

FFmpeg's FFV1 lossless video codec

A Free Software success story

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How did all this begin...?

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lossless video
codec

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Happy End

We needed something
that works...

Who is “we”?

The Austrian National A/V Archive (Österreichische Mediathek) ^a wanted to digitize video for long-term preservation.

^a <http://www.mediathek.at/>

For audio it's clear:

- Format is uncompressed(=lossless) PCM (WAV).
- We just applied the same requirements to video.
- But uncompressed was not an option (too huge!)

So how do others archive video professionally?

The situation we found:

- Majority uses lossy codecs:
IMX, ProRes, MPEG-2, MPEG-4
- Industry proposed format: JPEG2000-lossless/PCM in MXF
- One existing product: FrontPorch Digital "Samma"
- Issues with: Access, interoperability and transcoding of produced files (Even between different versions of same vendor)

The industry proposed format:

- Official ISO standard (lossy and lossless)
- Very few, but “maybe-compatible” implementations.
(Except for “libopenjpeg” all are proprietary)
- Industry focus on “lossy” mode
- Required special hardware for realtime with SD
(Imagine HD-and-beyond...)
- Very small userbase
- Very few transcoder options: expensive, limited and slow
- Difficult to open/use/transcode the videos. Even *now*.

What we found “on the street”:

- Similar compression to JPEG2000-lossless.
- Faster than JPEG2000-lossless.
- *Only* lossless. By design.
- Reference implementation as Free Software.
- Included in any application using FFmpeg by default.

FFV1's properties in 2009:

- Marked as “experimental”
- Only single-threading
- No bit-error tolerance/awareness
- Not standardized or documented
- Not known at all by professionals in A/V industry
- Even worse: It originated in the “Open Source community”.
Yikes!

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Funded work in progress... (PREFORMA/MediaArea/IETF)
- It originated in the “Open Source community”:
Actually, that’s a feature :)

Of course, we had fears, uncertainties and doubts ourselves...

So, here's what we did:

- Double checked FFV1's long-term sustainability
- Tested its implementation. Big time!
- Documented its usage
- Organized and funded improvement
- Started using it in-house



FFV1

So we “outed” ourselves and told others...

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What we encountered was:

Fear, Uncertainty and Doubt...

Fear:

- Can it be any good if no professionals are using it yet?
- Is it really mathematically lossless?
- Will I be able to open it in the future?
- Will we be alone when we use it?

Uncertainty:

- Why didn't the "big players" pick it up?
- It's not an official standard.
- Which applications support it - now and in the future?
- OpenSource is nice Freeware, but what about its quality?

Doubt:

- Open Source community can't come up with something as-good-as, or even better than "The Industry".
- Most production- and broadcasting facilities do lossy (IMX, ProRes, etc) - or use JPEG2000-lossless.
- "If it's free, it can't be any good"
- It's too cheap. We want the expensive/limited stuff!

Perception and politics:

- Image and “word on the street” more important for decision-makers than technical proof/properties.
- Any proprietary solution preferred *if* professional, big institutions use it - even if “problematic”.
- Preservability “promised” by paper more important than “guaranteed” by Free Software licensing.
- Preferred to have companies behind it.
- “Nobody ever got fired for buying IBM”

The FFmpeg/LibAV fork:

- FFV1 originated as in FFmpeg, invented by its project leader "Michael Niedermayer".
- Slight "stress" between these 2 projects.
- Support of new versions of FFV1 in LibAV?
- Disastrous if FFmpeg/LibAV had been proprietary competitors.

Classical user perception:

Use as-is and wait/hope for vendor to implement things...

The "4 Freedoms": to use, study, share and improve:

- Picked up FFV1, nourished and charished it:
 - Mediathek using FFV1.1 for preservation/production since 2011
 - FFV1.3 released in August 2013
- Solved our problem = Result is free for everyone else to use!
- Collaboration rather than competition
- FFV1: Another proof what Free Software makes possible

Incredibly effective use of resources:

- Now anyone is able to digitize and archive video at same (or better) quality, previously only available to large-budget institutions.
- A handful of decentralized developers created a solution matching or outperforming a million-dollar industry.
- Pay for what you actually need.
No business investment overhead.
- Now, lossless video playback/editing possible on off-the-shelf consumer PC hardware.

Free Software guarantees access and preservability:

- No forced format obsolescence
- Preserving actual source code of tools used to open/create formats
= archiving schematics and parts of recording/replayer unit.
- (Interoperability) issues can be fixed.
No black-box reverse-engineering + workarounds necessary.
- Tech-internals and development transparent and accountable

Even if source won't compile "as-is" in the future, making it work is possible without artificial restrictions.

Access/transcode formats:

- Regardless of user-base size or market interests.

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Access/transcode formats:

- Regardless of user-base size or market interests.
- Even with "*Unknown Future Technology 3000TM*,"
- Or alien hardware ;)
- Or just other CPU-architectures, compilers or programming languages.

To name just a few:

- Without the “4 freedoms”, using FFV1 for preservation would be a no-go.
- Improvements and usage possible without artificial restrictions.
- No vendor dependence. Free choice of (local) developers.
- Automatically supported by other applications using Free Software libraries (FFmpeg, LibAV)
- Adaptations to local environment possible.
- ...and many more!

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btw: Even proprietary vendors can benefit from that.

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But: Where's the romance?

Developers are proud of their work:

- Personal engagement in supporting and improving their creation.
- Creating solutions for people, rather than “the market”.
- You can talk with the actual persons creating the product.
- It makes using and dealing with software products more personal.
- Professional, handmade quality

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Well, I'd say that's pretty romantic ;)

Innovation powered by humans, rather than faceless corporations.

Who made lossless video as awesome as it is now:

- Michael Niedermayer
- Hermann Lewetz
- Dave Rice
- Carl-Eugen Hoyos
- Jérôme Martinez
- Luca Barbato
- Georg Lippitsch
- Christophe Kummer
- Christoph Gerstbauer
- and others of course. . .

Lessons learned

User perception is of great importance:

- Graphical UI tools / Fear of commandline
- Noone wants to be “The First”
- Layout/sexyiness of a website is important:
Cheap looking website = impression of low quality product
- Documentation:
“Use the force, read the source” equals “No documentation”
- Ease of access (Make a huge “Download!” button :))
- Option of support and setup as paid service.
- Public funding: Commercially focused innovation preferred.

Success of FFV1 contributed to:

- Improved image of Free Software (Open Source) for professional use-cases.
- Increased awareness of benefits of Free Software.
- Increased sensibility for vendor lock-in.
- Less FUD when choosing Free and Open solutions.
- And many more. . .

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The FSFE is enabling others to do the same, by:

- . . . decreasing FUD regarding Free Software.
- . . . encouraging others to develop and use Free Software.
- . . . talking to decision makers.
- . . . providing legal advice.
- . . . promoting importance of Free Software & Open Formats.
- . . . etc.

- Fin -

The “Free Software Foundation Europe”

is an independent, non-profit organisation which is actively supporting Free Software mainly in Europe, but also worldwide.

In order to secure fair and equal access for anyone to the information-society, it is important that everyone has the freedom to use, study, share and improve software.

FSFE's goal is, to improve the understanding and support for Free Software by being getting active in public, politics and laws.

www.fsfeurope.org

Thanks a lot for your attention!

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