

Data Storage and Data Migration, or: to do nothing is not an option

Reto Kromer • AV Preservation by reto.ch

Akademie der bildenden Künste

**Medienkunst:
Technologie und Erhaltungsstrategien III**
Wien, 7.–10. Jänner 2020

1

Magnetic Tape

- in use since the 1950s by IT
- cartridges are always on polyester base (old open reels can be on triacetate base)

2

Packaging

- open reel
- cassette
- cartridge

3

Recording

- linear or diagonally
- analogue or digital

4

LTO

- Linear Tape-Open
- answer from the IT industry to the bank and insurance sector
- in 2000 LTO-1
- currently LTO-8
- currently Hewlett Packard Enterprise, IBM, and Quantum form the LTO Consortium

5



6

Formatting

TAR

- from LTO-1 to LTO-4 only possibility
- still possible possible today

LTFS

- possible (and recommended) since LTO-5

7

TAR

- standard TAR
 - bloc size
 - number of archives per cartridge
 - archives needing more than one cartridge
- TAR with a proprietary data encoding (e.g. BRU, Retrospect)

8

LTFS

- different versions
- almost one implementation per vendor, but...
- ... "ltfs" and "mklts" common commands
- lossless compression (default) or uncompressed data
- unencrypted (default) or encrypted data

9

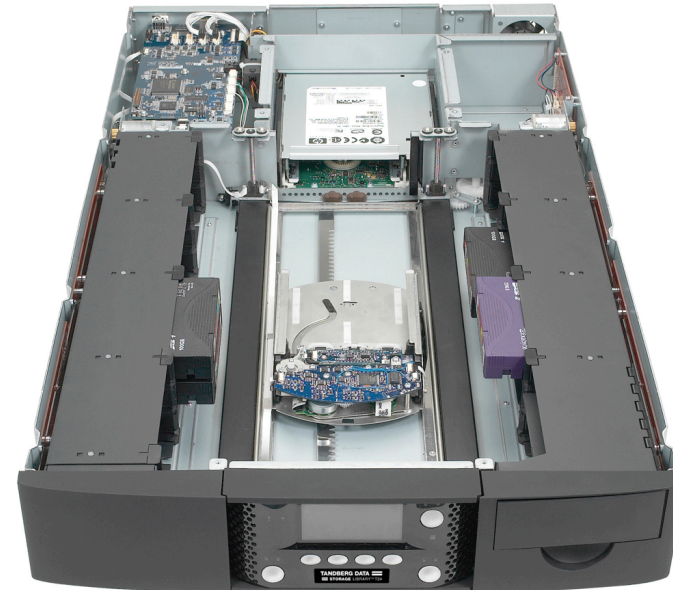
Drive

- internal or external unit
- library

10



11



12

Storage of the Tapes

- in a tape library
- on a shelf

13

Software

- proprietary or open source
- graphical user interface (GUI) and/or command-line interface (CLI)

14

Plan the Next Migration

- file naming
- code bars
- checksums
- write the full index to the cartridge
- technical metadata
- code to retrieve the files

15

#1: Film

FILM

- FILM_TIFF/Film_nnnnnn.tif
- Film_PCM.wav
- Film_ProRes.mov
- Film_H264.mp4

16

#2: Video

VIDEO

- Video_YUV422.mkv
- Video_ProRes.mov
- Video_H264.mp4

17

Longterm

- storage of the cartridges
- three copies...
- ... in geographically distant locations
- data integrity check
- data migration
- availability of LTO desks

18

Reading

Reto Kromer: **On the Bright Side of Data Migrations**, in «IASA Journal», n. 49 (December 2018), IASA, p. 18–22

→ retokromer.ch/publications/IASA_49.html

19

read | script | write

script to modify

- container
- codec
- both container and codec
- metadata
- filename

20

#1: ProRes-born Content

from:

- ProRes stored in a QuickTime (.mov) container

to:

- ProRes stored in a Matroska (.mkv) container

21

Update the Container

→ read file from source LTO

→ demultiplex file

- ProRes 422, 10 bit [yuv422p10le]
- ProRes 4444, 10 bit [yuv444p10le or yuva444p10le] or 12 bit [yuv444p12le]

→ multiplex file

→ write file to destination LTO

22

SMPTE RDD 36:2015

SMPTE REGISTERED DISCLOSURE DOCUMENT

Apple ProRes Bitstream Syntax and Decoding Process



Page 1 of 39 pages

The attached document is a Registered Disclosure Document prepared by the sponsor identified below. It has been examined by the appropriate SMPTE Technology Committee and is believed to contain adequate information to satisfy the objectives defined in the Scope, and to be technically consistent.

This document is NOT a Standard, Recommended Practice or Engineering Guideline, and does NOT imply a finding or representation of the Society.

Every attempt has been made to ensure that the information contained in this document is accurate. Errors in this document should be reported to the proponent identified below, with a copy to eng@smpte.org.

23

#2: Video

from:

- AVI / 8-bit and 10-bit uncompressed
- MOV / 8-bit and 10-bit uncompressed
- MP4 / 8-bit and 10-bit uncompressed

to:

- Matroska / FFV1

24

Container and Codec

- read file from source LTO
- demultiplex file
- decode file
 - $Y'CbCr$, 4:2:2, 8 bit, «raw» [uyvy422]
- encode file
- multiplex file
- write file to destination LTO

25

Container and Codec

- read file from source LTO
- demultiplex file
- decode file
 - $Y'CbCr$, 4:2:2, 10 bit, «raw» [yuv422p10le]
- encode file
- multiplex file
- write file to destination LTO

26

#3: Filename

from:

- Title_YUV422.mkv

to:

- Title_YCbCr422_9d5084b5b0a08d5022b39e0e75241d12.mkv

27

AV Preservation by reto.ch

chemin du Suchet 5
1024 Écublens
Switzerland

Web: reto.ch
Twitter: @retoch
Email: info@reto.ch



28