

# **FIAF TECHNICAL COMMISSION RECOMMENDATION on the deposit and acquisition of D-cinema elements for long term preservation and access**

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## **Introduction**

With the rapid expansion of D-Cinema venues, a growing number of cinema works are produced and distributed digitally; some of these are distributed on film as well, but increasingly works exist only in a digital format.

Archives acquiring contemporary cinema works, whether through voluntary or statutory agreements, therefore need to have systems capable of managing both the long-term preservation of digital cinema elements, and their future access. A key element of this is the need to define formats acceptable for archival deposit. In the case of certain types of legal deposit, such a specification is a contractual requirement.

The aim of this Recommendation, produced by the Technical Commission of FIAF, is to provide a concise description of the key concepts of digital distribution and to present a simple specification for the archival deposit of digital cinema works. In recognition of the continuously developing nature of digital technology, this document will be reviewed periodically and amended where necessary.

## **Background**

Current standards for digital cinema largely derive from Digital Cinema Initiatives (DCI), a body formed in 2002 by the Hollywood industry majors to create voluntary specifications for an open digital cinema architecture, in order to ensure a uniform high level of technical performance, reliability and quality control. DCI released the Digital Cinema System Specification (DCSS) in 2005, and the current version of this with subsequent amendments and addenda is available from <http://www.dcmovies.com/specification/>.

Some elements of the DCSS are already SMPTE/ISO standards, while others are currently at different stages in the SMPTE or ISO approval process. The DCSS recommendations have, in general, been adopted by the industry.

## **DCSS Elements**

Although there are many and varied routes to the production of a digital cinema work, there are three principal elements in the process:

**Digital Source Master (DSM)** – a DSM is not defined by any standards and therefore can be anything from a single combined picture and sound source (as basic as a Digibeta or an HD tape), to a complex set of separate picture and sound data files. A DSM is not the work in its final D-Cinema format, and as such it does not necessarily represent the work as it will be shown in the theatres.

**Digital Cinema Distribution Master (DCDM)** – the DCDM is the actual set of master files used to produce all D-Cinema projection copies, and is thus analogous to a film negative. It is formatted according to defined standards. There is, however, some flexibility in these standards, and so DCDMs can differ quite significantly from one another. DCDMs are not encrypted. The image in the DCDM is uncompressed (or losslessly compressed) and therefore can be of considerable size (up to several terabytes). Because of the practical difficulties in handling such a large size of file, DCDMs are typically only created as a virtual entity, a frame at a time, as the intermediate step between the DSM and the DCP. In other words, a complete DCDM of the work might not actually exist.

**Digital Cinema Package (DCP)** – The DCP is the ‘digital print’, containing images, soundtracks, subtitles, etc., that is sent to and projected in theatres, and therefore represents the work as shown to audiences. The images in DCPs are compressed so that, for example, a 4K 2 hour feature would occupy about 250 GB. The DCP is rigidly standardised to allow effective distribution.

### **Encryption**

An important part of the DCSS is the specification for encryption of the DCP, using Advanced Encryption Standard (AES), so that access to the work can be completely controlled. In simple terms, the distributor encrypts the DCP as part of the file-wrapping process, and creates a Key Delivery Message (KDM), a short file which is sent to the theatre with the DCP. The DCP can only be opened with this KDM, which typically also restricts the opening to a specific time period and a specific server/projector. Once the work has been projected and the allotted time period has expired, the DCP has reached the end of its useful life and is expected to be deleted from the cinema server.

It is also possible for the distributor to create a special kind of KDM which allows full access to the DCP content. These KDMs are only issued to servers which have been certified as a “Trusted Device”, in other words, one which the distributor has certified as being in a secure environment. A certified server using this type of KDM can, within the time frame specified, extract the AES key (in effect the master key) for the DCP, which can then be used at any time to decrypt the DCP and convert it, if wished into an unencrypted form.

Encryption is not mandatory, though, and DCPs without encryption can be (and frequently are) produced for use in post-production, or in theatrical distribution (e.g. for advertisements). Unencrypted DCPs can be played back on any standard D-Cinema equipment. From an unencrypted DCP it is of course possible to produce an encrypted DCP for distribution.

### **Archival Considerations**

The goal of the archive is to preserve the cinema work as far as possible in its original form and to allow access for the indefinite future. Unlike a conventional film print, the short life expectancy of both digital media and digital formats means that a preservation strategy based on preserving the original medium (such as the hard drive on which a D-Cinema work

is received by the archive) is not viable. Long-term preservation of digital data is a discipline still in its infancy, and is likely to present the major challenge to archives over the coming years. However, the purpose of this recommendation is not to offer long-term preservation solutions, but to specify which formats are acceptable for archival deposit of digital cinema works. As with analogue material, an archive is strongly advised to check the technical quality of any digital item deposited.

**Encrypted DCP:** Archival requirements may be at odds with the shorter term interests of producers and distributors, who may find that offering an encrypted DCP for long-term preservation is both convenient for them and no threat to their rights. However, the preservation of an encrypted DCP is at best a risky strategy: occurrences such as the loss of the key, changes in server hardware, failure to decrypt while the KDM is still active, are all likely to render the DCP worthless.

**Unencrypted DCP:** Although a lossily compressed format, and therefore not an absolute ideal for long term archival preservation, an unencrypted DCP does represent the work exactly as presented to the audience. The DCP can be copied without loss (unlike an analogue print), and because it is relatively small, the storage requirements are within most archives' reach. However, the compressed format is a compromise dictated by today's technology, and this may limit its value as a starting point for future versions or editions of the work.

**Digital Cinema Distribution Master:** The DCDM, being the uncompressed master, is theoretically ideal as a long-term preservation element. However, the DCDM for any particular production may not exist as an actual entity. An archive will also need to balance the advantages of having an uncompressed master, for instance the ability to generate higher quality versions of the work in the future, against the very high storage requirements.

**Digital Source Master:** The DSM does not necessarily represent the work in its final form, and its format is not defined by DCSS standards. It may not be easy (or even possible) to recreate the work in its final form from a DSM, so it cannot be considered as a primary archival version of the work. A high quality DSM shares the large storage requirements of a DCDM. An archive may wish to accept a DSM at its discretion, but not in place of a DCDM or DCP.

## **Recommendation**

- 1. Only a DCDM or an unencrypted DCP are acceptable formats for the long-term preservation of a cinema work.** Archives must be aware that a DCDM will be considerably larger than a DCP.
2. A DSM can also be accepted, but not in place of a DCDM or DCP.