

AV Content Integrity

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AV Content Integrity

*What is that? Where's the difference to
file MD5s?*

Different level

- Content = The actual information stored as payload.
- Hashcode is taken from a normalized form of **uncompressed**.
- Matching "*pix_fmt*".

Scope

- Video: Each frame = 1 object
- Audio: Group of samples = 1 object

Use cases

- Format normalization
- Rewrap container
- Transcode
- Add/edit embedded metadata?

Which target formats support this?

The Tool

- ffmpeg

Algorithms

- frameCRC
- frameMD5

Hashing video

```
$ ffmpeg -i VIDEOFILE  
  -an  
  -f framemd5  
  VIDEOFILE.framemd5
```

Hashing audio

```
$ ffmpeg -i VIDEOFILE  
-vn  
-filter_complex "asetnsamples=n=96000"  
-f framemd5  
VIDEOFILE.audio.framemd5
```

Which samplerate to choose here?

Modify the content

Rewrap container

...and add/edit metadata!

```
$ ffmpeg -i VIDEO_IN  
-c copy  
-map 0  
VIDEO_OUT.mkv
```

-map 0: "re-encode just the video streams, but copy all the other streams (like audio, subtitles, attachments, etc)"

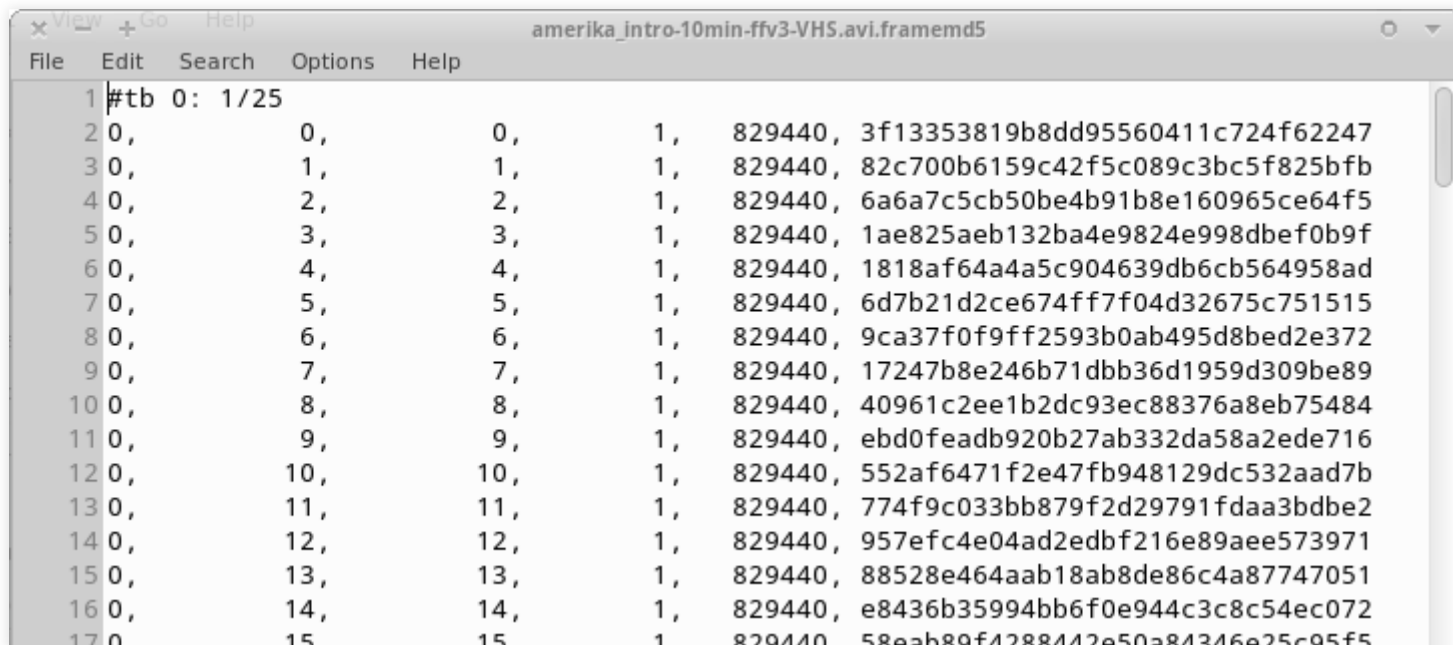
Transcode to FFV1

```
$ ffmpeg -i VIDEO_IN  
-c:a copy  
-c:v ffv1  
-g 1  
-pix_fmt +  
VIDEO_OUT.mkv
```

`-pix_fmt +` : Preserve or die.

Validating framemd5

Framemd5 is actually just a plain textfile...



```
View + Go Help
amerika_intro-10min-ffv3-VHS.avi.framemd5
File Edit Search Options Help
1 #tb 0: 1/25
2 0, 0, 0, 1, 829440, 3f13353819b8dd95560411c724f62247
3 0, 1, 1, 1, 829440, 82c700b6159c42f5c089c3bc5f825bfb
4 0, 2, 2, 1, 829440, 6a6a7c5cb50be4b91b8e160965ce64f5
5 0, 3, 3, 1, 829440, 1ae825aeb132ba4e9824e998dbef0b9f
6 0, 4, 4, 1, 829440, 1818af64a4a5c904639db6cb564958ad
7 0, 5, 5, 1, 829440, 6d7b21d2ce674ff7f04d32675c751515
8 0, 6, 6, 1, 829440, 9ca37f0f9ff2593b0ab495d8bed2e372
9 0, 7, 7, 1, 829440, 17247b8e246b71dbb36d1959d309be89
10 0, 8, 8, 1, 829440, 40961c2ee1b2dc93ec88376a8eb75484
11 0, 9, 9, 1, 829440, ebd0feadb920b27ab332da58a2ede716
12 0, 10, 10, 1, 829440, 552af6471f2e47fb948129dc532aad7b
13 0, 11, 11, 1, 829440, 774f9c033bb879f2d29791fdaa3bdbe2
14 0, 12, 12, 1, 829440, 957efc4e04ad2edbf216e89aee573971
15 0, 13, 13, 1, 829440, 88528e464aab18ab8de86c4a87747051
16 0, 14, 14, 1, 829440, e8436b35994bb6f0e944c3c8c54ec072
17 0, 15, 15, 1, 829440, 58eab89f1288112e50a81316e25c95f5
```

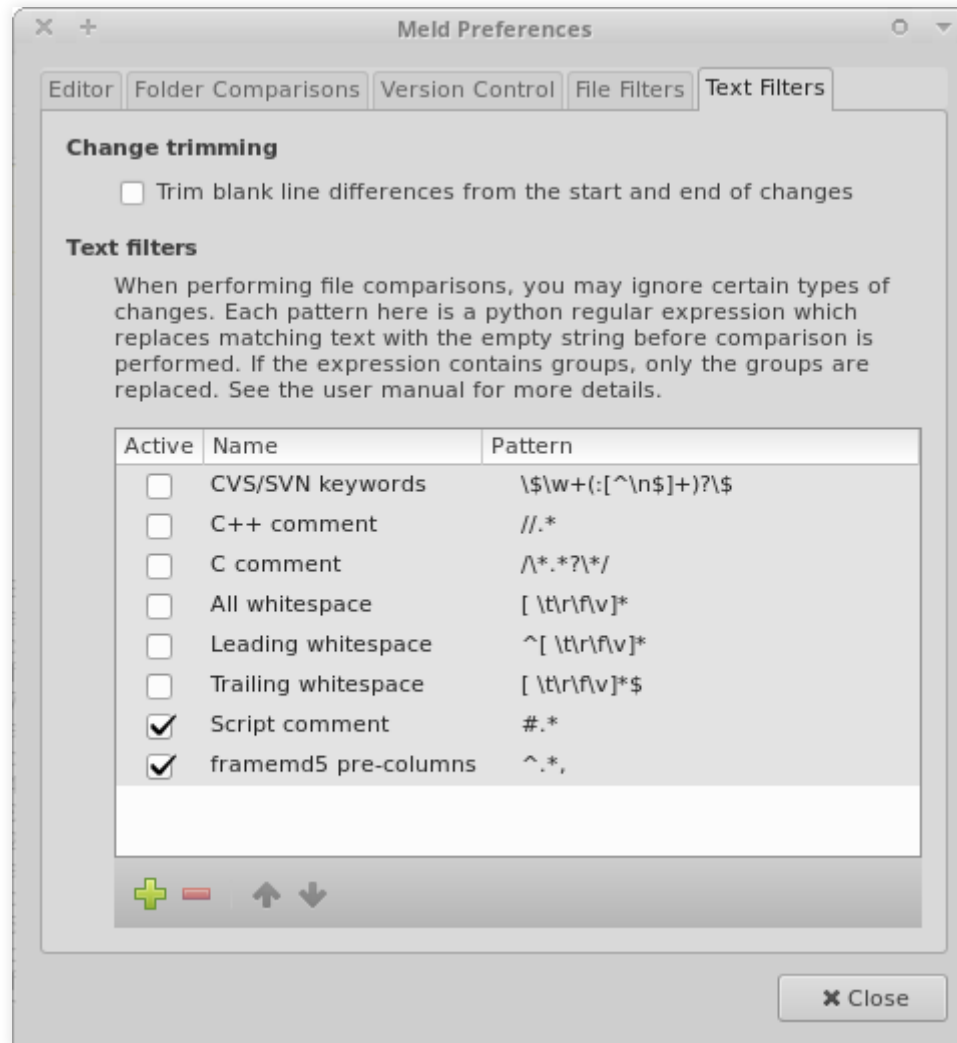
Content payload

Using a diff tool

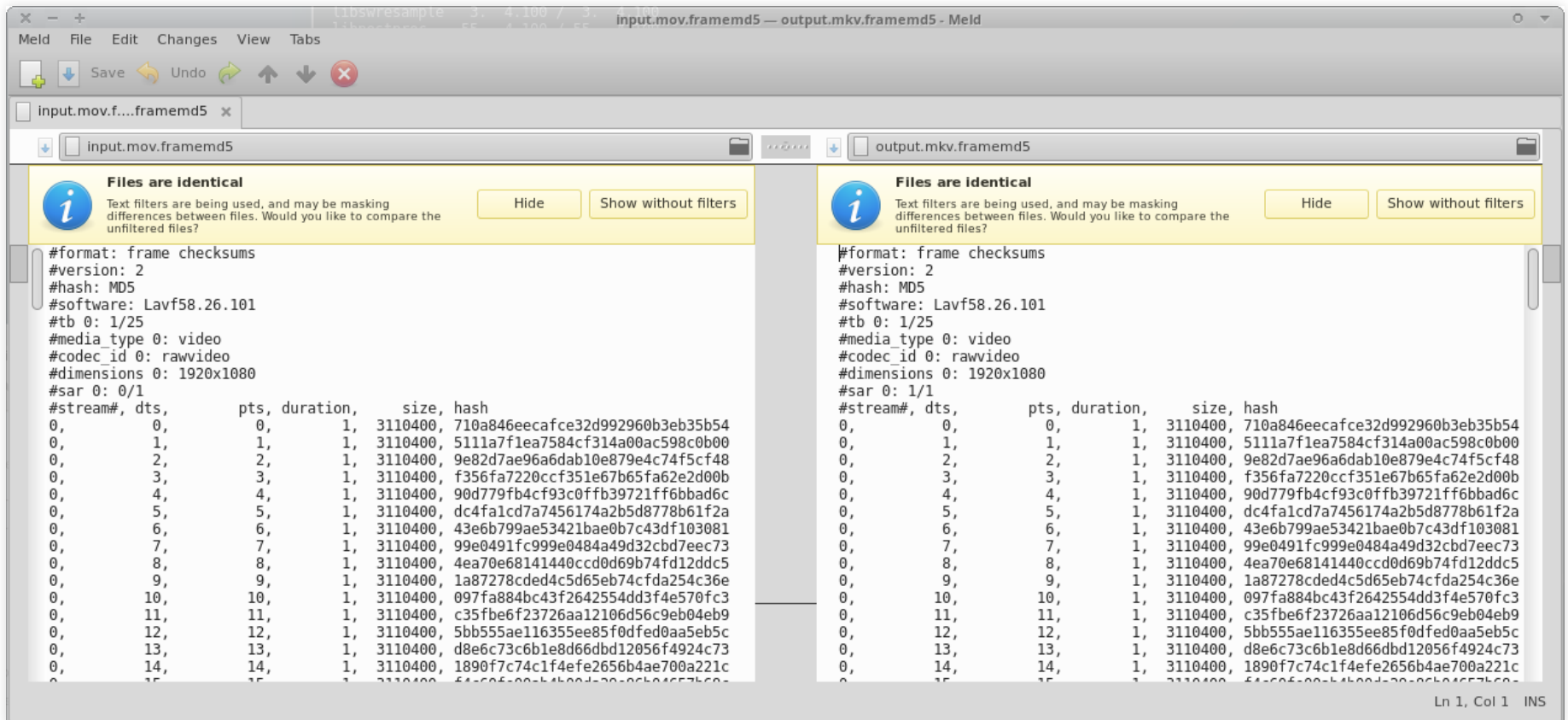
"Meld is a visual diff and merge tool targeted at developers."

Diff is just *one* (nice) option: Website: meldmerge.org

Adjusting diff filters



Comparing framemd5s



The screenshot shows a Meld window comparing two files: `input.mov.framemd5` and `output.mkv.framemd5`. Both panels display the same metadata and frame checksums, indicating the files are identical.

Files are identical
Text filters are being used, and may be masking differences between files. Would you like to compare the unfiltered files?
[Hide](#) [Show without filters](#)

Metadata:

- #format: frame checksums
- #version: 2
- #hash: MD5
- #software: Lavf58.26.101
- #tb 0: 1/25
- #media_type 0: video
- #codec_id 0: rawvideo
- #dimensions 0: 1920x1080
- #sar 0: 0/1

Frame Checksums Table:

#stream#	pts	duration	size	hash
0, 0	0, 1	1, 1	3110400, 710a846eeca	32d992960b3eb35b54
0, 1	1, 1	1, 1	3110400, 5111a7f1ea7	584cf314a00ac598c0b00
0, 2	2, 1	1, 1	3110400, 9e82d7ae96a6d	ab10e879e4c74f5cf48
0, 3	3, 1	1, 1	3110400, f356fa7220ccf	351e67b65fa62e2d00b
0, 4	4, 1	1, 1	3110400, 90d779fb4cf93	c0ffb39721ff6bbad6c
0, 5	5, 1	1, 1	3110400, dc4fa1cd7a745	6174a2b5d8778b61f2a
0, 6	6, 1	1, 1	3110400, 43e6b799ae534	21bae0b7c43df103081
0, 7	7, 1	1, 1	3110400, 99e0491fc999e	0484a49d32cbd7eec73
0, 8	8, 1	1, 1	3110400, 4ea70e6814144	0ccd0d69b74fd12ddc5
0, 9	9, 1	1, 1	3110400, 1a87278cded4c	5d65eb74cfda254c36e
0, 10	10, 1	1, 1	3110400, 097fa884bc43f	2642554dd3f4e570fc3
0, 11	11, 1	1, 1	3110400, c35fbe6f23726	aa12106d56c9eb04eb9
0, 12	12, 1	1, 1	3110400, 5bb555ae11635	5ee85f0dfed0aa5eb5c
0, 13	13, 1	1, 1	3110400, d8e6c73c6b1e8	d66dbd12056f4924c73
0, 14	14, 1	1, 1	3110400, 1890f7c74c1f4	efe2656b4ae700a221c

Ln 1, Col 1 INS

Now they match.

Exercise

Let's go back and actually *do* all that! :D

RAWcooked

"It's like 'zip-for-film™', and super-easy to use!"

Quote Source

Features

- DPX to FFV1
- WAV to FLAC
- Multi reels = multiple tracks
- Other files: embed as-is
- 100% reversible.

Website: mediaarea.net/RAWcooked

Exercise

- Create bag for DPX/WAV sequence
- Convert bag to RAWcooked FFV1/FLAC/MKV
- Uncompress back to DPX.
- Validate bag.

Links

- Video per-frame integrity check - verifying losslessness

Questions?

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