

On Audio-Visual File Formats

Reto Kromer • AV Preservation by reto.ch

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«Restoration Asia II»
Cinematheque, National Museum of Singapore
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Summary

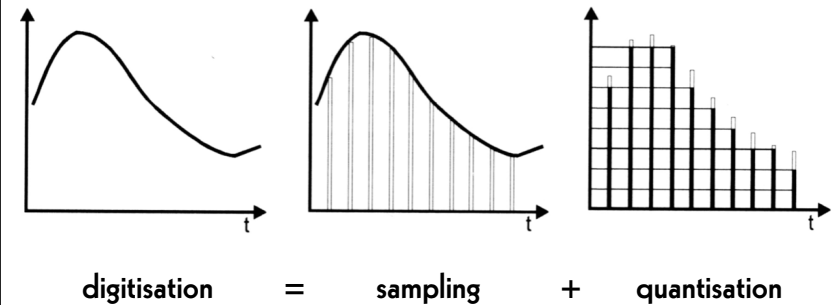
- digital audio and digital video
- container, codec, raw data
- different formats for different purposes
- audio-visual data transformations

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Digital Audio

- sampling
- quantisation

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Sampling

- 44.1 kHz
- 48 kHz
- 96 kHz
- 192 kHz

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Quantisation

- 16 bit
- 24 bit

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Digital Video

- resolution
- bit depth
- linear vs. logarithmic
- colour model
- chroma subsampling
- illuminant

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Resolution

- SD 480i / SD 576i
- HD 720p / HD 1080i
- 2K / HD 1080p
- 4K / UHD-1
- 8K / UHD-2

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Bit Depth

- 8 bit
- 10 bit
- 12 bit
- 16 bit

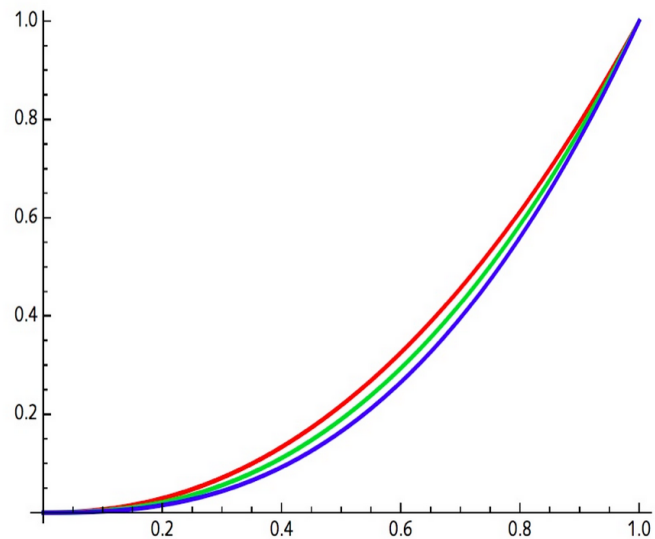
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Linear vs. Logarithmic

«medium grey»

- linear: 18%
- «logarithmic»: 50%

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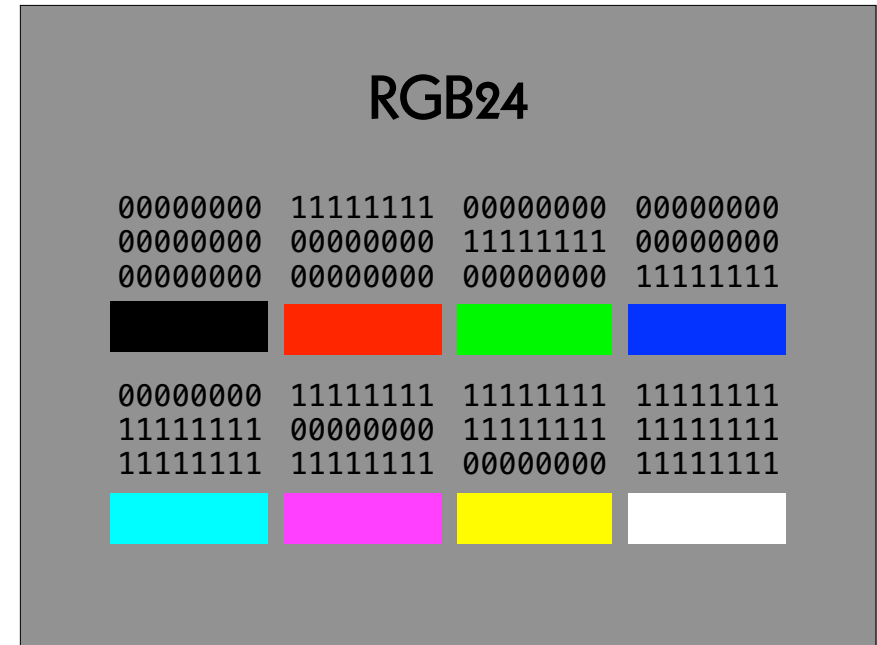
Colour Model

- XYZ
- RGB / R'G'B' / CMY / C'M'Y'
- Y'IQ / Y'UV / Y'D_BD_R
- Y'C_BC_R / Y'C_OC_G
- Y'P_BP_R

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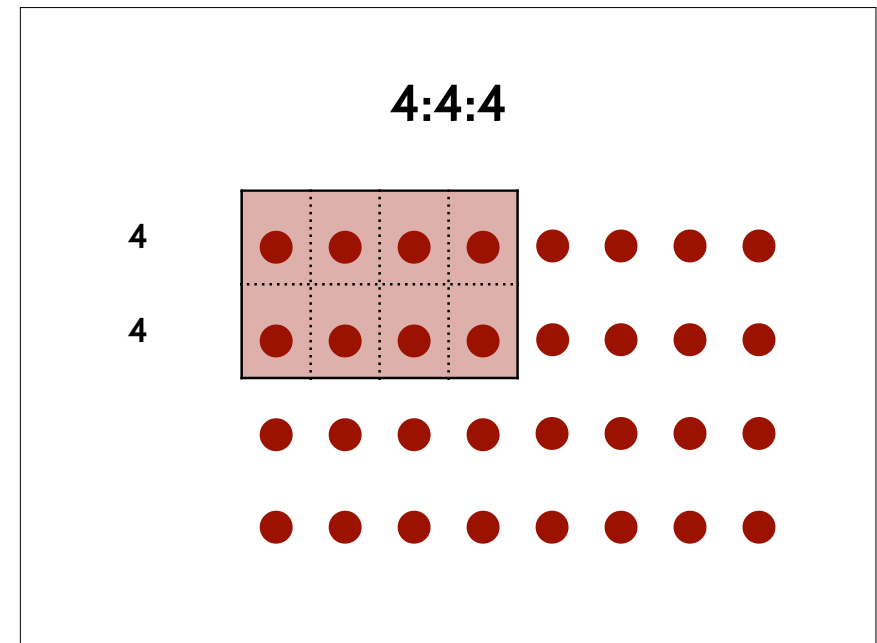


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Chroma Subsampling

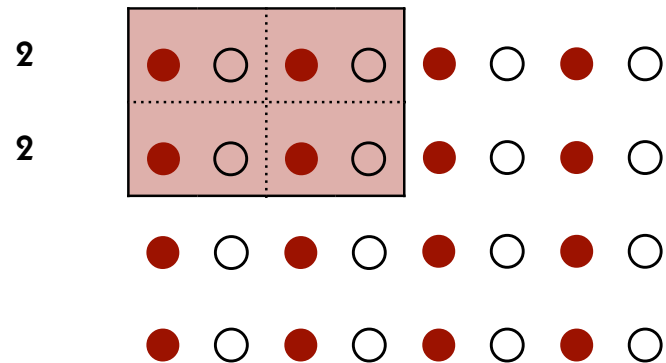
- 4:4:4
- 4:2:2
- 4:2:0 / 4:1:1

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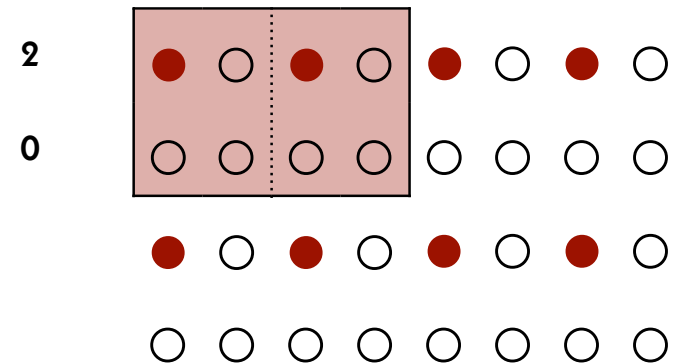
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4:2:2



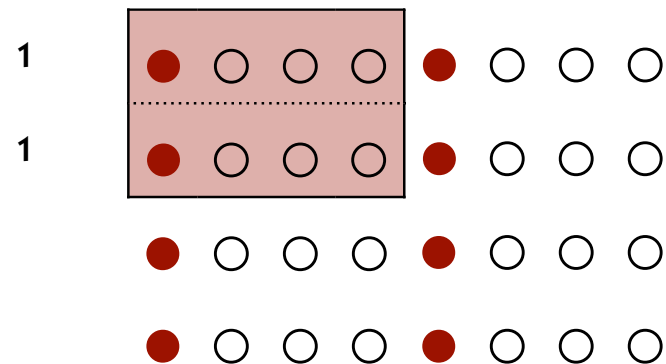
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4:2:0



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4:1:1

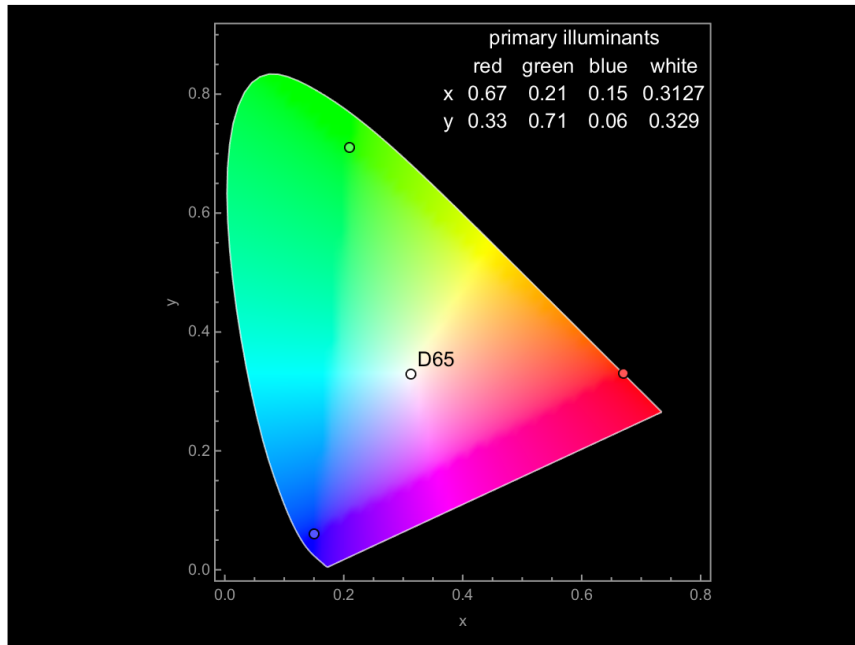


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Illuminant

- D50
- D55
- D65
- D75

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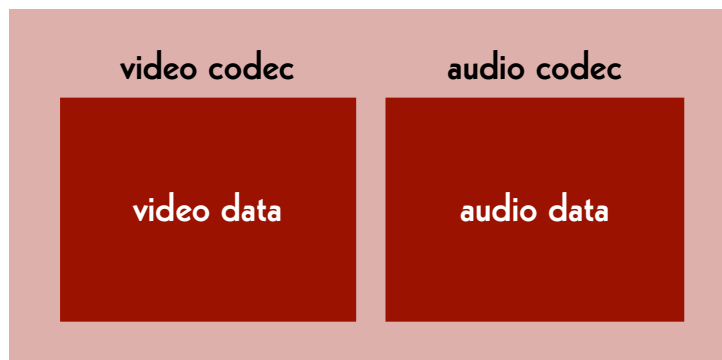
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```

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File Structure

audio-visual container



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Audio-Visual Container

- MP4
- MOV
- AVI
- MXF
- Matroska
- Flash

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Video Codec

- H.264
- ProRes 422
- DNxHD
- FFV1

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Audio Codec

- WAVE
- BWF
- AIFF
- FLAC
- AAC
- MP3

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**Data is anything
but «raw».**

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Audio Data

- mono (1.0)
- stereo (2.0)
- 5.1 (surround)

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Video Data

- rgb48le
- yuv444p16le
- rgb24
- yuv422p10le
- uyvy422
- yuv420p

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«Image Codec»

- TIFF
- DPX
- JPEG 2000
- OpenEXR

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«Image Container»

- folder
- tar
- MXF
- Motion JPEG

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Principles

- **The archive must be able to work with the file formats that it holds.**
- open source
- simple to use and well documented
- widely used by the community

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Different Purposes

archive master format:

→ for preservation

mezzanine format:

→ for professional use in postproduction

dissemination formats:

→ for widely spreading and easy access

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Elena Rossi-Snook:

**Archiving without access
isn't preservation,
it's hoarding.**

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Archive Master

image

- 2K, folder, TIFF, RGB, 4:4:4, 16 bit
- 2K, folder, DPX, R'G'B', 4:4:4, 10 bit

video

- HD, MP4, Y'C_BC_R, 4:2:2, 10 bit

audio

- BWF, 96 kHz, 24 bit

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Mezzanine

video

- HD, Apple ProRes 422 HQ
- HD, Avid DNxHD 175x

audio

- BWF, 48 kHz, 24 bit

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Dissemination

audio and video combined

- MP4

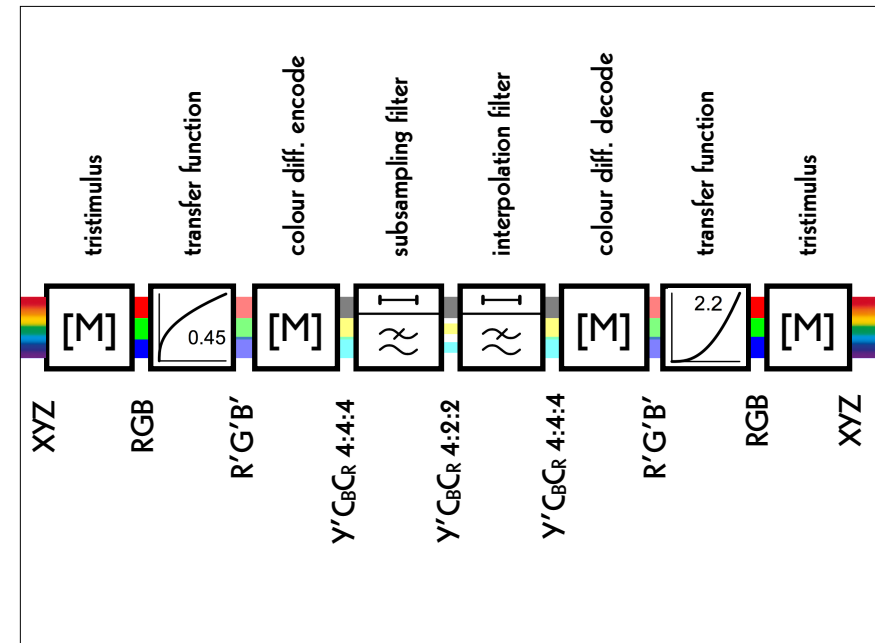
video

- SD, H.264, yuv420p
- HD, H.264, yuv420p, «lossy»

audio

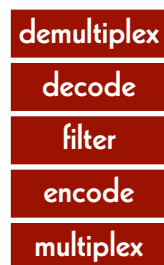
- AAC, 44.1 kHz, 16 bit

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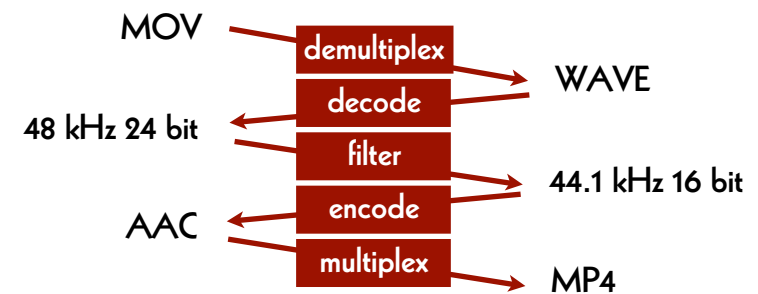
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Data Transformations



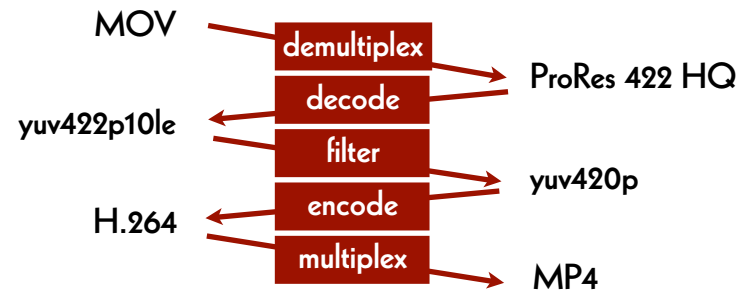
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Audio Exemple



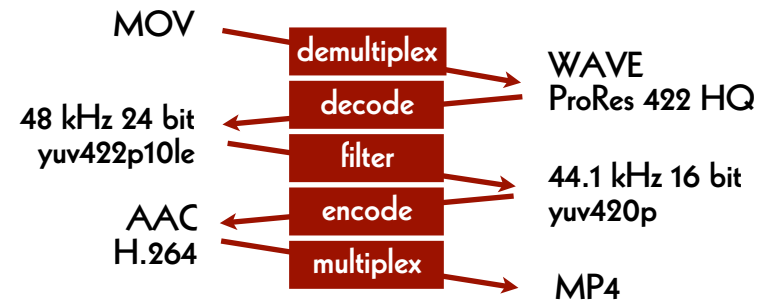
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Video Exemple



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Audio-Visual Exemple



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- David Pfluger & Agathe Jarczyk

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