Digital Archiving of Audiovisual Material
Pilot Projects in Europe

Fraunhofer Digital Cinema

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Digital Challenges and
Digital Opportunities
in Audiovisual Archiving

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1. Introduction
What happened before?

The EDCINE project

- User requirements, specification
- General process and system concept developed
  - use of open standards: JPEG 2000 and MXF
  - sustainable (as far as possible)
- JPEG 2000 profiles for film archiving standardised in ISO
- Demonstration system developed and tested
- EDCINE ran from August 2006 to July 2009
2. EDCINE for Archives – the general concept
Ingest – Preservation – Access

2. EDCINE for Archives – the general concept

JPEG 2000 – MXF – 2-Tier Storage Approach

How does it work?

- Use of standardised formats
- JPEG 2000 for image compression
- Uncompressed multi-channel, multi-language audio
- MXF for
  - Wrapping of images and sound, time code etc.
  - Metadata
- Two storage packages:
  - for long-term preservation: Master Archive Package (MAP)
  - for access: Intermediate Access Package (IAP)
2. EDCINE for Archives – the general concept
Two-tier storage data format, access on demand
## 2. EDCINE for Archives – the general concept

### JPEG2000 ISO Profiles Relevant for Digital Movies

<table>
<thead>
<tr>
<th>Profile</th>
<th>2k Distribution Profile</th>
<th>4k Distribution Profile</th>
<th>2k scalable Archive Profile</th>
<th>4k scalable Archive Profile</th>
<th>Master Archive Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile Indicator</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Max Resol.</td>
<td>2048x1080</td>
<td>4096x2160</td>
<td>2048x1080</td>
<td>4096x2160</td>
<td>16384x8192</td>
</tr>
<tr>
<td>Quality Layer</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>&lt;=5</td>
</tr>
<tr>
<td>Components</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>&lt;=8</td>
</tr>
<tr>
<td>Bitrate</td>
<td>&lt;=250 MBit</td>
<td>&lt;=250 MBit/s</td>
<td>&lt;=250 MBit/s for Layer0 &lt;=500 MBit/s for Layer1</td>
<td>&lt;=250 MBit/s for Layer0 &lt;=500 MBit/s for Layer1</td>
<td>Lossy and lossless</td>
</tr>
<tr>
<td>Purpose</td>
<td>DCP</td>
<td>DCP</td>
<td>IAP (compatible with Profile 3)</td>
<td>IAP (compatible with Profile 4)</td>
<td>MAP</td>
</tr>
</tbody>
</table>
3. Digital A/V Archiving Pilot Installations
   A joint approach of several European archives

Goal: gain experience with file-based digital A/V archiving

- Bring EDCINE concept to life in different environments
- Collect practical experience with a small collection first
- Identify problems and opportunities; evaluate processes
- Participating archives:
  - Cinémathèque Royale de Belgique
  - National Audiovisual Archive, Finland
  - Danish Film Institute
  - Imperial War Museum, UK
- Working name: "FIAF Archival Transcoding Engine"
3. Digital A/V Archiving Pilot Installations

The idea

What do we want to do?

- Digitise, scan and convert material into the JPEG 2000 archive formats
- Store, handle and manage the archive packages
  - Online: hard disks
  - Offline: data tapes
- Migration
- Quality control
- Search, browse, preview archived material
- Create different end-user formats from archive packages
- Everything in a compact, affordable system that is easy to use
3. Digital A/V Archiving Pilot Installations

Requirements

What do the participating archives need?

- Support for different source formats: film, video, files etc.
- Support for different output formats: DPX, DCP, H.264, Flash etc.
- Quality control during ingest and in the archive
- Playback of archived material
- Data management
  - Management of files on disks, tapes in robot, tapes on shelf
  - Database with metadata and connection to existing catalogues
- In general: defined processes and workflows for all important tasks
- Guidelines for compression settings, necessary preservation metadata, ...
- Definition of “sub-profiles“ for different source media types
3. Digital A/V Archiving Pilot Installations

Requirements – Source Formats

We start with these formats:

- For scanned film: DPX and TIFF
- Digital Cinema Packages (DCPs)
- Analogue and digital tape-based SD and HD video formats
- Audio: BWAV (multi-channel)
- Samma MXF files and other JPEG 2000 varieties
- Several multimedia file formats: MPEG2, H.264, AVI, Quicktime, JPEG (details yet to be defined)
- XML for metadata, sub-titles etc.
3. Digital A/V Archiving Pilot Installations
Requirements – Output Formats

We start with these formats:

- Uncompressed for highest quality: DPX and TIFF
- Audio: BWAV (multi-channel)
- Digital Cinema Packages (DCPs)
- H.264 for preview and high quality home use (Blu-ray Disc)
- MPEG2 for PC and DVD Video
- Professional broadcast file formats (details yet to be decided)
- XML for metadata, sub-titles etc.
3. Digital A/V Archiving Pilot Installations

Additional general requirements

What other capabilities must the system have?

- Easy to use, even by non-techies
- “Big knob” interface to adjust important parameters
- Possibility to burn-in information in output formats
- Flexibility: each archive has different requirements in detail
  - Formats
  - Processes
  - Processing parameters
4. Practical Realisation
How do we do it?
4. Practical Realisation

Main software components

Key feature: modular architecture

- Transcoding: Fraunhofer Universal Transcoding Framework
- Playback of archive files: Fraunhofer easyDCP Player
- Database and catalogue: Dspace (open source)
- Data tape management: Baccula (open source)
- Operating system: Linux
- Hardware: standard PC server systems
  - Multi-processor / multi-core server
  - Inexpensive RAID array
  - LTO tape library or single drive
- For video sources: any editing system (Final Cut, Avid, …)
5. Conclusion

- We start with a small system
- Modular and flexible: can grow with the archives’ needs
- Gain experience: for the developers and the users
- Define “sub-profiles” and documented processes for different types of material to be archived
- Collect information, educate users, archives and ourselves
- Build knowledge base for participating archives
5. Is everything done ... ?

Universal Archival Package

- Generation of dissemination format requires multiple processing steps
- Processing chains are configured by user
- Goal: Automatic, meta data controlled transcoding
Thank you for your attention!

Questions?

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Transcoding System
Distribution processing chain
Transcoding System
Modular Approach
Demonstrator System
The Prototype
Demonstrator System
Database Interface

Digital Film Archive

Big Buck Bunny

directed by: George Augenstein, Noah Beer
Country: Netherlands
Year: 2008
Runtime: 30 min
Genre: Animation
Source: ED-CINE

Abstract & Keywords

Abstract: The plot follows a day of the life of Big Buck Bunny when he meets three bullying rodents, Frank, Rinky and Gamera. The rodents amuse themselves by harassing helpless creatures of the forest by throwing stones, nuts and rocks at them. After the death of two of Bunny's favorite butterflies, and an offensive attack on Bunny himself, Bunny sets aside his gentle nature and orchestrates a complex plan for revenge.

Keywords: Rome Jumping, Animal, Bunny

Cast & Crew

Miscellaneous

Available formats & prices

Fraunhofer IIS

Information Society Technologies
ED-CINE
Archive Package Usage Scenarios
Master Archive Package

*.XML (Archive-Management Metadata)
*.XML (Movie-Descriptive Metadata)

*DPX
*.WAV
*.PNG
EDL, CDL, Projectfiles

*.XML (CPL, PKL)
*.MXF (Images, Audio, Subtitles)
Assetmap, Volindex
Language-Version Files

CPL, Color Timing, Pan/Scan, ...
HD
BlueRay

Poster Images
Advertising Material
Press Releases

MAP
One File

OAIS
Open Archival Information System
Reference Model
Archive Package Usage Scenarios
Intermediate Access Package

- XML (Archive-Management Metadata)
- XML (Movie-Descriptive Metadata)

- XML (CPL, PKL)
- MXF (Images, Audio, Subtitles)
- Assetmap, Volindex
- Language-Version Files

Conv. Data

DCP

IAP
One File

OAIS
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Reference Model