SMPTE STANDARD

MXF Multichannel Audio Labeling Framework

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Approved March 14, 2012
Sections 4.2, 4.3, 4.4 and Table 4 corrected on February 11, 2013

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 377-4 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.

Developments in the moving image production industries have led to increasing definition and use of many multichannel audio (herein abbreviated "MCA") schemes, with channel counts in excess of 20. Since the MXF file format was published in 2004 the requirement to identify such audio for efficient production, storage and distribution within MXF has led to this standard for audio labeling. Metadata associated with content adds value to that content in both automation – with the ability to save on costly and error-prone human input; and in manual handling – where the efficient searching and description of these assets enhances their re-use and thus the realizable value. This standard attempts to meet both these usage cases with the use of regular text-based structures for easy human and machine recognition.

This document defines a set of hierarchical SubDescriptors designed to be associated with audio essence contained in MXF file structures, which are illustrated in Figure 1. The parent abstract superclass is the "MCALabelSubDescriptor", which has three concrete subclasses. At the base of the hierarchy is the AudioChannelLabelSubDescriptor, which is applied to an *Audio Channel*. Above the AudioChannelLabelSubDescriptor is the SoundfieldGroupLabelSubDescriptor, which is applied to a *Soundfield Group* of audio channels. Above the SoundfieldGroupLabelSubDescriptor is the GroupOfSoundfieldGroupsLabelSubDescriptor, which is applied to a *Group Of Soundfield Groups* which are meant to be transmitted simultaneously. The MCALabelSubDescriptor and its three subclasses are the core of the Multichannel Audio Labeling Framework and are all derived from the MXF SubDescriptor as defined in SMPTE ST 377-1, Annex B.3. The metadata elements associated with each are considered the "set" of metadata elements for that subclass and are referred to as such in this document.

Robustness is increased with redundancy in the identification labels to reduce orphaned elements and aid disaster recovery. Use of externally registered elements such as RFC 5646 language codes increases commonality with other application areas to ease interoperability.

This document specifies only the MCA Labeling Framework. In order to utilize the framework in an application, it must be extended or constrained to fit that application, and metadata item values must be defined in the application-specific documents. See Annex C for more details.

It is expected that a number of applications will utilize the MCA Labeling Framework and write documents to standardize its use within the specific application space. Current examples include but are not limited to Digital Cinema and IMF.

1 Scope

This standard defines a labeling framework for multichannel audio essence in MXF file structures. It specifies the basic object model, structures and metadata items for the MCA Labeling Framework.

This standard enables text-based representation of Multichannel Audio Labels and defines one such representation.

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 395:2003) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 395M-2003). Documents with the same root number (e.g. 395) and publication year (e.g. 2003) 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.

SMPTE ST 335:2001, Television — Metadata Dictionary Structure

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

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

SMPTE ST 377-1:2011, Material Exchange Format (MXF) — File Format Specification

Amendment 1:2012 to SMPTE ST 377-1:2011

SMPTE ST 382:2007, Material Exchange Format —- Mapping AES3 and Broadcast Wave Audio into the MXF Generic Container

Amendment 1:2012 to SMPTE 382-2007

SMPTE ST 400:2004, Television —- SMPTE Labels Structure

SMPTE RP 428-4:2010, D-Cinema Distribution Master —- Audio File Format and Delivery Constraints

IETF RFC 5646, Tags for Identifying Languages

IETF RFC 5234, Augmented BNF for Syntax Specifications: ABNF

4 Glossary of Acronyms, Terms and Data Types

For the purposes of this document, the following terms and definitions apply in addition to those stated in SMPTE ST 377-1:

4.1
Audio Channel
distinct collection of sequenced audio samples that are intended for delivery to a single loudspeaker or other reproduction device

4.2
Soundfield
acoustical space created by simultaneously reproducing one or more audio channels

4.3
Soundfield Configuration
defined arrangement or configuration of loudspeakers that convey the intended Soundfield

4.4
Soundfield Group
SG
collection of Audio Channels meant to be played out simultaneously through a given Soundfield Configuration

4.5
Group of Soundfield Groups
GSG
collection of one or more Soundfield Groups which are meant to be transmitted simultaneously

5 MCALabelSubDescriptors

This specification defines three subclasses of MCALabelSubDescriptors arranged in a hierarchical fashion.

5.1 MCALabelSubDescriptor Subclasses

5.1.1 AudioChannelLabelSubDescriptor

The AudioChannelLabelSubDescriptor shall contain the intended routing destination of the audio channel, which may be a loudspeaker position such as Left Surround or a non-loudspeaker destination such as a HI connection.

Each AudioChannelLabelSubDescriptor shall be associated with a single Audio Channel. The structure and metadata items of the AudioChannelLabelSubDescriptor are specified in Section 6.4.

If an audio channel is part of a soundfield group, then its AudioChannelLabelSubDescriptor shall include the SoundfieldGroupLinkID that identifies that soundfield group as specified in Section 6.4.1.

Each AudioChannelLabelSubDescriptor may reference zero or one SoundfieldGroupLabelSubDescriptor as illustrated in Figure 1.

5.1.2 SoundfieldGroupLabelSubDescriptor

The SoundfieldGroupLabelSubDescriptor shall contain the intended Soundfield Configuration for the audio channels in the group, such as 5.1.

Each SoundfieldGroupLabelSubDescriptor shall be associated with a unique Soundfield Group. The structure and metadata items of the SoundfieldGroupLabelSubDescriptor are specified in Section 6.5.

Note: For redundancy, applications can duplicate all of the metadata items in the underlying AudioChannelLabelSubDescriptor (except the intended routing destination).

If a soundfield group is part of a group of soundfield groups, then its SoundfieldGroupLabelSubDescriptor shall include the GroupOfSoundfieldGroupsLinkID that identifies that group of soundfield groups as specified in Section 6.5.1.

A SoundfieldGroupLabelSubDescriptor may reference zero or more GroupOfSoundfieldGroupsLabelSubDescriptors.

A SoundfieldGroupLabelSubDescriptor shall be referenced by one or more AudioChannelLabelSubDescriptors.

5.1.3 GroupOfSoundfieldGroupsLabelSubDescriptor

The GroupOfSoundfieldGroupsLabelSubDescriptor should contain the intended use of the soundfield groups in the group, such as “English and Spanish Program ”.

Each GroupOfSoundfieldGroupsLabelSubDescriptor shall be associated with a unique Group of Soundfield Groups. The structure and metadata items of the GroupOfSoundfieldGroupsLabelSubDescriptor are specified in Section 6.6.

Note: For redundancy, applications can duplicate all of the common metadata items in the underlying SoundfieldGroupLabelSubDescriptor.

A GroupOfSoundfieldGroupsLabelSubDescriptor shall be referenced by one or more SoundfieldGroupLabelSubDescriptors.

5.2 MCA Label Dictionary ID Semantics

The specific meaning of each MCALabelSubDescriptor is domain dependent and relies upon the standard vocabulary created for the specific domain. Such meaning may include, for instance, actual speaker locations or rendering intent.

Specifically, documents utilizing the MCA Framework shall associate a unique UL appropriate for use as the value of the MCA Label Dictionary ID item in each MCALabelSubDescriptor. The same documents should also specify appropriate values for the MCA Tag Symbol.

5.3 MCALabelSubDescriptorExtension

The specification defines only a minimal set of items for each MCALabelSubDescriptor subclass. Applications using the framework may therefore define additional items, and MCALabelSubDescriptors may therefore contain items that are particular to only that application. MCALabelSubDescriptor extension shall be accomplished in one of three ways: By registering additional metadata items and associated UL's for the MCALabelSubDescriptors defined herein, extending the subclasses and creating new MCALabelSubDescriptor subclasses by registering new KLV keys as specified in Table 1 and Table 2, or by standardizing application specific metadata as described in Section 9 of SMPTE ST 377-1. These additional items shall be ignored if they are not recognized by a different implementation.

5.4 MCALabelSubDescriptor Uniqueness and Reference Schema (Informative)

The MCALabelSubDescriptor is the parent subclass and contains a set of metadata elements that are shared by the other three SubDescriptor subclasses. It is not used directly to label audio essence. Each SubDescriptor subclassis unique in its Set Key and includes the MCA Label Dictionary ID, MCA Link ID and MCA Tag Symbol from the superclass. The metadata sets for the three types of labels are intentionally redundant in order to allow for a number of uses and delivery scenarios. Different implementations can choose to use some or all of the redundant metadata fields depending on the nature of the implementation.

The MCA Link ID item is a required item. References between MCALabelSubDescriptor instances are accomplished by referencing the other MCALabelSubDescriptor's MCA Link ID in its metadata set. This allows a single audio channel to either stand on its own or to be associated with a soundfield group, and allows a soundfield group to either stand on its own or to be associated with a group of soundfield groups. It also allows audio channels that are part of a soundfield group to be transmitted separately and later associated to the correct soundfield group. By the same token, it allows soundfield groups that are part of a group of soundfield groups to be transmitted separately and later associated with the other soundfield groups in the group of soundfield groups.

The specific values for metadata items in the set are defined and registered by the individual application and as such are left to other application-specific documents.

6 MXF Structures

This section describes the structure of the MCALabelSubdescriptor in MXF. See Annex B for an informative discussion of the MCA Framework hierarchical class system.

6.1 MCA Framework Object Model

Figure 1 illustrates the MCA Framework object model.

The MCA Framework shall consist of instances of subclasses of the abstract class MCALabelSubDescriptor. This standard defines three concrete subclasses of the abstract MCALabelSubDescriptor, namely AudioChannelLabelSubDescriptor, SoundfieldGroupLabelSubDescriptor and GroupOfSoundfieldGroupsLabelSubDescriptor. The metadata elements associated with each are considered the "set" of metadata elements for that subclass and are referred to as such in this document.

In order to maintain locality of reference and permit decoders to process without first having to discover all File Packages, all MCALabelSubDescriptor instances associated with the audio described by a File Package shall be contained within the same File Package. Specifically, a SoundfieldGroupLabelSubDescriptor shall only reference GroupOfSoundfieldGroupsLabelSubDescriptors within the same File Package. Similarly, an AudioChannelLabelSubdescriptor shall only reference SoundfieldGroupLabelSubdescriptors within the same File Package. Applications may choose to duplicate SoundfieldGroupLabelSubdescriptors and GroupOfSoundfieldGroupsLabelSubDescriptors across File Packages depending on their requirements.

Note: A decoder can iterate over AudioChannelLabelSubDescriptors to find out what channels are present; or iterate over SoundfieldGroupLabelSubDescriptors to find out what Soundfield Groups are present. Some elements of the GenericDescriptor::SubDescriptors property can be strong references to other SubDescriptors besides MCALabelSubDescriptors.

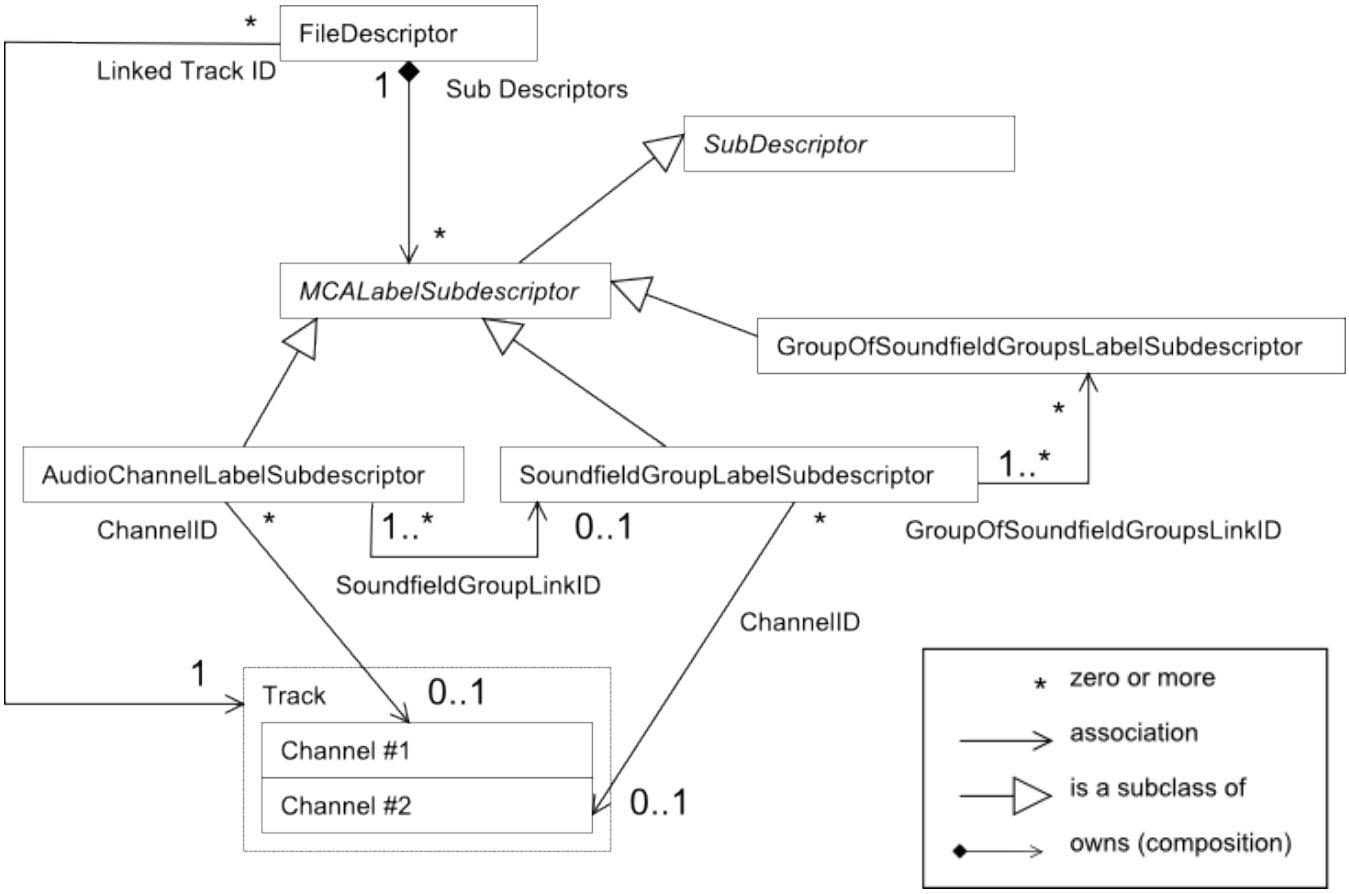

Figure 1 – MCA Framework Object Model

6.2 KLV Set Keys

MCALabelSubDescriptors shall be encoded as SMPTE ST 336 KLV Sets as specified in SMPTE ST 377-1. The Set Keys shall be as defined in Table 1.

Table 1 – Universal Label for MCALabelSubDescriptor Class Hierarchy

Byte No.	Description	Value (hex)	Meaning
1	Object Identifier	06h	
2	Label size	0Eh	
3	Designator	2Bh	ISO, ORG
4	Designator	34h	SMPTE
5	Registry Category Designator	02h	Groups (Sets and Packs)
6	Registry Designator:	0x53	Local Sets: 2-byte Local Tags with either 2 byte length (default) or BER encoded length
7	Structure Designator	01h	Set/Pack Registry
8	Version Number	01h	Registry Version
9	Item Designator	0Dh	Organizationally Registered
10	Organization	01h	AAF Association
11	Application	01h	MXF / AAF Association Structural Metadata Sets
12	Structure version	01h	Structure Version 1
13	Structure Kind	01h	MXF / AAF Association compatible sets and packs
14	Set Kind (1)	See below	Structural Metadata Set
15	Set Kind (2)	See below	Specific MCALabelSubDescriptor Set (see below)
16	Reserved	00h	Reserved

The values of byte 14 and byte 15 shall be as follows in Table 2:

Table 2 – MCALabelSubDescriptor Class Hierarchy Key Byte 14 and 15

Name and Symbol	Value of Byte 14 (hex)	Value of Byte 15 (hex)	Comments
MCALabelSubDescriptor	01h	6A h	See Section 6.3
AudioChannelLabelSubDescriptor	01h	6B h	See Section 6.4
SoundfieldGroupLabelSubDescriptor	01h	6C h	See Section 6.5
GroupOfSoundfieldGroupsLabelSub Descriptor	01h	6D h	See Section 6.6

6.3 MCALabelSubDescriptor

MCALabelSubDescriptors shall contain the required items and may contain the optional items listed below in Table 3.

Table 3 – MCALabelSubDescriptor Set

Item Name	Type	Len	Local Tag	UL	Req ?	Meaning
MCALabelSubDescriptor	Set Key	16		As defined in Table 1 and Table 2	Req	See Table 2
Length	BER Length	var			Req	Set length
All elements from the SubDescriptor set defined in SMPTE ST 377-1, Annex B.3						
MCA Label Dictionary ID	UL	16	dyn	06.0E.2B.34.01.01.01.0E.01.03.07.01.01.00.00.00	Req	The globally registered UL that defines the meaning of the MCALabelSubDescriptor instance.
MCA Link ID	UUID	16	dyn	06.0E.2B.34.01.01.01.0E.01.03.07.01.05.00.00.00	Req	Uniquely identifies the audio channel, soundfield group and group of soundfield groups instance described by the MCALabelSubDescriptor and is used to link instances of MCALabelSubDescriptors.
MCA Tag Symbol	UTF16String	>2	dyn	06.0E.2B.34.01.01.01.0E.01.03.07.01.02.00.00.00	Req	Symbol identifying this MCALabelSubDescriptor, which mnemonically reflects the meaning as defined in the MCA Label Dictionary ID, e.g. “cLs” for an AudioChannelLabelSubDescriptor Symbol, “c51” for a SoundfieldGroupLabelSubDescriptor Symbol.
MCA Tag Name	UTF16String	>2	dyn	06.0E.2B.34.01.01.01.0E.01.03.07.01.03.00.00.00	Opt	Optional text string that may be given to the MCALabelSubDescriptor to further describe it in human readable form, e.g. “Left Surround” for an AudioChannelLabelSubDescriptor Name, "5.1" for a SoundfieldGroupLabelSubDescriptor Name.
MCA Channel ID	UInt32	16	dyn	06.0E.2B.34.01.01.01.0E.01.03.04.0A.00.00.00.00	Opt	The numerical channel identifier within the essence, as defined in SMPTE ST 377-1:2011 Amendment1:2012 (Annex B.23 extension), if applicable
RFC 5646 Spoken Language	ISO-8String	var	dyn	06.0E.2B.34.01.01.01.0D.03.01.01.02.03.15.00.00	Opt	RFC 5646 language tag for this channel or Soundfield Group, e.g. "en-US"
MCA Title	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.01.05.10.00.00.00.00.00	Opt	Name of the overall program to which the audio essence track belongs

Item Name	Type	Len	Local Tag	UL	Req ?	Meaning
MCA Title Version	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.01.05.11.00.00.00.00.00	Opt	Version of the program to which the audio belongs, such as a specific cut of a movie.
MCA Title Sub-Version	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.01.05.12.00.00.00.00.00	Opt	Sub-version of the program to which the audio belongs such as a localized rendition that has the same cut as depicted in MCA Version.
MCA Episode	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.01.05.13.00.00.00.00.00	Opt	Episode of a MCA Title
MCA Partition Kind	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.01.04.01.05.00.00.00.00	Opt	Partition kind of a complete program such as a “Part”, “Post Production Reel” or “Act”.
MCA Partition Number	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.01.04.01.06.00.00.00.00	Opt	The position of the partition in the sequence of partitions that make up the complete program such as “3” for Reel 3.
MCA Audio Content Kind	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.03.02.01.02.20.00.00.00	Opt	Description of the audio content contained in the essence.
MCA Audio Element Kind	UTF16String	var	dyn	06.0E.2B.34.01.01.01.0E.03.02.01.02.21.00.00.00	Opt	Description of the audio element contained in the essence.

6.3.1 MCA Label Dictionary ID

The MCA Label Dictionary ID item shall be the globally registered UL that unambiguously indicates the meaning of the MCALabelSubDescriptor as defined by the application.

Note: An example of a meaning associated with the MCA Label Dictionary ID for an AudioChannelLabelSubDescriptor might be “Left Surround”, an example of a meaning associated with the MCA Label Dictionary ID for a SoundfieldGroupLabelSubDescriptor might be “Mono”, and an example of a meaning associated with the MCA Label Dictionary ID for a GroupOfSoundfieldGroupsLabelSubDescriptor might be “Program with Commentary”.

6.3.2 MCA Link ID

The MCA Link ID item is a UUID that shall uniquely identify the audio channel, soundfield group and group of soundfield groups instance described by the MCALabelSubDescriptor. It is used to link instances of MCALabelSubDescriptors as illustrated in Figure 1.

6.3.3 MCA Tag Symbol

The MCA Tag Symbol shall consist of a minimum of 2 and a maximum of 8 alphanumeric characters and start with an alpha character. The MCA Tag Symbol should be human-readable and reflect, in a mnemonic form, the meaning of that MCALabelSubDescriptor as defined by the MCA Label Dictionary ID.

Note: An example MCA Tag Symbol for an AudioChannelLabelSubDescriptor might be “cLs” (indicating Left Surround), an example MCA Tag Symbol for a SoundfieldGroupLabelSubDescriptor might be “cM” (indicating a Monaural soundfield configuration), and an example MCA Tag Symbol for a GroupOfSoundfieldGroupsLabelSubDescriptor might be “PrgCom” (indicating Program and Commentary).

Note: A 5.1 Soundfield Configuration would be represented by the symbol “c51” rather than “5.1”. A 5-channel Soundfield without LFE, properly referred to as 5.0, would be represented by “c50” where “0” means no LFE channel.

6.3.4 MCA Tag Name

The MCA Tag Name item is an optional text string that may be given to the MCALabelSubDescriptor that provides additional information in a human readable form. If present, it shall describe the Audio Channel, Soundfield Group or Group Of Soundfield Groups represented by the MCALabelSubDescriptor instance.

6.3.5 MCA Channel ID

MCA Channel ID shall be the numerical channel identifier within the essence, as defined in Amendment 1:2012 to SMPTE ST 377-1:2011.

6.3.6 RFC 5646 Spoken Language

The RFC 5646 Spoken Language item value shall be a hyphen-separated ISO-8 string conforming to RFC 5646.

6.3.7 MCA Title

The MCA Title item shall indicate the overall program to which the audio essence belongs, for example, the title of a feature film. The MCA Title string can be the full title, an extraction of the title or an abbreviation.

6.3.8 MCA Title Version

The MCA Title Version item shall indicate the version of the program to which the audio belongs.

The MCA Title Version field should be included, even if there is only one known version, in order to clearly differentiate the essence in case another essence version is later made.

The MCA Title Version value could be, for instance, a numerical value or a description such as Domestic, International, Unrated or Directors Cut.

6.3.9 MCA Title Sub-Version

The MCA Title Sub-Version item shall indicate the sub-version of the program to which the audio belongs.

The MCA Title Sub-Version field should always be included, even if there is only one known sub-version of the essence, in order to clearly differentiate the essence in case another essence sub-version is later made.

The MCA Title Sub-Version could be, for instance, a rendition of a particular Version of a Title that is designed to suit a particular market or territory while retaining the essential characteristics of the parent version; for example, a “localized” sub-version for Germany that is changed only in language and text, not by picture cut.

6.3.10 MCA Episode

The MCA Episode item shall indicate which episode of a title is represented. The MCA Episode is a single program instance within a series of program instances that share the same overall MCA Title,for example, an episode of a television series. An MCA episode is a complete program unto itself. The MCA Episode value shall contain a program instance title and can include a number that indicates its position among the total series of programs that share the same overall MCA Title.

6.3.11 MCA Partition Kind

The MCA Partition Kind item shall indicate the kind of partition of a complete program that is represented, such as a “Part”, “Post Production Reel” or “Act”.

6.3.12 MCA Partition Number

The MCA Partition Number item shall indicate the position of the partition in the sequence of partitions that make up the complete program, for instance, “3” for Part 3.

6.3.13 MCA Audio Content Kind

The MCA Audio Content Kind item shall indicate the kind of content contained in the audio essence as described in SMPTE RP 428-4. MCA Audio Content Kind may be used in addition to MCA Audio Element Kind if needed.

6.3.14 MCA Audio Element Kind

The MCA Audio Element Kind item shall indicate the kind of audio element contained in the audio essence as described in SMPTE RP 428-4.

6.4 AudioChannelLabelSubDescriptor

An AudioChannelLabelSubDescriptor shall contain the following items:

Table 4 – AudioChannelLabelSubDescriptor Set

Item Name	Type	Len	Local Tag	UL	Req?	Meaning
AudioChannelLabelSubDescriptor	Set Key	16		As defined in Table 1 and Table 2	Req	See Table 2
Length	BER Length	var			Req	Set length
All elements from the MCALabelSubDescriptor set defined in Section 6.3						
SoundfieldGroupLinkID	UUID	16	dyn	06.0E.2B.34.01.01.01.0E.01.03.07.01.06.00.00.00	Opt	MCA Link ID of the Soundfield Group to which this channel belongs

Other items may be added to contain application-specific metadata. The method of extending metadata items is detailed in Section 5.3.

6.4.1 SoundfieldGroupLinkID

If the Audio Channel is part of a Soundfield Group then the SoundfieldGroupLinkID shall be present in the AudioChannelLabelSubDescriptor Set. The SoundfieldGroupLinkID shall be the MCA Link ID of the SoundfieldGroupLabelSubDescriptor to which this Audio Channel belongs.

6.5 SoundfieldGroupLabelSubDescriptor

A SoundfieldGroupLabelSubDescriptor shall contain the following items:

Table 5 – SoundfieldGroupLabelSubDescriptor Set

Item Name	Type	Len	Local Tag	UL	Req ?	Meaning
SoundfieldGroupLabelSubDescriptor	Set Key	16		As defined in Table 1 and Table 2	Req	See Table 2
Length	BER Length	var			Req	Set length
All elements from the MCALabelSubDescriptor set defined in Section 6.3						
GroupOfSoundfieldGroupsLinkID	UUID Array	var	dyn	06.0E.2B.34.01.01.01.0 1.0E.01.03.07.01.04 .00.00.00	Opt	MCA Link ID's of the Group of Soundfield Groups to which this Soundfield Group belongs

Other items may be added to contain application-specific metadata. The method of extending metadata items is detailed in Section 5.3.

6.5.1 GroupOfSoundfieldGroupsLinkID

If the Soundfield Group is part of a Group Of Soundfield Groups, then the GroupOfSoundfieldGroupsLinkID is present in the SoundfieldGroupLabelSubdescriptor Set. The GroupOfSoundfieldGroupsLinkID shall contain an array of MCA Link ID's of the Group of Soundfield Groups to which this Soundfield Group belongs.

6.6 GroupOfSoundfieldGroupsLabelSubDescriptor

A GroupOfSoundfieldGroupsLabelSubDescriptor shall contain the following items:

Table 6 – GroupOfSoundfieldGroupsSubDescriptor Set

Item Name	Type	Len	Local Tag	UL	Req ?	Meaning
GroupOfSoundfieldGroupsLabelSubDescriptor	Set Key	16		As defined in Table 1 and Table 2	Req	See Table 2
Length	BER Length	var			Req	Set length
All elements from the MCALabelSubDescriptor set defined in Section 6.3						

Other items may be added to contain application-specific metadata. The method of extending metadata items is detailed in Section 5.3.

7 Textual Representation

Implementations should support a means of representing MCALabelSubDescriptors in a textual form.

This representation should be a Unicode string and shall be a valid Language Tag as defined in RFC 5646, which can include a “x” singleton private use extension.

Annex A MCA Framework Illustrated Examples (Informative)

The following figures illustrate the use of the MCA Framework to label audio essence. The audio essence belongs to a single audio program labeled "PROG1" and consists of 4 channels labeled "Lt", "Rt", "HI" and "VI", with the first two grouped in a soundfield group labeled "LtRt" and the last two in an soundfield group labeled "HIVI".

In Figure A.1, the audio essence is contained in a single SMPTE ST 382 essence container. As a result all MCALabelSubDescriptors are referenced through a single File Package.

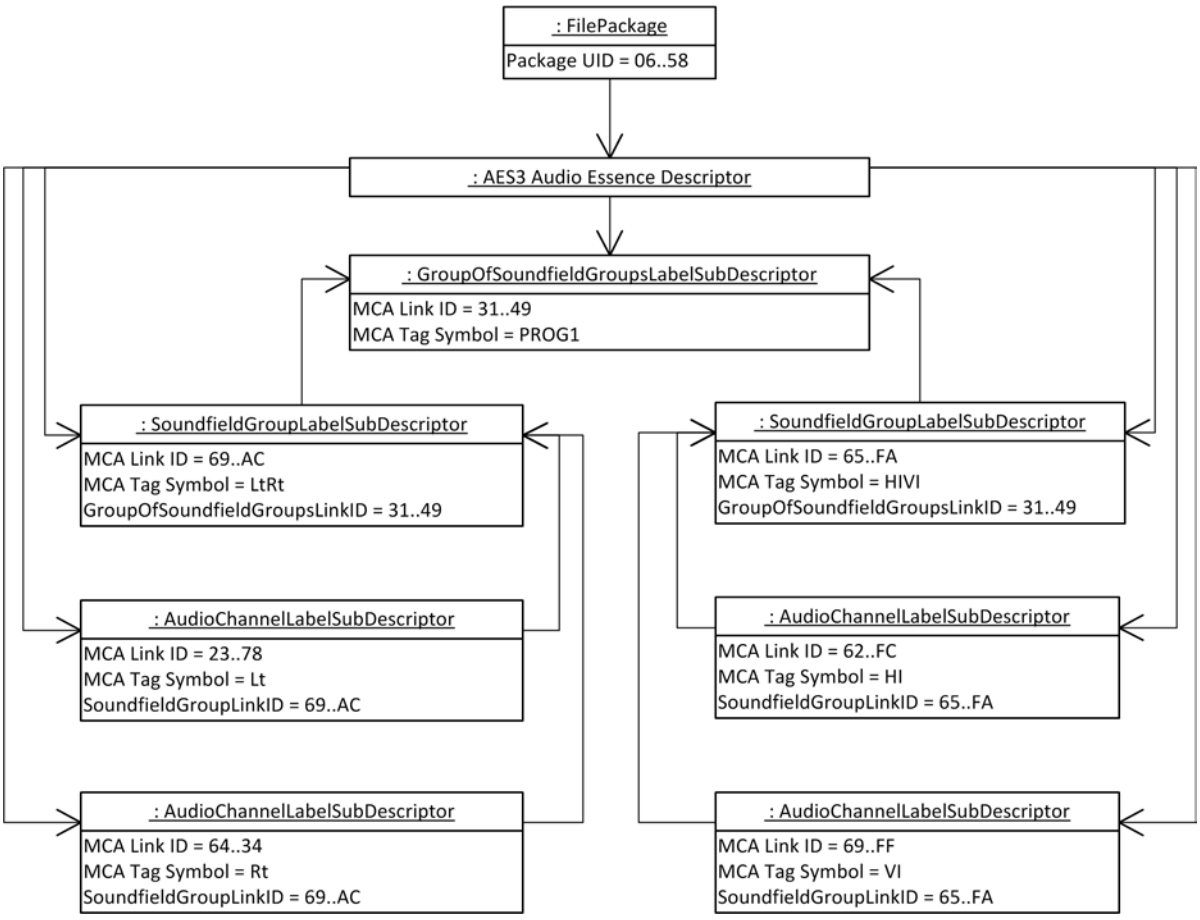

Figure A.1 – MCA Framework example for an audio program contained within a single essence container

In Figure A.2, the same audio essence is contained in two SMPTE ST 382 essence containers, each containing the audio essence corresponding to one of the two single soundfield groups and each within a distinct MXF file. The MCALabelSubDescriptors related to the first and second soundfield group are stored in the first file, respectively. Since the GroupOfSoundfieldGroupsLabelSubDescriptor applies to both soundfield groups, it is duplicated in both files. Implementations can detect this duplication by examining the MCA Link ID of the GroupOfSoundfieldGroupsLabelSubDescriptor, which is identical in both files.

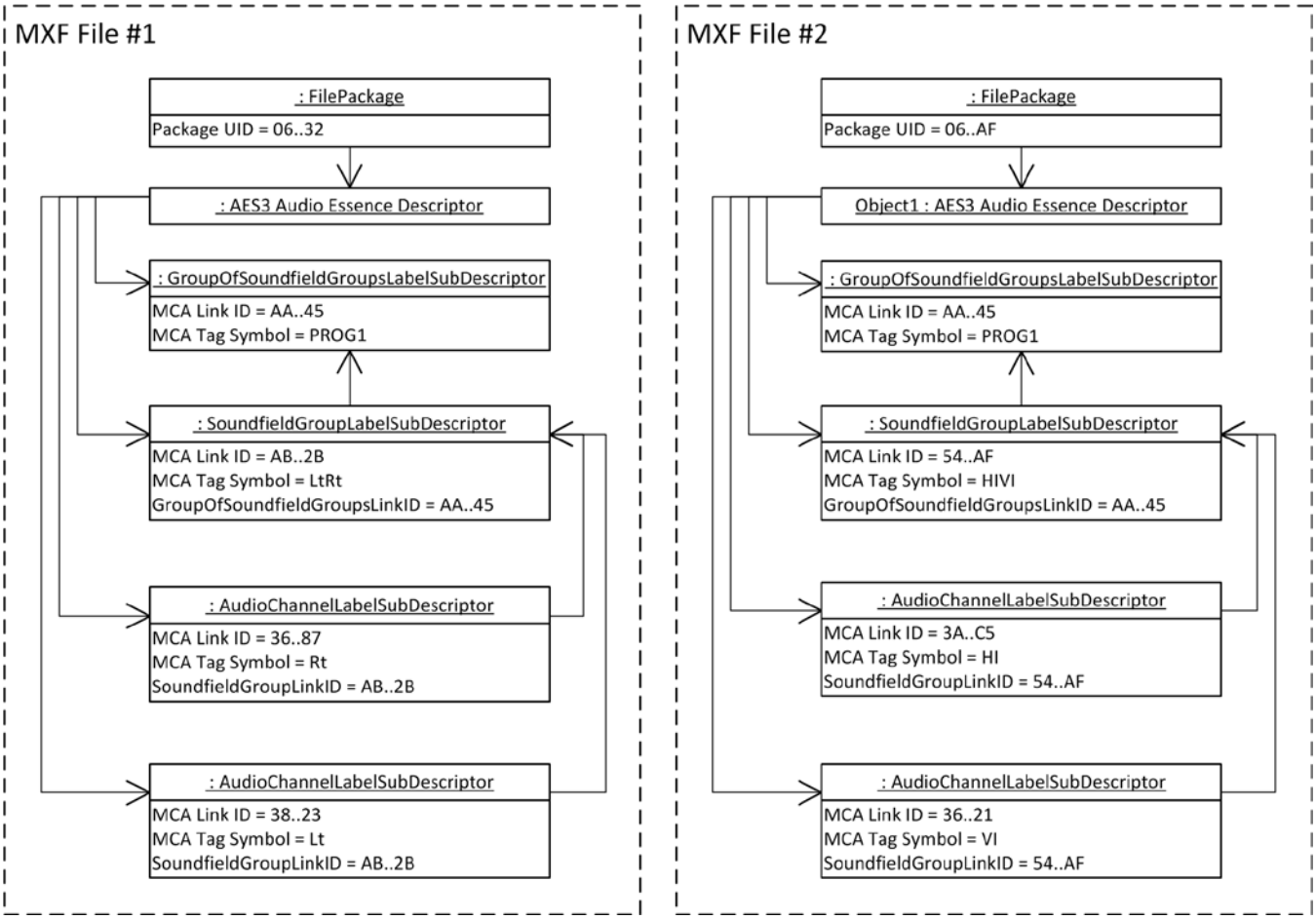

Figure A.2 – MCA Framework example for audio program contained within two distinct MXF files

Annex B MCA Framework Hierarchical Class System (Informative)

The Multichannel Audio Framework ("MCA Framework") is a hierarchical class system. It is based on the concept of Descriptors and Sub Descriptors as defined in SMPTE ST 377-1, Section 10.5. The hierarchical classes and the reference concepts laid forth in that document are the basis for the MCA Framework object model. An informative summary is presented here as a means to introduce the specifics of the MCA Framework object model and tie it into existing MXF structure.

In the MXF structure, Descriptors are derived from the Generic Descriptor, which is defined in SMPTE ST 377-1, Annex B.2. The Generic Descriptor is never used directly (i.e.; it is an abstract superclass). It is required for each individual Descriptor that is derived directly or indirectly from the Generic Descriptor that the Item Designator, Set Keys and Properties be defined.

SMPTE ST 377-1, Annex B.2 also provides for an array of strong references to SubDescriptors in a Generic Descriptor. The SubDescriptor class defined in SMPTE ST 377-1 is an abstract class and not used directly. Concrete subclasses of SubDescriptors can be used directly.

It should be noted that GenericDescriptor::SubDescriptors and MultipleDescriptor::SubDescriptorUIDs are distinct. The MultipleDescriptor::SubDescriptorUIDs describes multiple interleaved tracks, whereas GenericDescriptor::SubDescriptors is used to collect subdescriptors for a single Track.

The SubDescriptor that is the abstract class has a 16 byte Universal Label that is defined in SMPTE ST 336, Table 2. This UL describes the registry and structure in the first 8 bytes, with bytes 9-16 describing the specific item designators. Byte 14 and 15 of the item designators are the Set Kind bytes, which identify concrete subclasses of the SubDescriptor abstract class.

By the nature of the abstract class-subclass relationship, the subclasses inherit common metadata element fields (NOT field values) from their parent abstract class. This is indicated in the SubDescriptor (subclass) tables as a reference to the element fields in the abstract class table. Any data element fields that are unique to the subclass are called out explicitly in the SubDescriptor table.

The MCA Framework object model defines a parent abstract superclass named "MCALabelSubDescriptor". The concrete subclasses are the AudioChannelLabelSubDescriptor, the SoundfieldGroupSubDescriptor, and the GroupOfSoundfieldGroupsSubDescriptor. The MCALabelSubDescriptor and its three subclasses are the core of the Multichannel Audio Labeling structure and are all derived from the MXF SubDescriptor as defined in SMPTE ST 377-1, Annex B.3. The metadata elements associated with each are considered the "set" of metadata elements for that subclass and are referred to as such in this document.

Thusly each component of a 5.1 program, whether compressed or uncompressed, is associated with an AudioChannelLabelSubDescriptor and the program as a whole with a SoundfieldGroupLabelSubDescriptor, which is then handled as an entity. The GroupOfSoundfieldGroupsLabelSubDescriptor can be used, for instance, to label a transmission of 5.1, Lt-Rt, mono VI and mono SAP audio essence carried as independent soundfield groups in a single transport file or in individual packages. The GSG labels could also be used if the audio essence is carried in a single encoded bitstream, such as Dolby E, multiple audio channels within a single file, as with D-Cinema Track Files, or in individual packages. The soundfield groups might be played out separately or simultaneously depending on the specific implementation.

The Group of Soundfield Groups could also be used for applications in simultaneous ingest, mix-down or playout, among others. One such use might be to associate multiple soundfield groups to form an "English" version or a "French" version or a "Profanity-free" version.

Annex C Utilizing MCA Labels in An Application (Informative)

C.1 Steps Required to use MCALabelSubDescriptors in an Application

This document defines a structure and sets of metadata items that can be used to label multichannel audio. In order to utilize this structure, a specific application needs to determine which MCA Labels are appropriate for that application, which metadata fields within each MCALabelSubsecriptor instance are required, which are optional and which are not used. The application must then register UL's and specific values to be used in each metadata field that is utilized by the application. Lastly, the application can document how the multichannel audio data will be mapped into physical interfaces for further processing by other related systems. These specific constraints, metadata items and values with their UL information would take the form of published documents(s) that are specific to the given application. These documents would normatively reference existing documents from other applications as appropriate.

C.1.1 Choosing MCALabelSubDescriptors for the Application

The MCALabelSubdescriptor is always present in all applications, as it is the parent subclass. An application could choose to utilize one, two or all three of these MCALabelSubdescriptors depending on the way audio is used in the application.

The AudioChannelLabelSubDescriptor is used to label a single channel of audio, and thus would be present in almost all applications. If the application uses only individual audio channels and has no need to group channels together for playout into a defined soundfield, then the AudioChannelLabelSubDescriptor can be considered sufficient to describe the nature of the audio and how it is to be used within the application.

If the application delivers or plays audio channels through a transducer or set of transducers that turn the audio into sound, then the SoundfieldGroupLabelSubDescriptor can be utilized as means to indicate the nature of that soundfield. The SoundfieldGroupLabelSubDescriptor's MCA Link ID would be used as part of the AudioChannelLabelSubDescriptor so that the application can recognize which channels belong together and aggregate them accordingly. This is very useful and can be used whether the audio channels are in individual packages or the same package, travel on the same wire or travel on multiple wires. Many applications can accomplish all transmission and routing tasks just by using a combination of the AudioChannelLabelSubDescriptor and the SoundfieldGroupLabelSubDescriptor, so these would be all that are required.

For applications that deal with multiple programs, versions, languages and/or soundfield transmissions simultaneously, the MCA Framework provides the GroupOfSoundfieldGroupsLabelSubDescriptor. The GroupOfSoundfieldGroupsLabelSubDescriptor allows for a soundfleld group to be related with other soundfleld groups in an orderly naming scheme. The GroupOfSoundfieldGroupsLabelSubDescriptor would indicate the nature of the soundfields within the group of soundfield groups. The GroupOfSoundfieldGroupsLabelSubDescriptor's MCA Link ID would be used as part of the SoundfieldGroupLabelSubDescriptor so that the application can recognize which soundfields belong together and aggregate them accordingly. For example, in a broadcast application the GroupOfSoundfieldGroupsLabelSubDescriptor could be used for labeling a transmission that contained 5.1 and Lt-Rt soundfields, English and Spanish languages, Main Program and commentaries, or many other combinations.

C.1.2 Choosing Required and Optional Metadata Items

There are three metadata items in the MCALabelSubDescriptor that are required by this structure, which are the MCA Library Dictionary ID, the MCA Link ID and the MCA Tag Symbol. The others can be utilized as required, optional or not at all by any given application. Since the MCALabelSubDescriptor metadata items are inherited by each of the three MCALabelSubDescriptors, an application can further determine which metadata items are used for each MCALabelSubDescriptor utilized in the application.

For example, an application with a single program and with identical content and language between audio channels could simply utilize the MCA Label Dictionary ID, the MCA Link ID and the MCA Tag Symbol metadata items in the AudioChannelLabelSubDescriptor and SoundfieldGroupLabelSubDescriptor to route audio channels to their correct destination. By knowing the intended destination of an audio channel (e.g. the AudioChannelLabelSubDescriptor's MCA Label Dictionary ID indicates Left Surround) and the soundfield group to which the audio channel belongs (e.g. the SoundfieldGroupLinkID value in the AudioChannelLabelSubDescriptor indicates the 5.1 soundfield group to which the audio channel belongs), the audio channel can be reliably routed to the left surround speaker of a 5.1 speaker configuration.

If the application uses similar audio channels but with different languages and/or content, then the "MCA Spoken Language" and "MCA Audio Content Kind" metadata fields could be utilized to distinguish these channels and route them accordingly. By the same token, if different program titles, versions or sub-versions of the same title are being transmitted, the MCA Title, MCA Title Version and MCA Title Sub Version metadata items can be utilized.

As described in Section 5.4, the MCA structure allows for optional redundancy. For example, the SoundfieldGroupLabelSubDescriptor can contain redundant information from the AudioChannelLabelSubDescriptor and the GroupOfSoundfieldGroupsLabelSubDescriptor could contain redundant information from the SoundfieldGroupLabelSubDescriptors and/or AudioChannelLabelSubDescriptors in that group of soundfield groups. This redundancy results in a very robust labeling method for certain applications, especially when files are transmitted in separate packages. An application can use as few or as many of the redundant metadata items as needed.

C.2 Specifying Mapping into Physical Interfaces

If the application requires that multichannel audio be mapped into a physical interface, a document can be written to describe how this mapping is to be done for that application. This document would specify how multichannel audio that is labeled utilizing this structure would be ordered and mapped so that it can be properly understood and routed by downstream equipment that is used by the given application. There could be more than one layout that an application can recognize. For each of these, the mapping from MXF to the physical interface can be specified.