INTERNATIONAL STANDARD

ISO
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Digital cinema (D-cinema) packaging —

Part 9:
Asset mapping and file segmentation

Emballage du cinéma numérique (cinéma D) —

Partie 9: Cartographie d'avoir et segmentation de fichier

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Foreword

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 26429-9 was prepared by Technical Committee ISO/TC 36, *Cinematography*.

ISO 26429-9 was prepared by the Society of Motion Picture and Television Engineers (as SMPTE 429-9-2007) and was adopted, under a special "fast-track procedure", by Technical Committee ISO/TC 36, *Cinematography*, in parallel with its approval by the ISO member bodies.

ISO 26429 consists of the following parts, under the general title *Digital cinema (D-cinema) packaging*:

— *Part 3: Sound and picture track file* [equivalent to SMPTE 429-3]

— *Part 4: MXF JPEG 2000 application* [equivalent to SMPTE 429-4]

— *Part 6: MXF track file essence encryption* [equivalent to SMPTE 429-6]

— *Part 7: Composition playlist* [equivalent to SMPTE 429-7]

— *Part 8: Packing list* [equivalent to SMPTE 429-8]

— *Part 9: Asset mapping and file segmentation* [equivalent to SMPTE 429-9]

— *Part 10: Stereoscopic picture track file* [equivalent to SMPTE 429-10]

Introduction

This part of ISO 26429 comprises SMPTE 429-9-2007 and Annex ZZ (which provides equivalences between ISO standards and SMPTE standards referenced in the text).

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SMPTE 429-9-2007

SMPTE STANDARD

D-Cinema Packaging —
Asset Mapping and
File Segmentation

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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 Part XIII of its Administrative Practices.

SMPTE 429-9 was prepared by Technology Committee DC28.

1 Scope

This document specifies a generic method for mapping a D-Cinema Package (DCP) onto one or more file storage volumes. Data structures are specified which provide for the mapping of D-Cinema asset identifier values onto paths within a particular file storage scheme (e.g., filesystem paths). Where required, assets may be split across multiple storage volumes to allow efficient use of media and the mapping of assets larger than a given storage volume's capacity. The Asset Map and Volume Index structures and the associated provisions detailed herein are intended to provide a framework for simplified mapping of a DCP onto a wide variety of file storage systems.

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.

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.

1. World Wide Web Consortium (W3C) (2004, February 4). Extensible Markup Language (XML) 1.0 (Third Edition).

2. World Wide Web Consortium (W3C) (2004, October 28). XML Schema Part 1: Structures (Second Edition).

3. World Wide Web Consortium (W3C) (2004, October 28). XML Schema Part 2: Datatypes (Second Edition).

4. Internet Engineering Task Force (IETF) (November 1996) RFC1738 — Uniform Resource Locators (URL)

5. Internet Engineering Task Force (IETF) (1996, November). RFC 2396 — Uniform Resource Identifiers (URI): Generic Syntax

6. Internet Engineering Task Force (IETF) (2005, July). RFC 4122 — A Universally Unique Identifier (UUID) URN Namespace.

7. SMPTE 429-8-2007, D-Cinema Packaging — Packing List

4 Overview

D-Cinema content is composed of a number of distinct assets such as Composition Playlists and Track Files. For delivery between systems, these assets are combined into logical D-Cinema Packages (DCP). A DCP is a single delivery unit defined by a Packing List document [SMPTE 429-8]. The Packing List enumerates all the assets included in the DCP, and provides information necessary for a traceable and error-free delivery.

The DCP and its Packing List are specified independently of any media or file storage scheme. The Packing List contains the UUID identifiers of the assets in the package, not the location of those assets on some volume of media. The Asset Map provides the link between the asset identifier UUIDs and the files containing the assets. This layered approach has two distinct advantages. First, it simplifies specification of the Packing List by removing dependence on past, current or future media formats and constraints. Second, it allows the DCP and its underlying assets to be created once and mapped onto various target media as circumstances require.

The Asset Map structure, depicted in Figure 1 below, provides a mapping from the Packing List asset Ids to actual file locations within the file storage scheme. An Asset Map may contain mappings for more than one DCP, but shall not contain a partial mapping for a particular DCP. A DCP shall not span multiple Asset Maps. The Asset Map provides special identification for Packing List assets so that they may be located without scanning the entire volume.

A DCP storage volume (a distinct container of files) shall contain exactly one Asset Map. In a multi-volume mapping, a single Asset Map shall contain the complete mapping for all volumes, and shall be repeated on each volume. A Volume Index structure (defined in Section 8 below) shall be used to identify each volume in a multi-volume set.

Assets may be divided into multiple segments to allow spanning across multiple volumes (segmentation). The segments are called "chunks", and are stored in files, without additional structure. An Asset may be recreated by concatenating the constituent chunk files.
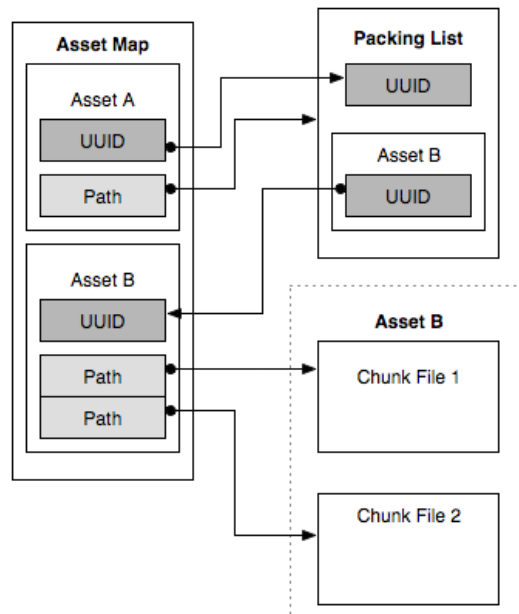

Figure 1 – Relationship between the Packing List and Asset Map structures

The definition of "volume" and the means of identifying the Asset Map on a volume shall be defined by a normative DCP Map Profile (see Section 9 "Media-Specific Constraints" below) for that media type. DCP Map Profiles shall normatively reference this document and shall follow the provisions of this document except where explicitly noted.

4.1 Ingesting a DCP Volume (Informative)

The process of reading a DCP into a D-Cinema system is termed *Ingest*. A system may provide a simple or elaborate ingest control interface - allowing coarse or fine-grained selection of items to be ingested — but the basic process of discovering the contents of a volume will always be the same.

As illustrated using pseudo-code in Figure 2 below, a DCP storage volume is ingested by first opening the Asset Map document on that volume. The means of identifying the Asset Map on the volume is defined by the normative DCP Map Profile (see Section 9) for that media type. The Asset Map is used to locate the Packing List(s) which detail the contents of the available DCP(s). Assets are chosen from the Packing List(s), and the selected assets are ingested by using the Asset Map to locate the chunks of data on the storage volume. The chunks are concatenated to restore the original file. (This example does not illustrate multi-volume ingest).

```
Ingest DCP volume:
  open the Asset Map

  for each Packing List in the Asset Map
    open the Packing List

    for each Asset in the Packing List
      if this Asset is wanted
        locate the corresponding Asset structure in the Asset Map

        for each chunk in the Asset structure
          read the chunk data
          write to destination

        test the message digest
```

Figure 2 – Example ingest process

4.2 XML File Structure

The structures defined in this document are represented using the Extensible Markup Language (XML) [XML 1.0], and specified using XML Schema [XML Schema Part 1: Structures] and [XML Schema Part 2: Datatypes]. This specification shall be associated with a unique XML namespace name [Namespaces in XML]. The namespace name shall be the string value "`http://www.smpte-ra.org/schemas/429-9/2007/AM`". This namespace name conveys both structural and semantic version information, but does not serve the purpose of a traditional version number field.

Table 1 lists the XML namespace names used in this specification. Namespace names are represented as Uniform Resource Identifier (URI) values [RFC 2396][1].

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[1] Readers unfamiliar with URI values as XML namespace names should be aware that although a URI value begins with a "method" element ("http" in this case), the value is designed primarily to be a unique string and does not necessarily correspond to an actual on-line resource. Applications implementing this standard should not attempt to resolve URI values on-line.

SMPTE 429-9-2007

Table 1 – XML Namespaces

Qualifier	URI
am	`http://www.smpte-ra.org/schemas/429-9/2007/AM`
xs	`http://www.w3.org/2001/XMLSchema`

The URIs found in Table 1 are normative. The namespace qualifier values (also called namespace prefixes in XML jargon) used in Table 1 and elsewhere in this document, namely "am" and "xs", are not normative. Specifically, they may be replaced in instance documents by any XML compliant namespace prefix. In other words, implementations shall expect any arbitrary XML compliant namespace prefix value that is associated with a URI from table 1.

5 AssetMap Structure

The `AssetMap` element is the top-level element of an Asset Map XML document. A single Asset Map document shall be present in a file on each DCP storage volume. The elements and structure of an AssetMap element are illustrated in Figure 3 and defined in the subsections that follow.
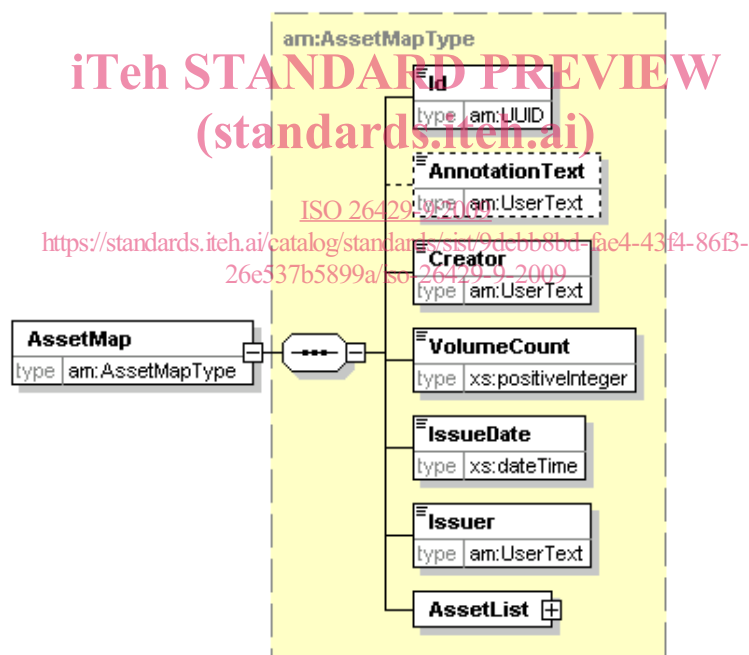

Figure 3 – AssetMap structure

5.1 Id

The `Id` element uniquely identifies the Asset Map structure. It is encoded as a `urn:UUID` [RFC 4122].

5.2 AnnotationText [optional]

The `AnnotationText` element is a free-form, human-readable annotation describing the Asset Map. It is meant strictly as a display hint to the user. The optional `language` attribute is an `xs:language` language code and indicates the language used. If the `language` attribute is not present, the default value `en` shall be used.

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5.3 Creator

The `Creator` element is a free-form, human-readable annotation describing the system (hardware/software) that was used to create the Asset Map for distribution. It is meant strictly as a display hint to the user. The optional `language` attribute is an `xs:language` language code and indicates the language used. If the `language` attribute is not present, the default value `en` shall be used.

5.4 VolumeCount

The `VolumeCount` element indicates the total number of volumes that are referenced by this Asset Map. The first volume in a set shall be numbered 1 (one).

5.5 IssueDate

The `IssueDate` element indicates the time and date at which the Asset Map was issued. It may be displayed to the user.

5.6 Issuer

The `Issuer` element is a free-form, human-readable annotation describing the person or company who has created the Asset Map for distribution. It is meant strictly as a display hint to the user. The optional `language` attribute is an `xs:language` language code and indicates the language used. If the `language` attribute is not present, the default value `en` shall be used.

5.7 AssetList

The `AssetList` element contains a list of `Asset` elements. The structure of the `Asset` element is described in the following section.

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6 Asset Structure

The `Asset` element is used to represent assets within the `AssetList` element of an `AssetMap`. The `Asset` element is of the type `AssetType`, illustrated in Figure 4 and defined in the subsections that follow.
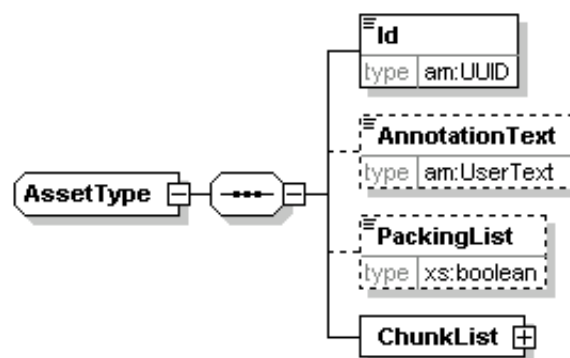

Figure 4 – Asset structure

6.1 Id

The `Id` element uniquely identifies the asset for management purposes. It is encoded as a `urn:UUID` [RFC 4122].