The FFV1 Video Codec in Practice: Opportunities and Challenges

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Digital Preservation:
Digital Formats, Network and Data Curation
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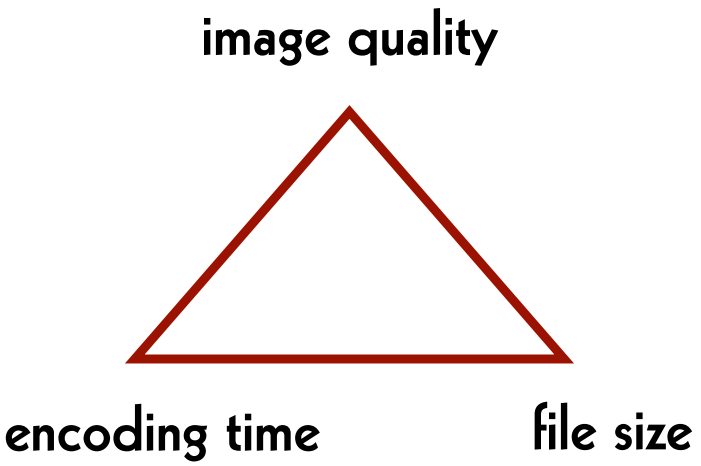
Summary

- The Dilemma
- Today's Solutions
- Future Directions

The Dilemma



Compression

- uncompressed
- lossless compression
- lossy compression
- chroma subsampling
- born compressed

Uncompressed

+ data processing is simpler
+ less computing power is needed

− more storage is need
− slower writing, transmission and reading

examples: TIFF, DPX, DNG, OpenEXR

Lossless Compression

+ less storage is need
+ faster writing, transmission and reading

− data processing is more complex
− more computing power is needed

examples: JPEG 2000, FFV1

Lossy Compression

- optimised for postproduction

  examples: ProRes 422, ProRes 4444; DNxHD, DNxHR

- optimised for access

  examples: H.264 (AVC), H.265 (HEVC), H.266 (VVC); AV1

Chroma Subsampling

from analogue television to digital television

4:4:4 sampling

- 4:2:2 subsampling for postproduction
- 4:2:0 and 4:1:1 subsamplings for access

Born Compressed

- optimised for both image acquisition and postproduction

  examples: CineForm RAW, ProRes RAW, Blackmagic RAW

Today's Solutions

JPEG 2000

- …

FFV1

- lossless video compression
- frames divided in slices, with checksums
- open source and patent free
- adopted by several archives

  ➔ Claudio Santancini

Archive Master and Mezzanine

single images ("film")
- Matroska, FFV1, 2K, RGB, 16 bit
- Matroska, FFV1, 2K, R'G'B', 12 bit

streams ("video")
- Matroska, FFV1, "HD", $Y'C_BC_R$ 4:2:2, 10 bit
- Matroska, FFV1, "HD", $Y'C_BC_R$ 4:4:4, 12 bit

audio
- Matroska, FLAC, 96 kHz, 24 bit
- Matroska, FLAC, 192 kHz, 24 bit

	avantages	disavantages
TIFF DPX OpenEXR	data easier to process	bigger files
JPEG 2000 FFV1	smaller files	data complexer to process

A Bridge

RAWcooked (command-line interface)

➔ mediaarea.net/RAWcooked

```
# to encode:
rawcooked input_path_of_folder
# to decode:
rawcooked rawcooked_input_file.mkv
# to get help:
rawcooked -h
man rawcooked
```

RAWcooked

- encoding into Matroska (.mkv) using FFV1 video codec and FLAC audio codec
- all metadata preserved
- decoding with bit-by-bit reversibility
- possibility to embed sidecar files such as MD5, LUT, XML and PDF
- compatibility with media players

Future Directions

Sustainability

from 2004 to 2012

- all power consumption from the grid

from 2013 to 2019

- no electricity from the grid is used for the IT

from 2020 to 2024

- no electricity at all comes from the grid

No Time to Wait

- 2016 in Berlin
- 2017 in Vienna
- 2018 in London
- 2019 in Budapest
- 2021 online edition
- 2022 in The Hague
- 2023 in Prague
- 2024 in Karlsruhe

Reading (1)

Reto Kromer: **Matroska and FFV1: One File Format for Film and Video Archiving?**, in «Journal of Film Preservation», n. 96 (April 2017), FIAF, Brussels, Belgium, p. 41–45

➔ retokromer.ch/publications/JFP_96.html

Reading (2)

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

Ways to store Bayer-type data

- pixel values generated by one de-mosaicking algorithm (digital blow-up)
- pixel values generated by mixing two green sensel values into one (digital reduction)
- raw sensel values

Reading (3)

Reto Kromer: **From the Sensor to the File: Different Ways to Work with Bayer-Type Data**, coming soonish

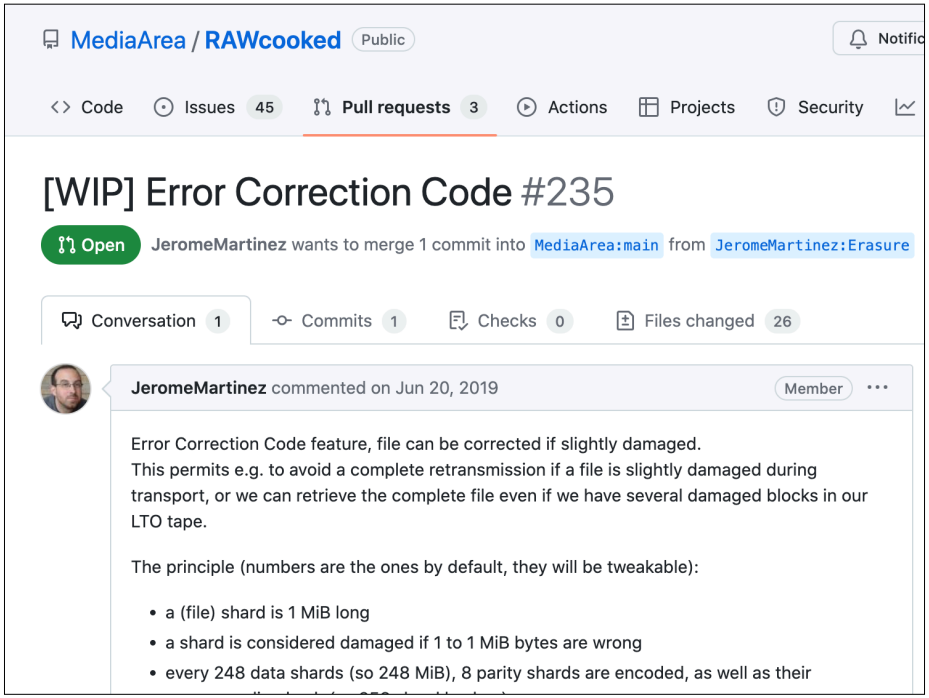
Improvements (1)

support of any type of channel, including:

- Bayer-type data
- multispectral imaging
- Y′CoCg colour model

Improvements (2)

- support of HDR
- support of 1D and 3D LUTs
- revision of the bit stream
- tuning of the compression algorithm (speed and rate)



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