

# Status of FFV1 & Matroska

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Update on Matroska and FFV1

2017-03-07 @MediaConch #preforma

# PREFORMA Challenge

Empower memory institutions to gain full control over the technical properties of digital content intended for long-term preservation.

**FFV1**

# FFV1 - A lossless video encoding

- 2003: Created in Open Source project "FFmpeg"
- 2006: Bitstream frozen (version 1)
- 2009: Picked up for preservation
- 2010: Funding improvements
- 2012: Added 14bit RGB, Multithreading, SliceCRC
- 2013: Official release of "FFV1.3"
- 2014: PREFORMA Project
- 2015: Standardization in progress
- 2016: Added 16bit RGB

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## Video

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### Significant characteristics of video files [\[edit\]](#)

### Preservation Format [\[edit\]](#)

- [FFV1/PCM in Matroska wrapper \(MKV\) \(Archivematica 0.7.1 and later\)](#)
- [MPEG-2/PCM in Material eXchange Format wrapper \(MXF\) \(Archivematica 0.7 and earlier\)](#)

### Access Format [\[edit\]](#)

MPEG-1/MP2

### Normalization tool [\[edit\]](#)

FFmpeg

### Comments [\[edit\]](#)

### FFV1/MKV [\[edit\]](#)

- [FFV1](#) is a completely lossless video codec. For a comparison of lossless codecs, see [Video Codecs Comparison '2007](#) [↗](#).
- [Matroska](#) (pronounced maTROSHka) is an open standard free video container format which can hold a large number of video and audio codecs. See <http://www.matroska.org/> [↗](#).

### Other containers and codecs [\[edit\]](#)

- According to [Library of Congress](#), "For file-based compressed video, conform to or approximate [MPEG-2\\_422 \(4:2:2 Profile\)](#) at [Main Level](#) (aka [MPEG-2 422@ML](#)) or [MPEG-2\\_MP](#) (Main Profile) at [Main Level](#) (aka [MPEG-2 MP@ML](#)). Uncompressed or losslessly compressed copies are preferred to compressed (for future development)." [Library of Congress Sustainability of Digital Formats: MPEG-2 Video Encoding \(H.262\)](#) [↗](#)
- For preservation of audio streams, [WAV PCM](#) or [WAV BWF](#) are preferred formats and [AIFF](#) is acceptable. See [Guidelines for the Creation of Digital Collections: Digitization Best Practices for Audio, Consortium of Academic and Research Libraries in Illinois, 2009](#) [▫](#), p. 2.
- [More information](#)
  - [More information on the Material Exchange Format \(MXF\) is available at Library of Congress Sustainability of Digital Formats: MXF](#) [↗](#)
  - [Digital Video Preservation Reformatting Project](#), Prepared by Media Matters, LLC for the Dance Heritage Coalition, Presented to The Andrew W. Mellon Foundation, June 2004 [▫](#)
  - [Arts and Humanities Data Service Preservation Handbook: Moving Image](#), Gareth Night, 2005 [▫](#)
  - [WP2 - Preservation Strategies](#), Richard Wright, PrestoPRIME WP2 BBC Research & Development, UK, 2009 [▫](#)
  - [A Primer on Codecs for Moving Image and Sound Archives: 10 Recommendations for Codec Selection and Management](#). Chris Lacinak, AudioVisual Preservation Solutions, 2010 [▫](#)

### Motion JPEG 2000 [\[edit\]](#)

- [Motion JPEG 2000 \(MJPEG2K\)](#) is emerging as a preferred format for video files. See for example:
  - [UKOLN Multimedia standards: MJ2](#) [↗](#)
  - [Lossless Video Compression for Archives: Motion JPEG2k and Other Options](#), Ian Gilmour, National Film and Sound Archive, Australia, R. Justin Dávila, System Architect and Technology Consultant, Media Matters LLC, date unknown [▫](#)

# FFV1 perks

- Losslessness
- Fixity
- Self-description
- Size

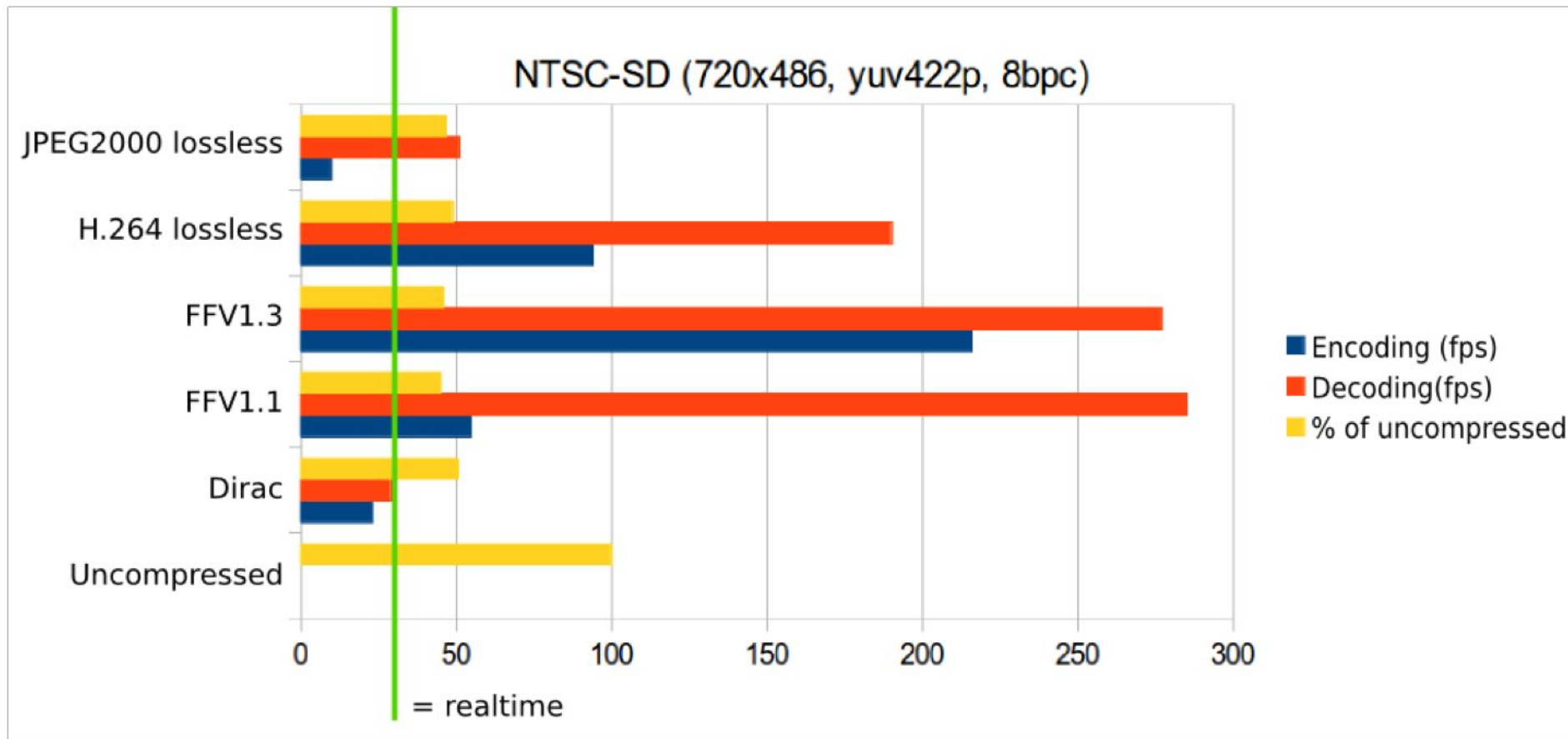
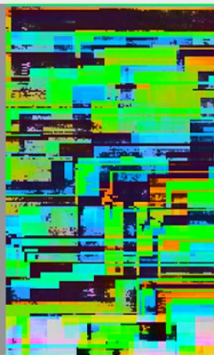
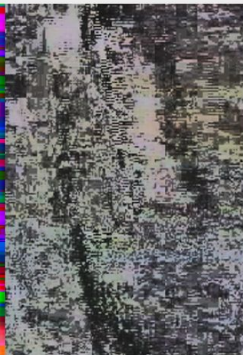
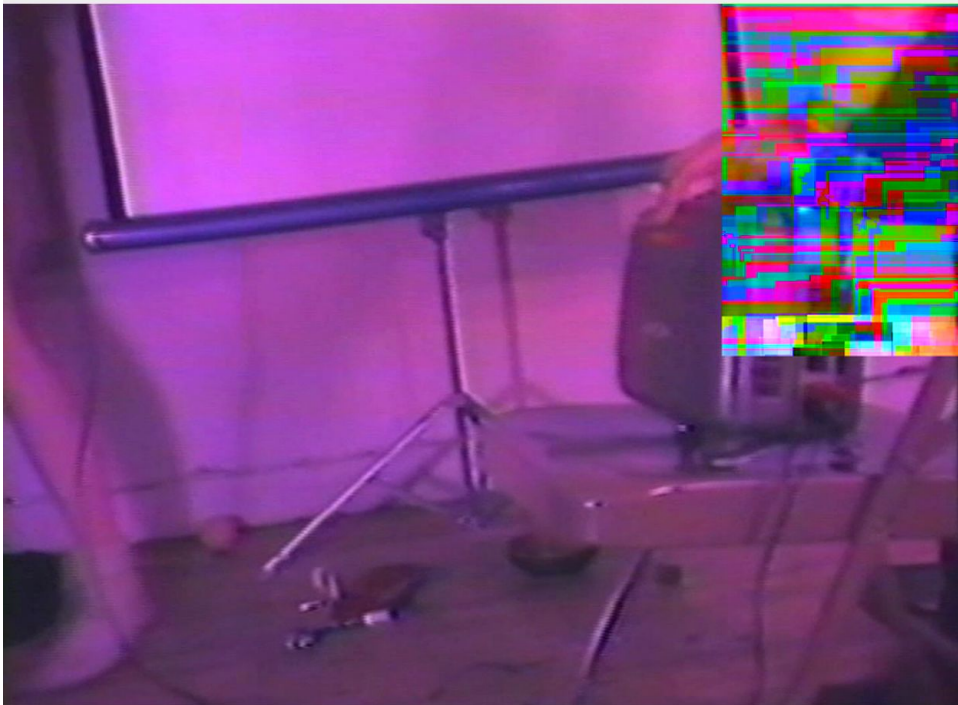


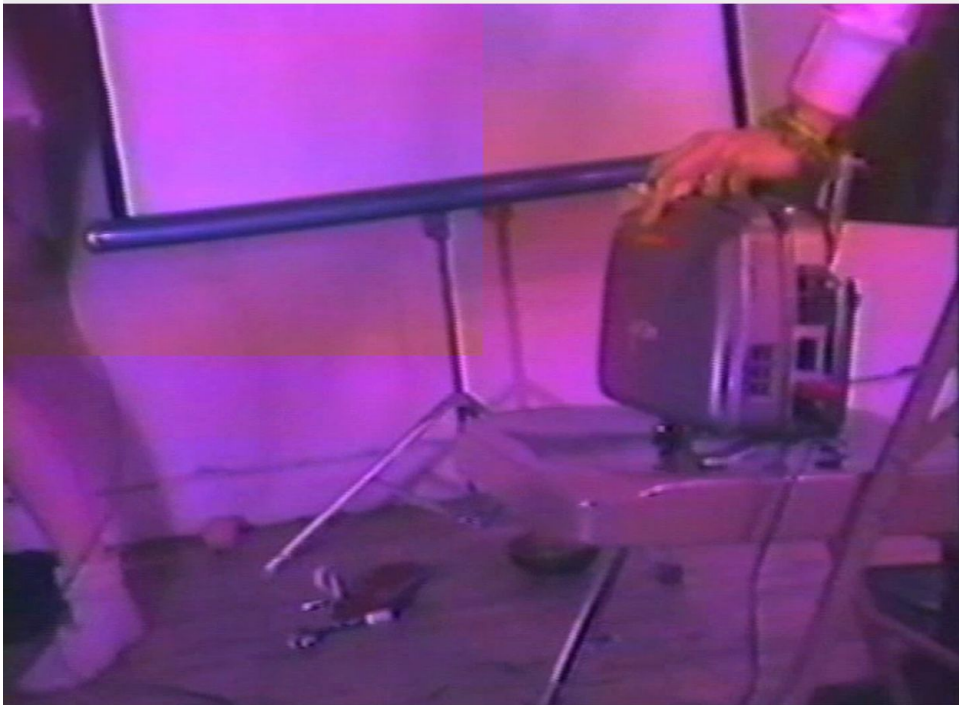
Figure 1: Speed / size comparison chart

“[ffv1 @ 0x7f9855046e00] CRC mismatch FC686A4F! frame 215”











**MATROŠKA**

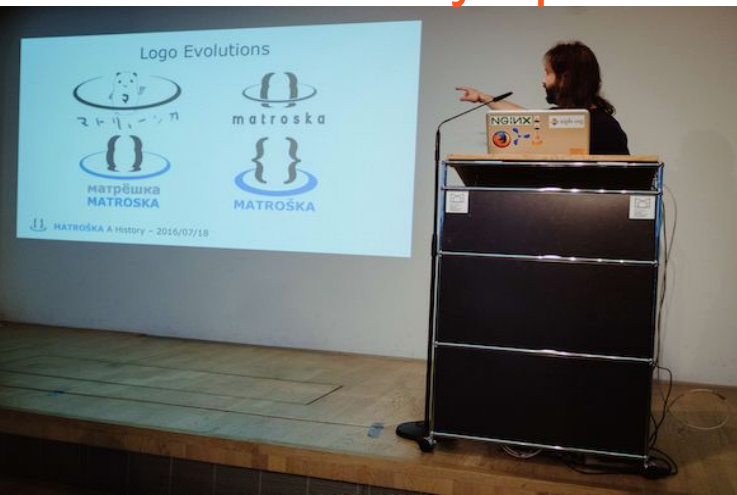
# Matroska - a metadata-infused wrapper

- Active use since 2002
- Widespread adoption as internet video format
- Foundation of Google's webm (web-streaming video)
- Subtitle management, chaptering abilities
- Extensible structured metadata
- File attachment capabilities (mostly used for subtitles)
- Broad support of audiovisual encodings

# EBML & Matroska

- Extensible Binary Meta Language (EBML is a Binary XML format)
- An EBML Schema defines an EBML Document like an XML Schema defines an XML Document
- Matroska and webm are EBML Document Type
- Storage is based on a structure of Element ID, Element Data Size, and Element Data
- Unlike XML, an EBML Document requires an EBML Schema to be interpreted semantically

# No Time To Wait - An Matroska & FFV1 Symposium



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# Codec Encoding for LossLess Archiving and Realtime transmission (cellar)

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**WG**      **Name** Codec Encoding for LossLess Archiving and Realtime transmission

**Acronym** cellar

**Area** Applications and Real-Time Area (art)

**State** Active

**Charter** [charter-ietf-cellar-01](#) Approved

**Dependencies** [Document dependency graph \(SVG\)](#)

**Personnel**

**Chairs**  [Tessa Fallon](#)  
 [Tim Terriberry](#)

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## Charter for Working Group

The preservation of audiovisual materials faces challenges from technological obsolescence, analog media deterioration, and the use of proprietary formats that lack formal open standards. While obsolescence and material degradation are widely addressed, the standardization of open, transparent, self-descriptive, lossless formats remains an important mission to be undertaken by the open source community.

FFV1 is a lossless video codec and Matroska is an extensible media container based on EBML (Extensible Binary Meta Language), a binary XML format. There are open source implementations of both formats, and an increasing interest in and support for use of FFV1 and Matroska. However, there are concerns about the sustainability and credibility of existing specifications for the long-term use of these formats. These existing specifications require broader review and formalization in order to encourage widespread adoption.

There is also a need for a lossless audio format to complement the lossless video codec and container format. FLAC is a lossless audio codec that has seen widespread adoption in a number of different applications including archival applications. While there are open source implementations of the codec, no formal standards for either the codec itself or its use in container formats currently exist. Review and formalization of the FLAC codec standard and its use in Matroska container formats is needed for wider adoption.

Using existing work done by the development communities of Matroska, FFV1, and FLAC, the Working Group will formalize specifications for these open and lossless formats. In order to provide authoritative, standardized specifications for users and developers, the Working Group will seek consensus throughout the process of refining and formalizing these standards. Initial specifications can be accessed here:

# Specification Development via GitHub

- <https://github.com/Matroska-Org/ebml-specification>
- <https://github.com/Matroska-Org/matroska-specification>
- <https://github.com/FFmpeg/FFV1/>
- <https://github.com/xiph/flac>
  
- <https://www.ietf.org/mailman/listinfo/cellar>



# What does a specification look like?

## Prior to CELLAR

- EBML and Matroska documentation was in Drupal site
- FFV1 documentation was in LyX

## Within CELLAR

- EBML, Matroska, and FFV1 is managed in Markdown, converted to HTML and RFC formats

## # Introduction

`EBML`, short for Extensible Binary Meta Language, specifies (byte) aligned format inspired by the principle of XML (a fraction of data).

The goal of this document is to define a generic, binary, space-efficient format that can be used to define more complex formats (such as content) using an `EBML Schema`. The definition of the `EBML` idea behind HTML and XML as a good one: separate structure and content into the same structural layer to be used with multiple, possibly different semantic layers. Except for the `EBML Header` and a few global specifications, the `EBML` format specification is intended to define how other `EBML`-based formats are defined.

`EBML` uses a simple approach of building `Elements` upon their length, and value) as this approach is well known, easy to parse, and selective data parsing. The `EBML` structure additionally allows for an arrangement to support complex structural formats in an efficient manner.

## # Notation and Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are interpreted as described in [RFC2119].

This document defines specific terms in order to define the format of `EBML`. Specific terms are defined below:

**Child Element**: A `Child Element` is a relative term to describe `Elements` immediately contained within a `Master Element`.

**EBML**: Extensible Binary Meta Language

**Element Data**: The value(s) of the `EBML Element` which is identified by the `Element ID` and `Element Data Size`. The form of the `Element Data` in this document and the corresponding `EBML Schema` of the `Element` are defined in the `Element Type`.

**Element Data Size**: An expression, encoded as a `Variable String`, that defines the length in octets of `Element Data`.

**EBML Body**: All data of an `EBML Document` following the `EBML Header` is considered the `EBML Body`.

[[Docs](#)] [[txt](#)] [[pdf](#)] [[xml](#)] [[html](#)] [[Tracker](#)] [[WG](#)] [[Email](#)] [[Diff1](#)] [[Diff2](#)] [[Nits](#)]

Versions: ([draft-lhomme-cellar-ebml](#)) 00

cellar

S. Lhomme

Internet-Draft

Intended status: Standards Track

D. Rice

Expires: March 27, 2017

M. Bunkus

September 23, 2016

## Extensible Binary Meta Language draft-ietf-cellar-ebml-00

### Abstract

This document defines the Extensible Binary Meta Language (EBML) format as a generalized file format for any type of data in a hierarchical form. EBML is designed as a binary equivalent to XML and utilizes a storage-efficient approach to building nested Elements with identifiers, lengths, and values. Similar to how an XML Schema defines the structure and semantics of an XML Document, this document defines an EBML Schema to convey the semantics of an EBML Document.

### Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on March 27, 2017.

# Recent CELLAR work

- EBML focus
- Adopting of underlying standards and references to existing standards
- Defining color and display metadata (colorspace, HDR, full/broadcast range)
- Definition of EBML Schema to express the structure of EBML Document Types
- Clarified interlacement support
- Support for unknown display aspect ratios
- FFV1 slice structure clarification (more explicit definition of each slice element)
- Security considerations section
- Test file libraries in GitHub (examples of logical errors and extent of what is permitted)

# CELLAR work in progress

- Matroska reference timecode support
- Updating how encoding support is defined
- Review of Matroska's metadata registry
- 360 degree / VR video metadata
- Language authority updates
- Rationale numbers as timestamps
- FFV1 version 1.4, context of color and range
- Attachment updates
- Extend subtitle support for other data forms of temporal data (captions, etc)
- Recommendations of practices for use of Matroska and FFV1 in preservation

# Thanks

2017-03-07 @MediaConch #preforma