
The EDCINE Project for Archives:

A System Architecture for Digital Film
Archives using JPEG 2000 and MXF

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The EDCINE Project – Enhanced Digital Cinema

- European project with 18 Partners funded by EC in FP6 (7/2006-6/2009)
- Optimization, enhancement and development of new technologies for Digital Cinema
- 3 application fields:
 - Content streaming to cinemas
 - Advanced movie experiences
 - **Digital archives and access to archives**

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 Goals

Develop a system concept for a digital film archive

- Interview of archives
- Define and evaluate data formats
- Define a system architecture

Build a demonstrator

- Validate overall concept
- Gain experience with real-world content
- Collect feedback from archives

Cooperation with film archive associations
(ACE, FIAF)

The System Concept

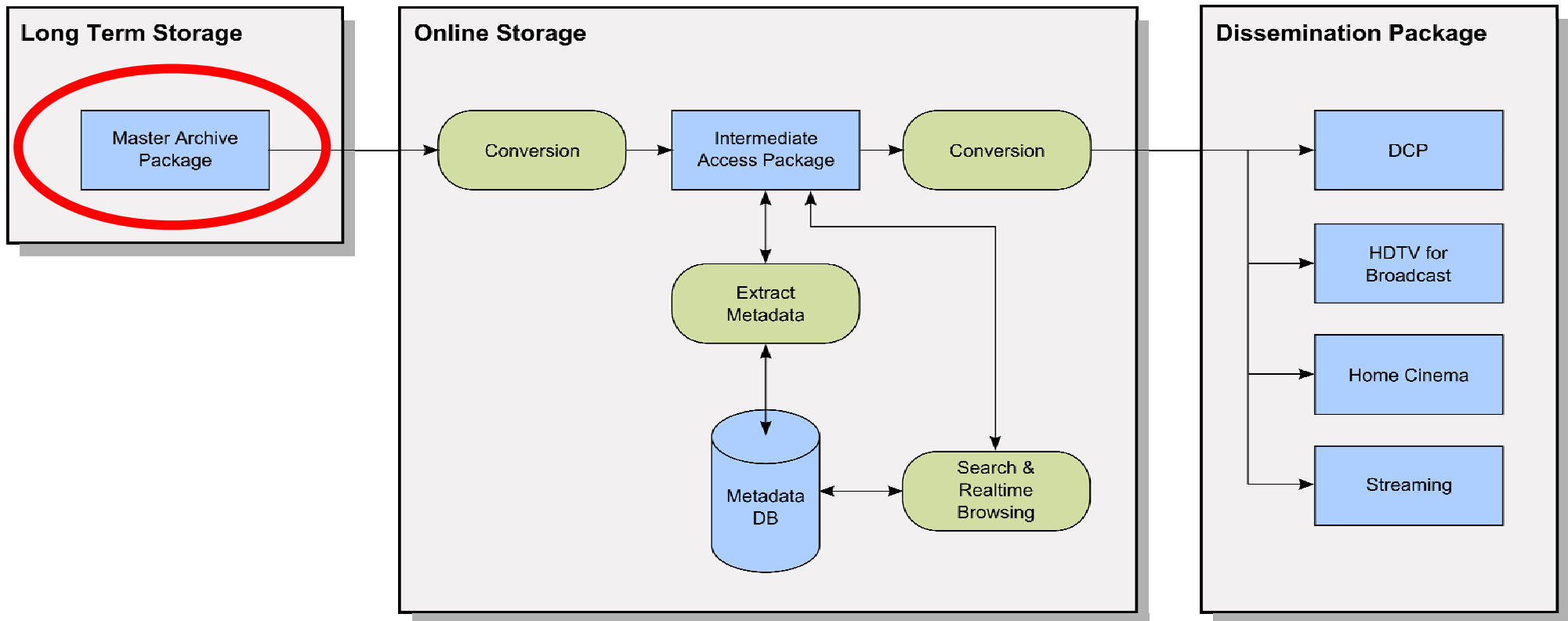
Two-tier data format

- Master Archive Package for conservation
- Intermediate Access Package for access

Asset store approach (OAIS Reference Model)

Dissemination Packages created on demand

Two Tier Data Format



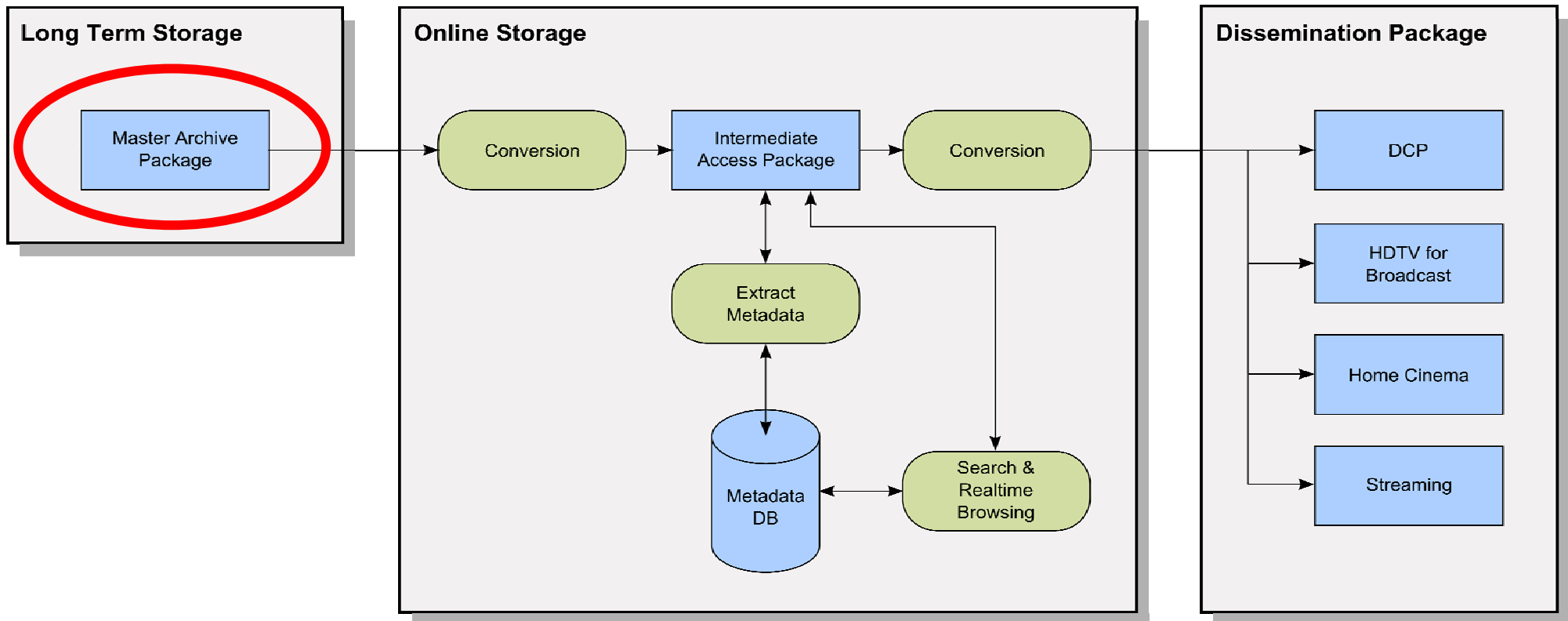
The Master Archive Package

Main goal: Preservation of original data

Typical characteristics:

- Lossless compression
- Arbitrary (highest justifiable) resolution
- Original frame rate of the source
- Can contain the whole film area, including soundtrack, sprocket holes etc.
- Metadata for Management

Two Tier Data Format



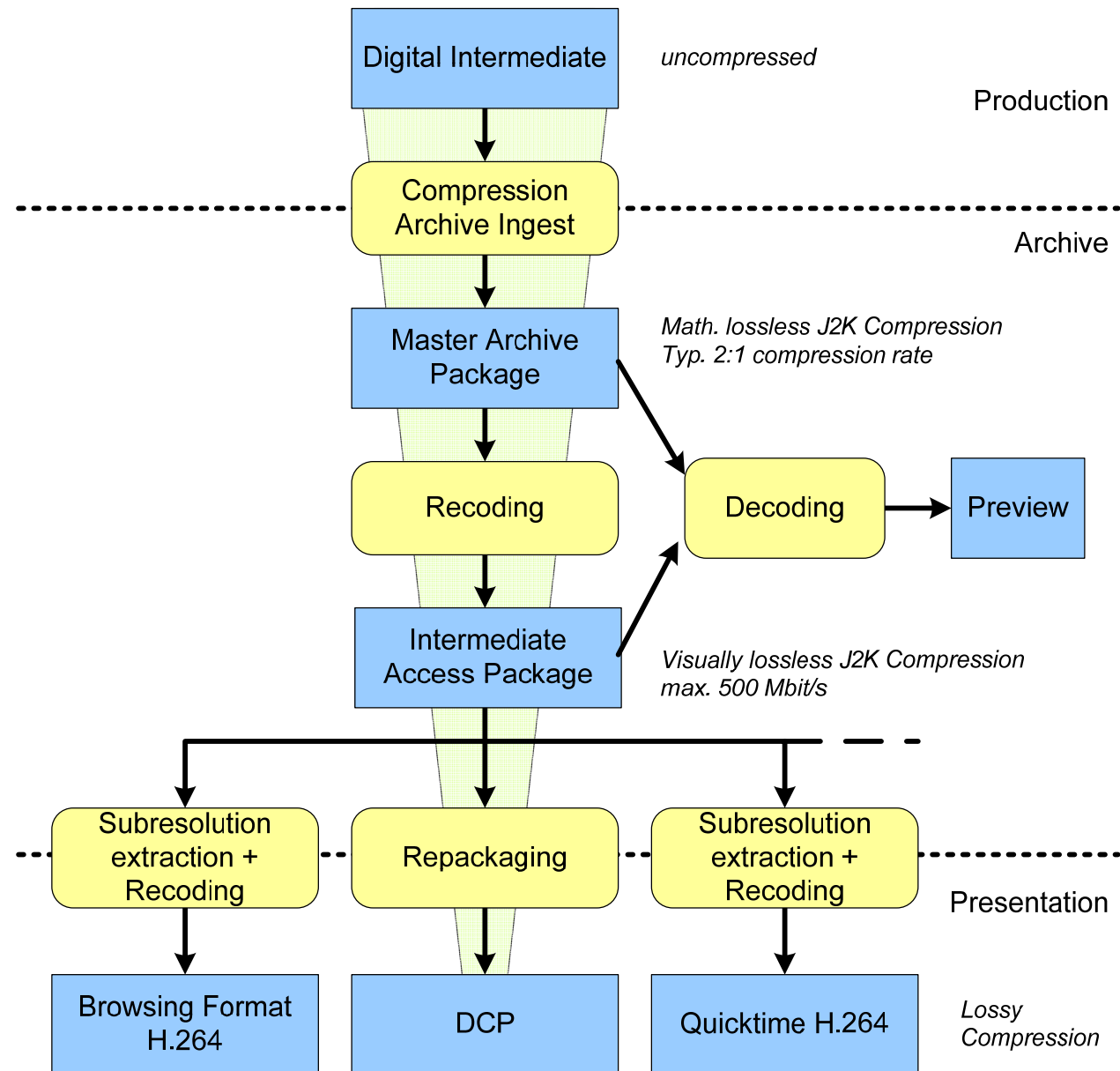
The Intermediate Access Package

Main goal: Access copy of archived item

Typical characteristics:

- Lossy compression (up to 500 MBit/s)
 - Fixed resolution (e.g. 2048 x 1080)
 - Fixed frame rate (e.g. 24 or 48 FPS)
 - Contains only projectable image area
 - Compatible to SMPTE DC28 standards
- DCPs can be created without image recoding; ideal to generate dissemination packages

Workflow-Datarate



JPEG 2000 Profiles for Digital Cinema and Archives

Up to now: 24fps, 48fps

Upcoming extensions:

- In standardisation (Broadcast rates):
Additional framerates: 25fps, 30fps, 50fps, 60 fps
(SMPTE -> ISO SC29/WG1: JPEG2000 -> ISO TC36)
- Under consideration:
Archival framerates: 16fps, 18fps, 20 fps, 22fps

Data Formats

Image Encoding

- Open and well-documented standard
- Possibility to store lossless and lossy
- Conversion to other resolutions, quality levels, formats etc. → scalability

Metadata

- Open standard
- Extendable

Packaging / Wrapping

and: audio, subtitles, text, still images, ...

Image Encoding

JPEG 2000

- Standard: ISO/IEC 15444-1:2004
- Intra-frame compression
- Wavelet-based compression
- EBCOT entropy encoding
 - Scalability: resolution & quality
- Profiles for D-Cinema
Profiles for archives in standardisation
- No royalties or license fees for part 1

Data Encoding with JPEG2000

Scalable Dataformat for
Digital Cinema and Archives

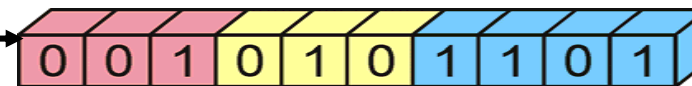


Quality
Scalability

Resolution
Scalability



Encoding



Scalable Bitstream

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	≤ 250 MBit	≤ 250 MBit/s	≤ 250 MBit/s for Layer0 ≤ 500 MBit/s for Layer1	≤ 250 MBit/s for Layer0 ≤ 500 MBit/s for Layer1	Lossy and lossless
Purpose	DCP	DCP	IAP (compatible with Profile 3)	IAP (compatible with Profile 4)	MAP

Metadata & Packaging / Wrapping

Material Exchange Format MXF

- Wrapping format for essence & metadata
- SMPTE standard
- Agnostic to essence encoding and metadata representation

Asset store: everything in one MXF file

- Images
- Audio (multiple languages and channels)
- Metadata (descriptive, technical and historical)
- Explicit and unique references to other items

The EDCINE Digital Film Archive System

Complete system

Modular approach

Web-based highly interactive user interface

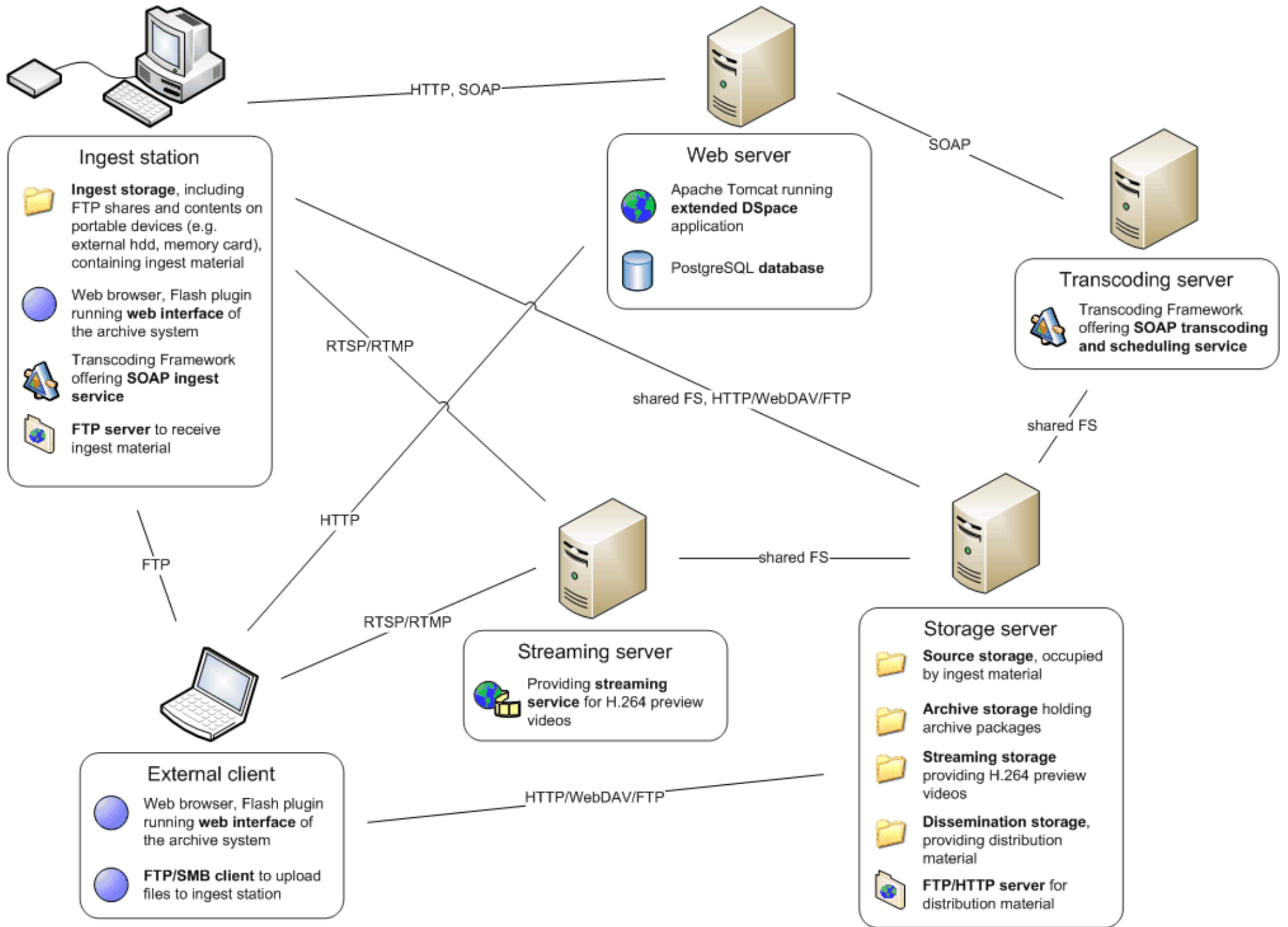
Database

Storage system

Transcoding system

Streaming server for preview

Demonstration prototype

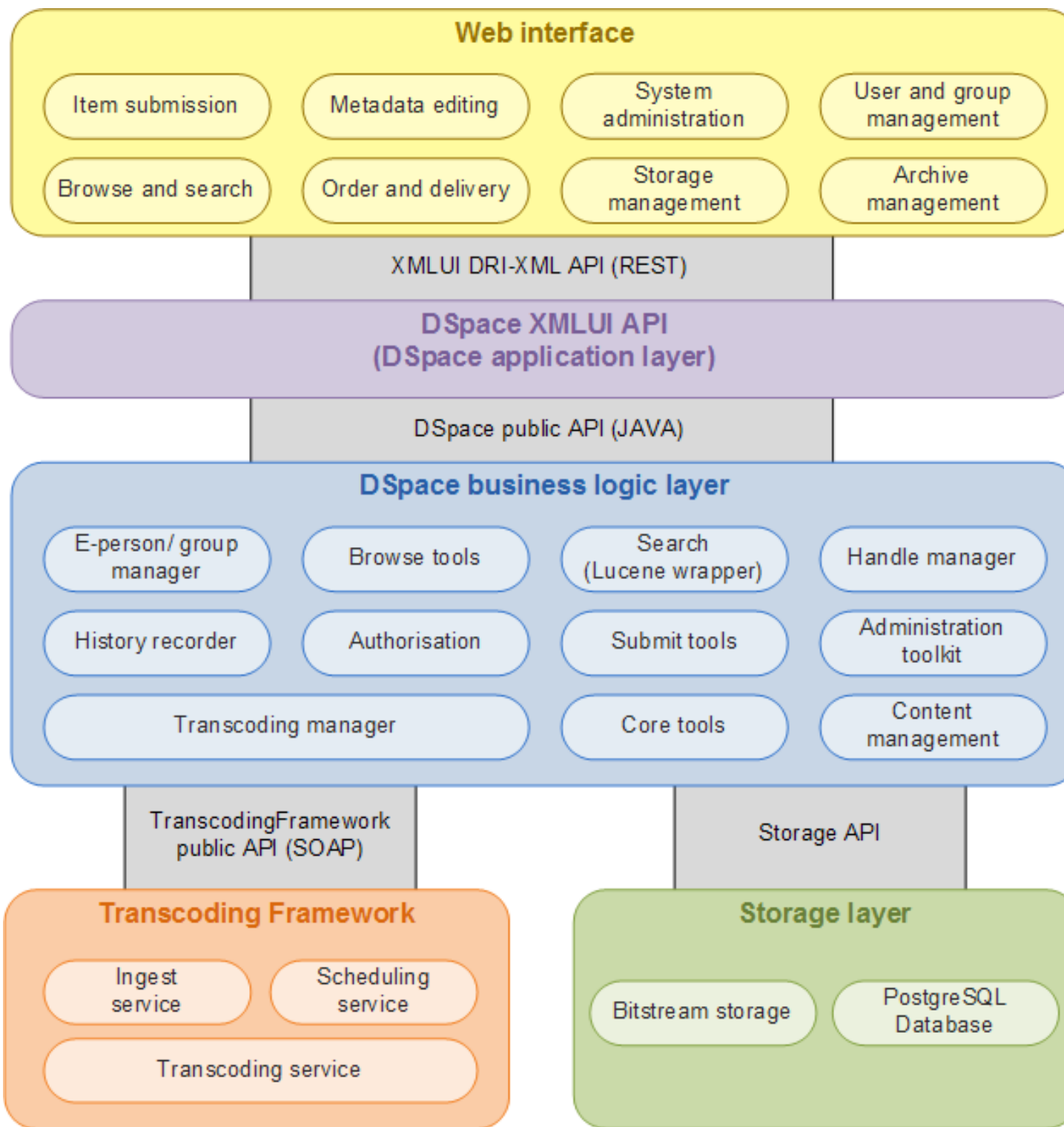


Archive management and database system

Foundation: DSpace



open source document repository
developed by the DSpace Foundation
widely used, especially at academic
institutions
major functionality needed for archives
OAIS model oriented system
not optimized for multimedia content
modular system, extendable





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Big Buck Bunny

[Preview](#)

directed by Goedegebure, Sacha
Country Netherlands
Year 2008
Runtime 10 min
Genre Animation
Source EDCine DFA

[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 fruits, nuts and rocks at them. After the deaths 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 Rope Jumping
Animal
Bunny

- [Cast & crew](#)
- [Miscellaneous](#)
- [Available formats & prices](#)

Big Buck Bunny - BBB320.mov - Mozilla Fi...
http://ux1040:8080/ol/ui/player.jsp?type=swf&streamurl=BBF

00:00:28 / 00:09:57

Fertig

The Transcoding System

Transform media from one format to another:

moving image sequences

audio data

metadata

Modular system for

encoding, wrapping

image, sound, metadata processing

decoding, unwrapping

Extendable

Controlled via SOAP → Interoperability!

Transcoding Web Services

SOAP: Simple Object Access Protocol

XML-based web services

commands and responses over TCP/IP

platform-independent

highly interoperable

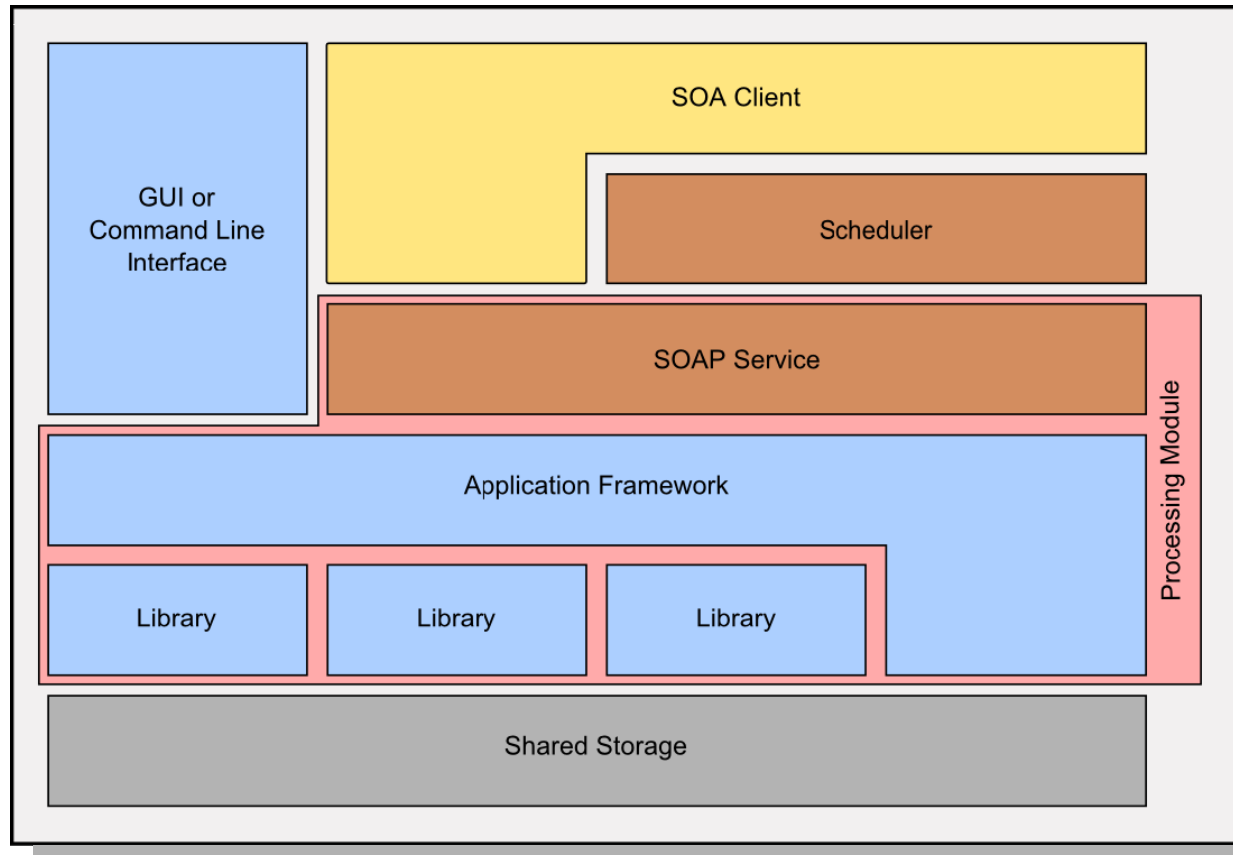
SOAP is used to control transcoding processes

location of source and target files

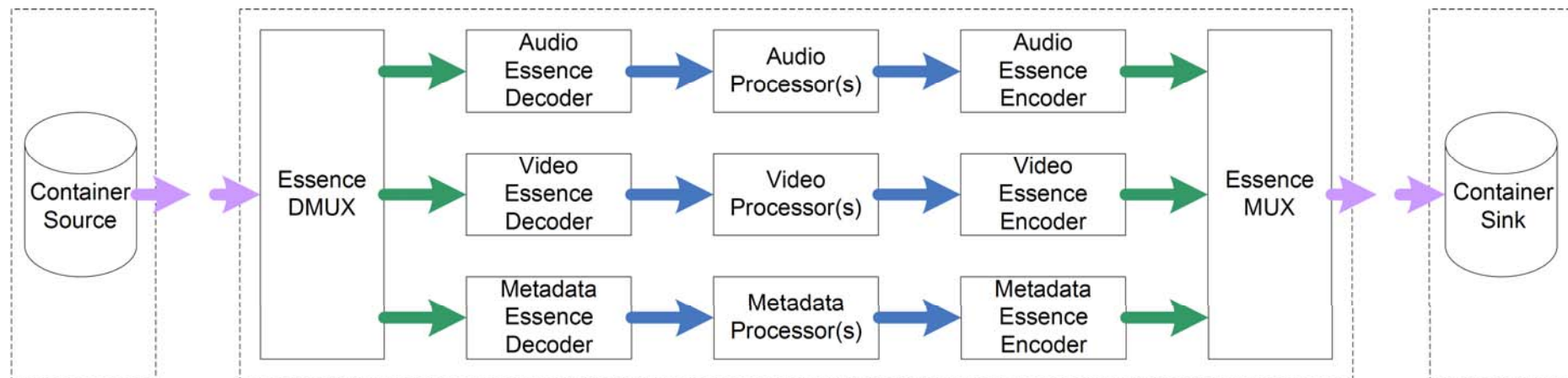
transcoding parameters

process handle, status information

transcoding queue management



A Generic Processing Chain



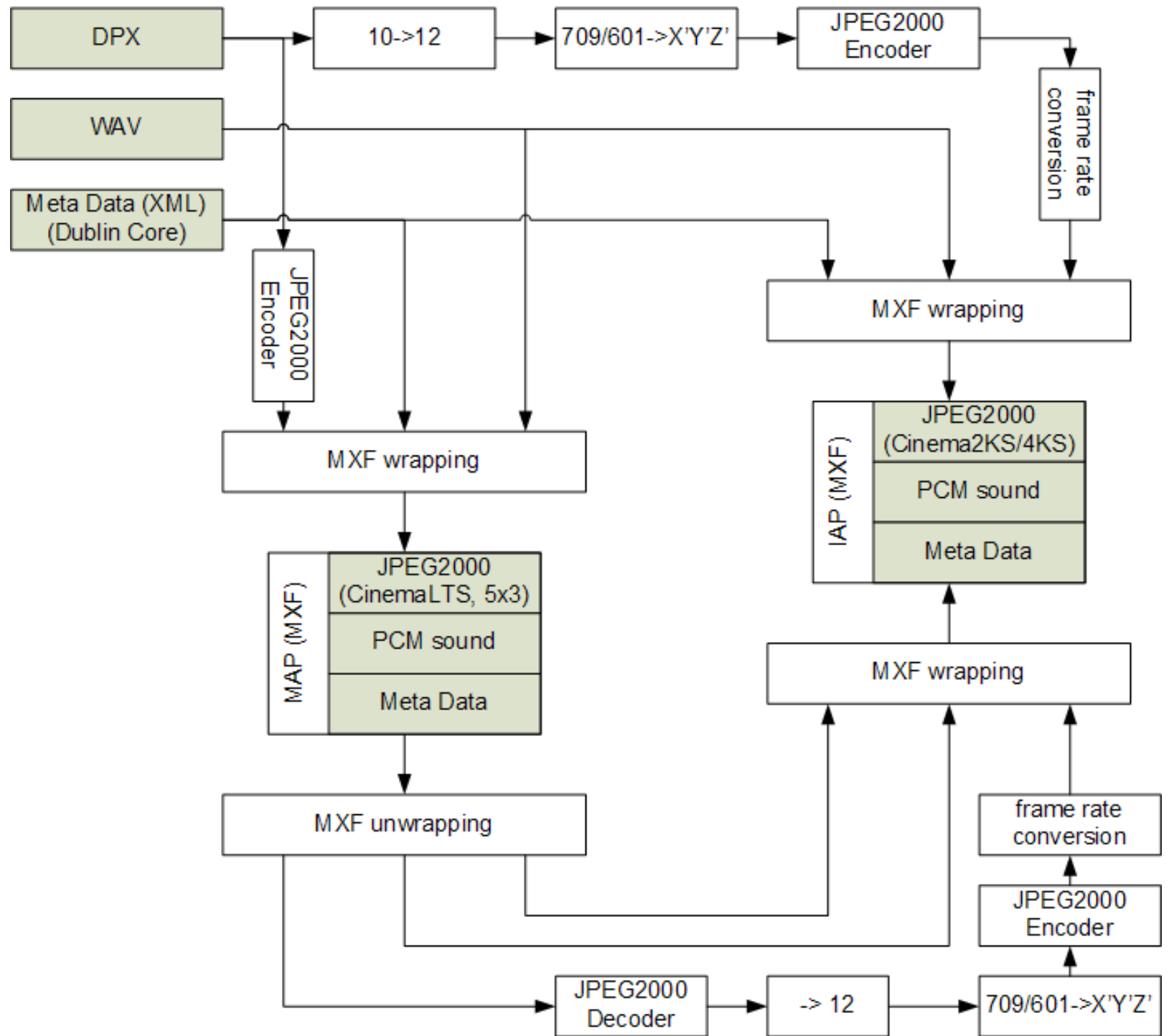
Possible Image Processing Operations

Compression / Decompression
Colour Space Transformation
Colour Correction
Scaling and Cropping
Frame Rate Conversion and Mapping
Gamma Transform
Component Elimination
Subsampling / Upsampling
Precision Adjustment
...

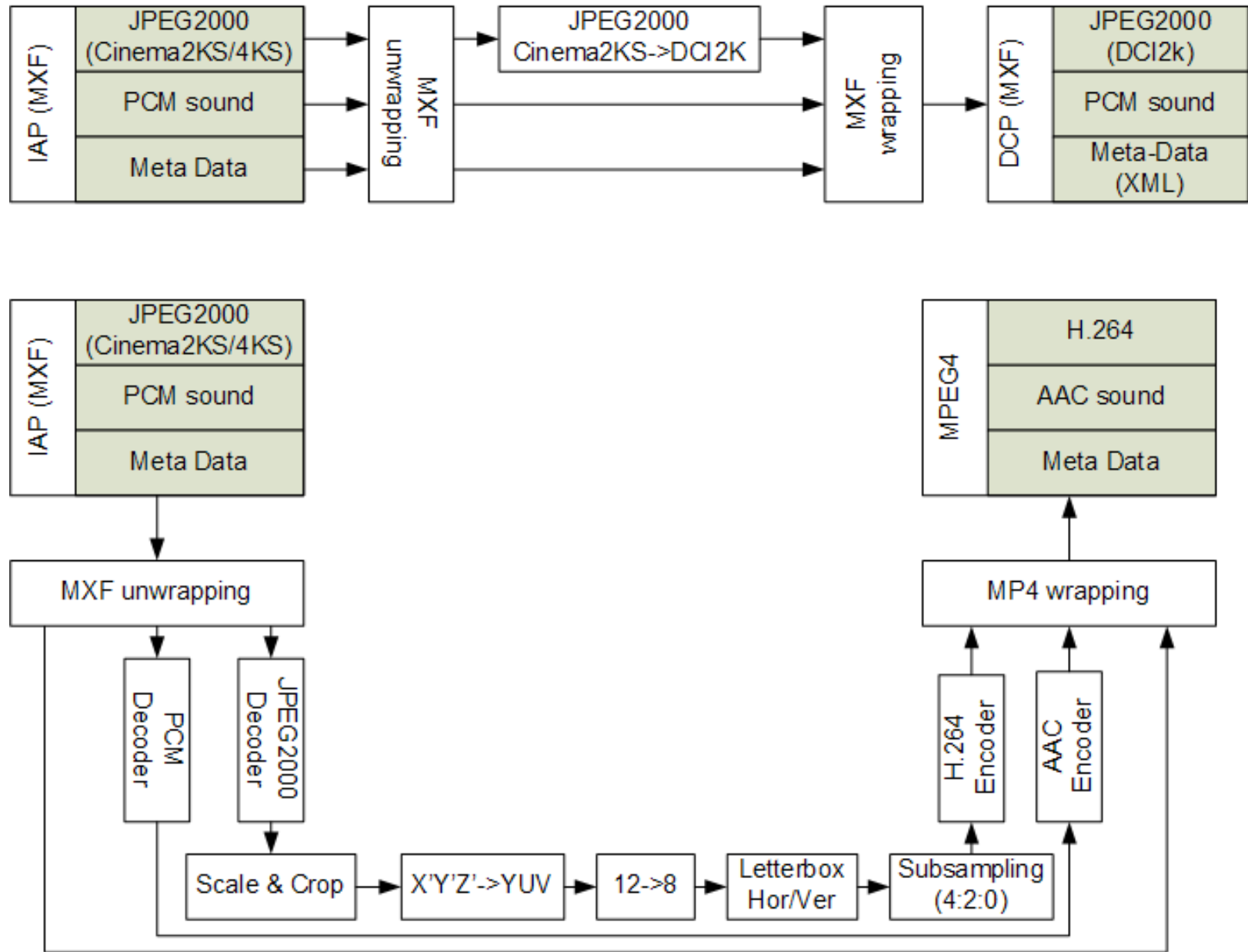
Possible Audio Processing Operations

Compression / Decompression
Sample Rate Conversion and Resampling
Quantisation Bit Depth Conversion
Time Stretching
Multi-Channel Up- and Downmix
Audio Processing for Hearing Impaired People
...

Ingest Chain



Distribution Chain



Conclusions

Digital archive system concept developed

- Modular architecture
 - for all sizes of archives
 - integration with existing solutions
- Using open and established standards
 - JPEG 2000 Profile for archives
 - Definition of MXF operational pattern and MXF application specification

Demonstrator realized

- Will be shown in workshops
- Pilot installations planned



Thank you very much for your attention!

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