Fraunhofer Digital Cinema

Overview of the EDCINE archive concept and open standards for digital film archives

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Overview – Reminder EDCINE objectives

- European research project funded by EC in FP6 (7/2006-6/2009)
- Optimization, enhancement and development of new technologies for Digital Cinema
- Three application fields:
  - (1) Content streaming to cinemas
  - (2) Advanced movie experiences
  - **(3) Digital archives and access to archives**
    - Partner:
      Fraunhofer IIS, CRB, MOG Solutions

Archives – The Problem Area

Transition from film to digital cinema started!

- What is the best way to archive new movies? Separation Master, Bits on Film, **Digital Archive**
- What are the future digital movie formats for archives?
- In which way is it possible to access these archives? Are there new opportunities?

Project Steps

Develop a system concept for digital film archives

- Collection of user requirements, Interview of archives
- Evaluate data formats and define specifications
- Define a system architecture

Build a demonstrator

- Development of software modules and tools
- Development of prototype system

In addition:

- Presentations on conferences and trade shows
- Workshops
- Standardisation of formats

Preservation Strategies

Many factors relevant, if film should be archived digitally or on film:

Digital produced Material:

- digital (long-term) archiving useful

Existing film material in good condition:

- Long-term archiving should stay on film
- Digitisation for easier access should be considered

=> Original source quality should be preserved to avoid losses

Format question

- No commonly agreed standard formats and procedures for digital film archives
- Digital video tape (coded data bound to tape) is no satisfactory solution
- Proprietary file and data tape formats from postproduction systems are no solution either
- Generic IT equipment and systems become continuously more powerful and cheaper!

=> standardised file-based open formats should be choosen

The EDCINE System Concept

Two different formats / packages:

- MAP (Master archive Package) for long-term preservation
- IAP (Intermediate Access Package) for access

Common approach:

- Compression format: JPEG 2000
- Container and metadata: MXF
- Asset store approach: OAIS model

Access:

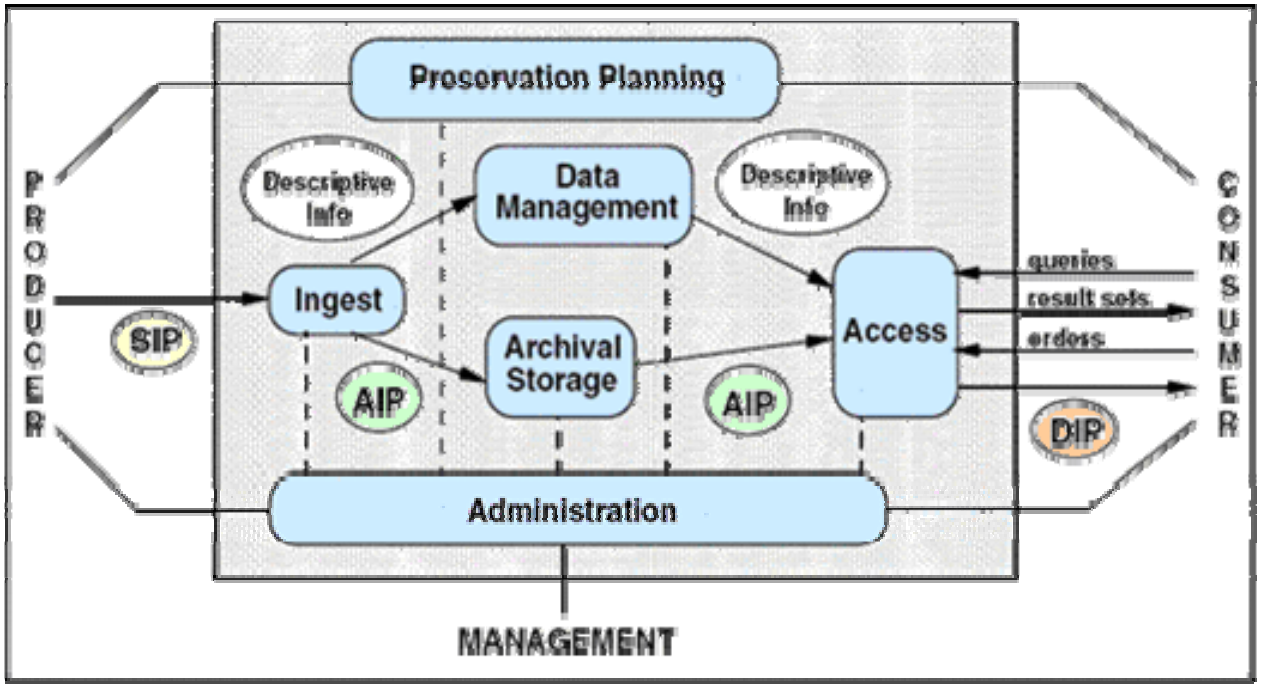
- Different distribution formats can be created on demand from the IAP

OAIS Reference Model

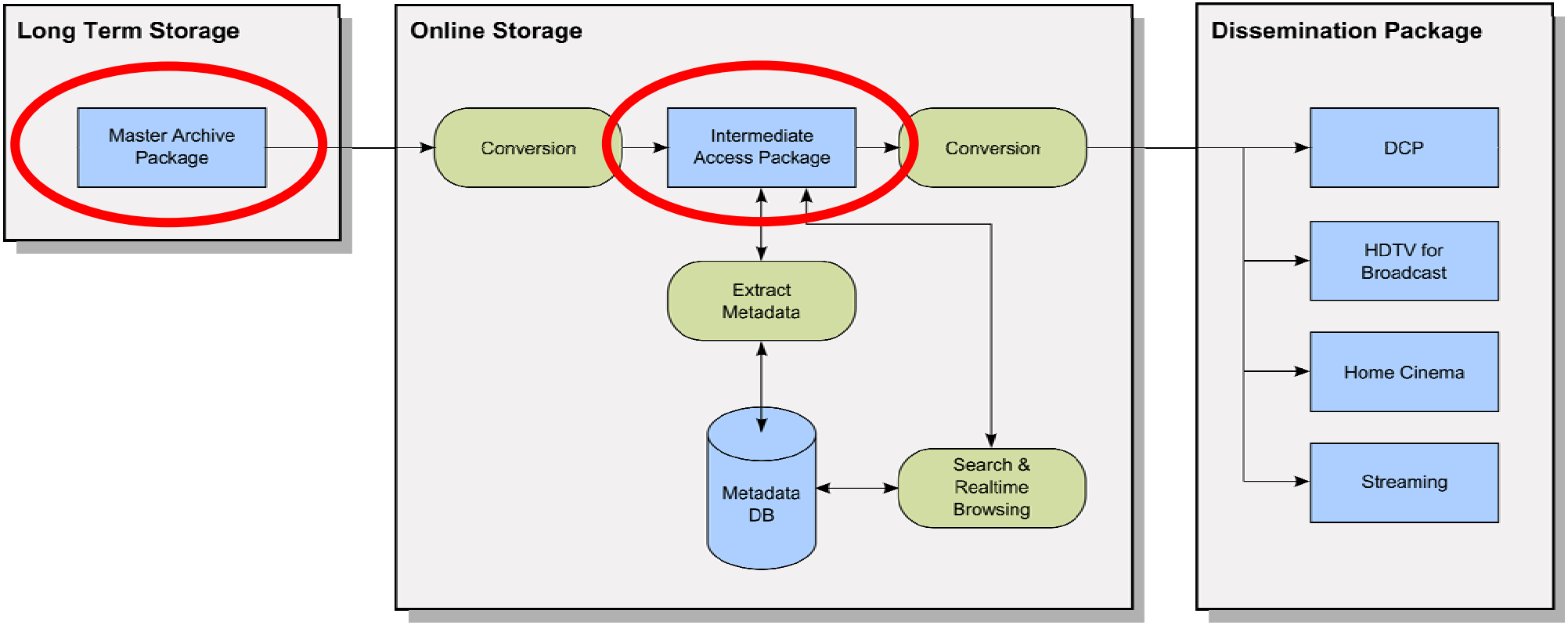
SIP Submission Information Package
e.g. DPX+WAV+XML

AIP Archival Information Package
e.g. MAP or IAP

DIP Dissemination Information Package
e.g. H.264 MPEG-File



Two Tier Data Format



The Master Archive Package MAP

Digitally archived item for preservation

Typical characteristics:

- lossless compression: JPEG 2000 5/3
- arbitrary (highest justifiable) resolution
- original frame rate of the source
- can contain the whole film area, including soundtrack, sprocket holes etc.

The Intermediate Access Package IAP

Digital viewing copy of archived item

Typical characteristics:

- lossy compression: JPEG 2000 9/7 (up to 500MBit/s)
- fixed resolution (e.g. 2048 x 1080)
- 24 or 48 FPS
- contains only projectable image area
- compatible to SMPTE D-Cinema standards

→ DCPs can be created without image recoding; ideal to generate dissemination packages

A universal and extendable Solution

Universal:

- Can be used for all kinds of moving images
- Flexible and scalable:
  fits all types and sizes of archives
- Use of standard IT technology and equipment

Customise and tailor to archive‘s requirements:

- Adapted to archive’s workflows
- source and target formats exchangeable
- Different processing steps for image and sound conversion possible
- Use of own metadata schemes possible

Tweak parameters of MAP and IAP

Open Standards for Digital Film Archives

Why Open Standards?

Standardised data formats

- can be read and written by everyone
- are well documented
- not restricted to one manufacturer
- will be known also in hundred years

Important aspect:

- Patents or other IPs
- Licensing Terms and Conditions
- Non discriminatory terms of use

Most important standards used in EDCINE

JPEG2000 for image compression
ISO 15444-1

MXF for wrapping
EBU/SMPTE 377M bis 394M

OAIS for asset store
ISO 14721:2003

Other activities within ISO

Technical Committee ISO TC36

- Cares about cinematography in general
- Lately, also involved in Digital Cinema
- Adopted and transformes standards from SMPTE DC 28, MXF to ISO
- Current status: under development

Example: IEC/ISO JTC1 SC29 / WG1

ISO - International Standardisation Organisation

Sub-Committee 29, Working Group 1

The JPEG Committee

Members appointed by their national standardisation bodies

Usually companies, but also research organisations, universities etc.

The SC29 / WG1 Digital Cinema Ad hoc Group

ISO 15444-1:2004-AMD1:

- JPEG 2000 profiles for D-Cinema distribution

ISO 15444-3

- Motion-JPEG 2000

ISO 15444-1:2004-AMD2:

- JPEG 2000 profiles for long-term preservation
- JPEG 2000 profiles for archive access

Other stuff (wireless, error correction, ...)

JPEG2000 ISO Profiles relevant for digital movies

Profile	2k Distribution Profile	4k Distribution Profile	2k scalable Archive Profile	4k scalable Archive Profile	Master Archive Profile
Profile Indicator	3	**4**	5	**6**	7
Max Resol.	2048x1080	4096x2160	2048x1080	4096x2160	16384x8192
Quality Layer	1	1	2	2	<=5
Components	3	3	3	3	<=8
Bitrate	<=250MBit	<=250 MBit/s	<=250MBit/s for Layer0 <=500MBit/s for Layer1	<=250MBit/s for Layer0 <=500MBit/s for Layer1	Lossy and lossless
Purpose	**DCP**	**DCP**	**IAP (compatible with Profile 3)**	**IAP (compatible with Profile 4)**	**MAP**

JPEG 2000 Profiles for Digital Cinema and Archives

Up to now: 24fps, 48fps

Upcoming extensions:

- In standardisation:
  Additional framerates: 25fps, 30fps, 50fps, 60 fps
  (SMPTE -> ISO SC29/WG1: JPEG2000
  -> ISO TC36)

- Under consideration:
  Archival framerates: 16fps, 18fps, 20fps, 22fps

Intellectual Property Rights Situation in General

Intellectual Property:

- Patents
- Proprietary algorithms, methods and formats

3 major routes:

- No rights secured
- Royalty free, non-discriminatory licensing policy
- Licenses to be payed for

Intellectual Property Rights and JPEG 2000

Part 1 - Core Coding System: royalty free licensing policy

The JPEG committee tries actively to take care of potential patent issues

However, nobody can guarantee that there will be no problems

The same problem basically applies to any image encoding method and format

Details on JPEG 2000 policies to be found on http://www.jpeg.org/jpeg2000

Free and Open Source Implementations of JPEG 2000

OpenJPEG
JasPer

- Free, but not easy to use
- Can be used for own development activities

but:

- Relatively slow
- No out-of-the box solution
- Just command line tools

Thank you for your attention!

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