

SMPTE STANDARD

D-Cinema Packaging —
DCP Operational Constraints



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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 Operations Manual.

SMPTE ST 429-2 was prepared by Technology Committee 21DC.

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 document specifies a D-Cinema Package (DCP), a collection of files containing d-cinema essence and related metadata to be ingested and reproduced by a d-cinema playback system.

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

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 382:2007) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 382M-2007). Documents with the same root number (e.g. 382) 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 377-1:2011] Material Exchange Format (MXF) — File Format Specification

[SMPTE ST 377-4:2012] MXF Multichannel Audio Labeling Framework

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

[SMPTE ST 400:2012] SMPTE Labels Structure

[SMPTE ST 422:2006] Material Exchange Format — Mapping JPEG 2000 Codestreams into the MXF Generic Container

[SMPTE ST 428-1:2006] D-Cinema Distribution Master — Image Characteristics

[SMPTE ST 428-2:2006] D-Cinema Distribution Master — Audio Characteristics

[SMPTE ST 428-7:2010] D-Cinema Distribution Master — Subtitle

[SMPTE ST 428-10:2008] D-Cinema Distribution Master — Closed Caption and Closed Subtitle

[SMPTE ST 428-12:2013] D-Cinema Distribution Master — Common Audio Channels and Soundfield Groups

[SMPTE ST 429-3:2007] D-Cinema Packaging — Sound and Picture Track File

[SMPTE ST 429-4:2006] D-Cinema Packaging — MXF JPEG 2000 Application

[SMPTE ST 429-5:2009] D-Cinema Packaging — Timed Text Track File

[SMPTE ST 429-6:2006] D-Cinema Packaging — MXF Track File Essence Encryption

[SMPTE ST 429-7:2006] D-Cinema Packaging — Composition Playlist

[SMPTE ST 429-8:2007] D-Cinema Packaging — Packing List

[SMPTE ST 429-10:2008] D-Cinema Packaging — Stereoscopic Picture Track File

[SMPTE ST 429-12:2008] D-Cinema Packaging — Caption and Closed Subtitle

[SMPTE ST 430-2:2006] D-Cinema Operations — Digital Certificate

[SMPTE ST 2029:2009] Uniform Resource Names for SMPTE Resources

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

[ISO/IEC 15444-1:2004] Information Technology — JPEG 2000 Image Coding System: Core Coding System

[ISO/IEC 15444-1:2004/Amd 1:2006] Profiles for Digital Cinema Applications

[ISO/IEC 15948:2004] Information Technology — Computer Graphics and Image Processing — Portable Network Graphics (PNG): Functional Specification

[IEC 61966-2-1:1999] Colour Measurement and Management in Multimedia Systems and Equipment — Part 2-1: Default RGB Colour Space - sRGB

Internet Engineering Task Force (IETF) (July 2005). [RFC 4122] A Universally Unique Identifier (UUID) URN Namespace

Internet Engineering Task Force (IETF) (February 2006). [RFC 4246] International Standard Audiovisual Number (ISAN) URN Definition

4 Glossary and Acronyms

In addition to the glossary terms and acronyms presented here, the reader should also be aware of terms defined in [SMPTE ST 377-1] and [SMPTE ST 429-7].

d-cinema	digital cinema
DCP	Digital Cinema Package
ISAN	International Standard Audiovisual Number
UMID	Unique Material Identifier
UUID	Universally Unique Identifier
XML	eXtensible Markup Language

5 Overview (Informative)

D-cinema content is composed of a number of distinct elements such as Composition Playlists and Track Files (d-cinema assets). For delivery to d-cinema systems, assets are combined into a logical D-Cinema Package (DCP). The syntax and semantics of these assets and the DCP are described by the family of d-cinema specifications depicted in Figure 1. To promote modularity and layering, each document has a limited scope and often defines a single structure or format.

This specification describes operational constraints applicable to the complete DCP. While structure-specific constraints are addressed in the document that defines a particular structure, this document defines constraints that apply to the combined set of structures that comprise a DCP. For instance, constraints specific to the Composition Playlist, such as those related to content markers, must be defined in the Composition Playlist (CPL) specification, whereas constraints that apply to the DCP as a whole, such as composition edit rate, will be defined in this document.

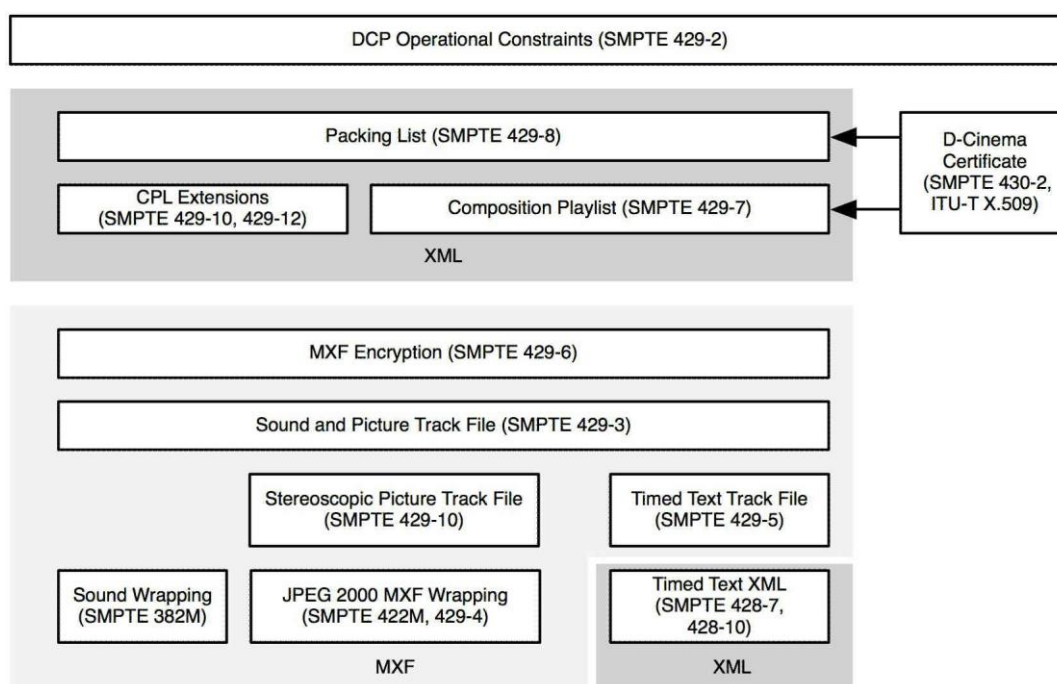


Figure 1 – DCP Family of Specifications

5.1 D-Cinema Package

A D-Cinema Package (DCP) is a set of files consisting of one (1) Packing List [SMPTE ST 429-8] and each of the files referenced by that Packing List. Figure 2 illustrates this structure. The figure shows a Packing List with ten asset references. Each asset reference points to one of the nine track files or the Composition Playlist. A Packing List may reference any combination of Track Files and Composition Playlists, however the set of referenced files must contain no duplicates.

A DCP may contain one or more complete Compositions, or it may contain components of compositions destined to complete, augment or replace previously distributed material.

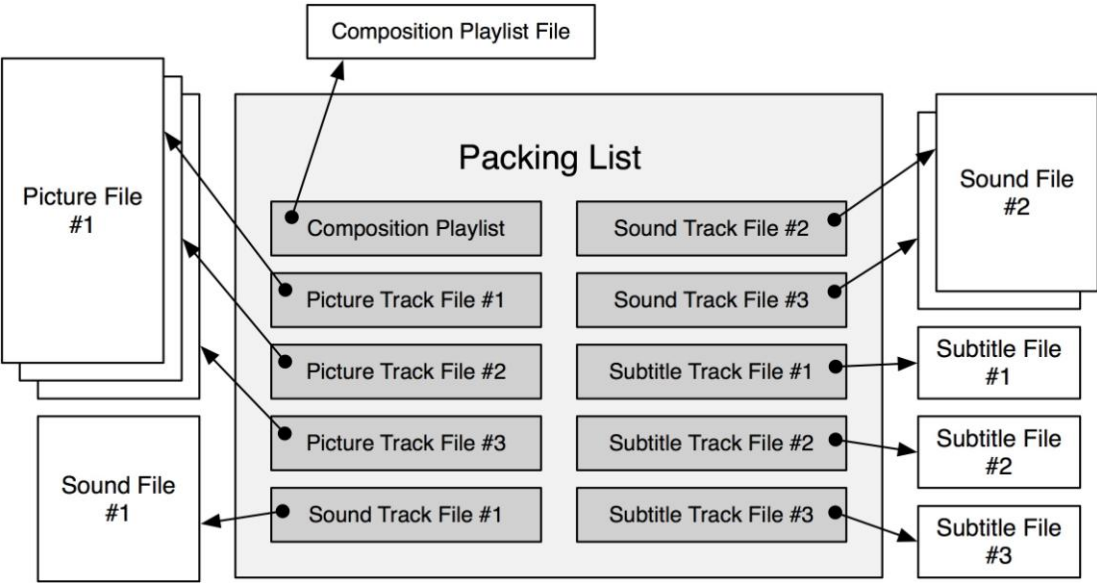


Figure 2 – A D-Cinema Package consists of a Packing List and the files to which it refers

5.2 D-Cinema Composition

A Composition is a set of files consisting of one (1) Composition Playlist document [SMPTE ST 429-7] and each of the Track Files (see Section 10 below) referred to from within that Composition Playlist. Figure 3 illustrates this structure for a composition having three reels of image, sound and subtitles.

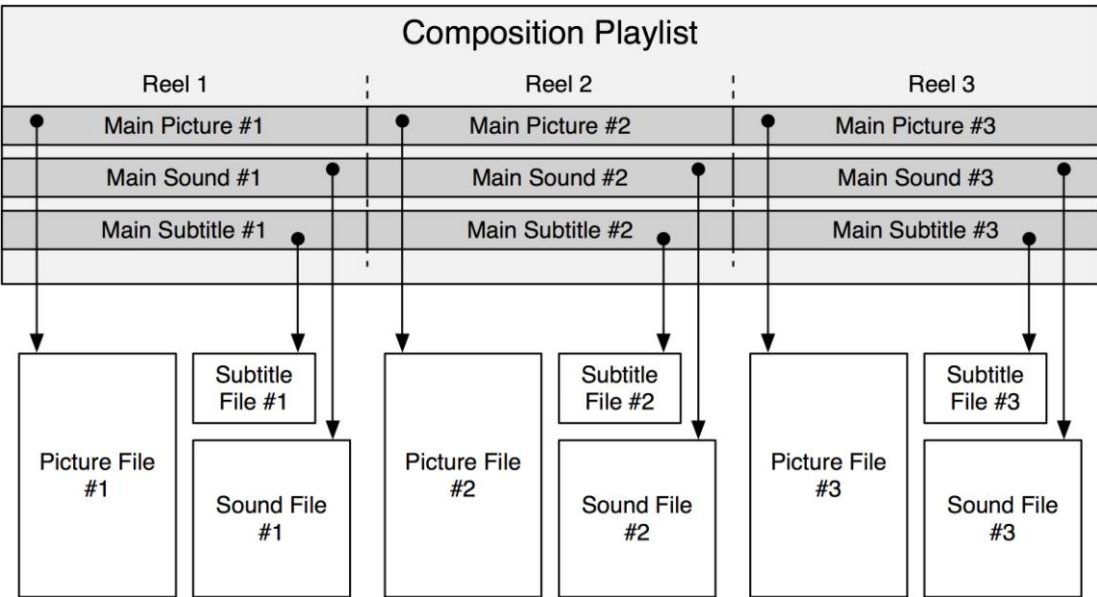


Figure 3 — A Composition consists of a Composition Playlist and the Track Files to which it refers

6 DCP Constraints

6.1 Minimum Contents

A DCP shall consist of one Packing List and one or more assets (i.e., Composition Playlists and/or Track Files), referenced by the Packing List.

6.2 UUID Generation

UUID values are used throughout the DCP to uniquely identify assets and data structures. All UUID values in a DCP shall be generated as specified in [RFC 4122]. UUID values which identify assets or encryption keys shall be generated using a truly-random or pseudo-random number source, and shall have a Version field value of '4' (0100b¹) [RFC 4122].

6.3 XML Character Encoding

XML documents ([SMPTE ST 428-7], [SMPTE ST 429-7], [SMPTE ST 429-8]) in a DCP shall be encoded using the UTF-8 character encoding [ISO/IEC 10646-1].

7 Packing List Constraints

The Packing List document which defines the DCP contents shall be created as specified in [SMPTE ST 429-8]. Note that the specification requires that each Packing List document must have a unique UUID value in the top-level Id element. A Packing List may reference assets which are referenced by other Packing Lists.

7.1 Asset Identity

The value of the Id element within each Asset element shall be extracted from the referenced asset per the specification for the asset (see [SMPTE ST 429-3] and [SMPTE ST 429-7].)

7.2 Unique Set of Assets

Each Asset element shall contain an Id element value that is unique within the Packing List.

7.3 Digital Signature

When a Packing List document is digitally signed as specified in [SMPTE ST 429-8], digital certificates in the signer's certificate chain shall conform to the provisions of [SMPTE ST 430-2].

7.4 Group ID

7.4.1 Composition Packages

A *Composition Package* is a DCP containing only the complete set of assets comprising one or more compositions. The GroupId element shall not be present in the Packing List of a Composition Package.

7.4.2 Asset Packages

An *Asset Package* is a DCP containing Track Files and/or Composition Playlists comprising one or more incomplete compositions (i.e., some assets needed to complete the composition are not present in the package.) Asset Packages shall be identified by the presence of the GroupId element in the Packing List. An

¹ The 'b' suffix on this value indicates a binary encoding, most significant bit (MSB) first.