynamic DM Tracks depending on applications. Each DM Track owns one or more DM Segments each of which strongly references the DM Framework for Text-based Metadata.

The Text-based DM Framework specifies the Generic Stream Text-based Sets and the UTF-8 or UTF-16 Text based Set as a Subclass of the Text-based Object to support the following two carriage mechanisms:

1. Generic Stream Partitions specified by SMPTE ST 410 are used for "bulky" text-based documents where the Generic Streams Payload is referenced through the Generic Stream Text-Based Set. The Generic Stream Text-based Set properties do not carry the text data, but include the linkage information (Stream SID) of the Generic Stream that contains the Text-based Metadata document.
2. Text-based Metadata is carried as payload of the- UTF-8 or UTF-16 Text-based Set.

Figure 1 illustrates the inheritance hierarchy of text-based Descriptive Metadata Sets by a UML diagram. Examples of the Header Metadata implementation and the linkage to the Text-based Metadata are given in Section 8.3.

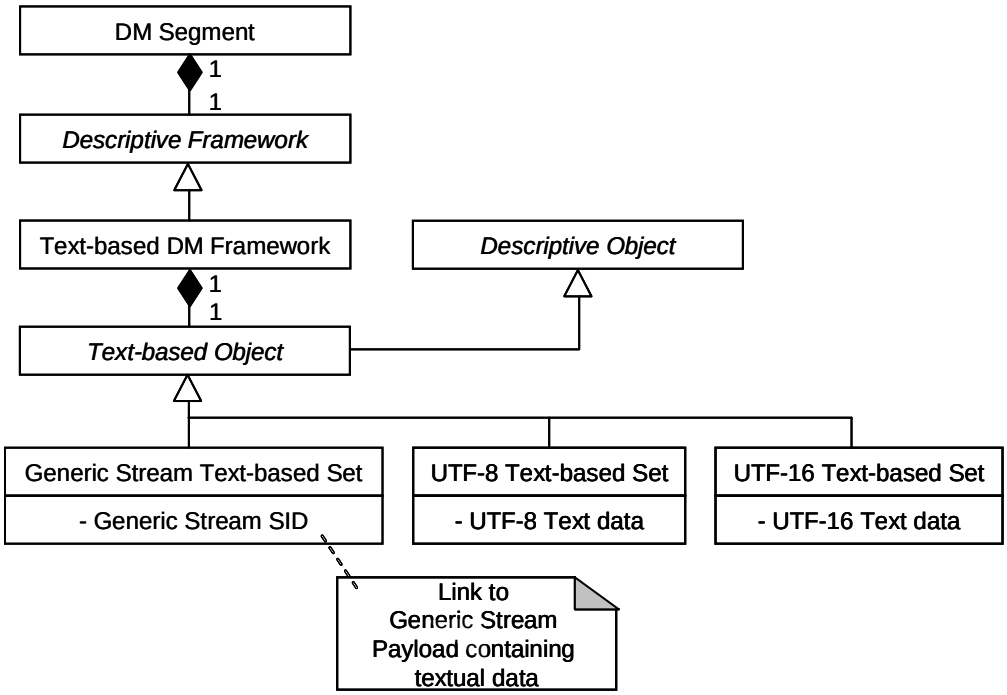

Figure 1 – Inheritance hierarchy of text-based Descriptive Metadata Sets

6 Generic Stream Partition for Text-based Metadata

6.1 Generic Stream Partition Pack

The Generic Stream Partition Pack comprises a Generic Stream Partition Pack Key, a Length and a Value as defined in SMPTE ST 410.

6.1.1 Generic Stream Partition Pack Key

The Key of the Generic Stream Partition Pack shall be as defined in SMPTE ST 410.

6.1.2 Generic Stream Partition Pack Length

The length field shall be as specified in SMPTE ST 410.

6.1.3 Generic Stream Partition Pack Values

The value of each item within the Generic Stream Partition Pack shall be as specified in SMPTE ST 410.

Note: The Generic Stream Payload represents Metadata and not Essence. Consequently, according to SMPTE ST 410, there is not an entry in the Essence Containers Batches of the Partition Packs and the Preface Set to identify the Generic Streams Payload.

6.2 Generic Stream Data Element coding

This sub-section provides the specification on Generic Stream Data Element coding for Text-Based Metadata carriage.

6.2.1 Generic Stream Data Element Key

The default Generic Stream Data Element key defined in SMPTE ST 410 shall be used.

Byte 12 of the Generic Stream Data Element Key signals the arrangement of the underlying data and the values shall be as given in Table 1.

Table 1 – Data Arrangement Byte 12

Bit	Value	Meaning
0	1	Marker bit to prevent termination of key
1	0	The KLV is not a part of the data and should be removed before processing
3,2	01 10 11	Generic Stream is Little-Endian Generic Stream is Big-Endian or is a byte-stream Endian-ness of the Generic Stream is unknown
7-4	0000	Reserved – set to 0

Byte 13 of the Generic Stream Data Element Key signals the wrapping strategy applied to the underlying data and the values shall be as given in Table 2.

Applications that use UTF-16 encoding for the Text-based Metadata and the value of 11 for bits 3,2 shall define an alternative mechanism to signal the endian-ness of the Generic Stream Payload.

Note: One mechanism to achieve this is to require the Unicode byte order mark (BOM) to be present at the start of the text stream.

Table 2 – Wrapping Signaling Byte 13

Bit	Value	Meaning
0	1	Marker bit to prevent termination of key
1	0	The first byte of a KLV triplet has no special importance.
2	0	The Generic Stream is not divided into Access Units.
3	0	The Generic Stream Data is not Frame Wrapped.
7-4	0000	Reserved – set to 0

6.2.2 Generic Stream Data Element Length

The length field shall be as specified in SMPTE ST 410.

6.2.3 Generic Stream Data Element Value

The value shall be the entire document of the Text-based Metadata.

6.3 Generic Stream Constraints

The Generic Stream Partition shall contain a single KLV Packet which wraps the entire document of Text-based Metadata. If multiple documents need to be wrapped, then a separate Generic Stream shall be used for each document.

The repetitions of the Generic Stream Payload shall be allowed.

Indexing a Generic Stream Payload is not needed for Text-based Metadata and therefore the Index Table shall not be used.

7 Descriptive Metadata Scheme and Sets for Text-Based Metadata

7.1 Universal Label for Descriptive Metadata Scheme

The presence of Text-based DM Frameworks within the Header Metadata shall be signaled by adding the Universal Label defined in Table 3 to the Descriptive Metadata Scheme Batch of the Preface Set.

Table 3 – Descriptive Metadata Scheme UL value for Text-based Metadata

Byte No.	Description	Value (hex)	Meaning
1~12	See SMPTE ST 377-1	—	Universal Label for MXF Descriptive Metadata Schemes as defined by MXF File Format Specification
13	Structure / Scheme Kind	03h	Text-based Descriptive Metadata Scheme
14	Scheme Version	01h	Version 1
15	Framework Identification	01h	Text-based DM Framework
16	Reserved	00h	Reserved

7.2 Descriptive Metadata Set definitions

7.2.1 Descriptive Metadata Set Keys

The common Key of the Descriptive Metadata Sets for the Text-based Metadata Scheme shall be as given in Table 4.

Table 4 – Common Key value for Descriptive Metadata Sets

Byte No.	Description	Value (hex)	Meaning
1~12	See SMPTE 377-1	–	Key for MXF Descriptive Metadata Schemes as defined by MXF File Format Specification
13	Structure / Scheme Kind	03h	Text-based Descriptive Metadata Scheme
14	Set Definition	Yyh	See Table 5
15	Set Definition	Zzh	See Table 5
16	Reserved	00h	Reserved

Byte 6 indicates Registry Designator and shall have the value of 13h for BER long or short form encoded length and 53h for 2-byte length as specified in SMPTE ST 377-1. If the size of text data exceeds 64Kbyte limit of 2-byte length, BER long or short encoding shall be used.

The definitions of bytes 14 and 15 of the Keys for the Descriptive Metadata Sets shall be as given in Table 5.

Table 5 – Definitions of bytes 14 and 15

Set Name	Byte 14	Byte 15	Description
Text-based DM Framework	01h	01h	See Table 6
Generic Stream Text–based Set	02h	01h	See Table 9
UTF-8 Text–based Set	02h	02h	See Table 10
UTF-16 Text–based Set	02h	03h	See Table 11

7.2.2 Text-Based DM Framework

The Text-based DM Framework shall be as given in Table 6.

Note: For removal of the Text-based DM Framework, the DM Plug-In Instance removability specified in SMPTE ST 377-1 can be used.

Table 6 – Text-based DM Framework

Item Name	Type	Item Designator	Local Tag	Length	Req	Value
Text-based DM Framework	Set Key			16	Req	As specified in Table 4 and Table 5
Length	BER Length			Var	Req	
All items in the Descriptive Framework specified in SMPTE ST 377-1 except the Group UL						
Text-based Object	StrongRef	06.01.01.04 05.41.01.00	Dyn	16	Opt	Instance UID of the instance of a Text-based Object. This may be a Generic Stream Text-based Set, a UTF-8 Text-based Set or a UTF-16 Text-based Set

7.2.3 Text-based Object

The Text-based Object shall be as given in Table 7. This shall be an Abstract Class.

Note: According to SMPTE ST 377-1, Abstract Classes are never encoded as Metadata Sets.

The Text-based Metadata Payload Scheme ID shall be used to identify particular Text-based Metadata scheme.

The value of “Text-based Metadata Payload Scheme ID" should be a SMPTE Universal Label registered according to SMPTE ST 400M (in SMPTE RP 224). It may be a UUID.

All instances of the same Text-based Metadata payload scheme shall be identified with the same "Text-based Metadata Payload Scheme ID" value.

Implementations that associate specific instances of Text-based Metadata payload schemes with specific Application Environments shall use the "Descriptive Metadata Application Environment ID" property defined in SMPTE ST 377-1.

Table 7 – Text-based Object

Item Name	Type	Item Designator	Local Tag	Length	Req	Value
Text-based Object	Group UL			16		Defines the Abstract Text-based Object Group
All items in the Descriptive Object specified in SMPTE ST 377-1 except the Group UL						
Text-based Metadata Payload Scheme ID	AUID	04.06.08.06 00.00.00.00	Dyn	16	Req	Unique identifier for Text-based metadata payload scheme
Text MIME Media Type	UTF-16 char String	04.09.02.02 00.00.00.00	Dyn	Var	Req	A text string that defines the data type of the text. A value shall be selected from the values listed at the following web site. http://www.iana.org/assignments/media-types/text/
RFC5646 Text Language Code	UTF-16 char String	03.01.01.02 02.14.00.00	Dyn	Var	Req	Identifies the language code used as defined by RFC5646
Text Data Description	UTF-16 char String	03.02.01.06 03.02.00.00	Dyn	Var	Opt	Description of the text data (e.g. XML name space)

The Universal label for the Text-based Object shall have the value defined in Table 8.

Table 8 – Universal Label for Text-based Object

Byte No.	Description	Value (hex)	Meaning
1~12	See SMPTE ST 377-1	—	Universal Labels for Abstract Descriptive Metadata Groups as defined by MXF File Format Specification
13	Structure / Scheme Kind	03h	Text-based Descriptive Metadata Scheme
14	Object Kind	03h	Text-based Object
15	Reserved	01h	Reserved
16	Reserved	00h	Reserved

7.2.4 Generic Stream Text-based Set

The Generic Stream Text-based Set shall be as given in Table 9.

Table 9 – Generic Stream Text-based Set

Item Name	Type	Item Designator	Local Tag	Length	Req	Value
Generic Stream Text-based Set	Set Key			16	Req	As specified in Table 4 and Table 5
Length	BER Length			Var	Req	
All items in Table 7 except the Group UL						
Generic Stream SID	UInt32	01.03.04.08 00.00.00.00	Dyn	4	Req	Body SID of the linked Generic Stream Partition

7.2.5 UTF-8 Text-based Set

The UTF-8 Text-based Set shall be as given in Table 10. The UTF-8 text data shall be present within the value of the UTF-8 Text data item of the UTF-8 Text-based Set.

Table 10 – UTF -8 Text-based Set

Item Name	Type	Item Designator	Local Tag	Length	Req	Value
UTF-8 Text-based Set	Set Key			16	Req	As specified in Table 4 and Table 5
Length	BER Length			Var	Req	
All items in Table 7 except the Group UL						
UTF-8 Text Data	UTF-8 char String	03.01.02.20 03.01.00.00	Dyn	Var	Req	The UTF-8 text string of the Text-based Metadata.

7.2.6 UTF-16 Text-based Set

The UTF-16 Text-based Set shall be as given in Table 11. The UTF-16 text data shall be present within the value of the UTF-16 Text data item of the UTF-16 Text-based Set.

Table 11 – UTF-16 Text-based Set

Item Name	Type	Item Designator	Local Tag	Length	Req	Value
UTF-16 Text-based Set	Set Key			16	Req	As specified in Table 4 and Table 5
Length	BER Length			Var	Req	
All items in Table 7 except the Group UL						
UTF-16 Text Data	UTF-16 char String	03.01.02.20 03.02.00.00	Dyn	Var	Req	The UTF-16 text string of the Text-based Metadata.

8 Guideline on Text-Based Metadata Implementation

8.1 Selection of Carriage Mechanism

This document defines the two carriage mechanisms for Text-based Metadata that have the same function and therefore a particular application using this document should select the carriage mechanism which is appropriate for the Text-based Metadata being used within that application.

The Generic Stream Partition should be used for carriage of "bulky" text-based documents.

Applications may provide limited space for the Header Metadata or may need to keep the size of the Header Metadata constant. If the size of text data exceeds such space supported within an application, the Generic Stream Partition should be used for carriage of the Text-based Metadata.

Applications where the Header Metadata needs to be closed, but the text-based data is only received in while the file is being written, in that case, a Stream ID could be assigned and encoded in the Header Metadata while the text-based data is written into a Genetic Streams Partition towards the end of the files.

In all other cases, an application should carry the Text-based Metadata within the MXF Header Metadata.

8.2 Text-Based Metadata identification

In order to identify particular Text-based Metadata scheme for its intended application, each application needs to specify a unique Text-based Metadata Payload Scheme ID as described in Section 7.2.3.

8.3 Header Metadata Implementation (Informative)

8.3.1 Text-Based Metadata carriage in Generic Stream Payload

SMPTE ST 410 mandates specifying the linkage from the Header Metadata to the Generic Stream Payload using the Stream ID. This sub section gives a guideline on the linkage from the MXF Header Metadata to the Stream ID of the Generic Stream Payload using MXF Descriptive Metadata Plug-in.

Figure 2 illustrates the structure of the Header Metadata along with the linkage to the Generic Stream Payload. The DM Static Track Set is added to the Material Package and the DM Segment in the DM Track strongly references the Text-based DM Framework which includes the Generic Stream Text-based Set. The Generic Stream Text-based Set further includes the Generic Stream SID item which specifies Body SID of the linked Generic Stream Partition Pack.

The structure shown in Figure 2 is an example and other implementations might be used depending on applications; e.g., the DM Track might be added to the Source Package. The DM Event Track or the DM Timeline Track might also be used.

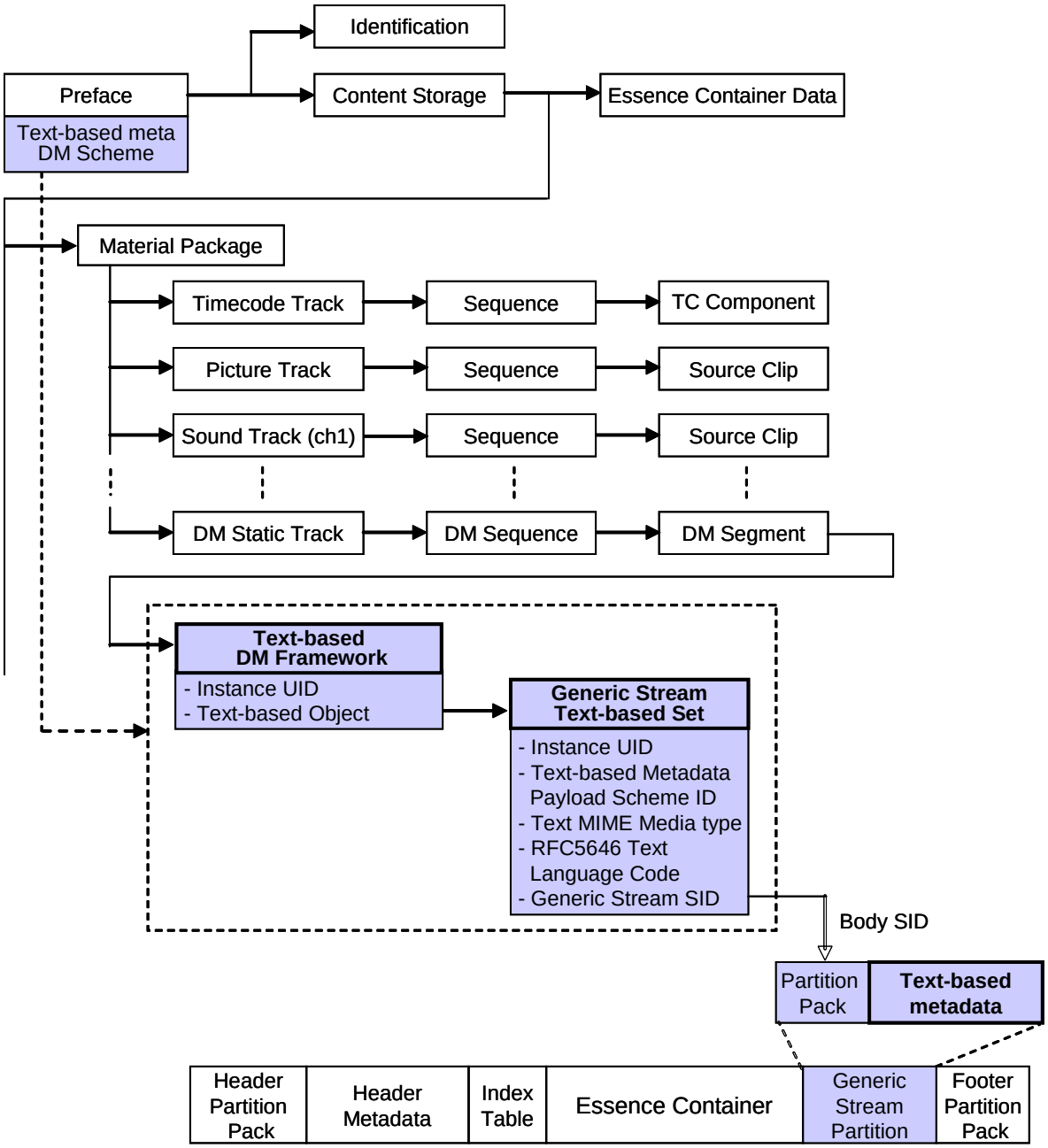

Figure 2 – Example of the Header Metadata Structure

8.3.2 Text-Based Metadata carriage in the Header Metadata

Figure 3 illustrates the structure of the Header Metadata which includes the Descriptive Metadata item for Text-based Metadata. The DM Static Track Set is added to the Material Package and the DM Segment in the DM Track strongly references the Text-based DM Framework which links to the UTF-8 Text-based Set.

The structure shown in Figure 3 is an example and other implementations might be used depending on applications; e.g., the DM Track might be added to the Source Package. The DM Event Track or the DM Timeline Track might also be used.

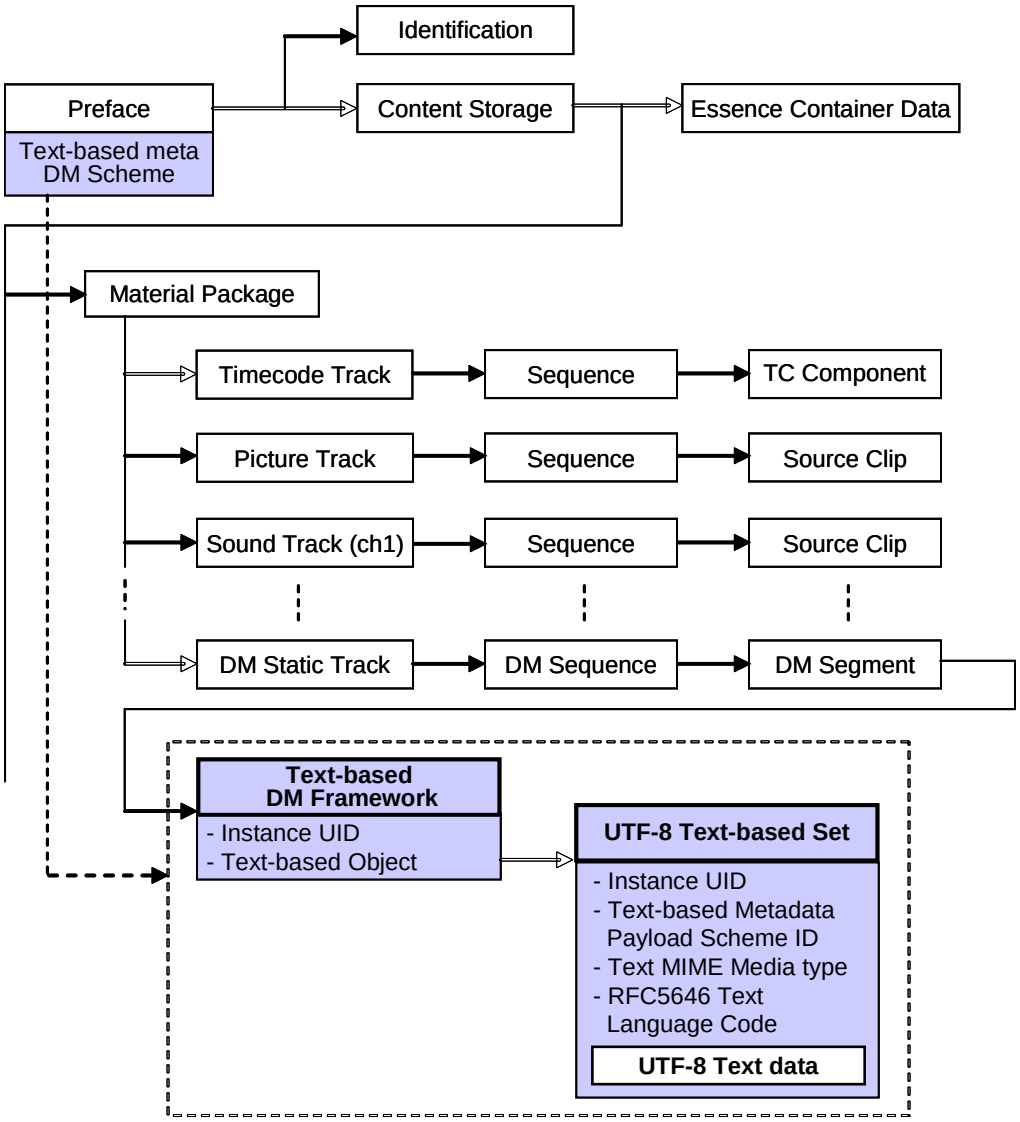

Figure 3 - Example of the Header Metadata Structure

Annex A Bibliography (Informative)

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 298:2009) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 298M-2009). Documents with the same root number (e.g. 298) and publication year (e.g. 2009) are functionally identical.

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

SMPTE RP 210, Metadata Dictionary Registry of Metadata Element Descriptions

SMPTE RP 224, SMPTE Labels Register