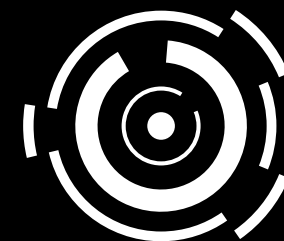


Setting up a film digitisation workflow

Presto4U workshop
København, 22 September 2014

Mikko Kuutti, Deputy Director

KANSALLINEN AUDIOVISUAALINEN INSTITUUTTI
NATIONELLA AUDIOVISUELLA INSTITUTET
NATIONAL AUDIOVISUAL INSTITUTE



In Brief

- 1957 established as Suomen elokuva-arkisto / Finnish Film Archive
- 1979 public body operating under the Ministry of Education
- 2008
 - radio & television archiving started – name changed to Kansallinen audiovisuaalinen arkisto (KAVA) / National Audiovisual Archive
- 2014
 - merger with the Centre for Media Education and Audiovisual Media (formerly Board of Film Classification) – name changed to Kansallinen audiovisuaalinen instituutti (KAVI) / National Audiovisual Institute
 - budget 7.4 million €
 - 87 staff

NATIONAL AUDIOVISUAL INSTITUTE
Collection statistics 2013

6 300 prints of 1 250 Finnish feature films
image material on 20 000 Finnish films
16 000 prints of 10 000 foreign feature films

SCANNING AND PRESERVING FILM HERITAGE

Film Industry Digital Timeline

- sound production went digital decades ago
- 1998 first full digital intermediate DI process in Denmark
- 2000 first full DI process in Finland (and in Hollywood)
- 2012
 - in the Nordic countries, all cinemas digital
 - analogue film distribution stops
 - the only film lab in Finland goes bankrupt
- 2013
 - Fuji stops making cine films, Kodak barely escapes bankruptcy

Implications of Digital for film archives

- demise of film as a medium
 - film collections usable only in a few cinemas
 - almost all access will be digital
 - large-scale digitisation is required
 - new films will have to be archived in digital formats
 - long-term digital preservation has to be deployed – and trusted
- film archives facing a profound transformation
 - from steady memory organisations into fast-moving IT houses

National Audiovisual Archive Institute

- Strategy
 - develop KAVI into a hybrid archive for both analogue & digital films
 - digital access
- Funding
 - some extra funding since 2009, ca. 1 mill. € annually since 2011
- Storage
 - project started in Jan 2010, in use in early 2011
 - partnered with the IT Centre for Science
- Digitisation
 - first equipment in early 2011, scanner installed in autumn 2011

SCANNING AND PRESERVING FILM HERITAGE

Digital Services unit

- a DCP production line
 - providing access in cinemas to Finnish film heritage
- throughput about 30 feature films/year
- restorations are separate projects
 - 3–5 restorations yearly
- feature films scanned at oversize 4k
- 2k workflow an option
 - express DCPs, newsreels & short films



Digital Services unit

- hardware

- Scanity 4k scanner
- laser diffraction sound scanner
- 190 TB (usable) Fibre Channel SAN
 - multiple concurrent 4k+ streams
- off-site tape storage
 - 10 km dedicated fibre link

- software

- Resolve, Revival, PFClean, Fraunhofer Curator / easyDCP, OpenCube, Pro Tools, Cedar

- 7 staff

- head of unit
- scanner operator
- colourist
- colourist-editor
- 2 x image restorers
- sound restorer

SCANNING AND PRESERVING FILM HERITAGE
CSC — IT Center for Science Ltd

- non-profit company 100 % owned by the Ministry of Education & Culture
- traditionally provides computing services for universities
- Finland's supercomputing centre
- National Audiovisual Institute partner since the establishment of the fully digital Radio & Television Archive in 2008
- provides expertise & services to the National Audiovisual Institute:

	man-months
Radio & Television Archive	16
other	7

SCANNING AND PRESERVING FILM HERITAGE

Outsourced Services

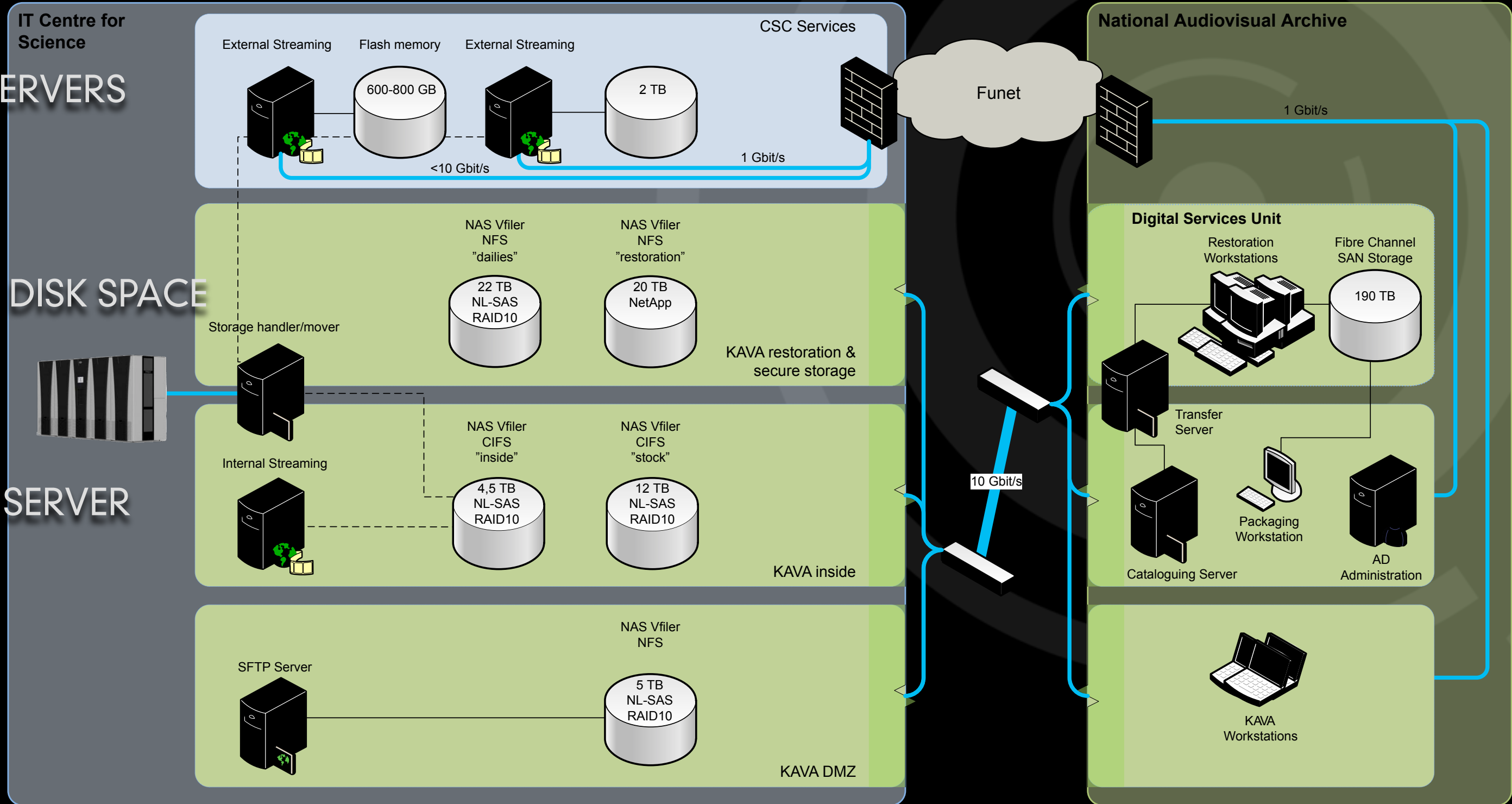
STREAMING SERVERS

RESTORATION DISK SPACE

TAPE ARCHIVE

INTRANET FILE SERVER

SFTP SERVER



CSC Tape archive specs

- Archiving System
 - 6 x SGI C2108 servers
 - Intel Xeon X5650 2.66 GHz CPUs
 - 24–96 gigabytes of RAM/server
 - 2 x 10 Gbps Ethernet
 - SGI IS5000 storage system
 - DMF archiving software (HSM)
 - OpenVault software
 - CXFS cluster file system
- Disk Cache
 - Spectra Logic T-Finity, 5 frames
 - 2 x SFA10K-X controllers
 - 10 disk shelves
 - HGST 3 TB hard disks
 - 3 x 10⁷ terabytes of disk caches
- Tape Library and Tape Drives
 - Total capacity of 2934 slots
 - 10 x IBM TS1140 FC drives
 - IBM 3592 JC tape capacity 4 TB

Digitising the Domestic Film Collection

National Audiovisual Institute
Finland
2014

Digitising the Domestic Film Collection

Yearly schedule FEATURE FILMS

Digital copy

- Light post work
- Approximately 30–40 DCPs a year
- 4k or 2k.

Restoration

- 3–5 films per year.
- More extensive post work as schedule allows.
- According to demand.
- Typically 4k.

Full restoration

- 1–2 important films per year.
- Always 4k.

Digitising the Domestic Film Collection

Yearly schedule OTHER FILMS

Short films

- According to demand
- Typically 2k

Preservation copies

- All domestic films with nitrate elements only.
- Always 4k.

Others

- Defence forces camera negatives until all available in 4k.

Domestic feature films

CHOOSING THE TITLES



No decent prints available



10 titles yearly



Cinémathèque



Silent films



The 1960s

Domestic feature films

QUALITY PRINCIPLES

“The content in the digital copy should be as close as possible to the content of the premiere print.”

“Censorship cuts shall not be returned unless they were cut after the premiere.”

“If there is no certainty of the final cut of the film, the source for the edit needs to be documented (e.g. script)”

Domestic feature films

QUALITY PRINCIPLES

“A screening of a film print should always take place before colour grading, digital restoration and audio processing”

“The target level for digital restoration must match the schedule”

“Audio can be processed slightly more aggressively – especially the dialogue.”

Film preparation

- The conservator chooses the best available source elements
- Splices and tears are repaired
- Film is cleaned – nitrate most often by hand, acetate and polyester in cleaning machine (Lipsner&Smith CF9200)
- Light change marks are checked at the scanner and if necessary they are taped over
- Sound elements are chosen with the sound engineer

Image and sound digitisation

- Started by test scans to examine possible issues.
- Original negative
 - 10 bit logarithmic DPX (P3 processing)
- Duplicate positive / print
 - CRT characteristic DPX may be used (Rec 709 processing)
- Anamorphic images are scanned as on film to be stretched at mastering
- Sound is digitised at least at 24 bits and 96 kHz

Image and sound digitisation

- IMAGE
 - DFT Scanity: 4k, 15 fps
- SOUND
 - SoundDirect (optical)
 - MWA MB-51 (magnetic)
 - 192 kHz / 96 kHz, 24 bit
 - Laser shrinkage detector (LSD) – automatic pitch control
- LOCAL STORAGE
 - Scale Logic 190 TB (usable) Fibre Channel SAN
 - multiple concurrent 4k+ streams

Image resolution

- High standard restorations are always processed at 4k
- Other 35mm negatives are digitised at 4k. In some cases post processing may be done at 2k
- Duplicates and prints may be digitised at 2k
- Short films mainly at 2k
- 16mm sources at 2k

Colour grading

- The aim is to grade the image to its original look.
- For negative the lights need to be redefined.
- Colour grading is accepted by supervising conservator.
- Colour grading is usually done before digital restoration.
- After colour grading the picture must be at its final state as a continuous sequence including all the replaced frames.

Colour grading (+ editing)

- DaVinci Resolve
 - Linux & OS X
- Adobe Premiere CS6

Image restoration

- Films are restored semi-automatically with manual verification
- High standard projects are also restored manually on frame by frame basis
- Image can be stabilised and flicker can be removed
- Dirt, scratches, tears, damages and splices are repaired
- Fully damaged or missing frames are principally replaced from other sources
- A missing frame can be interpolated or duplicated from a neighbouring frame

Image restoration

- DaVinci Revival
- Digital Vision Phoenix
- Pixel Farm PFClean

Sound restoration

- Best possible source elements are chosen:
Can be sound negative, magnetic tape or a well preserved print
- Artefacts caused by time, usage and possibly the digitisation are fixed: hiss, clicks, snaps, rasp, noise and high frequency distortion
- Frequency response and dynamics can be processed if the comprehensibility of dialogue can be significantly improved
- Mono sound is coded on the centre channel only and In general, sound formats are mastered to preserve the original soundscape

Sound restoration

- Cedar Cambridge
 - Automatic chain: de-hiss, de-clickle, de-crackle, de-buzz, de-clip
 - Manual restoration
 - 96 kHz, 24 bit
- ProTools / iZotope / Waves
 - EQ, de-clicker, expander, de-click ...
 - Manual editing, mastering
 - 48 kHz, 24 bit

Mastering

- DCP

All feature films and other titles that are destined for cinema screenings. The DCP image is cropped to the screening aspect ratio of the original print. Edges of the camera aperture will not appear on screen.

- HD

1080p Prores 422 (HQ) is made of all titles.

- Streaming

H.264 mp4-file for preview is produced for the internal collection management system.



Mastering

- OpenCube DCP
- EasyDCP
- Curator suite

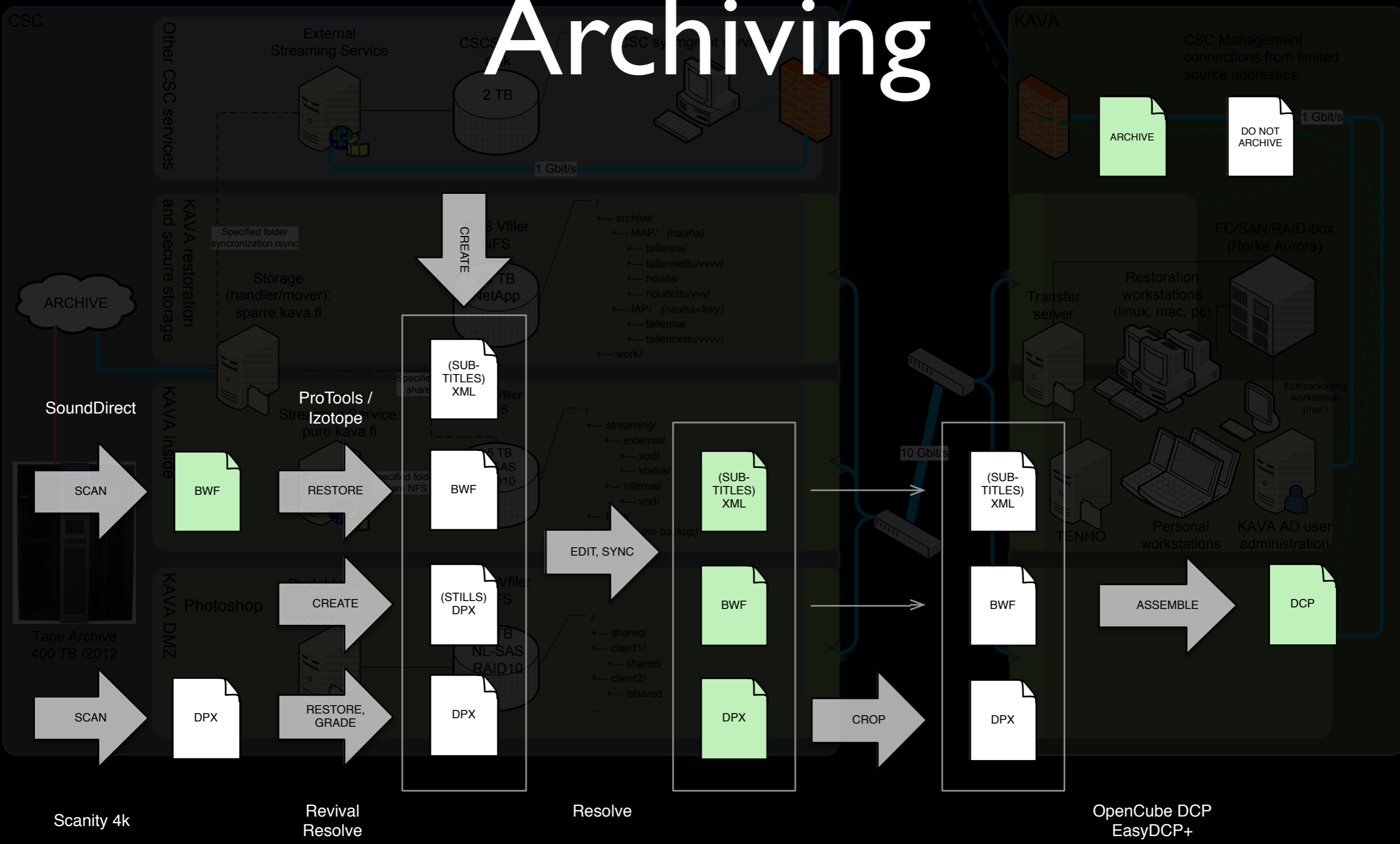
Metadata Inspector

Annotation Text	: PahkaSuo0172916.dpx
Aspect Ratio	: 1.66
Duration as Timecode	: 00:10:04:18
Duration in Frames	: 14514
Edit Rate	: 24 / 1
Frame Rate	: 24 / 1
Input Bit Depth	: 12
Intrinsic Duration as Timecode	: 00:10:04:18
Intrinsic Duration in Frames	: 14514
Offset in Frames	: 0
Resolution	: 1800 x 1080
Source File	: /Volumes/restoration-1/archive/IAP/tallemnettu/2013/1549807-PahkahulluSuomi/2xx28016-4dc3-4156-91...
Type	: Picture Track
UUID	: 2xx28016-4dc3-4156-911e-fc3e3c3f0400

Preview



Archiving



Preservation scans will be archived

Archiving

One feature film:

$$90 \text{ min film} = 24 \text{ fps} \times 60 \text{ (sec)} \times 90 \text{ (min)}$$

130 000 frames

$$\text{Master archive package: } 55 \text{ MB/fr} \times 130\,000 \text{ fr} = 7,1 \text{ TB}$$

Access package (DCP): approx. 200 GB

$$\text{Original: } 2 \times \text{tape} = 14,2 \text{ TB}$$

$$\text{Restored: } 2 \times \text{tapes} = 14,2 \text{ TB}$$

$$\text{DCP: } 2 \times \text{tape} + \text{disc} = 0,6 \text{ TB}$$

29 TB/film

