MediaConch

Implementation and policy checking
on FFV1, Matroska, LPCM (and more)

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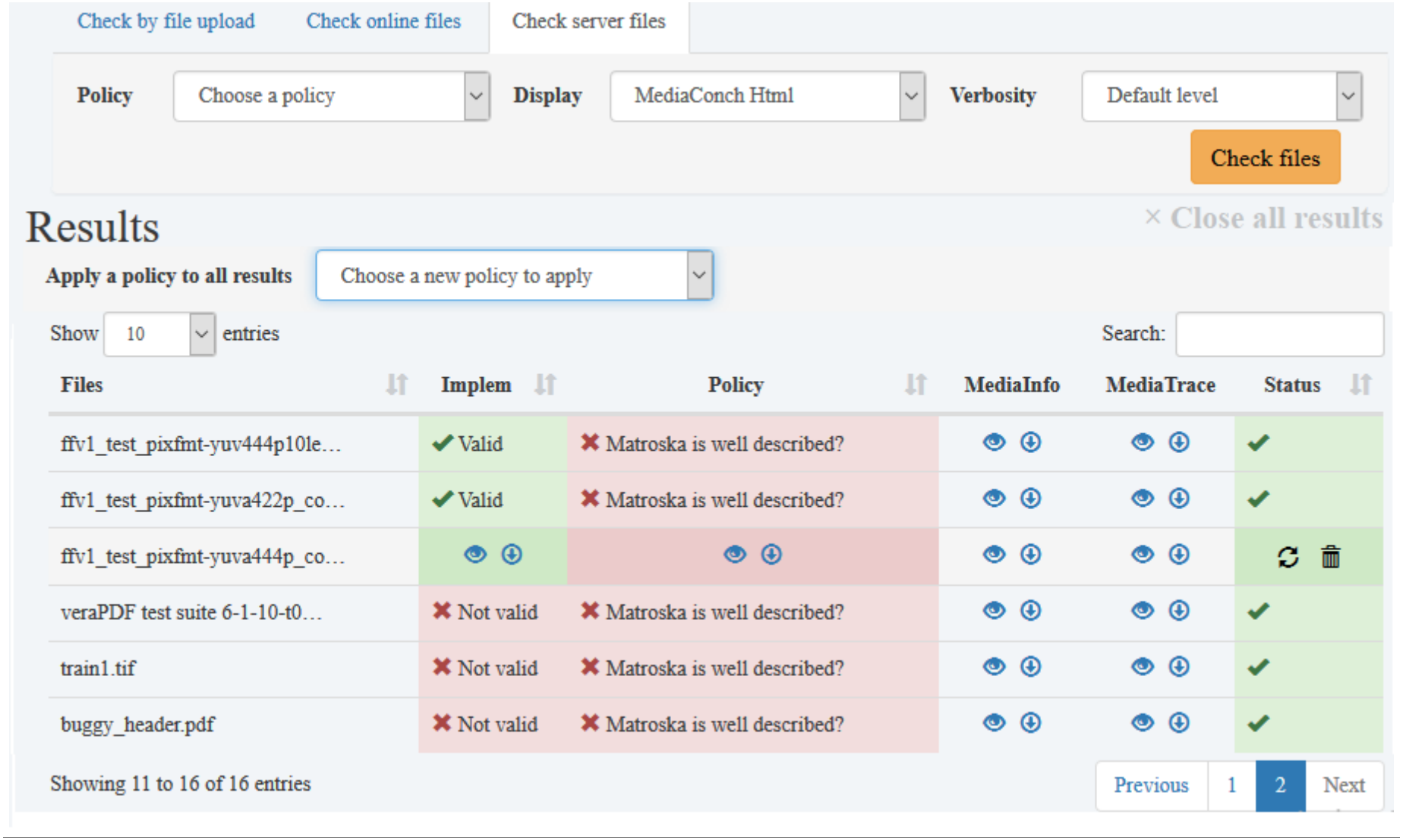
What is MediaConch?

MediaConch is a conformance checker

- Implementation checker
- Policy checker
- Reporter
- Fixer

What is MediaConch?

Implementation and Policy reporter



What is MediaConch?

Implementation report:

MediaConch Report

File: C:/temp/FFV1+PCM_WithChecksum_Untouched.mkv

MediaConch EBML Implementation Checker

Toggle all verbosity:

- **EBML-ELEM-START** Tests run: 1 | Results: ✓
- **EBML-VER-COH** Tests run: 1 | Results: ✓
- **EBML-DOCVER-COH** Tests run: 1 | Results: ✓
- **EBML-ELEMENT-VALID-PARENT** Tests run: 87 | Results: ✓
- **EBML-ELEMENT-NONMULTIPLES** Tests run: 70 | Results: ✓
- **EBML-ELEMENT-CONTAINS-MANDATES** Tests run: 43 | Results: ✓
- **EBML-ELEMENT-IN-SIZE-RANGE** Tests run: 43 | Results: ✓
- **EBML-VALID-MAXID** Tests run: 1 | Results: ✓
- **EBML-VALID-MAXSIZE** Tests run: 1 | Results: ✓
- **HEADER-ELEMENTS-WITHIN-IDLENGTH-LIMIT** Tests run: 1 | Results: ✓
- **ELEMENTS-WITHIN-MAXIDLENGTH** Tests run: 1 | Results: ✓
- **HEADER-ELEMENTS-WITHIN-MAXSIZELENGTH** Tests run: 1 | Results: ✓
- **ELEMENTS-WITHIN-MAXSIZELENGTH** Tests run: 1 | Results: ✓
- **MKV-SEEK-RESOLVE** Tests run: 4 | Results: ✓
- **EBML-CRC-FIRST** Tests run: 6 | Results: ✓
- **EBML-CRC-VALID** Tests run: 6 | Results: ✓
- **MKV-VALID-TRACKTYPE-VALUE** Tests run: 2 | Results: ✓
- **MKV-VALID-BOOLEANS** Tests run: 3 | Results: ✓

MediaConch FFV1 Implementation Checker

- **FFV1-SLICE-CRC-VALID** Tests run: 4 | Results: ✓

MediaConch PCM Implementation Checker

Policy report:

MediaConch Report

File: C:/temp/FFV1+PCM_WithChecksum_Untouched.mkv

- Example MKV FFV1 digitization policy ✗ fail

  Example of a digitization specification of analog SD video to FFV1 and Matroska.

  Type: and | **Rules run:** 17 | **Fail count:** 5 | **Pass count:** 12

  - **Is it Matroska?** ✓ pass
  - **Matroska version 4 or greater?** ✓ pass
  - **Unique ID is present?** ✓ pass
  - **Is the video FFV1?** ✓ pass
  - **FFV1 is version 3.4 or later?** ✓ pass
  - **FFV1 is encoded in GOP size of 1?** ✗ fail
  - **FFV1 uses slice crcs?** ✓ pass
  - **Display Aspect Ratio is 4/3?** ✗ fail (Actual: 1.222)
  - **Frame Rate is Constant?** ✓ pass
  - **ColorSpace is YUV?** ✗ fail (Actual: RGB)
  - **Chroma Subsampling is 4:2:2?** ✗ fail
  - **Audio is PCM?** ✓ pass
  - **Audio is 48000 Hz?** ✓ pass
  - Is this NTSC or PAL SD? ✗ fail
  - Bit Depth is 8 or 10? ✓ pass
  - Audio is Stereo or Mono? ✓ pass
  - Bit Depth is 16 or 24? ✓ pass

What is MediaConch?

General information about your files

Key	Value
C:/Programmation/PreFormaMediaInfo/SampleTestFiles/FFV1/ffv1_3.mkv	
General	
UniqueID	88323790047680325859674626238128084708
Format	Matroska
Format_Version	4
FileSize	126167
Duration	1.000
OverallBitRate	1009336
FrameRate	25.000
FrameCount	25
StreamSize	2511
Video	
StreamOrder	0
ID	1
UniqueID	1
Format	FFV1
Format_Version	3.4
CodecID	V_MS/VFW/FOURCC / FFV1
Duration	1.000
BitRate	989250
Width	320

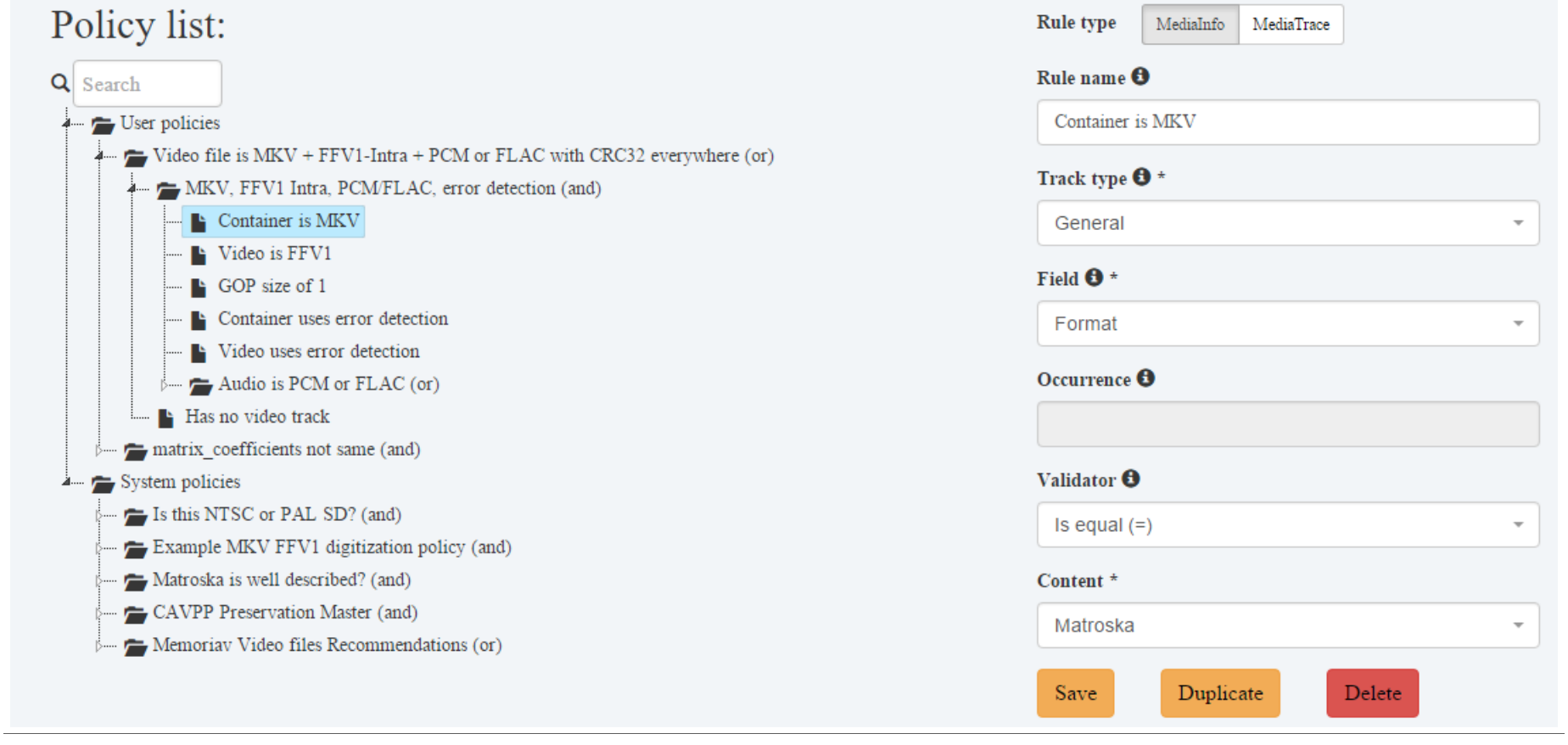
What is MediaConch?

Inspect your files

Offset	Key	Value
0x00000000	EBML (30 bytes)	
0x0000001e	Segment (35726 bytes)	
0x0000001e	Header (12 bytes)	
0x0000002a	SeekHead (115 bytes)	
0x0000009d	Void (88 bytes)	
0x000000f5	Info (139 bytes)	
0x00000180	Tracks (112 bytes)	
0x00000180	Header (5 bytes)	
0x00000185	CRC-32 (6 bytes)	
0x0000018b	TrackEntry (101 bytes)	
0x0000018b	Header (2 bytes)	
0x0000018d	CRC-32 (6 bytes)	
0x00000193	TrackNumber - 1 (3 bytes)	
0x00000196	TrackType - 1 (3 bytes)	
0x00000199	CodecID - V_FFV1 (8 bytes)	
0x000001a1	TrackUID - 1 (4 bytes)	
0x000001a5	FlagLacing - 0 (3 bytes)	
0x000001a8	Language - und (7 bytes)	
0x000001af	DefaultDuration - 40000000 (8 bytes)	
0x000001b7	Video (12 bytes)	
0x000001c3	CodecPrivate (45 bytes)	
0x000001c3	Header (3 bytes)	
0x000001c6	version	3 (0x3)
0x000001c6	micro_version	4 (0x4)
0x000001c6	coder_type	0 (0x0)

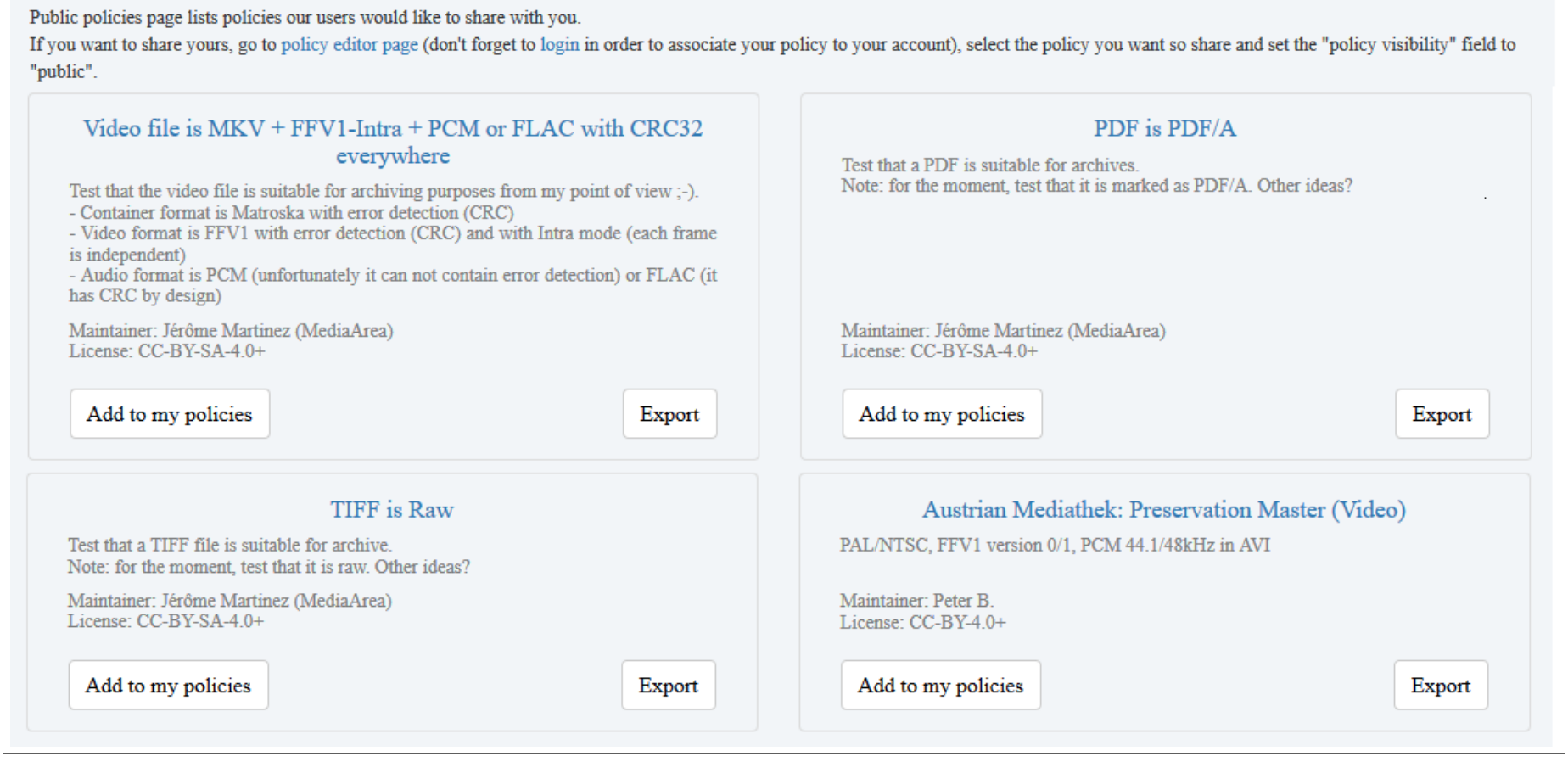
What is MediaConch?

Policy editor



What is MediaConch?

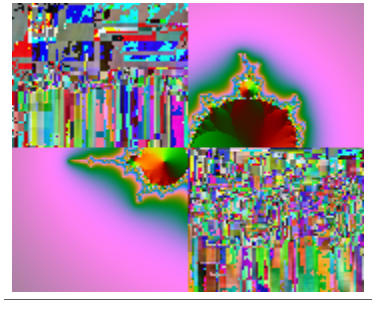
Public policies



What is MediaConch?

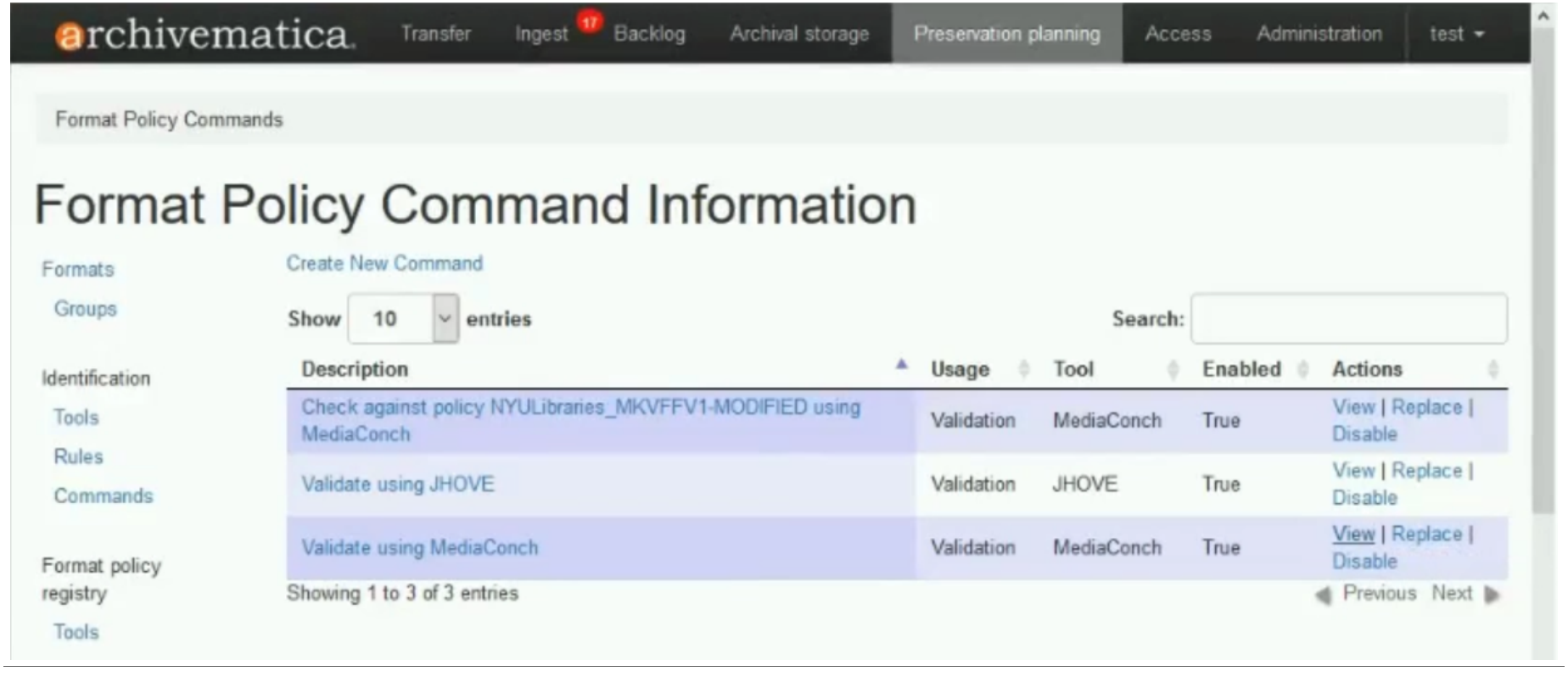
Fixer

- Segment sizes in Matroska
- Matroska “bit flip” correction
- FFV1 “bit flip” correction



Integration

Archivematica is an integrated suite of open-source software tools that allows users to process digital objects from ingest to access in compliance with the ISO-OAIS functional model



MediaConch interfaces

- Graphical interface
- Web interface
- Command line
- Server (REST API)
- (Work in progress) a library (.dll/.so/.dylib)

MediaConch output formats

- XML (native format)
- Text
- HTML
- (Work in progress) PDF
- Tweakable! (with XSL)

Open source

- GPLv3+ and MPLv2+
- Relies on MediaInfo (metadata extraction tool)
- Use well-known open source libraries: Qt, sqlite, libevent, libxml2, libxslt, libexslt...

Supported formats

- Priorities for the implementation checker
  - Matroska
  - FFV1
  - PCM
- Can accept any format supported by MediaInfo for the policy checker
  - MXF + JP2k
  - QuickTime/MOV
  - Audio files (WAV, BWF, AIFF...)
  - ...

Supported formats

Can be expanded

- By plugins
  - Support of PDF checker: VeraPDF plugin
  - Support of TIFF checker: DPF Manager plugin
  - You use another checker? Let us know
- By internal development
  - More tests on your preferred format is possible
  - It depends on you!

Versatile

Several input formats are accepted

- FFV1 from MOV or AVI
- Matroska with other video formats
- (Work in progress) Extraction of a PDF or TIFF attachement from a Matroska container and analyze with a plugin (e.g. VeraPDF and DPF Manager)
- ...

Versatile

Input can be from:

- Files (local/network)
- FTP/FTPS/SFTP
- HTTP/HTTPS
- Amazon S3

Versatile

Binaries are provided for:

- Windows
- Mac

  Homebrew users:"brew install mediaconch", that's all!
- Linux (Ubuntu, Debian, Fedora, OpenSUSE...)

  Since Ubuntu 16.04 and Debian Testing/9 users:

  "apt-get install mediaconch" or in Ubuntu Store, that's all!

  (it is in the official distros repository)
- Embedded devices? Doable

  (we tested it on a Raspberry Pi )
- Can be ported on other distros (BSD...)

Standardization

- Matroska is widely used but not (yet) standardized
- FFV1 is gaining increasing usage in preservation contexts but is not (yet) standardized

CELLAR: IETF workgroup

- Open standards group
- Goal to IETF-standardize Matroska/FFV1/FLAC
- A lot of progress, especially with Matroska/EBML specs
- https://datatracker.ietf.org/wg/cellar/charter/

FFV1 performance

- NOA tested on SD 8-bit content:
  - i7-2600 (4 cores+HT, 3.4-3.8 GHz)
  - 3-4x real time
  - 4-5x decoding speed increase compared to JP2k
- VIAA tested on SD 10-bit content (FFmpeg 3.2):
  - E5-2698V3 (16 cores+HT, 2.3-3.6 GHz)
  - 0.7x real time/thread, 11-12x real time/all cores+HT
  - 3-4x decoding speed increase compared to JP2k
  - Better compression ratio by 2% compared to JP2k (9% with additional FLAC audio compression)

FFV1 performance

- This is an average, results varies depending on the content of files
  - From 0.4x to 2.4x (average 0.7x) real time/thread (encoding/decoding)
  - From 0.7x to 16x (average 3.5x) the speed of JP2k (FFmpeg)
- Not convinced?
  - Test on your own files
  - MediaArea will provide test scripts
  - We can perform tests for you

Worldwide

- 2 project leaders
  - Jerôme Martinez (Digital Media Analysis Specialist, France)
  - Dave Rice (Archivist, USA)
- Presentations worldwide
  - IASA, France
  - FIAT/IFTA, Austria
  - FOSDEM, Belgium
  - AMIA, USA
  - Code4Lib, USA
  - JTS, Singapore
  - (3-6 October 2016) IPRES, Switzerland
  - (25-29 September 2016) IASA, USA

Matroska research corpus

- We analyze all Matroska files from archive.org
- Interface with some statistics of Matroska elements usage (e.g. files with CRC-32 elements...)
  https://mediaarea.net/MediaConchCorpus/

What's next?

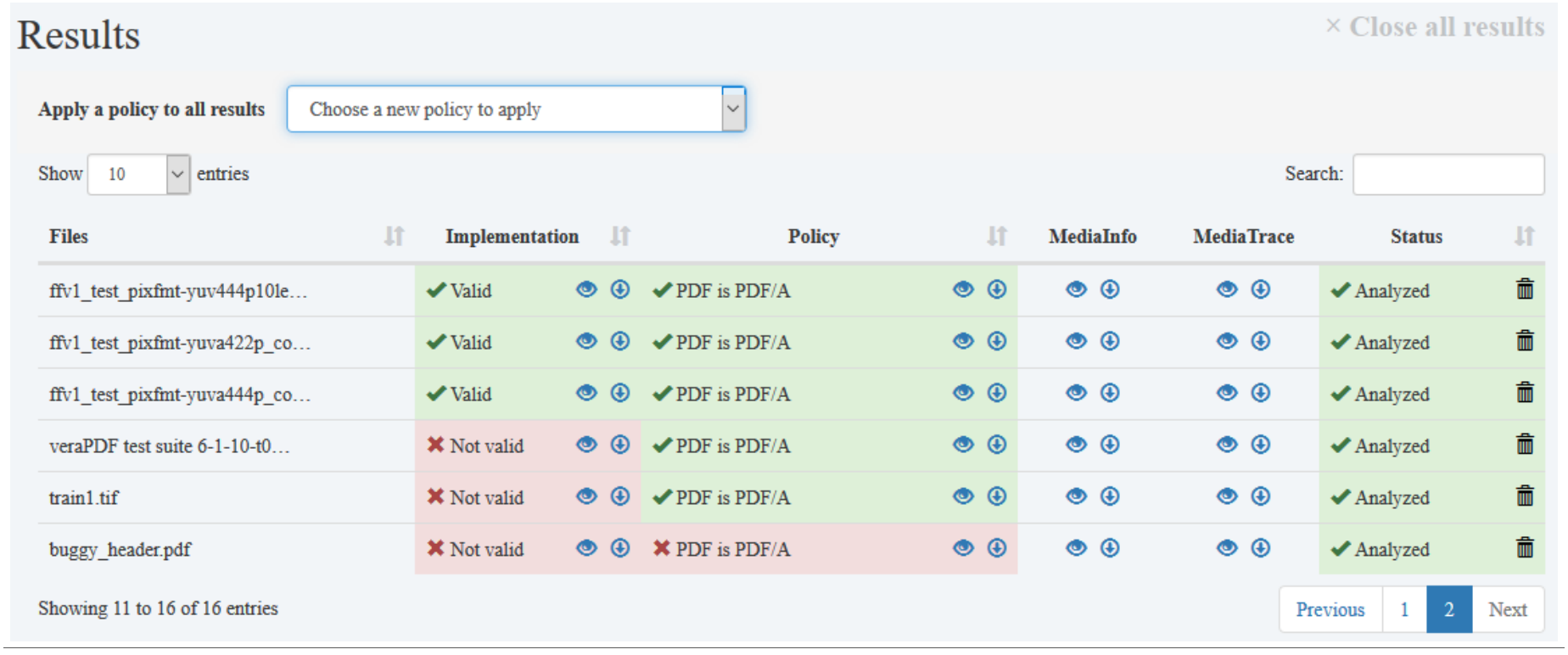
- Continue to improve handling of huge collections
- Continue to improve user interface
- Support of embedded attachments
- Statistics
- Finish standardization of Matroska and FFV1
- More conformance tests
- More fixing cases

And after PREFORMA sponsorship?

It depends on you!

- This is open source
- Driven by user requests
- Everyone can develop or sponsor a development
- Potential features:
  - Support of tests for your prefered format (MOV? MXF? JP2k? WAV?)
  - Support of other checkers (BWF MetaEdit? QCTools?)
  - Integration in your workflow
  - ...

Example (Plugins)



Example (Plugins)

MediaConch Report

File: buggy_header.pdf

PDF/A-1B validation profile

PDF file is not compliant with Validation Profile requirements.

Toggle all verbosity:

- **ISO 19005-1:2005/6.3.7(3)** Tests run: 1 | Results: ✗ Fail count: 1
  - **Name:** isSymbolic == false || nrCmaps == 1
  - **Results:** fail ✗
  - **specification:** ISO 19005-1:2005
  - **clause:** 6.3.7
  - **testNumber:** 3
  - **description:** Font programs' "cmap" tables for all symbolic TrueType fonts shall contain exactly one encoding
  - **object:** TrueTypeFontProgram
  - **Value context:** root/document[0]/pages[0](4 0 obj PDPage)/contentStream[0](5 0 obj PDContentStream)/operators[9]/font[0](NEFXYB+Calibri)/fontFile[0]
- **ISO 19005-1:2005/6.2.3(2)** Tests run: 1 | Results: ✗ Fail count: 1
- **ISO 19005-1:2005/6.1.8(1)** Tests run: 14 | Results: ✗ Fail count: 2
- **ISO 19005-1:2005/6.1.7(2)** Tests run: 5 | Results: ✗ Fail count: 1
- **ISO 19005-1:2005/6.7.11(1)** Tests run: 1 | Results: ✗ Fail count: 1

Example (Plugins)

DPF Manager

MediaConch Report

File: train1.tif

dpfmanager:Baseline 6.0

Toggle all verbosity:

- **{count(tags.tag[name=SubIFDs]) == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=ImageLength] > tags.tag[name=ImageLength]}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=ImageWidth] > tags.tag[name=ImageWidth]}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=NewSubfileType]}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=NewSubfileType].cardinality == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=NewSubfileType] == 0} || {tags.tag[name=SubIFDs].ifd.tags.tag[name=NewSubfileType] == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=NewSubfileType] == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs]}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=ImageDescription]}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=ImageLength].cardinality == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=ImageWidth].cardinality == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=Compression].cardinality == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=XResolution]}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=YResolution]}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=XResolution].cardinality == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=YResolution].cardinality == 1}** Tests run: 1 | Results: ✗ Fail count: 1
- **{tags.tag[name=SubIFDs].ifd.tags.tag[name=Make]}** Tests run: 1 | Results: ✗ Fail count: 1

Stay in touch

MediaArea: https://mediaarea.net, @MediaArea_net

MediaConch: https://mediaarea.net/MediaConch, @MediaConch

Jérôme Martinez: jerome@mediaarea.net

Slides: https://mediaarea.net/Events