Practical comparison of containers/codecs for long-term preservation of digital video

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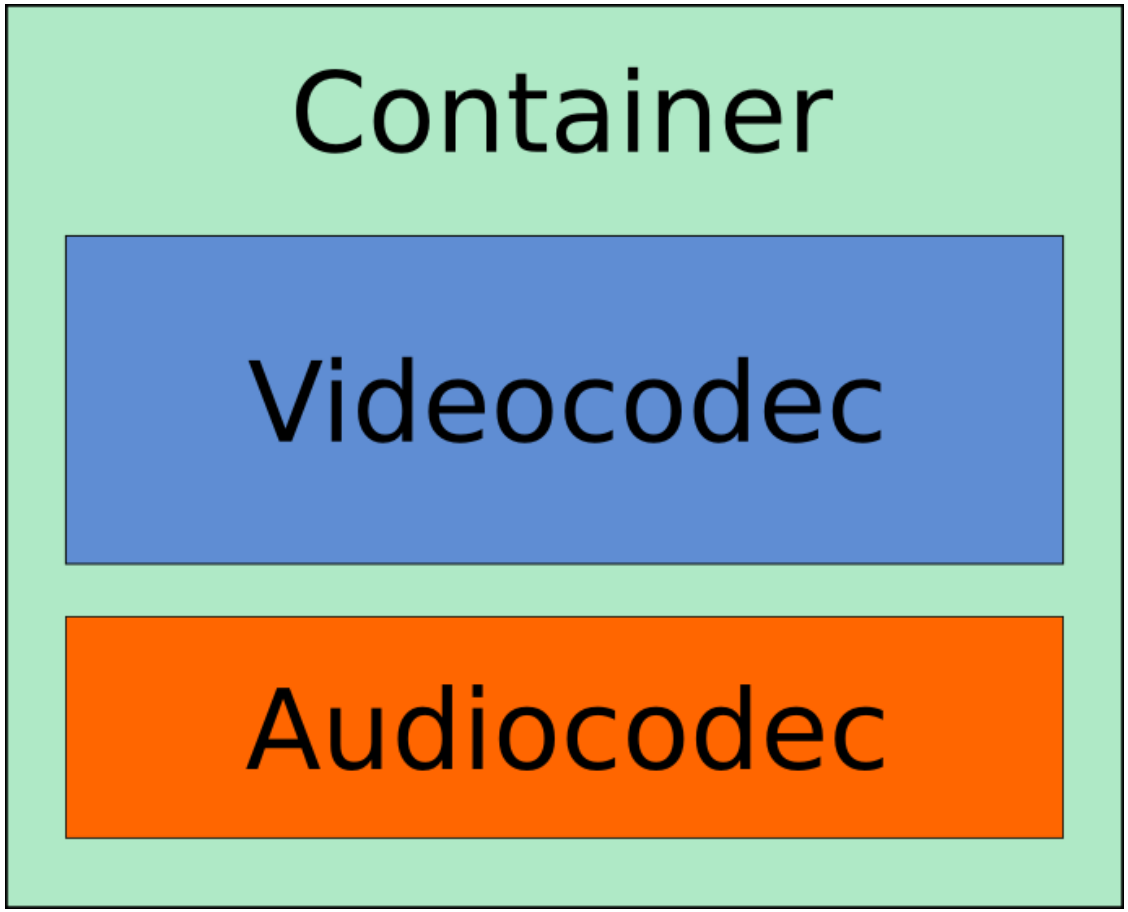
25. Jun 2014

. . . and how video digitization led the Mediathek to re-thinking democratization of professional software solutions.

Digital video

Choose your destiny
The “digital video trinity”



Digital video
There's more to consider...

Multiple factors:

- Pixel resolution (straight/anamorphic)
- Group Of Pictures (GOP)
- Bitrate
- Framerate (PAL, NTSC, film, "esoteric", etc.)
- Scanning mode (interlaced/progressive)
- Colorspace (YUV, RGB, XYZ)
- Subsampling (4:4:4, 4:2:2, 4:2:0, etc)
- Bits-Per-Component (bpc)
- ...

Which codec / container?

Videocodecs
Lossy or lossless?

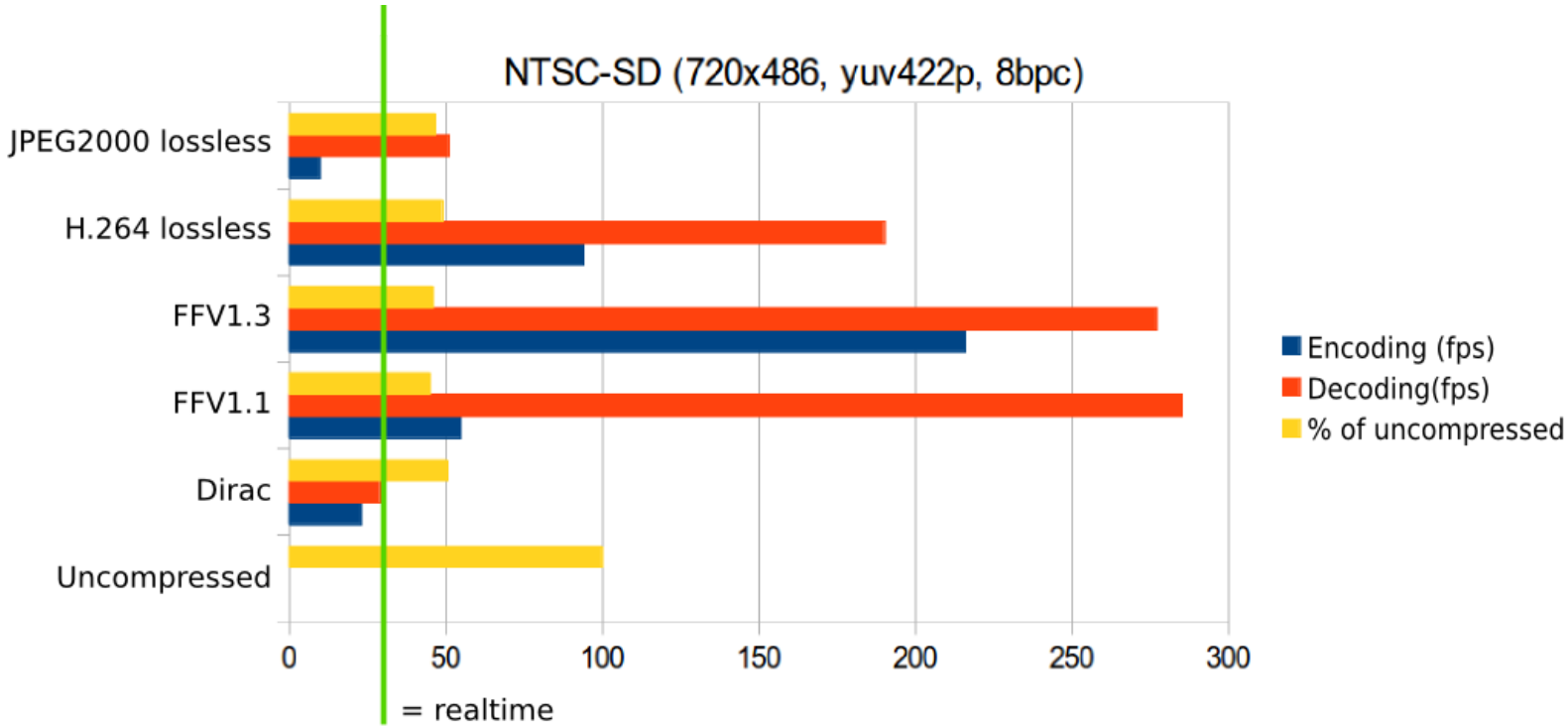
If lossy is good enough for professional video, why not use 320kbps MP3 for audio archiving? ;)

So, let's do lossless:

- h264-lossless
- JPEG2000-lossless
- FFV1
- Dirac
- Uncompressed

`http://download.das-werkstatt.com/pb/mthk/info/video/comparison_video_codecs_containers.html`

Videocodecs
Performance comparison



Example SD-PAL VHS:
1.186 GiB/Min uncompressed vs. **400 MiB/Min** in FFV1

Unsettled format question

Considerations:

- Different focus/demands:
  Broadcast, production, preservation
- "*Minimalistic standards*" vs. "*All-In-One*"
- Metadata:
  - Schemas, formats and "All-In-One" file or not?
  - Accessing embedded metadata?
  - Updating the AIP (e.g. augmenting metadata)

Unsettled format question
Current industry proposed standard

JPEG2000/MXF

- Both formats are Open Standards
- Both are an “All-In-One” approach

Unsettled format question
Jack of all trades. . .

Let's reconsider "All-in-One":

Unsettled format question
Jack of all trades. . .

VS

Unsettled format question

Jack of all trades. . .

. . . using the right tool for the right job:

Unsettled format question
Jack of all trades. . .

Multi-feature formats can be good:

Unsettled format question
Jack of all trades. . .

VS

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Source: http://www.amazon.de/Wenger-Schweizer-Offiziersmesser-Messer-Schatulle/dp/B000R0JDSI

Data format(s) for long-term preservation
What can I open *now* and in 'x' years?

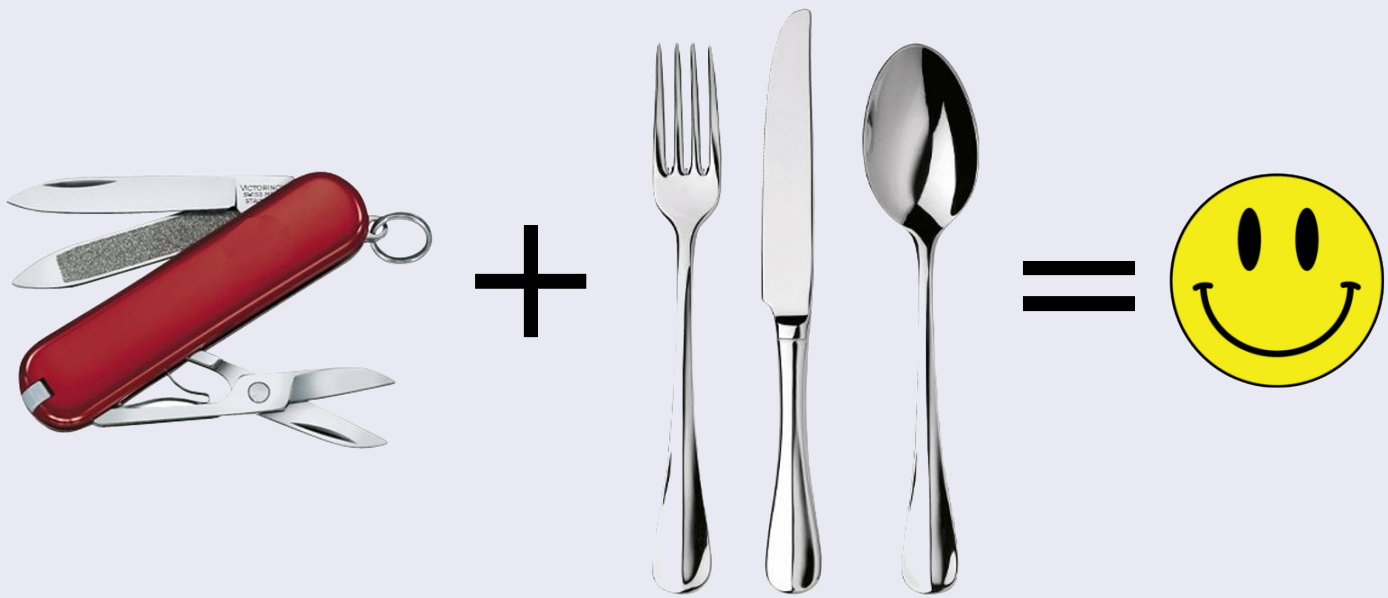
Practical experiences:

- Minimalistic standards:
  - As complex as necessary
  - As simple as possible
  - = easier to implement = interoperable = sustainable
- Closed vs. Open implementation:
  - Open Standards are a very good thing!
    If done correctly.
  - Closed implementation:
    Even if based on a standard, it's a black box
  - Just open:
    No standard, but open = transparent, sustainable, fixable
- Metadata:
  Text(XML) or images in files vs. embedded in container

Pragmatic solution at the Mediathek

Folder package / Minimalistic Standards

FFV1/PCM/AVI + Metadata files:



Data format(s) for long-term preservation
FFV1 lossless video codec

FFV1 = "FFmpeg Video Codec 1"

- All implementations are free and open (FFmpeg)
- FFmpeg = Most widely used program-library for video
- Only lossless
- Realtime on commodity hardware:
  - SD PAL in realtime (single-threading) - 2010
  - Full-HD in realtime (multi-threading) - 2013
- Available to everyone: public and private
- Migration to future formats: No problemo ;)
- Not an official standard (yet)

Nothing is perfect...

- ...so we payed for improvement of FFV1

The Austrian Mediathek
A real world example

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Yet, it was still cheaper than *one* license of closed, proprietary alternatives - *and* in some cases even offered us more features.

The Austrian Mediathek
A real world example

Using and professionalizing Free Software (Open Source) enables us:

- Lossless video workflow from A-Z
  (FFV1. No retranscoding required)
- High quality: affordable, sustainable and highly interoperable
- Vendor neutral
- Digitization check on actual archive copy
- Playback and edit the lossless archive copy in realtime
- Regular PC hardware is sufficient in most cases
- Transcoding to almost any target format (DVD, Web, Mobile, J2K, etc)
  Thanks to FFmpeg
- And much, much more...

What's all this to you?

We archiving institutions have...

- common interest +
- common challenges =
- common solutions ?!

. . . which brings us to:

Democratization

Overcoming physical limitations
In our new software-driven world

Think about this...

- Freeware (gratis) != Free Software (freedom)
- Closed, proprietary software = Black box. Just us as-is
- Black boxes for education?
- Use, study, share and improve vs. "just use as-is"
- Monoculture of closed tools/devices =
  Healthy ecosystem? Dependencies? Access to knowledge?

Overcoming physical limitations
What can we learn from other IT areas?

Empowering archives/users:

- The freedom to use, study, share and improve (=Free Software)
- Source code = schematics (building components included)
- Same applies to your working environment, tools, etc.
- Paid "Open Source": *You* choose your support and conditions. No lock-in. Local vendor support.

So: Why not?

Questions?
Comments?

Links and references

- DVA-Profession:

  `http://www.dva-profession.mediathek.at/`

- Minimalistic Standards:

  `http://fsfe.org/activities/os/minimalisticstandards.html`

- The archivist's video codec and container FAQ:

  `http://download.das-werkstatt.com/pb/mthk/info/video/FAQ-digital_video_archiving.html`

- Comparing video codecs and containers for archives:

  `http://download.das-werkstatt.com/pb/mthk/info/video/comparison_video_codecs_containers.html`

- FFV1 on Wikipedia:

  `https://en.wikipedia.org/wiki/FFV1`

- FFmpeg on Wikipedia:

  `http://en.wikipedia.org/wiki/Ffmpeg`

Thank you very much for your attention!

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