



## TECHNICAL SPECIFICATIONS

### Digital Cinema Package

A **Digital Cinema Package (DCP)** is a collection of digital files used to store and convey Digital cinema (DC) audio, image, and data streams.

The term has been defined by Digital Cinema Initiatives, LLC in their recommendations for packaging of DC contents. General practice adopts a file structure that is organized into a number of usually multi-gigabyte size Material eXchange Format (MXF) files, which are separately used to store audio and video streams, and auxiliary index files in XML format.

The MXF track files contain image and audio essence that are compressed and encoded in order to reduce the huge amount of required storage. Encryption is an optional solution and is used to protect from unauthorized use. The image track file contains compressed JPEG 2000 essence and the audio is a wrapped 24bit linear PCM multichannel WAV file. The adopted (optional) encryption standard is AES 128 bit in CBC mode.

The newer SMPTE standards are used to conform the recommendations among different tool vendors and producers. Interop, the legacy DCP standard, is still required to be supported by DCP players.

### Technical specifications

The DCP root folder (in the storage medium) contains a number of files, some used to store the image and audio contents, and some other used to organize and manage the whole playlist.

### Picture MXF files

Picture contents may be stored in one or more *reels* corresponding to one or more MXF files. Each reel contains pictures as MPEG-2 or JPEG 2000 essence, depending on the adopted codec. MPEG-2 is no longer compliant with the DCI specification. JPEG 2000 is the only accepted compression format.

Supported frame rates are:

#### – SMPTE (JPEG 2000)

- 24, 25, 30, 48, 50, and 60 fps @ 2K
- 24, 25, and 30 fps @ 4K
- 24 and 48 fps @ 2K stereoscopic

#### – MXF Interop (JPEG 2000) – Deprecated

- 24 and 48 fps @ 2K (MXF Interop can be encoded at 25 frame/s but support is not guaranteed)
- 24 fps @ 4K
- 24 fps @ 2K stereoscopic



– MXF Interop (MPEG-2) – Deprecated: 23.976 and 24 fps @ 1920x1080

Maximum frame sizes are 2048x1080 for 2K DCI, and 4096x2160 for 4K DCI.  
Common formats are:

– SMPTE (JPEG 2000)

- Flat (1998x1080 or 3996x2160), ~1.85:1 aspect ratio
- Scope (2048x858 or 4096x1716), ~2.39:1 aspect ratio
- HDTV (1920x1080 or 3840x2160), 16:9 aspect ratio (~1.78:1) (although not specifically defined in the DCI specification, this resolution is DCI compliant per section 8.4.3.2).
- Full (2048x1080 or 4096x2160) (~1.9:1 aspect ratio, official name by DCI is Full Container. Not widely accepted in cinemas.)

– MXF Interop (MPEG-2) – Deprecated: Full Frame (1920x1080)

- 12 bits per pixel precision (36 bits total)
- XYZ colorspace
- Maximum bit rate is 250 Mbit/s (1.3 MBytes per frame at 24 frame/s)

### **Sound MXF files**

Sound contents are stored in reels, too, corresponding to picture reels in number and duration. In case of multilingual features, separate reels are required to convey different languages. Each file contains linear PCM essence.

– Sampling rate is 48,000 or 96,000 samples per second

– Sample precision of 24 bits

– Linear mapping (no companding)

– Up to 16 independent channels.