

Automated video optimisation

Egg, 26 February 2024: For some months now, the ArchivistaBox desktop has offered the option of optimising videos so that they require as little storage space as possible in HD quality. The corresponding tools are now also available in the open source Linux distribution AVMultimedia. The new version 2024/II also includes the 'subtitleadjust' utility to efficiently edit or modify subtitle files.

https://archivista.ch/cms/wp-content/uploads/file/avmultimedia_vidopt_eng.mp4

Hurdles in the optimisation of videos

Let's start by asking why the solution presented here was created in the first place. Currently, video files can be obtained from many legal sources as part of private copying. Be it via MediathekView, via Internet television such as Yallo.tv or Teleboy.tv or even from YouTube (here the easiest way is via FreeTube).

Unfortunately, these files are available in very different qualities.

This often results in considerable file sizes, which, for a private film archive for example, can put a lot of strain on the hard drive. A film downloaded from Teleboy in HD quality can easily take up 6 to 9 GB. Although MediathekView allows you to specify the quality when downloading, the attributes 'High', 'Medium' and 'Low' do not mean that the corresponding videos are only available in the same resolution.

The screenshot shows the MediathekView 14.0.0 application window. The main window displays a list of video files with columns for Nr., Sender, Thema, Titel, Datum, Zeit, Dauer, Größe [MB], HQ, UT, Geo, and URL. The list includes various films such as 'Suche Mann für meine Frau', 'Krauses Glück', 'Grimme-Preis für den Spielfilm "Hanne"', and 'Running Against The Wind'. Below the list, there is a detailed view of a selected film, 'Suche Mann für meine Frau - Spielfilm, Deutschland 2005', showing its description and a video player interface.

Nr.	Sender	Thema	Titel	Datum	Zeit	Dauer	Größe [MB]	HQ	UT	Geo	URL
784504	3sat	Fernsehtext	Suche Mann für meine Frau - Spielfilm	20.10.2019	21:44:00	01:26:49	1269				https://rodtzf-a.akamaihd.net/dach/3sat/23/04/230416_suche_mann.f...
786005	3sat	Krause	Krauses Glück - Spielfilm, Deutschland 2016	07.07.2019	22:25:00	01:28:12	1524				https://rodtzf-a.akamaihd.net/dach/3sat/19/07/190707_krauses_glu...
786029	3sat	Kultur	Grimme-Preis für den Spielfilm "Hanne"	21.08.2020	19:30:00	00:02:20	40				https://rodtzf-a.akamaihd.net/dach/3sat/20/08/200820_hanne_event.f...
795858	3sat	puzzle	"Running Against The Wind" - Ein äthiopis...	28.07.2023	12:14:00	00:29:08	423				https://rodtzf-a.akamaihd.net/dach/3sat/23/07/230728_1215_sending...
798018	3sat	Spielfilm	Rivale - Spielfilm, Deutschland 2020 (...)	15.02.2024	21:02:00	01:31:34	1262				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240215_rivale_spiel...
798019	3sat	Spielfilm	Dampfnudelblues. Ein Eberhoferkrimi (...)	17.07.2019	20:16:00	01:26:48	1263				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240212_dampfnudelblu...
798020	3sat	Spielfilm	Im Weißen Rössl - Spielfilm, Österreich (...)	31.05.2018	15:33:00	01:39:03	1461				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240212_im_weißen_r...
798021	3sat	Spielfilm	Dampfnudelblues. Ein Eberhoferkrimi (...)	17.07.2019	20:16:00	01:26:48	1263				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240212_dampfnudelblu...
798022	3sat	Spielfilm	Cop Secret - Spielfilm, Island 2021	18.02.2024	23:20:00	01:35:53	1370				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240218_cop_secret_spi...
798023	3sat	Spielfilm	The Painted Bird - Spielfilm, Tschechien...	17.02.2024	23:17:00	02:42:55	2152				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240217_the_painted_b...
798024	3sat	Spielfilm	Jo Nesbø's Headhunters - Spielfilm, Nor...	19.05.2017	22:39:00	01:33:47	1351				https://rodtzf-a.akamaihd.net/dach/3sat/23/01/230129_jo_nesboes_h...
798025	3sat	Spielfilm	Rivale - Spielfilm, Norwegen/Deutschland 2011	10.02.00		01:31:34	1262				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240215_rivale_spiel...
798026	3sat	Spielfilm	Große Freiheit - Spielfilm, Österreich/D...	15.02.2024	22:34:00	01:51:34	1545				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240215_grosse_freih...
798027	3sat	Spielfilm	Große Freiheit - Spielfilm, Österreich...	15.02.2024	22:34:00	01:51:34	1545				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240215_grosse_freih...
798028	3sat	Spielfilm	Im Schwarzen Rössl - Heilmattler, Österre...	08.12.2017	15:19:00	01:31:10	1310				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240204_im_schwarzen...
798029	3sat	Spielfilm	Klondike - Spielfilm, Ukraine/Türkei 2022	22.04.2023	22:48:00	01:36:10	1340				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240222_klondike_spiel...
798030	3sat	Spielfilm	Astrid - Spielfilm, Schweden/Dänemark...	21.05.2020	20:15:00	01:57:57	1704				https://rodtzf-a.akamaihd.net/dach/3sat/22/01/220123_astrid_spiel...
798031	3sat	Spielfilm	Astrid - Spielfilm, Schweden/Dänemark...	21.05.2020	20:15:00	01:57:57	1704				https://rodtzf-a.akamaihd.net/dach/3sat/22/01/220123_astrid_spiel...
798032	3sat	Spielfilm	Tod im Strandhaus - Spielfilm, USA 2019	10.05.2021	22:15:00	01:24:48	1220				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240211_tod_im_strandh...
798033	3sat	Spielfilm	Weißer, weißer Tag - Spielfilm, Island/Sch...	14.02.2024	22:26:00	01:44:33	1492				https://rodtzf-a.akamaihd.net/dach/3sat/24/02/240215_weisser_weiss...
798034	3sat	Spielfilm	Postcard Killings - Spielfilm, USA/Deuts...	07.11.2022	22:15:00	01:40:11	1402				https://rodtzf-a.akamaihd.net/dach/3sat/24/01/240128_postcard_killing...
798035	3sat	Spielfilm	Tagendachtage - Spielfilm, Deutschland...	07.01.2024	00:18:00	01:42:36	1465				https://rodtzf-a.akamaihd.net/dach/3sat/24/01/240106_tagendachtage...
798036	3sat	Spielfilm	Schneitsch nach Rimini	04.08.2018	17:30:00	01:28:37	1283				https://rodtzf-a.akamaihd.net/dach/3sat/24/01/240120_schneitsch_nac...
798037	3sat	Spielfilm	Ein Mord mit Aussicht - Spielfilm, Deutsch...	07.05.2019	20:15:00	01:26:57	1240				https://rodtzf-a.akamaihd.net/dach/3sat/22/07/220710_mord_mit_auss...
798038	3sat	Spielfilm	Die Kinder von Windermere - Spielfilm...	27.01.2020	22:15:00	01:27:56	1229				https://rodtzf-a.akamaihd.net/dach/3sat/24/01/240126_die_kinder_von...
798039	3sat	Spielfilm	Rat mal, wer zur Hochzeit kommt	12.08.2018	20:15:00	01:28:08	1265				https://rodtzf-a.akamaihd.net/dach/3sat/22/02/220219_rat_mal_wer_z...
798040	3sat	Spielfilm	Freies Land - Spielfilm, Deutschland 2019	04.10.2021	22:15:00	02:04:06	1744				https://rodtzf-a.akamaihd.net/dach/3sat/24/01/240112_freies_land_spie...
798041	3sat	Spielfilm	In Berlin wächst kein Orangenbaum - S...	13.01.2024	23:39:00	01:28:18	1272				https://rodtzf-a.akamaihd.net/dach/3sat/23/05/230531_in_berlin_waech...
798042	3sat	Spielfilm	Freies Land - Spielfilm, Deutschland 20...	04.10.2021	22:15:00	02:04:06	1744				https://rodtzf-a.akamaihd.net/dach/3sat/24/01/240112_freies_land_spie...

Beschreibung

Fernsehtext

Suche Mann für meine Frau - Spielfilm, Deutschland 2005

Eine Verwechslung lässt den liebevollen, leicht chaotischen Familienvater Christoph zu der Überzeugung kommen, dass er nur noch wenige Monate zu leben hat. Voller Panik beschließt der Kontrollfreak, Vorsorge für die Zeit nach seinem Tod zu treffen: Er ist fest entschlossen, einen passenden Mann für seine schon bald verwitwete Ehefrau Friederike zu finden. Die Suche gestaltet sich aber schwieriger

avmultimedia_vidopt_gpl.mp4 00:01:38 00:01:23 -00:09:39 1/1 -/0

And for those who would like to add at this point that a private film archive can always be stored on a hard drive, it should be noted that a feature film such as 'The Good Shepherd' (obtained via MediathekView) requires approx. 6.5 GB of space. Extrapolated to one TB, this is 130 films. After optimisation with the tools presented here, the same film still requires approx. 1.2 GB.

Of course, video files can also be converted using standard programmes such as FFmpeg or VLC. However, it is not always easy to "get" the right parameters. This is because different parameters are required depending on the quality of the original files.



Automated optimisation with vidopt

The solution presented here was developed for precisely this reason. “Guessing” the optimum values for ffmpeg often worked, but not always. If a film is available in 50 frames/second, it can be compressed quite easily with 25 frames/second. However, 25 frames/second should not be used for files with 29.97 or 30 frames/second. With 60 frames/second, it makes more sense to carry out the optimisation at 30 frames/second.

A film with 1920×1080 pixels can be scaled to HD quality with 1280×720 pixels relatively “safely”. The situation is not quite so simple if the film has 1440×720 pixels. Should it be optimised to 960×480 pixels?

Video files can also contain many audio tracks. Of course, it can make sense to preserve these for films that contain several languages. However, this is not the case if there are two or more audio tracks (e.g. eac3 and aac). In this case, one audio track is sufficient.

The videos are optimised in three steps. Before this can be started, the files to be optimised must be placed in a folder (e.g. /home/archivista/data/in for AVMultimedia). The following three programmes must then be started one after the other:

vidopt1 /home/archivista/data/in

vidopt2 /home/archivista/data/in

vidopt3 /home/archivista/data/in

It is important to note that vidopt2 can only be started once all files have been processed with vidopt1. The same applies to vidopt3. The console program ‘ffmpeg’ is used for optimisation. If you want to know how these programmes work, you can take a look at the log files.

tail -f /home/data/archivista/av.log

tail -f /home/data/archivista/vidopt1.log

tail -f /home/data/archivista/vidopt2.log

After running the three programs, the optimised videos can be found in the directory. The original film files can be found in the following directory:

/home/archivista/data/vidbackup

Finally, three comments: Firstly, the optimisation requires considerable computing power. A minimum of 8 CPU cores or 16 threads should be available. Secondly, the more CPU cores, the better, as all CPU cores plus/minus are used for the optimisation. Thirdly, the optimisation only takes place if ffmpeg is not already running. This ensures that the corresponding computer is not

overloaded with jobs.



Optimisation of subtitle files

Newer streams sometimes also have one (or more) "subtitle tracks". Older films, on the other hand, are often only available in English. German subtitles can often be found for more well-known works (e.g. via opensubtitles.org).

However, these subtitles somehow don't fit. Be it because, for example, the subtitles are available at 24.97 frames/second, but the film runs a little "faster" at 25 frames/second. Even such a small difference results in a difference of 162 frames or 6.48 seconds over a 90-minute feature film ($3600 \cdot 1.5 \cdot 25.0 - 3600 \cdot 1.5 \cdot 24.97$). This is of course enough to "destroy" any cinematic enjoyment.

Subtitle files can also contain the same text passages several times. Here is an example from the Swiss television news programme of 21 February 2021:

00:03.600 --> 00:03.620

Mit Live-Untertiteln von SWISS TXT

00:05.200 --> 00:05.220

Mit Live-Untertiteln von SWISS TXT

00:07.380 --> 00:07.400

**Guten Abend,
willkommen zur "Tagesschau".**

00:08.400 --> 00:08.420

**Guten Abend,
willkommen zur "Tagesschau".**

00:10.000 --> 00:10.020

**Guten Abend,
willkommen zur "Tagesschau".**

00:10.640 --> 00:10.660

**Das sind unsere Schlagzeilen
von heute Mittwoch:**

With video players (e.g. mpv), this currently leads to the same subtitles being displayed several times, although one display would be sufficient. When

optimising video files, any subtitles are automatically optimised. The example above becomes:

00:00:03.520 --> 00:00:05.409
Mit Live-Untertiteln von SWISS TXT

00:00:07.380 --> 00:00:10.020
Guten Abend,^M
willkommen zur "Tagesschau".

00:00:10.640 --> 00:00:13.307
Das sind unsere Schlagzeilen^M
von heute Mittwoch:

This means that the subtitles are not displayed multiple times (sometimes "flickering") during playback. The separate 'subtitleadjust' tool is called up automatically during video optimization. If a separate subtitle file is available, 'subtitleadjust' can also be called up individually. To eliminate any discrepancies in speed or start, there are corresponding options in 'subtitleadjust':

subtitleadjust in.srt out.srt [change=*x.xxx|+hh:mm:ss| -hh:mm:ss]

After the name of the output file, the speed and the start position can be adjusted. Here are two examples:

subtitleadjust in.srt out.srt *0.999

This results in the time data in out.srt being entered correspondingly slower (correction from 25 to 24.97 frames/second). If the start position is to be shifted forwards by 20 seconds, this can be solved in this way:

subtitleadjust in.srt out.srt -00:00:20

Sometimes subtitle files also have character sets that are not consistent. The programme subtitlefix8859-1 is available for this purpose. The following command can be used to add a subtitle file to a video:

subtitle vidwithout.mp4 subtitle.vtt videowith.mp4



Final remarks

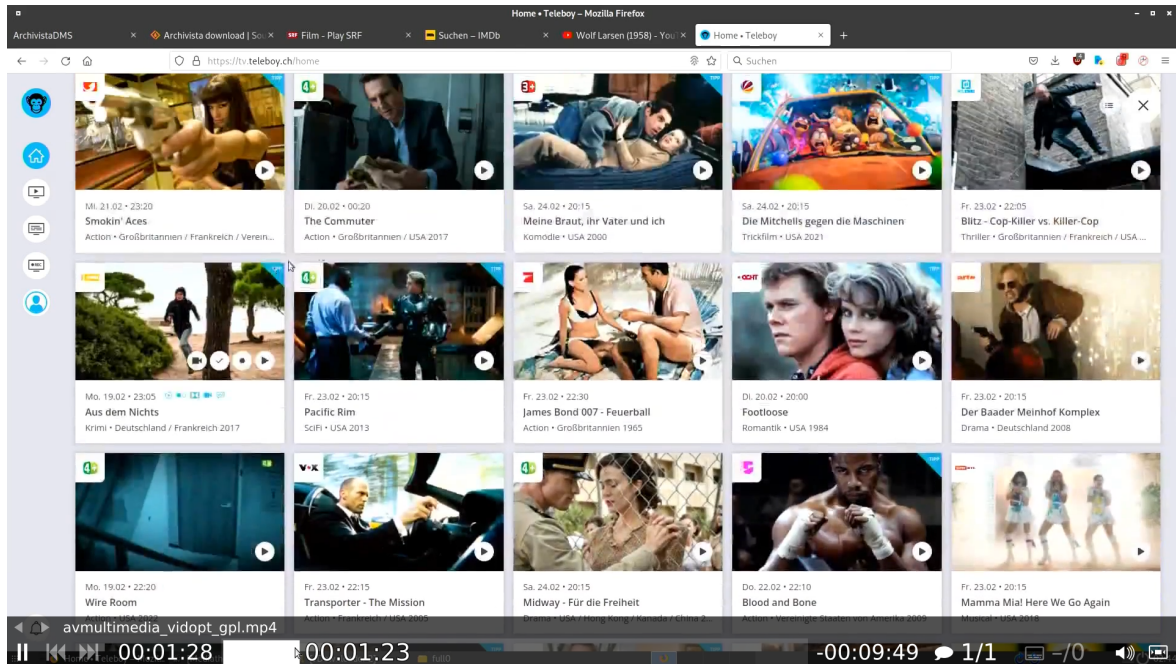
The programmes vidopt1, vidopt2, vidopt3 and subtitleadjust presented here are available in source code on every AVMultimedia distribution under /home/cvs/archivista/jobs. The wrappers vidopt1, vidopt2, vidopt3 and subtitleadjust are available under /usr/bin so that they can be called easily. There are also wrappers to adjust video and subtitle files accordingly. The most important tools are

```
videoonly video.mp4 videoonly.mp4 [tracknr]
videocombine videoonly.mp4 audioonly.mp4 video.mp4
videocombine2 videoonly.mp4 audio1.mp4 audio2.mp4 video.mp4
audioonly video.mp4 audioonly.mp4 [tracknr]
subtitle video.mp4 subtitle.srt|subtitle.vtt
videosubtitle.mp4 [deu|eng|fra]
subtitle2 vidonly.mp4 audio1.mp4 audio2.mp4 sub.srt|sub.vtt
vidout.mp4 [lang]
subtitleonly video.mp4 subtitle.srt [tracknr]
subtitlefix8859-1 subtitle8859-1.srt subtitleutf8.srt
```

All these little helpers are small wrappers that make working with the 'ffmpeg' console programme a little easier. An example of this is videocombine2:

```
#!/bin/bash
if [ ! "$1" ];then
    echo "$0 videoonly.mp4 audio1.mp4 audio2.mp4 video.mp4"
    exit 1
else
    in="$1"
    a1="$2"
    a2="$3"
    out="$4"
    ffmpeg -i "$in" -i "$a1" -i "$a2" \
        -map 0:v:0 -map 1:a:0 -map 2:a:0 -c copy "$out"
fi
```

If you often work with ffmpeg, you may not need the utilities. However, for those who do not work with ffmpeg on a daily basis, these tools may be helpful. It should also be noted that there are currently no graphical tools for any of the helpers presented here. However, calling them up via the console is deliberately kept simple so that this should not be a problem in day-to-day work.



Finally, I would like to make the following comment. The programmes presented here comprise approx. 1500 lines of code. The programmes were applied to several thousand video files. The error rate is 1 to 2 per thousand, which were not satisfactorily optimised with the test files. It had to be established that a file was optimised too much or too “weakly”.

Several hundred hours of work were necessary before the tools ran as they currently do. This work was motivated by the fact that it is not practical for a private film archive to have to purchase several hard drives with many dozens of TB.

Compressing videos always leads to certain losses in quality. Measured against the price saved on hardware, this is probably the lesser evil. In the author's opinion, a home cinema experience can certainly be achieved with a standard projector, even if “only” HD quality (1280×720 pixels) is available. With this in mind, have fun with AVMultimedia 2024/II.

Note: Customers of the ArchivistaBox should know that these tools are of course also available in the current version of the ArchivistaBox. For the optional applications (e.g. LosslessCut), the flag ‘optos’ can be set for customers. If this is the case, the opt.os file is also installed during the update. And because the flag is available for the first time with version 2024/II, the update to version 2024/II must be carried (this time only) out twice.



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