

# Using EIDR in Digital Cinema

*Interim Technical Note – Version 0.5 (11-Apr-2016)*

## 1. Scope

This Technical Note specifies best practices for the use of Entertainment ID Registry (EIDR) identifiers in the theatrical exhibition of Digital Cinema. Associating a unique, persistent, non-proprietary identifier with theatrical content (including but not restricted to Features and Trailers), will enable the integration of disparate systems and automate existing manual processes.

The scope of this document is restricted to the portion of the digital distribution chain that begins with SMPTE Digital Cinema Packages (DCPs), and encompasses other downstream systems used by theatrical distributors.

Explicitly out-of-scope are post-production workflows, where the use of EIDR identifiers is already well-established and documented elsewhere. Also excluded are so-called “Interop” DCPs. This is a legacy format that is being phased out in favor of SMPTE DCPs. Note: The Composition Playlist discussed in this document should not be confused with a similar structure found within the Interoperable Mastering Format (an emerging post-production standard): despite superficial similarities, they have separate SMPTE specifications.

## 2. Overview

DCPs are the means of distributing cinematic content to theatrical exhibitors who have deployed digital projection systems. Work to develop a standard architecture was initiated early in the 2000's by Digital Cinema Initiatives, LLC (a joint venture of several major studios), and the architecture is embodied in a series of standards developed by SMPTE. DCPs are the replacement for reels of 35mm film, and (as of 2010) are the only mechanism for theatrical distribution. A DCP is just a collection of files, and the delivery from distributor to exhibitor takes several forms, including shipping a hard drive, transmission via satellite, or transmission over a high-speed internet link.

In part because of the relatively recent adoption of Digital Cinema, there are still many manual processes that are a legacy of the film era. Automating those processes will require uniquely identifying content distributed via DCPs across the various systems used by exhibitors, including the following components:

- **Theater Management Systems (TMS):** these are installed in theaters and perform many functions including: the ingestion & storage of DCPs; distribution of content to the projectors in each auditorium of the multiplex; scheduling the projection of features (and ancillary content such as the pre-show); and serving as a repository of DCP authorization keys, which are known as Key Delivery Messages (KDM).

- **Media Block/Projector Systems:** this is the actual projection system. It is often separated into the projector and media block: the latter system is responsible for authenticating, decrypting, and marshalling the content into a format understood by the projector.
- **Ticketing/POS systems:** these facilitate the purchase and issuing of tickets, and are responsible for dealing with credit-card processors. They need to be aware of which Features are showing in which auditoriums.
- **Booking Systems:** whereas the previous systems are concerned with day-to-day operations, the booking system keeps track of which Features are scheduled (present and future), and need to communicate with corresponding systems maintained by film distributors.

A few observations about these systems are in order. First of all, the separation of function is logical, not necessarily physical (e.g. there is no rigorous definition of functions performed by a TMS). Secondly, many of these systems came into existence before the emergence of digital cinema. For each category, there are multiple vendors, and in the absence of standards there is no common way to refer to a Feature. Finally, all these systems have reporting capabilities: again, no standardization.

The lack of standards is exacerbated by the consolidation of theater chains into large corporations managing thousands of screens apiece, and the increasingly global nature of distribution, which requires multiple language and subtitle variants of the same movie. Another complication is that even the name of the movie might vary from country to country, and yet another is that cultural preferences may result in different edits.

In present practice, it is common for a distributor to have to create up to 50 variants of the same Feature. Once received by a multiplex, it is not uncommon to have to manually transcribe information about the feature (perhaps originally derived from a booking) into the ticketing and TMS systems.

The lack of a common naming convention for Features results in *ad hoc* procedures that are prone to error. Depending on the name of a Feature (e.g. “Psycho”) is particularly prone to confusion, whether from simple misspelling to confusion between entirely different Features that happen to have similar or even identical names (e.g. remakes).

As a mitigation, the Inter-Society Digital Cinema Form (ISDCF) has adopted the Digital Cinema Naming Convention (DCNC). Used by both Interop & SMPTE DCPs, this attempts to encode critical Feature metadata (including the title, but also language, aspect ratio, etc.) into a file name. Although in widespread use, it is very fragile (the word “Convention” is used advisedly). For SMPTE DCPs, the Composition Playlist contains a superset of DCNC metadata and is preferred.

Cutting this Gordian knot will take place over time, but achieving a common means of naming a feature is the starting point.

The next two sections describe DCPs in more detail, and introduces the Composition Playlist (CPL), a standard structure found within the DCP that contains a logical point for insertion of an EIDR identifier to achieve this goal.

### 3. Digital Cinema Package (DCP)

A Digital Cinema Package is a collection of files that contain the following components:

- One Packing List (PKL) that lists the contents (track files and CPLs) of the DCP. It is based on XML.
- Multiple Track Files, each of which contains Essence (content) of a particular media type (e.g. audio) lasting a non-zero duration. Each track file is associated with a UUID (RFC 4122) for disambiguation.
- One or more Composition Playlists (CPLs).

As previously noted, there are two distinct flavors of DCP: the legacy “Interop” DCPs (based on a combination of conventions and standards; and SMPTE DCPs, which are rigorously defined in a series of standards (ST 429-X). Current Digital Cinema projectors can handle either format, and currently (early 2016) Interop DCP’s predominate. However, SMPTE DCPs are expected to completely replace Interop in the next few years.

### 4. Composition Playlist (CPL)

The Composition Playlist (CPL) is a data structure contained within the DCP that specifies how a digital cinema system should play back the various components of the content (e.g. audio, video, subtitles). For SMPTE DCPs, the CPL is an XML structure specified by ST 429-7; Interop DCPs use a similar structure based on an early draft of ST 429-7 that contains only limited metadata.

Each CPL is based on a timeline that covers the duration of the content in integral Edit Units based on the frame rate. The timeline is partitioned into an ascending sequence of Reels. Each Reel is organized by content type (audio, visual, etc.), and content type specifies an interval (equal to the duration of the containing Reel) that maps to a subset (defined by starting offset and duration) of a separate track file. This is shown in Figure 1, which depicts the mapping between Reel 1 and corresponding track files.

Note that 1) every frame of the content must fall within some Reel; 2) for a given Reel and essence type, there is a reference to a sub-interval of a track file containing that essence; 3) a track file may therefore be longer an duration than the sub-interval mapped to a Reel.

The separation of media Track files (which contains the essence) from the CPL (which specifies how they are to be combined for a particular piece of content) allows an efficient packaging of closely related titles. For example, distributing English and French versions of the same movie doesn’t need to be sent as two DCPs (wastefully duplicating the visual track). Instead, a DCP is created that contains both English and French track files, and two corresponding CPLs.

Another characteristic of CPLs worth noting (though not directly relevant) is that they may refer to track files not present within the DCP. This is done for operational flexibility: a DCP may be sent that contains a new CPL that acts as an update: it refers to track files previously received from a previous DCP. Managing this is one of the responsibilities of the TMS, which typically ingests the files of a DCP into a separate storage array (i.e. a movie is not played directly from a DCP shipped on a hard disk).

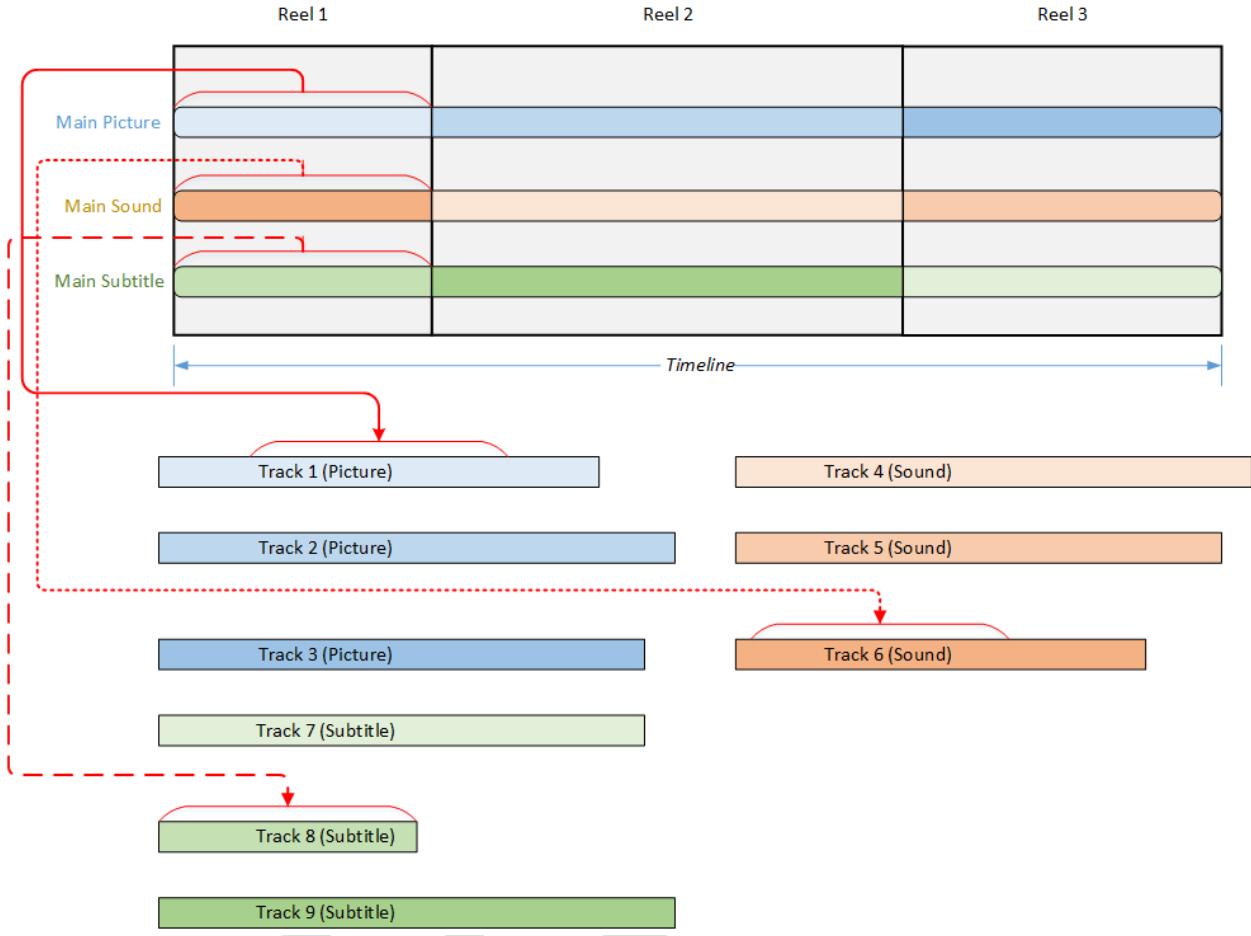


Figure 1: Composition Playlist

## 5. Putting an EIDR into a CPL

Each CPL has the desirable property of being associated with exactly one Edit (level 2) EIDR. The converse is not true: for example, a CPL may be superseded by a newer CPL that corrects an error in the first that doesn't involve the essence. Each will refer to the same Edit EIDR. EIDR also permits different picture timelines to correspond to a single Edit, e.g. if dub cards are added at the end of the main program<sup>1</sup>.

Better yet, existing post-production processes ensure that a Edit EIDR exists for each CPL. What remains is to devise a convention for embedding Edit Level EIDRs in CPLs as part of the DCP creation process.

<sup>1</sup> Thanks to Pierre-Anthony Lemieux for this observation.

There is an additional constraint that must be done without revising any of the SMPTE specifications, a process that would take at least a year (two would be more realistic).

Within the CPL, the **ContentVersion** field seems ideally suited for this. According to the SMPTE 429-7 spec, it “defines the version of the content referred to” by the content, which matches the notion of a Edit EIDR. Unfortunately, this field must occur exactly once, so it is likely that it is already being used as part of some existing workflow. A more serious problem is that legal identifiers allowed in **ContentVersion** are constrained by the SMPTE 429-2:2013 Operational Constraints specifications, and EIDR identifiers are not currently allowed<sup>2</sup>.

With **ContentVersion** being unavailable, the alternative is to make use of the CPL’s extension mechanism. This was not present in the original CPL, but was added in SMPTE ST 429-16 as a list of **ExtensionMetadata** Elements. Each of these defines a **PropertyList** of name-value pairs that may be scoped by a URI to distinguish it from other extension data.

This document proposes the following:

- 1) Use **ExtensionMetadata** to specify an EIDR, according to the following convention:

```
<ExtensionMetadataList>
    <ExtensionMetadata scope="http://eindr.org/EIDR/2016">
        <Name>EIDR</Name>
        <PropertyList>
            <Property>
                <Name>structural-type</Name>
                <Value>urn:eindr:10.5240:XXXX-XXXX-XXXX-XXXX-C</Value>
            </Property>
        </PropertyList>
    </ExtensionMetadata>
</ExtensionMetadataList>
```

- 2) If a future revision to SMPTE ST 429-2 is to allow an EIDR, use **ContentVersion** as follows:

```
<cpl:ContentVersion>
    <cpl:Id>urn:eindr:10.5240:XXXX-XXXX-XXXX-XXXX-C</cpl:Id>
    <cpl:LabelText>structural-type</cpl:LabelText>
</cpl:ContentVersion>
```

In both cases, the **structural-type** would correspond to the Structural Type of the EIDR record, which is one of:

- Abstraction (for Level 1 EIDRs)
- Performance (for Edit (Level 2) EIDRs)
- Digital (for Level 3 EIDRs)

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<sup>2</sup> ST 429-2 is in the process of being revised, and if approved will likely relax this restriction and allow EIDRs to be used. In this event, storing the EIDR **ContentVersion** would be preferred over **ExtensionMetadata** (but could appear either place).

Per the previous discussion, Edit EIDRs are preferred, and should cover all the use cases for linking to the other systems on the Exhibition side. In particular, there are separate Edit EIDRs for a Feature available in both 2D and 3D. Features in different languages are also distinguished by Level 2 EIDRs (via the **VersionLanguage** field).

## 6. Downstream Applications

Embedding EIDR urn: references into Feature CPLs would bring immediate benefits to several processes related to theatrical exhibition that are currently manual.

Many Theatre Management systems depend upon manual mapping of Feature CPLs to master “titles” in order to interpret playout logs for reporting purposes, to facilitate playlist building and to target pre-show content at particular film titles. This would no longer be necessary and such systems could draw upon the EIDR registry as a source of master titles.

It is common for TMS systems to be linked to POS/scheduling systems so that the schedules already planned by the exhibitor can be directly imported into the TMS and downstream playback systems. EIDR tagged CPLs in combination with adoption of EIDR title integration on both sides could unlock fully automated theatrical operation.

Content delivery and KDM fulfilment is another very manual process which could be similarly improved. Exhibitors book titles with distributors, but receive CPLs (packaged as DCPs) and KDMs (which refer to CPLs). EIDR tagged CPLs in combination with adoption of EIDR title integration at other points in the value chain could empower fully automated KDM and DCP logistics all the way from distributor instruction to screen.

This work would also provide a key foundation on which to build not only more streamlined automated operation, but also to integrate theatrical exhibition systems with external systems as the industry evolves further to embrace the information technology transformation already taking place across other industries, characterized by innovations in the cloud, mobile, big data and machine learning. These offer the promise of deeper customer engagement, increased understanding of customer preferences and behaviors, optimization of theatrical programming based on data analysis and algorithmic machine learning, and new revenue opportunities for exhibitors and content owners.

## 7. References

- [SMPTE ST 429-2](#): Digital Cinema Package — DCP Operational Constraints
- [SMPTE ST 429-7](#): Digital Cinema Package — Composition Playlist
- [SMPTE ST 429-16](#): Additional Composition Metadata and Guideline
- [RFC 4122](#): A Universally Unique IDentifier (UUID) URN Namespace
- EIDR System Version 2.0, [Registry User Guide](#)
- ISDCF [Digital Cinema Naming Convention](#)