

Formats de fichiers pour l'audiovisuel

Reto Kromer • AV Preservation by reto.ch

Atelier Memoriav
Archivage numérique en mutation
Cinémathèque Lichtspiel à Berne
2 novembre 2021

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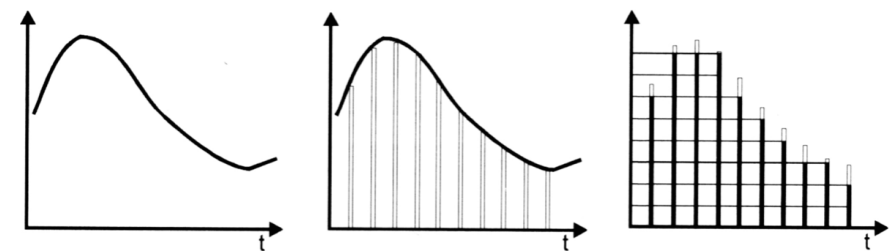
Table des matières

- son et image numériques
- structure des fichiers
- formats de fichiers
- avantages et inconvénients

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Son et image numériques

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numérisation = échantillonnage + quantification

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Audio numérique

- échantillonnage
- quantification

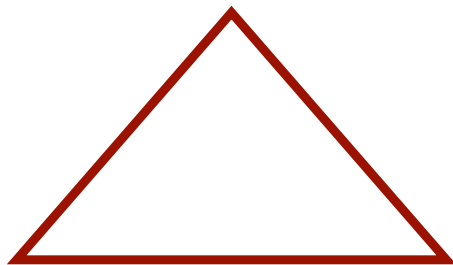
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Vidéo numérique

- définition
- profondeur de couleurs
- linéaire, exponentielle, logarithmique
- espace colorimétrique
- sous-échantillonnage et compression
- illuminant

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qualité de l'image



temps d'encodage taille du fichier

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Compression

- non compressé
- compressé sans perte
- compressé avec perte
- sous-échantillonnage
- compressé à la création

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Non compressé

- + données plus faciles à traiter
- + logiciels plus rapides à exécuter
- fichiers plus lourds
- fichiers plus lents à écrire, lire et transmettre

Exemples: TIFF, DPX, DNG, OpenEXR

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Compressé sans perte

- + fichiers plus légers
- + plus rapides à lire, écrire, transmettre
- données plus complexes à traiter
- logiciels plus longs à exécuter

Exemples: JPEG 2000, FFV1

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Compressé avec perte

- optimisé pour l'acquisition et/ou pour la postproduction
- optimisé pour la diffusion

Exemples (mezzanine): ProRes 422, ProRes 4444; DNxHD, DNxHR

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

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Sous-échantillonnage

- 4:4:4
- 4:2:2
- 4:2:0 / 4:1:1

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Compressé à la création

- optimisé tant pour l'acquisition que pour la postproduction

Exemples: CineForm RAW, ProRes RAW, Blackmagic RAW

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Des vérités qui dérangent

- les capteurs sont daltoniens
- les capteurs Bayer ne produisent pas une image RGB complète

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United States Patent [19] 3,971,065
Bayer [45] July 20, 1976

[54] COLOR IMAGING ARRAY [57] ABSTRACT
[75] Inventor: Bryce E. Bayer, Rochester, N.Y. A sensing array for color imaging includes individual luminance- and chrominance-sensitive elements that are so intermixed that each type of element (i.e., according to sensitivity characteristics) occurs in a repeated pattern with luminance elements dominating the array. Preferably, luminance elements occur at every other element position to provide a relatively high frequency sampling pattern which is uniform in two perpendicular directions (e.g., horizontal and vertical). The chrominance patterns are interlaid therewith and fill the remaining element positions to provide relatively lower frequencies of sampling.

[73] Assignee: Eastman Kodak Company, Rochester, N.Y.

[22] Filed: Mar. 5, 1975

[21] Appl. No.: 558,477

[52] U.S. CL. 358/41; 350/162 SP; 350/317; 358/44

[51] Int. Cl. H04N 9/24

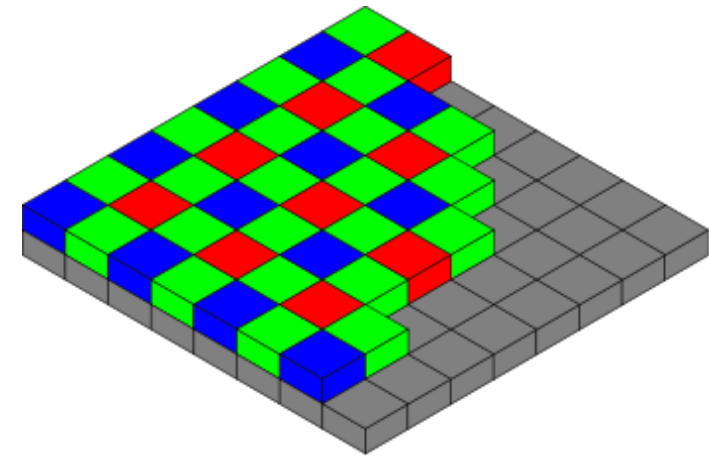
[58] Field of Search 358/44, 45, 46, 47, 358/48; 350/317, 162 SP, 315/169 TV

[56] References Cited
UNITED STATES PATENTS
2,446,791 8/1948 Schroeder 358/44
2,508,267 5/1950 Kasperowicz 358/44
2,584,483 4/1952 Ehrenhaft et al. 358/44
3,725,372 4/1973 Kurokawa et al. 358/46

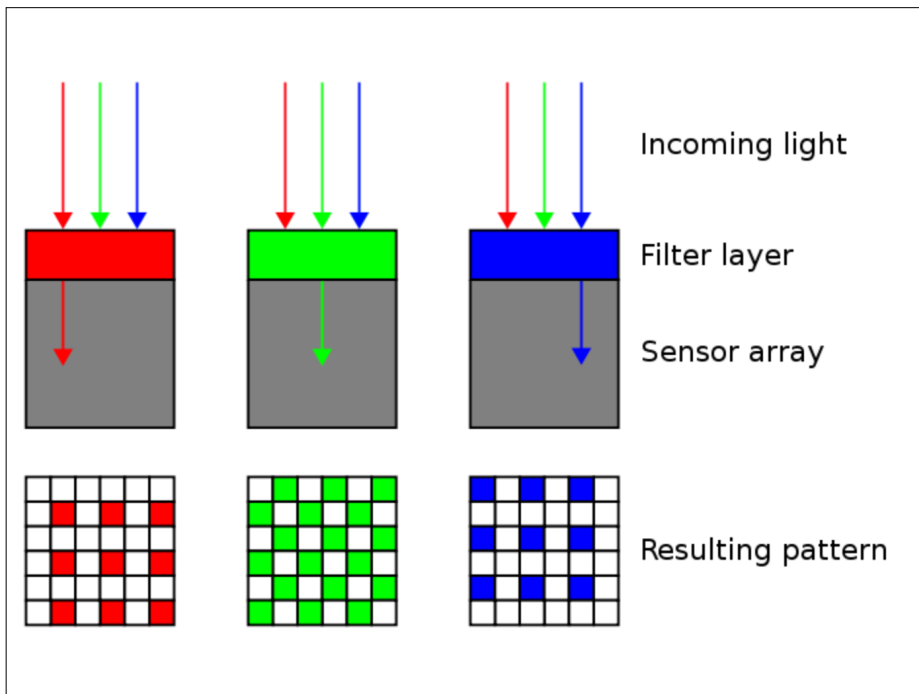
Primary Examiner—George H. Libman
Attorney, Agent, or Firm—George E. Grosser

11 Claims, 10 Drawing Figures

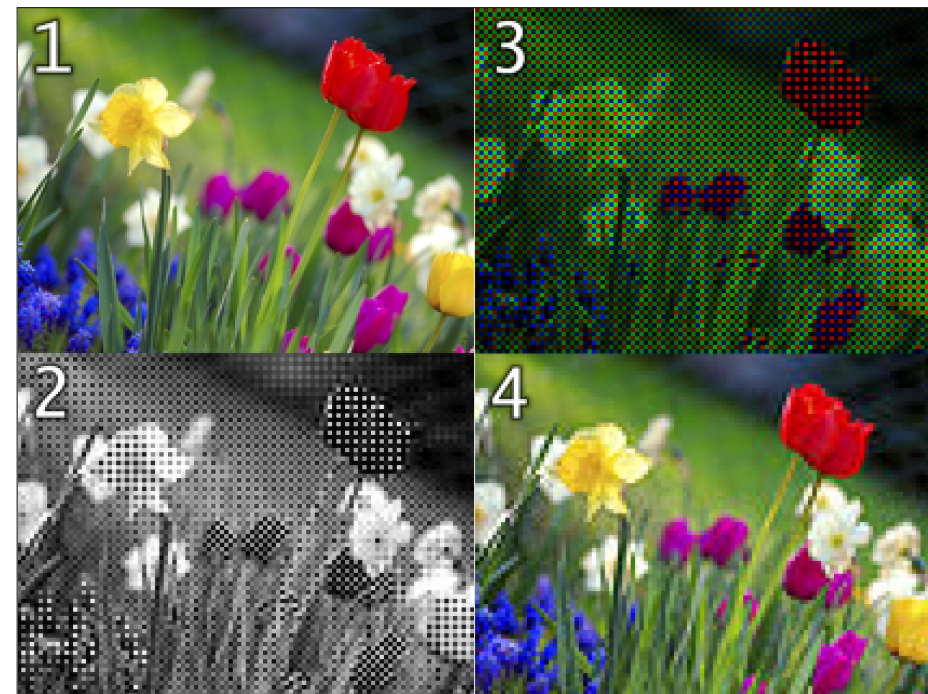
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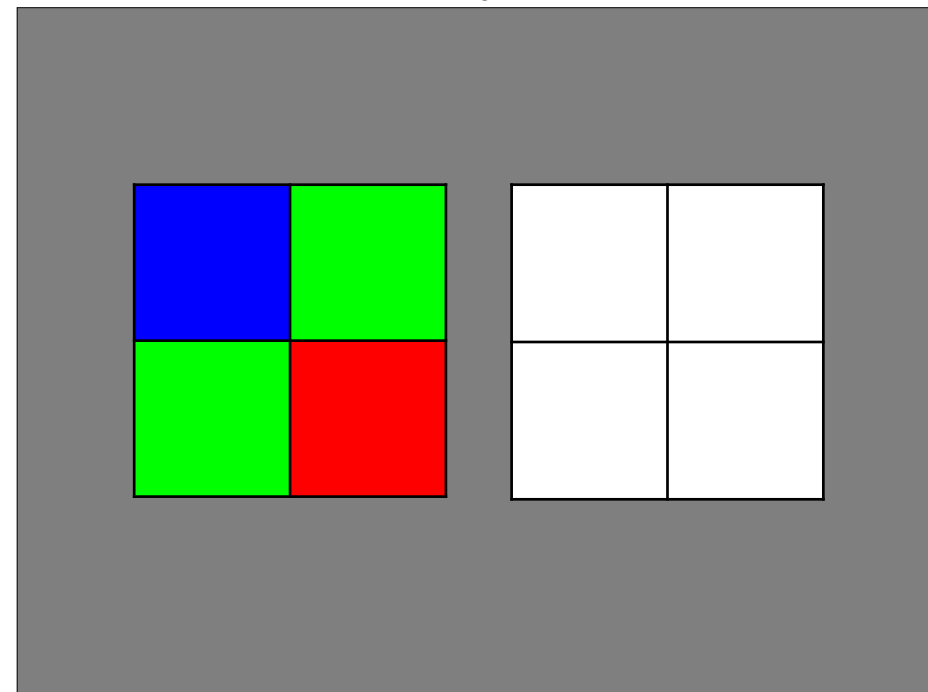
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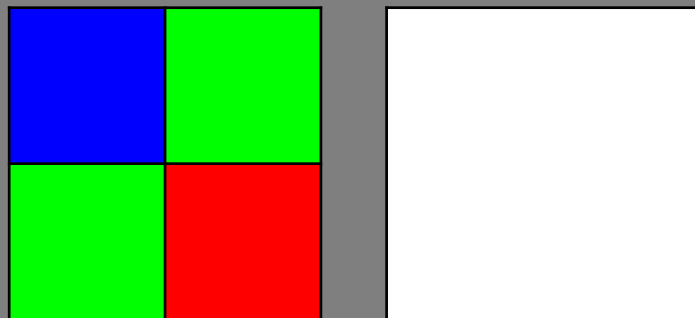
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21

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0 G ₂ 0	R 0 0	R G ₂ B	R G B

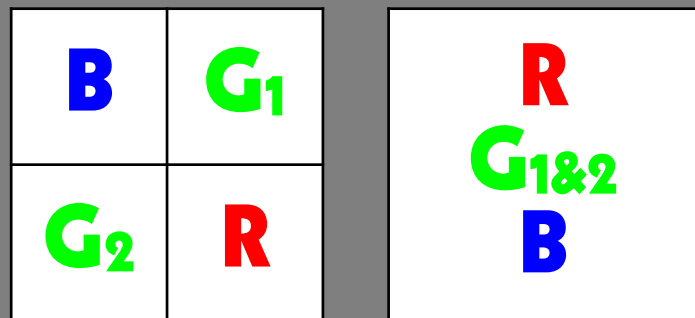
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110101 010101	010100 001011	101001010101 011111010010 110101010101
101010 011010	101001 010101	

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Deux façons d'utiliser les données Bayer

gonflage numérique au RGB

- 3 fois la quantité de données générées
- le fichier a la pleine résolution du capteur
- seulement $\frac{1}{3}$ des données sont réelles

réduction numérique au RGB

- $\frac{3}{4}$ de la quantité de données générées
- le fichier a $\frac{1}{2}$ de la résolution du capteur
- toutes les données sont réelles

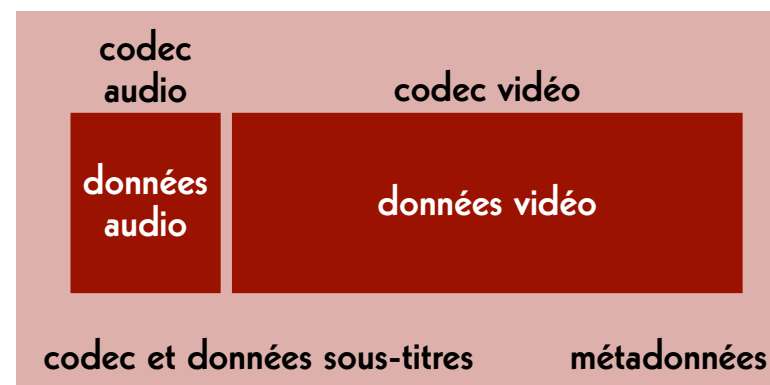
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Structure des fichiers

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Structure des fichiers

conteneur multimédia



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Conteneur pour flux

- MP4
- QuickTime (.mov)
- AVI
- Flash
- MXF
- Matroska (.mkv)

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Conteneur pour images

- dossier
- TAR
- ZIP
- MXF
- Matroska (.mkv)
- CinemaDNG
- Motion JPEG

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Codec audio

- WAVE
- BWF
- AAC
- MP3
- FLAC

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Codec vidéo (master)

images

- TIFF
- DPX
- JPEG 2000
- OpenEXR
- DNG

vidéo

- 8 bit raw
- 10 bit raw
- HuffYUV
- FFV1

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Codec vidéo (mezzanine)

- ProRes 422, ProRes 4444, ProRes RAW
- DNxHD, DNxHR
- CineForm RAW
- Blackmagic RAW

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Codec vidéo (diffusion)

- H.264 (AVC)
- H.265 (HEVC)
- H.266 (VVC)

- AV1

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Données audio

- pcm_s16le
- pcm_s24le
- pcm_s32le

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Données vidéo

- rgb48le
- rgb24
- rgb72le
- bayer_bggr16le
- bayer_bggr24le
- yuv444p16le
- yuv422p10le
- uyvy422
- yuv420p
- yuv444p24le

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Formats de fichiers

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Différents formats pour différentes utilisations

master d'archivage

→ pour la préservation et l'archivage

formats mezzanine

→ pour le montage et la postproduction

formats de diffusion

→ pour la distribution et l'accès

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Principes

- **Une archive doit être capable de traiter les formats de fichiers qu'elle possède.**
- open source
- simple à utiliser et bien documenté
- largement utilisé par la communauté

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Master d'archivage (actuel)

film

- dossier, TIFF, 2K ou 4K, RGB, 16 bit
- MXF, DPX, 2K ou 4K, R'G'B', 10 bit

vidéo

- AVI, «raw», HD, Y'CbCr 4:2:2, 10 bit
- Matroska, FFV1, HD, Y'CbCr 4:2:2, 10 bit

audio

- WAVE ou BWF, 96 kHz, 24 bit
- FLAC, 96 kHz, 24 bit

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Formats mezzanine (actuel)

vidéo

- ProRes 4444, 2K
- DNxHR, 2K
- ProRes 422 HQ, HD
- DNxHD 175x, HD

audio

- BWF, 48 kHz, 24 bit
- WAVE, 48 kHz, 24 bit

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Formats de diffusion (actuel)

MP4

vidéo

- H.264, SD, Y'CbCr 4:2:0, 8 bit, lossy
- H.264, «HD», Y'CbCr 4:2:0, 8 bit, lossy

audio

- AAC, 44.1 kHz, 16 bit
- AAC, 48 kHz, 16 bit

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Master d'archive et mezzanine

film

- Matroska, FFV1, 4K ou 2K, RGB, 16 bit

vidéo

- Matroska, FFV1, «HD», Y'CbCr 4:2:2, 10 bit

audio

- Matroska, FLAC, 192 kHz, 24 bit

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Formats de diffusion

MP4

vidéo

- H.265, «HD», Y'CbCr 4:2:0, 8 bit, lossy
- H.266, «HD», Y'CbCr 4:2:0, 8 bit, lossy
- AV1, «HD», Y'CbCr 4:2:0, 8 bit, lossy

audio

- AAC, 96 kHz, 16 bit

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Avantages et inconvénients

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conteneur:

- dossier
- TAR
- ZIP
- MXF
- Matroska
- AXF

codec:

- TIFF
- DPX
- JPEG 2000
- FFV1
- OpenEXR
- CineForm RAW
- ProRes RAW
- Blackmagic RAW

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	avantages	inconvénients
TIFF DPX OpenEXR	traitement plus simple	fichiers plus lourds
JPEG 2000 FFV1	fichiers plus légers	traitement plus complexe

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Conteneur MXF (.mxf)

codec vidéo

- DPX
- JPEG 2000
- DNxHD, DNxHR
- ProRes 422, ProRes 4444

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**SMPTE REGISTERED
DISCLOSURE DOCUMENT**



**MXF Archive and Preservation
Format Registered Disclosure
Document**

Page 1 of 113

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.

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All other inquiries in respect of this document, including inquiries as to intellectual property requirements that may be attached to use of the disclosed technology, should be addressed to the proponent identified below.

Proponent Contact Information:

Kate Murray
Library of Congress
101 Independence Ave, S.E.
Washington, DC 20540-1300

Email: kmur@loc.gov

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MXF / DPX

MXF

→ SMPTE RDD 48:2018

DPX

→ SMPTE ST 268M:2015

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MXF / JPEG 2000

MXF

→ SMPTE RDD 48:2018

JPEG 2000

→ ISO/IEC 15444-1:2019

→ etc.

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MXF / DN_x

MXF

→ SMPTE RDD 48:2018

DN_xHD, DN_xHR

→ non publié

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MXF / ProRes

MXF

→ SMPTE RDD 48:2018

ProRes 422, ProRes 4444

→ SMPTE RDD 36:2015

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Conteneur Matroska (.mkv)

codec vidéo

- FFV1
- ProRes 422, ProRes 4444

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SMPTE RDD 36:2015

SMPTE REGISTERED DISCLOSURE DOCUMENT

Apple ProRes Bitstream Syntax and Decoding Process



Page 1 of 39 pages

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Proponent contact information:

ProRes Program Office
Apple Inc.
1 Infinite Loop, MS: 77-2YAK
Cupertino, CA 95014
USA

Email: ProRes@apple.com

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Matroska/FFV1

Matroska (.mkv)

→ IETF Internet Draft

FFV1

→ IETF RFC 9043

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Stream: Internet Engineering Task Force (IETF)
RFC: 9043
Category: Informational
Published: August 2021
ISSN: 2070-1721
Authors: M. Niederemayer D. Rice J. Martinez

RFC 9043 FFV1 Video Coding Format Versions 0, 1, and 3

Abstract

This document defines FFV1, a lossless, intra-frame video encoding format. FFV1 is designed to efficiently compress video data in a variety of pixel formats. Compared to uncompressed video, FFV1 offers storage compression, frame fixity, and self-description, which makes FFV1 useful as a preservation or intermediate video format.

Status of This Memo

This document is not an Internet Standards Track specification; it is published for informational purposes.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Not all documents approved by the IESG are candidates for any level of Internet Standard; see Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at <https://www.rfc-editor.org/info/rfc9043>.

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Format de fichier OpenEXR (.exr)

OpenEXR

- licence BSD à 3 clauses
- non standardisé

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Matroska / ProRes

Matroska (.mkv)

→ IETF Internet Draft

ProRes 422, ProRes 4444

→ SMPTE RDD 36:2015

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AV Preservation by reto.ch

zone industrielle Le Trési 3
1028 Préverenges
Switzerland

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



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