

# Fraunhofer Digital Cinema



# Technology of the EDCINE Digital Film Archive System The Prototype

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# Introduction

Overview

Archive management and database

Film archive specific extensions

Transcoding system

Hierarchical storage management

Actual hard- and software used in the prototype

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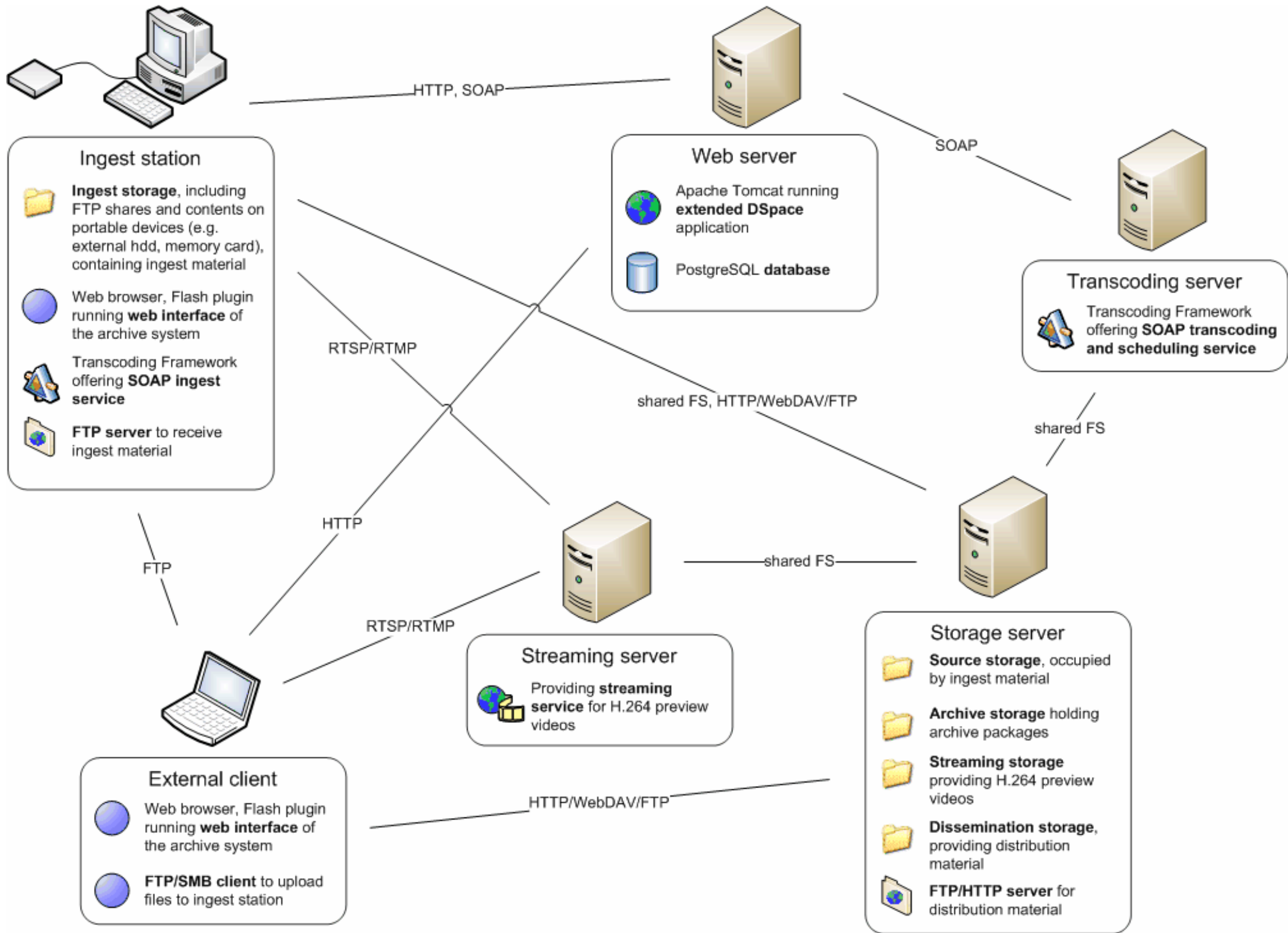
# The EDCINE Digital Film Archive System

Complete system

Modular approach

- Web-based highly interactive user interface
- Database
- Storage system
- Transcoding system
- Streaming server for preview

Demonstration prototype



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# Archive management and database system

Foundation: DSpace



[dspace.org](http://dspace.org)

- 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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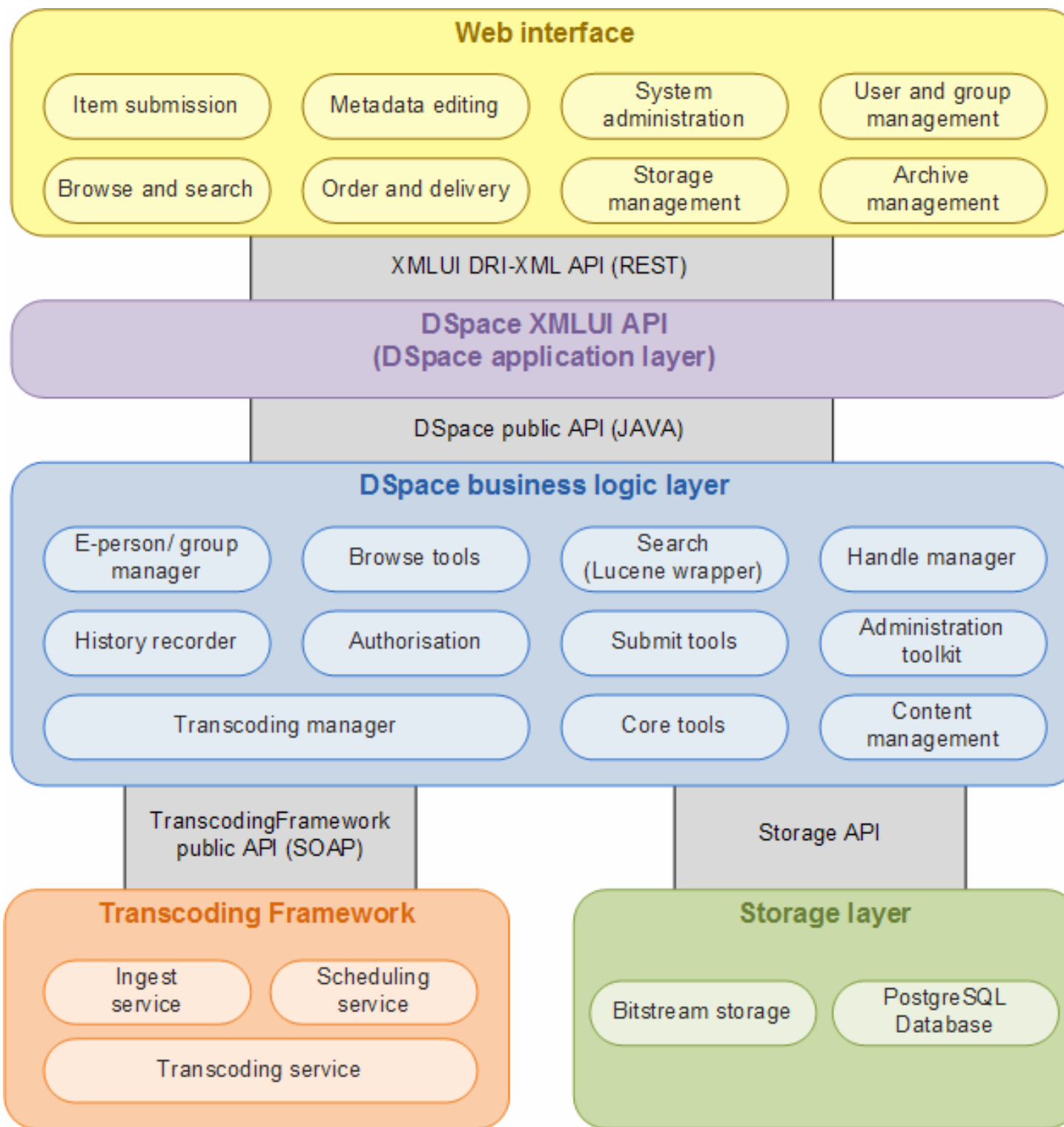
# Film Archive Specific Extensions for DSpace

Completely new highly interactive user interface

Streaming media server

Storage support for MAP and IAP

Control of transcoding system







[Archive Home](#)

[Search Archive](#)

[Browse](#)

[? Browse](#)

[? Item](#)



## Big Buck Bunny

*directed by* Goedegebure, Sacha

*Country* Netherlands

*Year* 2008

*Runtime* 10 min

*Genre* Animation

*Source* EDCine DFA

[Preview](#)

### Abstract & keywords

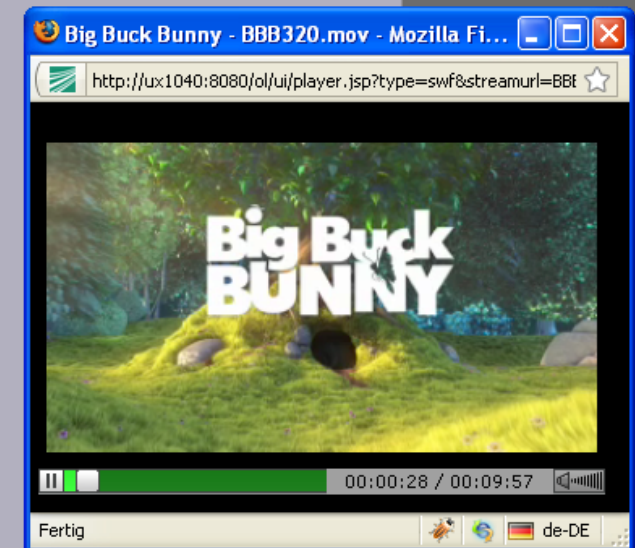
*Abstract* The plot follows a day of the life of Big Buck Bunny when he meets three bullying rodents, Frank, Rinky and Gamera. The rodents amuse themselves by harassing helpless creatures of the forest by throwing fruits, nuts and rocks at them. After the deaths of two of Bunny's favorite butterflies, 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](#)



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# 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!

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# The Transcoding System – Key Features

Flexible, modular system

Different input and output formats

Variable image sizes, colour spaces, bit depths, sub-sampling, ...

Hardware Acceleration

Multicore / Multicomputer

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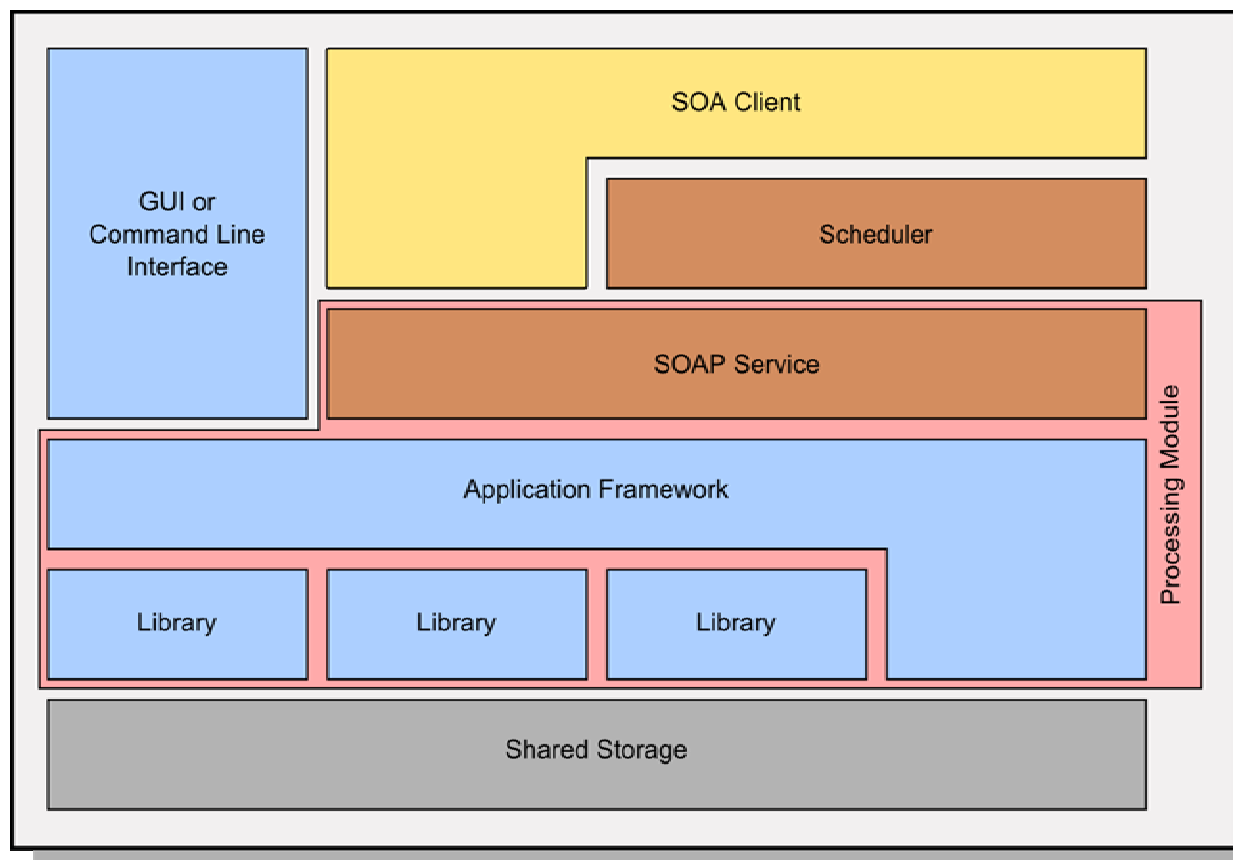
# Transcoding Web Services

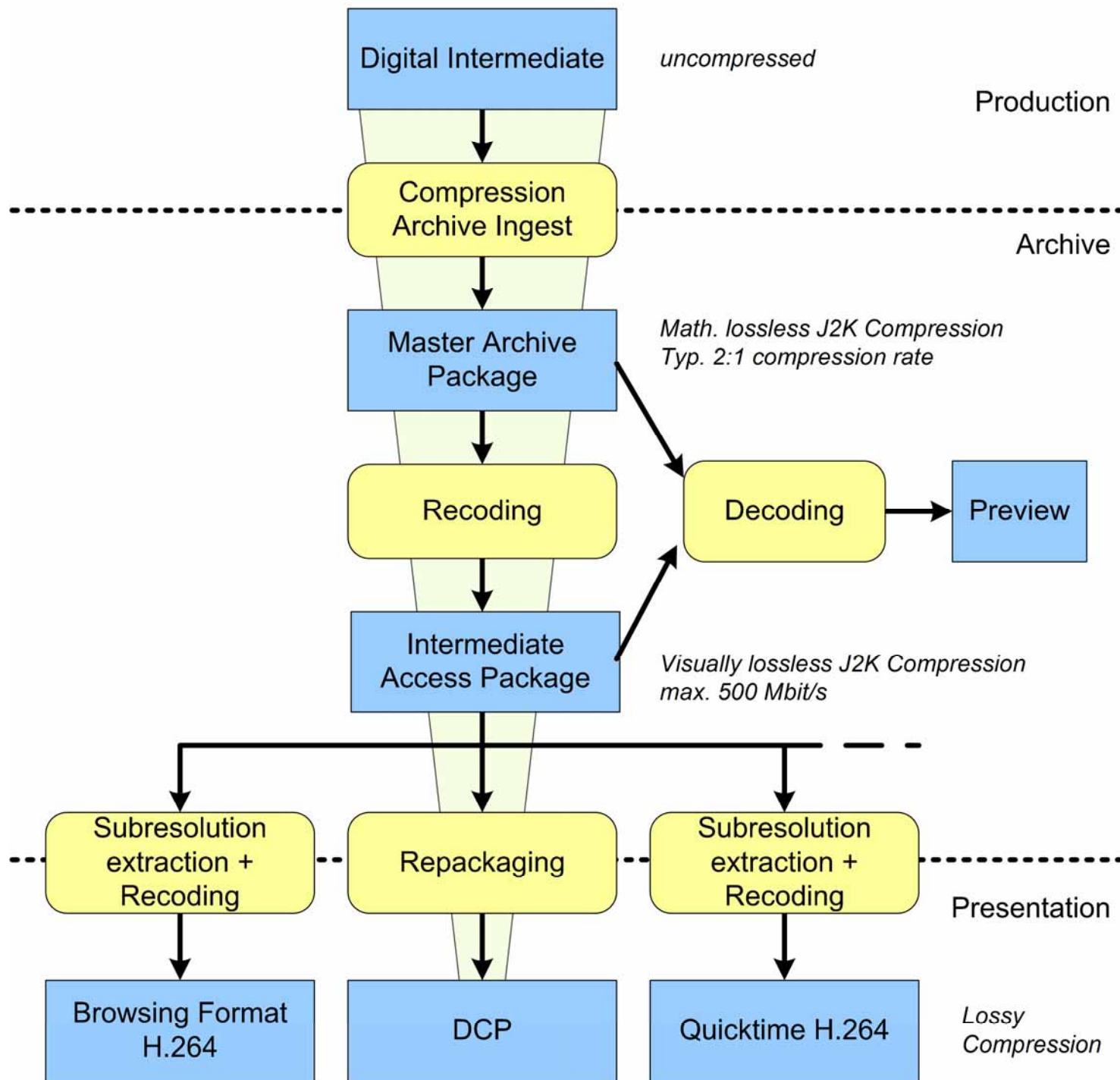
SOAP: Simple Object Access Protocol

- 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





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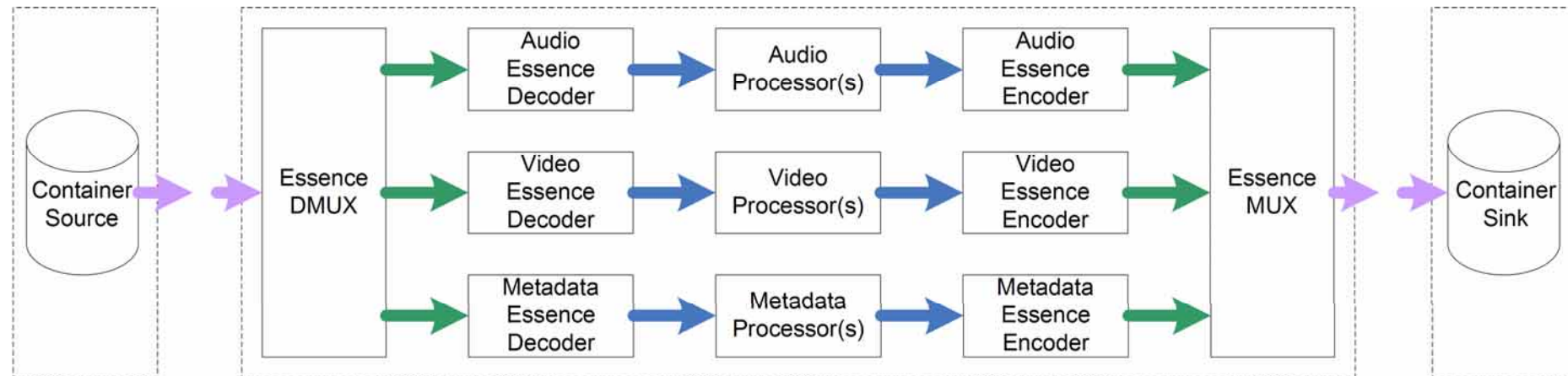
# Processing Chains

Specific combination of data manipulation modules:

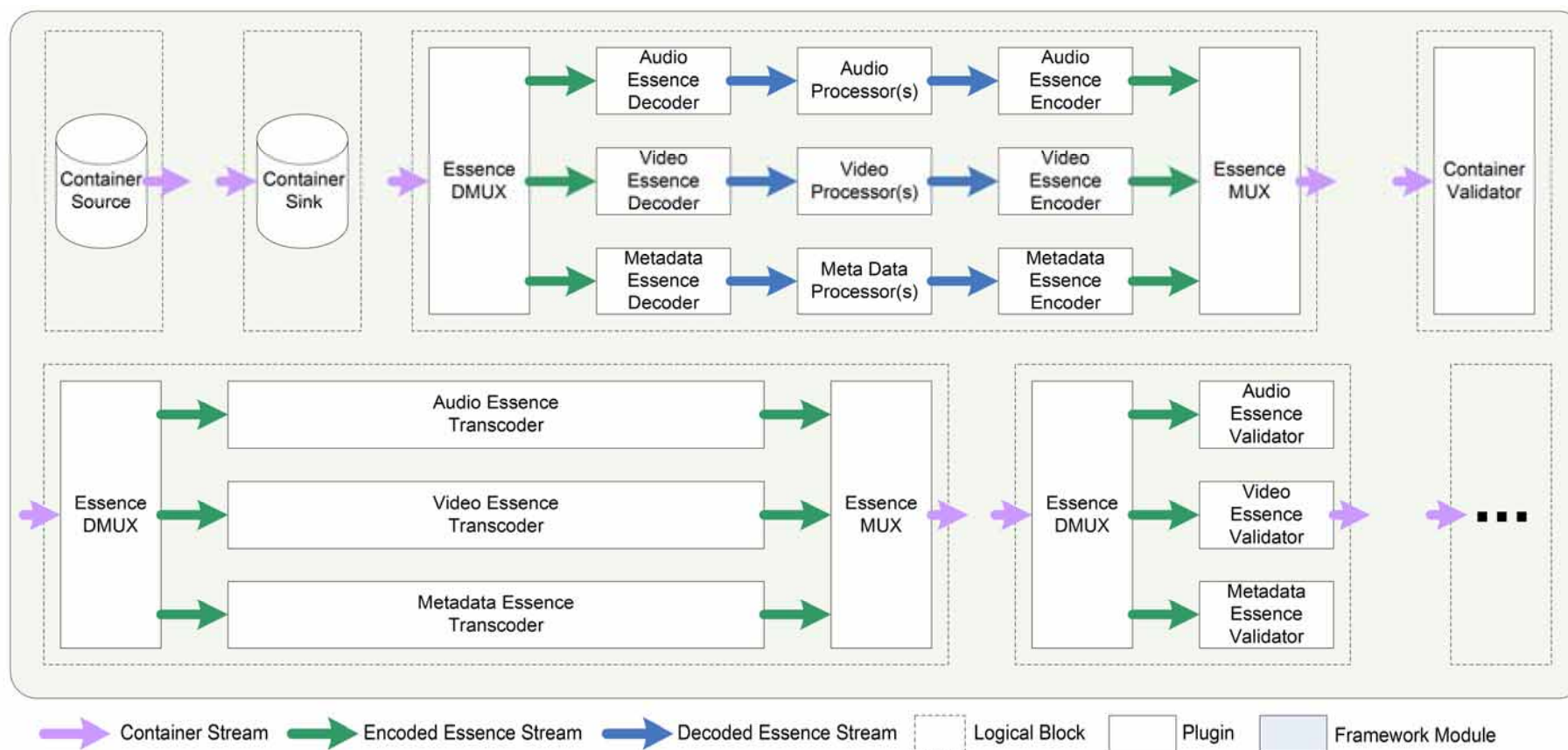
- read in file
- unwrap container format
- decode image, sound, metadata
- process image, sound, metadata
- encode image, sound, metadata
- wrap in container format
- write file

Several application-specific chains can exist simultaneously!

# A Generic Processing Chain







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# Possible Image Processing Operations

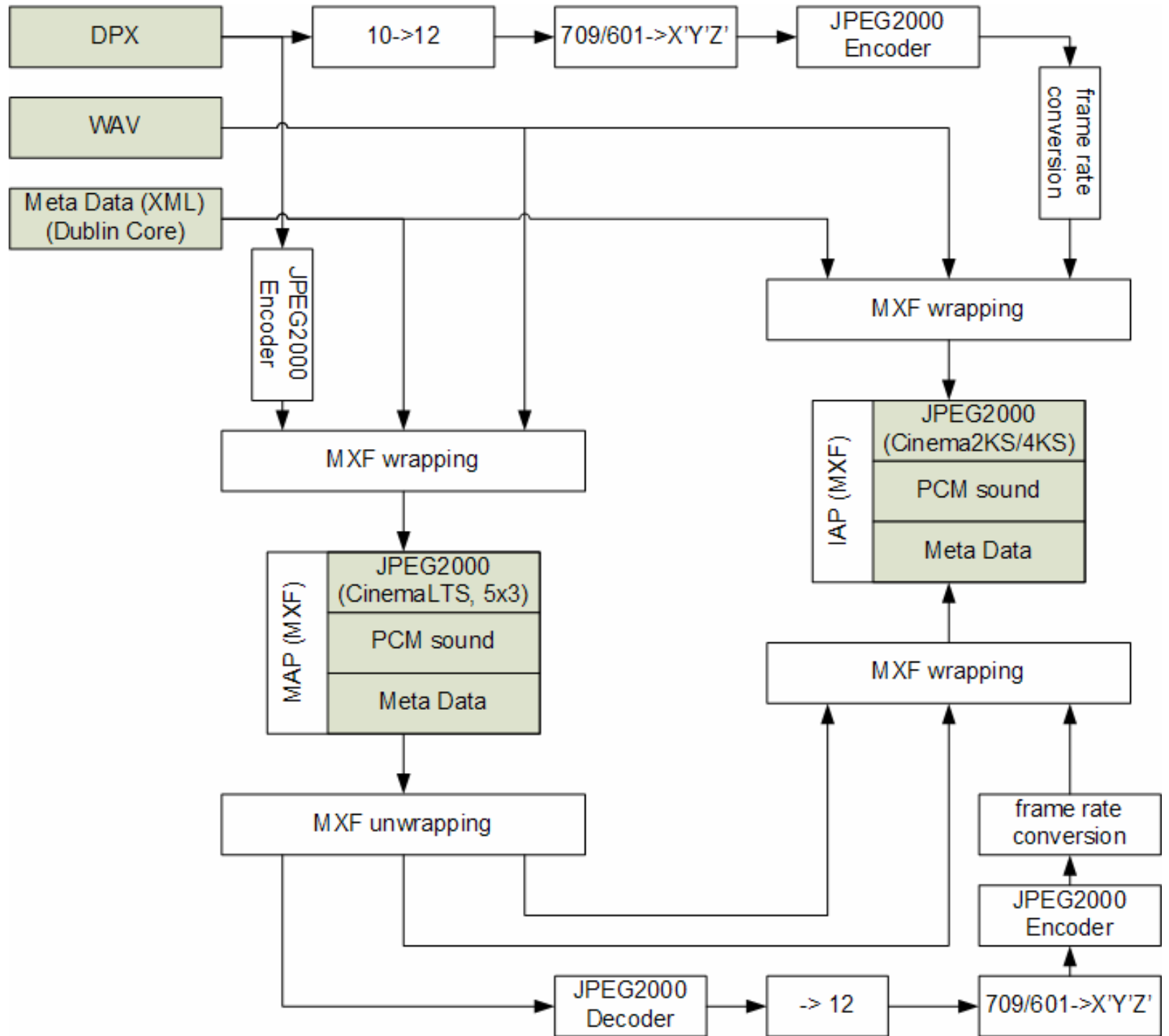
Compression / Decompression  
Colour Space Transformation  
Colour Correction  
Scaling and Cropping  
Frame Rate Conversion and Mapping  
Gamma Transform  
Component Elimination  
Subsampling / Upsampling  
Precision Adjustment  
...

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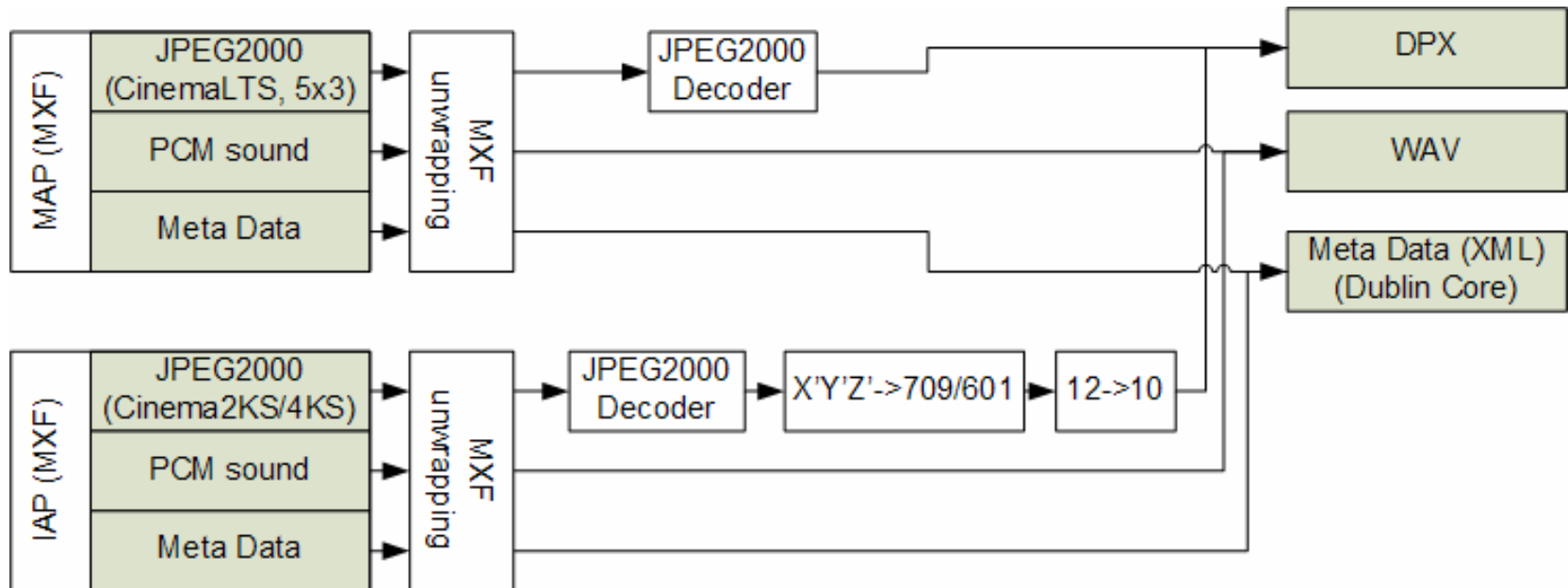
# Possible Audio Processing Operations

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

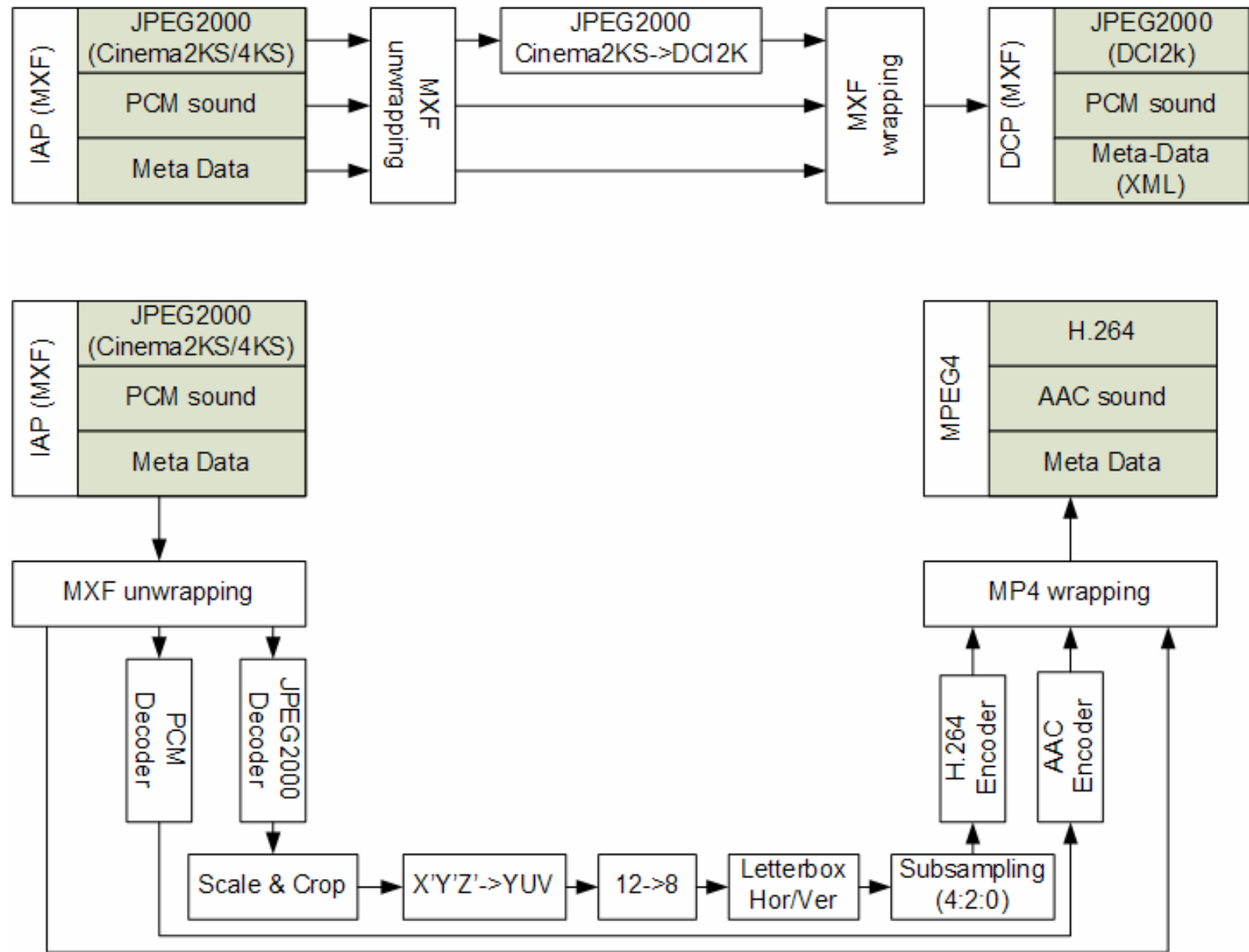
# Ingest Chain



# Decoding Chain



# Distribution Chain



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# Hierarchical Storage Management

Rule-based automated management of file storage

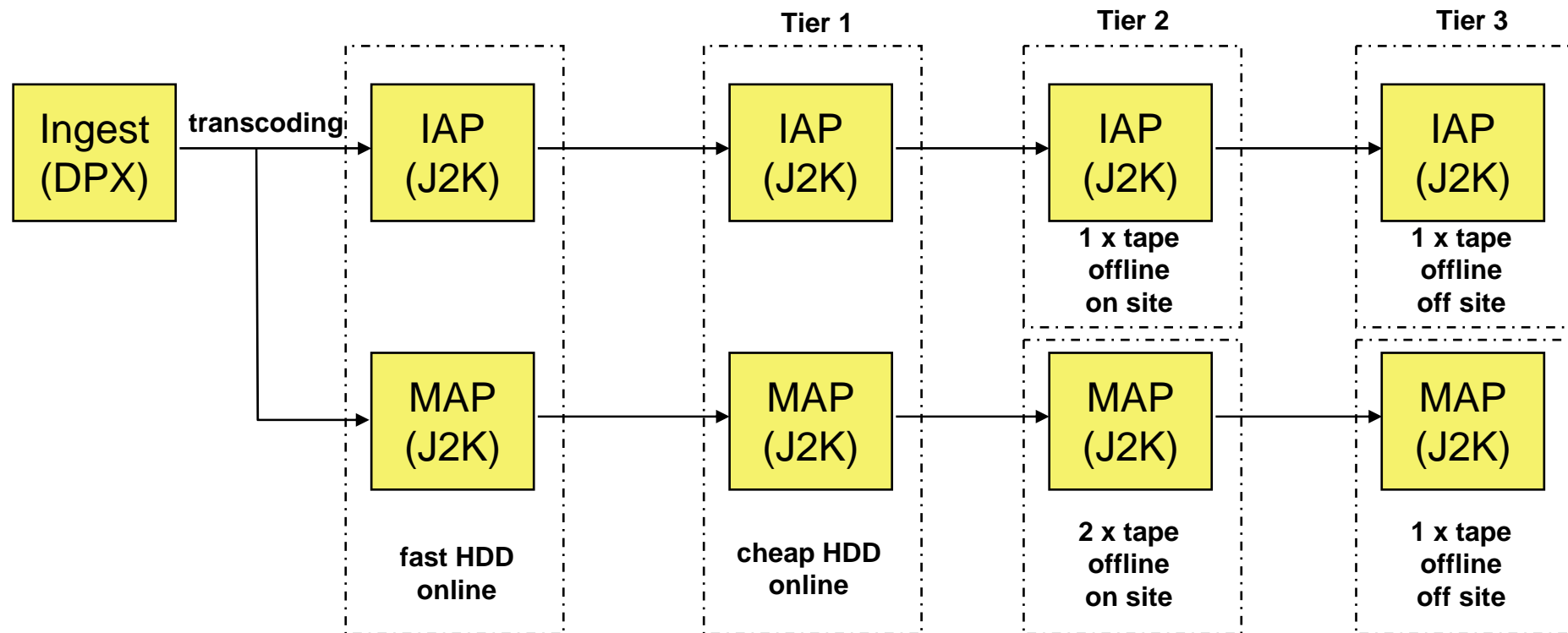
Automated continuous creation of copies in different locations → redundancy!

Automated relocation of files to data tapes (also in multiple copies if desired)

Off-site copies possible

Automated migration to new storage media and systems

# Hierarchical Storage Management - Example





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# Hierarchical Storage Management – Access

**Archiving:** file is copied to tape or second disk

**Releasing:** file is removed from original location

**Staging:** file is recreated from tape or disk in original location

Operations can be rule based or explicitly controlled

Staging can happen automatically when file is accessed

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## Hard- and Software of the Prototype

### Storage and control node:

- dual quad-core CPU, 8GB RAM, 500GB internal hard disks
- 4TB external storage (SATA)
- Unix operating system
- hierarchical file system with archiving to disks
- postgresSQL database
- DSpace software + EDCINE extensions

### Transcoding node

- dual quad-core CPU, 8GB RAM, Unix
- connected to storage node via 2 x 1Gbit ethernet

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# Practical Applications

Entry level solution:

- single-PC solution, transcoding system only
- manual control

Turnkey system:

- complete solution: archive management system with database, web user interface, transcoding system, storage system
- software and hardware

Customized solution:

- individually tailored to customer's requirements

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# Conclusions

Demonstration of a complete solution

Practical implementation of proposed standards

Next step: real world implementation

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# Practical Demonstration

easyDCP

easyDCP Player

EDCINE Digital Film Archive System

Hierarchical Storage Management

# Thank you for your attention!

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