

WHAT IS A DCP AND HOW DO I CREATE ONE?

Brian Quandt and Eric Sauer



WHO WE ARE

- **Brian Quandt**, Lead Engineer
- Key developer of ISO MPEG standard.
- Software engineer with honorary Dr. degree and 20+ years experience in film and television
- Expertise in Dailes, 3D, VR technologies and art.



WHO WE ARE

- **Eric Sauer**, Projection Engineer and VP Business Development
- Worked in recording industry as a CD mastering engineer in Film Scoring, Production and Post Production Sound, 24 Frame Video Playback and Projection Engineering.
- 20+ years experience at major studios in film/television industry.



WHAT WE DO

- Provide a cloud-based tool.
- That creates DCI-compliant DCPs.
- The “film delivery” format required by most theaters and screening rooms and many film festivals.



WHY USE DCPS?

- Industry-based standard.
- Container allows addition of materials that play on main projector without head switch.
- Designed as a theater-hardened playback environment.



WHO WE HELP

- **Indy Filmmakers**
- **Major Studios**



INDEPENDENT FILMMAKERS

- A cloud-based tool, you can access anywhere.
- Deliver digitally to any screening room with Internet Access. (No transport...)
- Easy to use and inexpensive.
- Ultimate in scalability (don't have to wait in line.)



A-LIST STUDIOS

- First client Christopher Nolan's cameraman.
- Professional Support for Aspera and Sohonet.
- Aspera and Sohonet meet studio requirements for security and file transfer speed (complete feature films).



WHAT IS A DCP?

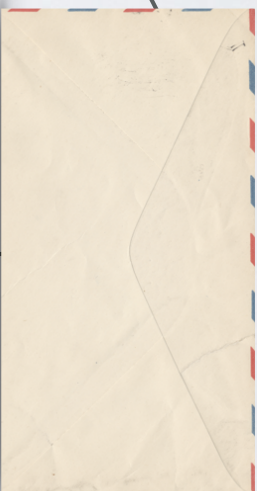
- Digital Cinema Package (container)
- Managed by the Digital Cinema Initiative
- ISDCF—Intersociety Digital Cinema Forum (isdcf.com)



WHAT'S IN A DCP?



Pictures stored in reels
correspond to MFX files



XML Instruction Files:

- Asset Map File
- Composition Playlist File
- Packing List (PKL) File
- Volume Index File
- Subtitle Files



Sound stored in reels
correspond to MFX files



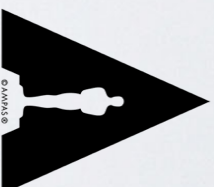
DIGITAL CINEMA INITIATIVE

- Created in March 2002.
- Joint venture of Disney, Fox, Paramount, Sony, Universal and WB.



DIGITAL CINEMA INITIATIVE

- Coordinated efforts with ASC, AMPAS, DCI
- In conjunction with NATO in US and DIRE in the EU
- Plus SMPTE, and ISO, and
- CIE, CNC, CST, FFA
- ISDCF, EDDCF, ICTA, NAB



ACADEMY
OF MOTION PICTURE
ARTS AND SCIENCES

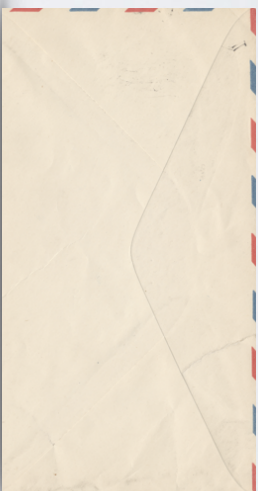


DCI'S GOAL

“DCI's primary purpose is to establish and document voluntary specifications for an open architecture for digital cinema that ensures a uniform and high level of technical performance, reliability and quality control.”



WHAT DID THE DCP ACHIEVE?



Delivery Spec (DCP)



System Spec



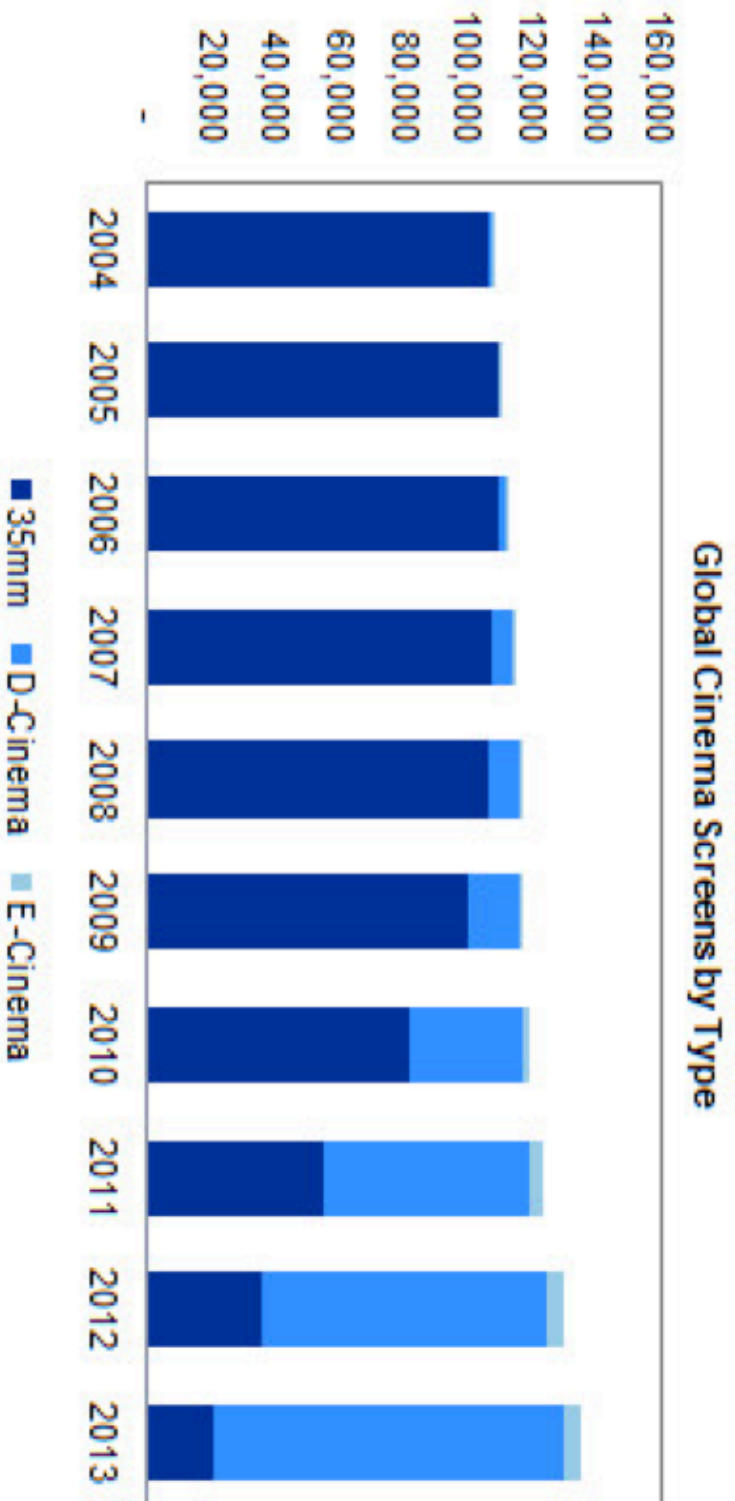
Financing (Virtual Print Fee)



Consistent QC



WHAT DID THE DCI ACHIEVE?



Source: IHS, July 2013

INTERSOCIETY DIGITAL CINEMA FORUM

- Meets once a month to discuss:
- DCP
- KDM (Key distribution message)
- FLM (Facility List Management)
- Formatting drives
- 3D luminance, subtitles, captions, SMPTE specs.



FLAVORS OF DCP



Interop

Not a standard

Set of suggestions

Used with most Hollywood films

Also known as Interop JPEG



SMPTE

Move towards actual standard

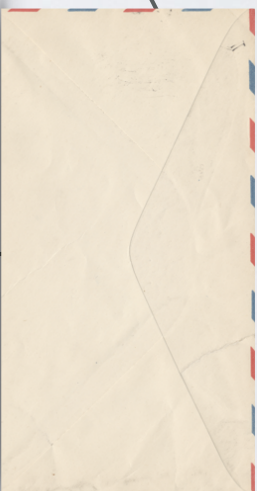
Trying desperately to move
to release

DCI 1.0, DCI 1.1 and DCI 1.2

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SOUND MIXF FILES

- Stored in reels
(corresponding to pic reels in # and duration)
- Separate reels for different languages
- Contains linear PCM essence



SOUND MIXF FILES

- Sampling rate 48,000 or 96,000 samples/second
- Sample precision 24 bits
- Linear Mapping (no companding)
- Up to 16 channels



PICTURE MXF FILES

- Stored in one or more reels corresponding to MXF files.
- Pictures as MPEG-2 (nonstandard) or JPEG2000 essence.



SUPPORTED SPECS

- 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)



SUPPORTED FRAME RATES

SMPTE (JPEG 2000)

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



SUPPORTED FRAME RATES

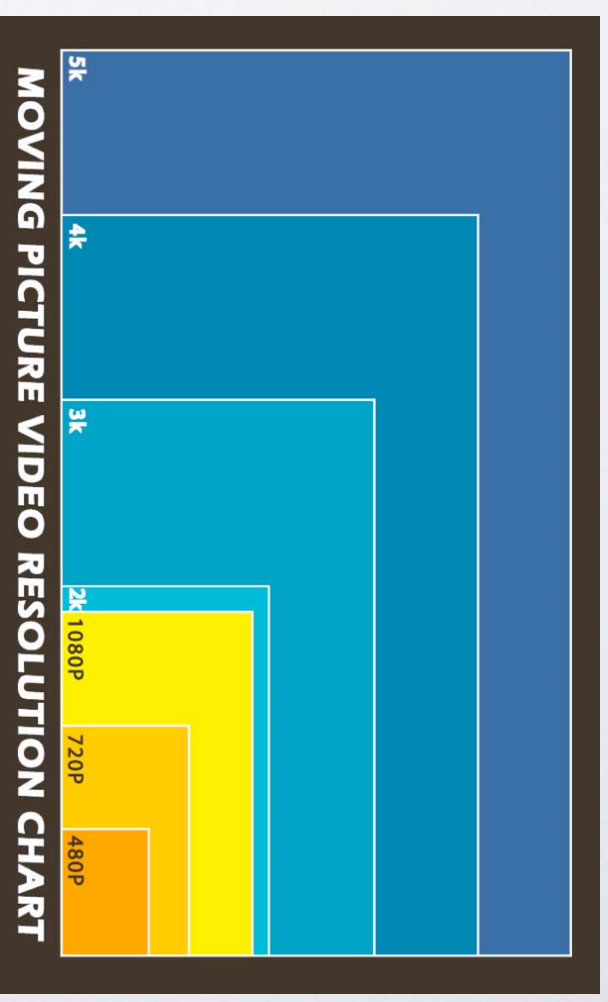
MXF Interop (JPEG 2000) – Deprecated

- 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



MAXIMUM SUPPORTED FRAME SIZES

- 2048x1080 for 2K DC
- 4096x2160 for 4K DC



COMMON FRAME FORMATS

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*
- Full (2048x1080 or 4096x2160)**

HOW ARE DCPS DELIVERED?

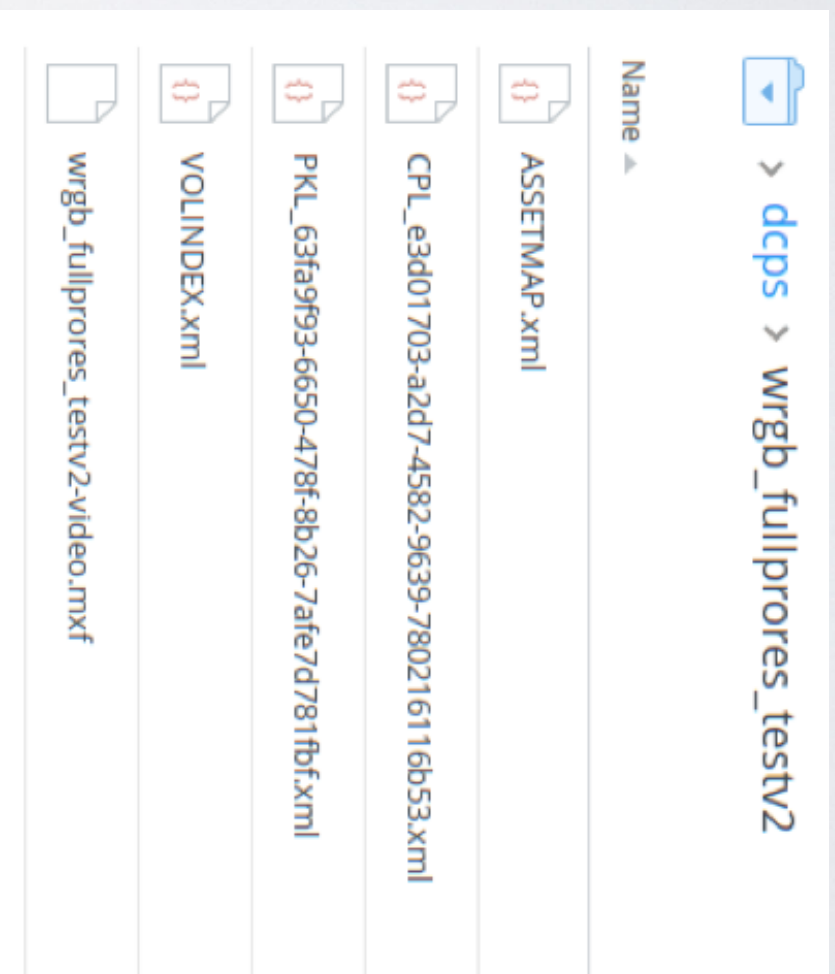


Physical Media
HDD or USB stick
CRU dataport dx115



A Folder of Files
Asset Map File
Composition Playlist File
Packing List (PKL) File
Volume Index File

FILE FOLDER LAYOUT



Name ▲	
> dcps > wrgb_fullprores_testv2	
ASSETMAP.xml	
CPL_e3d01703-a2d7-4582-9639-780216116b53.xml	
PKL_63fa9f93-6650-478f-8b26-7afe7d781fbf.xml	
VOLINDEX.xml	
wrgb_fullprores_testv2-video.mxf	

What does this DCPs tell you?

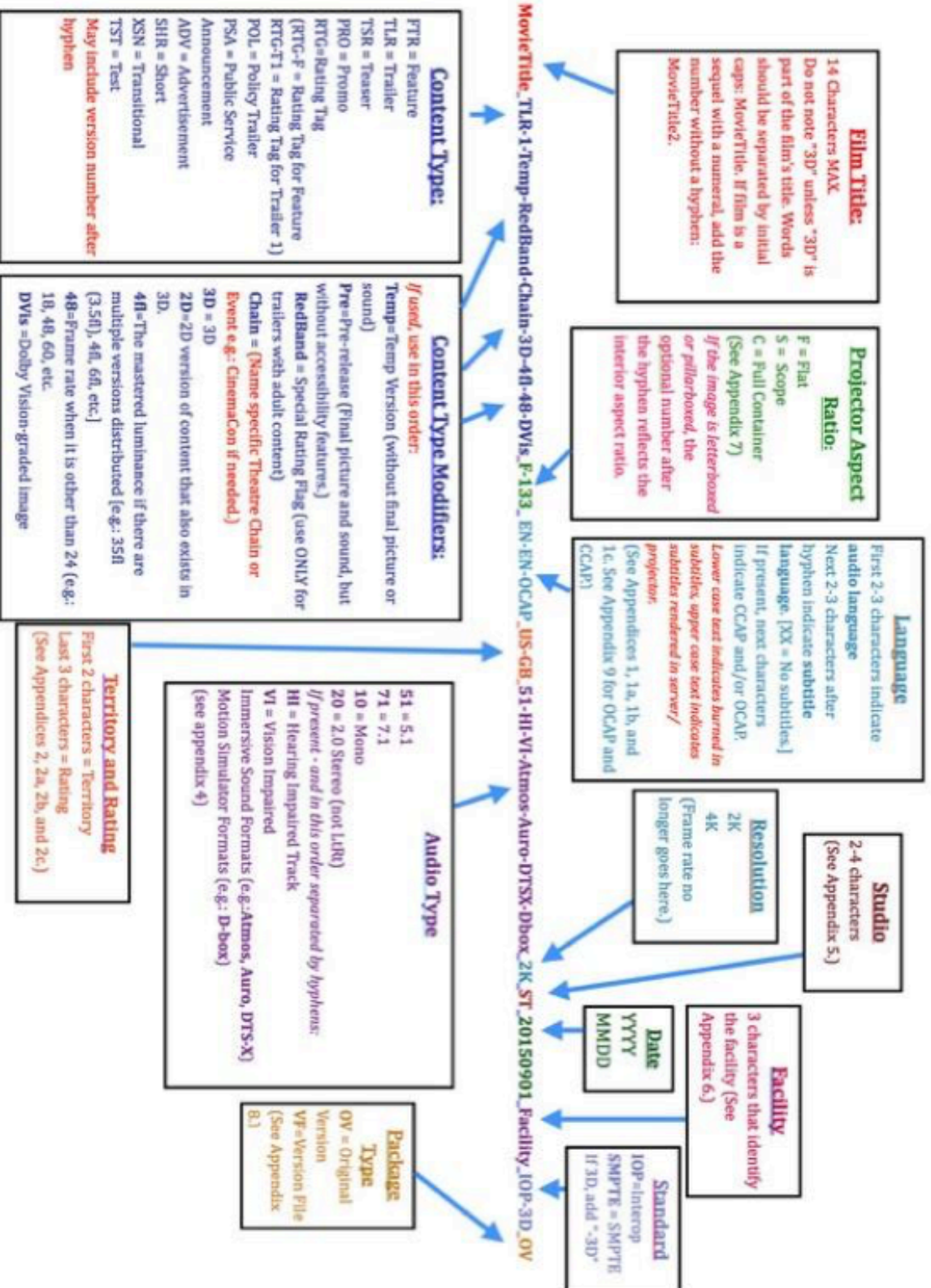
FILE FOLDER LAYOUT

 <u>final raindance-audio.mxf</u>	<u>9/16/2015 7:06 AM</u>	<u>VLC media file (.m...</u>	<u>4,446,622 KB</u>
 <u>final raindance-video.mxf</u>	<u>9/16/2015 7:06 AM</u>	<u>VLC media file (.m...</u>	<u>61,055,576 ...</u>
 <u>ASSETMAP</u>	<u>9/16/2015 7:06 AM</u>	<u>File</u>	<u>2 KB</u>
 <u>CPL 0e4a792d-c970-46b6-87e9-ff673b75...</u>	<u>9/16/2015 7:06 AM</u>	<u>XML Document</u>	<u>2 KB</u>
 <u>PKL 56a494cb-d7fb-4f38-a060-91731207...</u>	<u>9/16/2015 7:06 AM</u>	<u>XML Document</u>	<u>2 KB</u>
 <u>VOLINDEX</u>	<u>9/16/2015 7:06 AM</u>	<u>File</u>	<u>1 KB</u>

What does this DCPs tell you?



WHAT'S IN A NAME?



WHAT'S IN A NAME?

AngieTribeca_FTR-1_Ep101_FI78_EN-FR_INT-TD_51_HD_WB_041216_TVM_IOP_OV



WHAT'S IN A NAME?

Film Title Projector Aspect Ratio Territory & Rating Resolution Date Standard

Angie Tribeca_FTR-1_Ep101_FI78_EN-FR_INT-TD_51_HD_WB_041216_TVM_IOP_OV

Content Type (CT modifiers) Language Audio Type Studio Facility Package Type



FILE FOLDER LAYOUT

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 <u>VOLINDEX</u>	<u>9/16/2015 7:06 AM</u>	<u>File</u>	<u>1 KB</u>

What does this DCPs tell you?



THE KEY TO KDMS

- KDM stands for Key Distribution Message
- DCPs offer a very secure system of encryption.
- The method of the encryption is RSA pair-based without an authorized root authority.
 - Essences are wrapped into MXF based on a random "secret value".
 - Projector's public cert is looked up in a database based on the Projectors ID.
 - The projector public cert is combined with authoring system's private cert.
 - Upon delivery to the projector at playback, the system derives the "secret value" by decoding the message based on the projector's private cert and the authoring company's public cert.

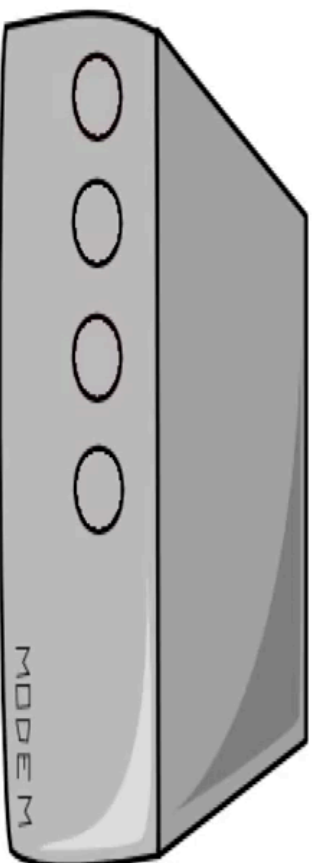


THE KEY TO KDMs

- Often delivered to projectionist as an email with attached XML file (which is the key).
- All KDMs are time-specific and will engage and expire based on the studio's requirements.



WHY ARE WE WATCHING THIS?



MAKE A DCP THE OLD FASHIONED WAY

- I. Video Editorial copy sent to DC mastering facility
 - a. Content edited/corrected for audience presentation
 - b. Conversion to frame based material (billions and billions)
 - c. Conversion to XYZ colorspace
 - d. Compressed to JPEG 2000
 - e. Authored into a video MXF essence file



MAKE A DCP THE OLD FASHIONED WAY

2. Audio Editorial copy sent to DC mastering facility
 - a. Content edited to match video changes
 - b. Converted to raw uncompressed channels
 - c. Converted to 24bit audio
 - d. Authored into an audio MXF essence file



MAKE A DCP THE OLD FASHIONED WAY

3. MXF essence files analyzed and proper XML 'index' files created
4. All data copied to a HDD/CRU
5. Data sent back to distribution for delivery to theater





Making a DCP the New Way



THANK YOU!

Make your own DCP's; try it for free at AutoDCP.com



Q&A AND COMMON PROBLEMS IN THE FIELD

1. What spec has my system been tested against, and known to work with?
2. Am I following the DCP naming convention?
3. Is the frame rate 23.976 or 24 fps?
4. Are KDMs making your life miserable?
5. Other?

