Demystifying FFmpeg & FFplay

What is FFMPEG ?

Andrew Weaver, 01/26/2017

"FFmpeg is the leading multimedia framework, able to decode, encode, transcode, mux, demux, stream, filter and play pretty much anything that humans and machines have created. It supports the most obscure ancient formats up to the cutting edge."

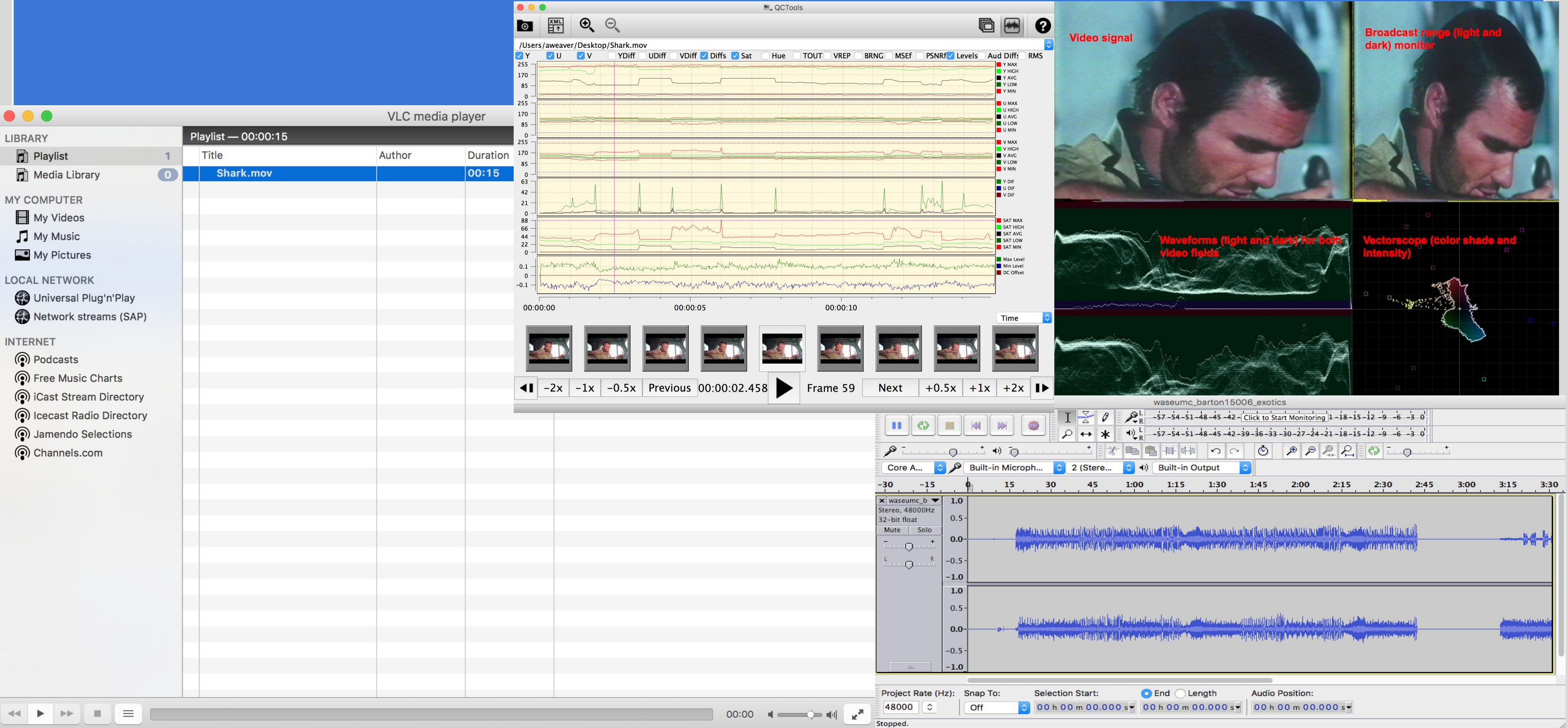
Shark! was produced by Cinematográfica Calderón S.A. and Heritage Entertainment Inc.
He-Man and the Masters of the Universe was produced by Filmation Associates and Mattel

What is FFMPEG ?

- Make derivatives
- Re-wrap files
- Edit files
- Generate metadata
- Generate checksums
- Visualize metadata
- Manipulate streams
- Generate test sources
- Add audio/video effects
- Anything you can think of!*

(*Not literally true, but sometimes feels like it)

Places you might have seen FFmpeg/FFplay



How to get FFMPEG ?

OSX:

Install Homebrew by opening Terminal and running:

```
/usr/bin/ruby -e "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/master/install)"
```

Then run:

```
brew install ffmpeg --with-sdl2
```

Alternately:

Download static build from
https://ffmpeg.org/download.html

Download link address:
http://evermeet.cx/ffmpeg/ffmpeg-83180-gcf3affa.dmg

Extract and drag FFmpeg into a folder

Windows:

Download static build from
https://ffmpeg.org/download.html

Download link address:
https://ffmpeg.zeranoe.com/builds/win64/static/ffmpeg-20170123-e371f03-win64-static.zip

Extract and drag FFmpeg into a folder

Instructions available here:
http://www.wikihow.com/Install-FFmpeg-on-Windows

Scary Script

CUNY TV ‘make slate’ filter chain

```
ffmpeg -y -nostdin -v info -hide_banner -stats -i /Users/aweaver/Desktop/Shark!_trim.mp4 -f lavfi -i
smptehdbars=s=1920x1080:r=30000/1001:sar=16/9:d=60 -f lavfi -i aevalsrc=0.1*sin(1000*2*PI*t):d=60:s=48000:c=stereo -f lavfi -i
color=c=BlueViolet:s=1920x1080:r=30000/1001:sar=16/9:d=8.2,geq=r='X/W*r(X,Y)':g='(1-X/W)*g(X,Y)':b='(H-Y)/H*b(X,Y)' -f lavfi -i
aevalsrc=0:d=20:s=48000:c=stereo -f lavfi -i color=black:s=1920x1080:r=30000/1001:sar=16/9:d=8.2 -f lavfi -i
sine=r=48000:frequency=1:beep_factor=400:duration=8.2 -f lavfi -i color=black:s=1920x1080:r=30000/1001:sar=16/9:d=1.8 -f lavfi -i
aevalsrc=0:d=1.8:s=48000:c=stereo -f lavfi -i color=black:s=1920x1080:r=30000/1001:sar=16/9:d=30 -f lavfi -i
aevalsrc=0:d=30:s=48000:c=stereo -metadata:s:v:0 timecode=00:58:30;00 -r ntsc -c:v mpeg2video -intra_vlc 1 -non_linear_quant 1 -qmin 1 -dc
10 -lmin QP2LAMBDA -ps 1 -flags +ildct+ilme -pix_fmt yuv422p -top 1 -mpv_flags strict_gop -drop_frame_timecode 1 -s 1920x1080 -vtag xd5b
-aspect 16:9 -q:v 1 -qmax 8 -g 15 -bf 2 -b:v 50M -maxrate:v 50M -minrate:v 50M -bufsize 17825792 -rc_init_occupancy 17825792 -acodec
pcm_s24be -ar 48k -map [with_slate_video] -map [with_slate_stereo1] -map [with_slate_mono1] -map [with_slate_mono2] -filter_complex
fieldorder=tff,pad=640:640*(9/16)*(255/256):(ow-640)/2:(oh-340)/2,scale=size=hd1080:interl=1,setsar=1/1,setdar=16/9,fps=fps=ntsc,format=yuv4
22p,lut=y=if(gt(val\,235)\,235\,val):u=if(gt(val\,235)\,235\,val):v=if(gt(val\,235)\,235\,val),copy[program_video];aformat=channel_layouts=s
tereo,asplit[a][b];[a]aformat=channel_layouts=stereo[stereo1];[b]aformat=channel_layouts=mono,asplit[mono1][mono2],[1:v:0][2:a:0][3:v:0][4:a
:0][5:v:0][6:a:0][7:v:0][8:a:0]concat=n=4:v=1:a=1[slate_v][slate_a];[slate_v]drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNe
ue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=388:y=158:textfile=/tmp/makebroadcast.rObigR,drawtext=fontsize=80:fontfile=/System
/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=388:y=340:textfile=/tmp/makebroadcast.bQd8ss,drawtext=fo
ntsize=50:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=388:y=460:textfile=/tmp/makebr
oadcast.znurGT,drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=388:
y=793:text='VIDEO',drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=
388:y=831:text='1080i',drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20
):x=388:y=869:text='59.94DF',drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\
,60+20):x=790:y=793:text='AUDIO',drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*l
t(t\,60+20):x=790:y=831:textfile=/tmp/makebroadcast.D9xmaT,drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor
=white:enable=gte(t\,60)*lt(t\,60+20):x=790:y=869:textfile=/tmp/makebroadcast.ORV1sP,drawtext=fontsize=32:fontfile=/System/Library/Fonts/Hel
veticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=790:y=908:textfile=/tmp/makebroadcast.cSm90e,drawtext=fontsize=32:fontfile
=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=790:y=947:textfile=/tmp/makebroadcast.ZjY0FQ,dra
wtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=1151:y=908:text='Durat
ion',drawtext=fontsize=32:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60)*lt(t\,60+20):x=1151:y=947:tex
tfile=/tmp/makebroadcast.7fTjK9,drawtext=fontsize=420:fontfile=/System/Library/Fonts/HelveticaNeue.dfont:fontcolor=white:enable=gte(t\,60+20
)*lt(t\,60+20+8.2):x=(w-text_w)/2:y=(h-text_h-line_h)/2:text='%{eif\:60+20+11-t\:d}',scale=size=hd1080,format=yuv422p,setsar=1/1,setdar=16/9
,fps=fps=ntsc[slate_v1];[slate_a]asplit[slate_stereo1][slate_stereo2];[slate_stereo2]aformat=channel_layouts=mono,asplit[slate_mono1][slate_
mono2];[9:v:0]format=yuv422p,setsar=1/1,setdar=16/9[end_black];[10:a:0]asplit[end_stereo1][end_stereo2];[end_stereo2]aformat=channel_layouts
=mono,asplit[end_mono1][end_mono2];[slate_v1][slate_stereo1][slate_mono1][slate_mono2][program_video][stereo1][mono1][mono2][end_black][end_
stereo1][end_mono1][end_mono2]concat=n=3:v=1:a=3[with_slate_video][with_slate_stereo1][with_slate_mono1][with_slate_mono2]
```

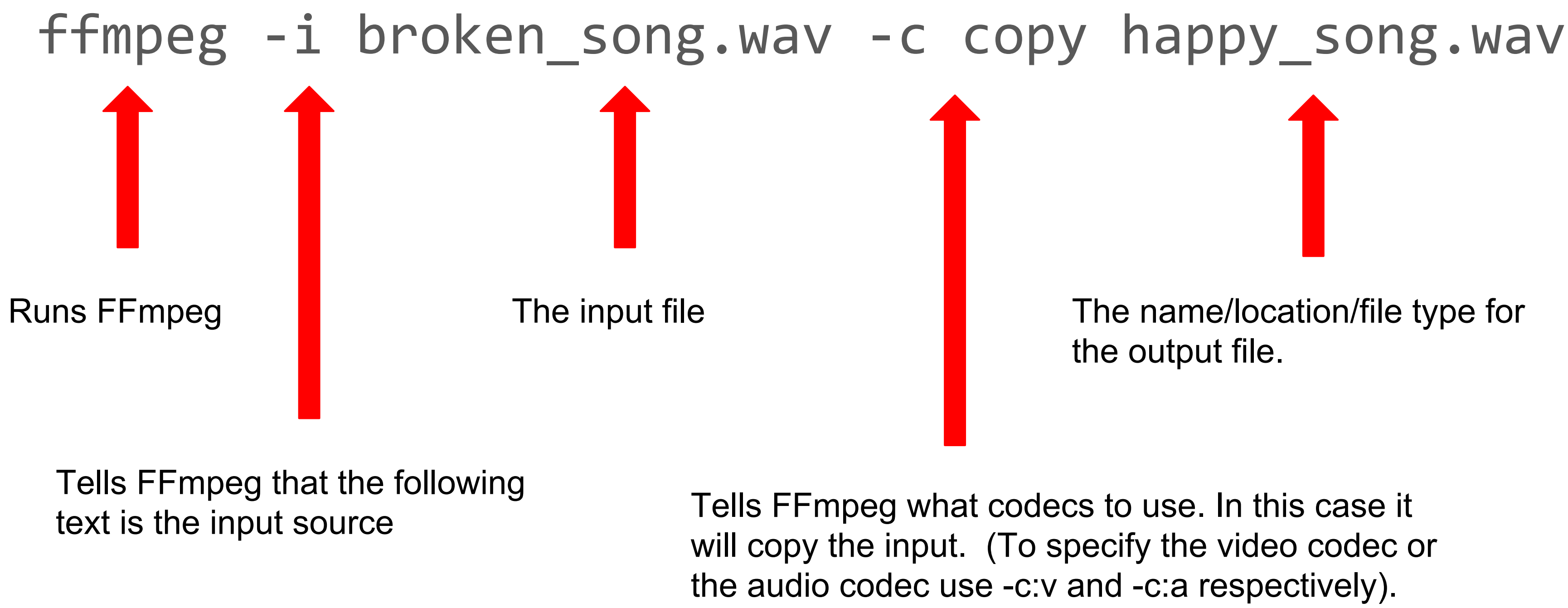
Not So Scary Script

```
ffmpeg -i broken_song.wav -c copy happy_song.wav
```

What does it do?

Takes a .wav file and copies the audio from it into a new file also wrapped in .wav.

Not So Scary Script



```
ffmpeg -i broken_song.wav -c copy happy_song.wav
```

Runs FFmpeg

Tells FFmpeg that the following text is the input source

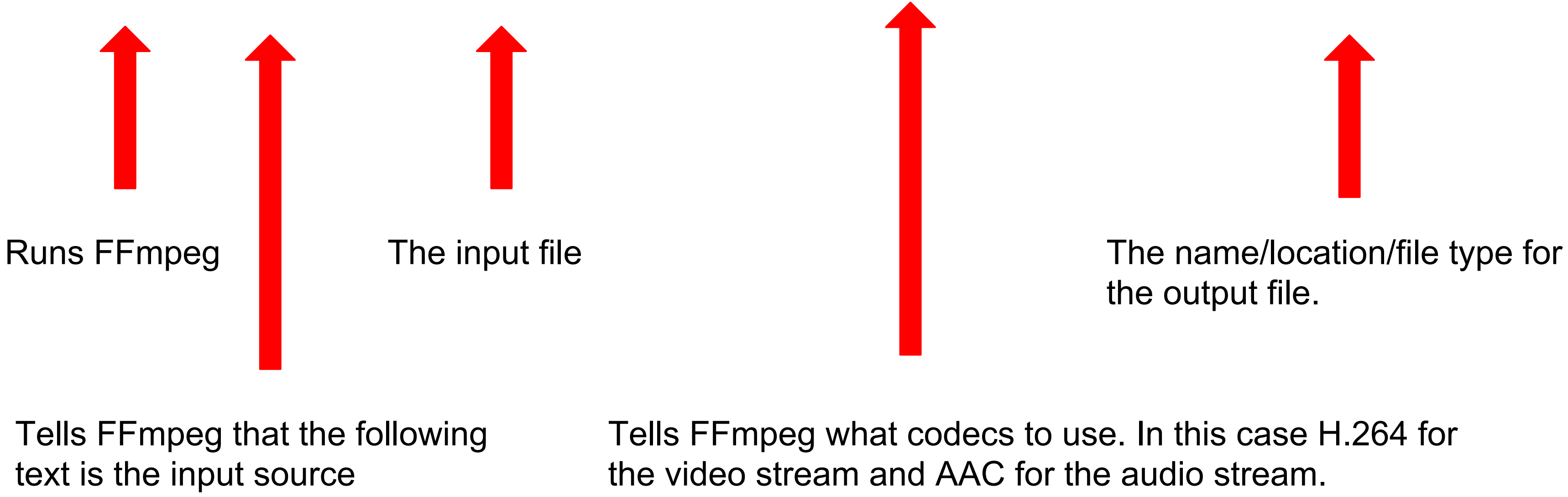
The input file

Tells FFmpeg what codecs to use. In this case it will copy the input. (To specify the video codec or the audio codec use -c:v and -c:a respectively).

The name/location/file type for the output file.

Another Not So Scary Script

```
ffmpeg -i master_file.mkv -c:v h264 -c:a aac access_file.mp4
```



Runs FFmpeg

The input file

The name/location/file type for the output file.

Tells FFmpeg that the following text is the input source

Tells FFmpeg what codecs to use. In this case H.264 for the video stream and AAC for the audio stream.

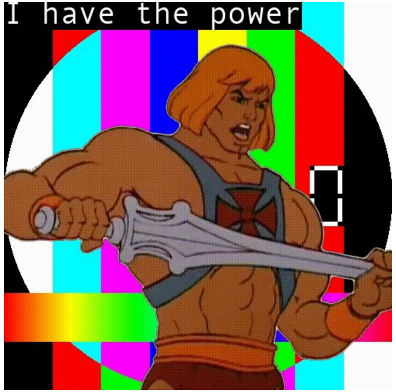
He-Man script

OSX

```
ffmpeg -f lavfi -i testsrc=500x500 -i https://github.com/privatezero/NDSR/raw/master/heman.tiff -filter_complex
"[0:v][1:v]overlay=-30:55,drawtext=fontfile=/Library/Fonts/Andale Mono.ttf:text='I have the
power':fontcolor=white:fontsize=40:box=1:boxcolor=black" -r 10 -t 5 ~/desktop/power.gif
```

Windows (Thanks @MadamImAdamLott!!):

```
ffmpeg -f lavfi -i testsrc=500x500 -i https://github.com/privatezero/NDSR/raw/master/heman.tiff -filter_complex
"[0:v][1:v]overlay=-30:55,drawtext=fontfile=/Windows/Fonts/lucon.ttf:text='I have the
power':fontcolor=white:fontsize=40:box=1:boxcolor=black" -r 10 -t 5 ~power.gif
```



He-Man script

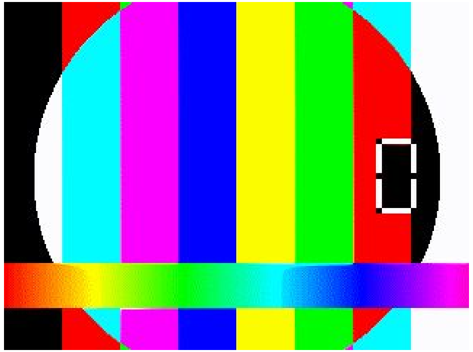
```
ffmpeg -i https://github.com/privatezero/NDSR/raw/master/heman.tiff ~/desktop/power.gif
```

He-Man script

```
ffmpeg -f lavfi -i testsrc ~/desktop/power.gif
```

Tells FFmpeg to
use virtual device
‘lavfi’

Use virtual test
source generator
for the input



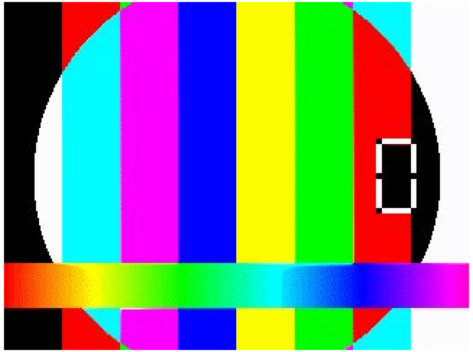
FFmpeg devices page:
https://www.ffmpeg.org/ffmpeg-devices.html

He-Man script

```
ffmpeg -f lavfi -i testsrc -r 10 -t 5 ~/desktop/power.gif
```

-t sets length of output (5 seconds)

-r sets frame rate (10 fps)



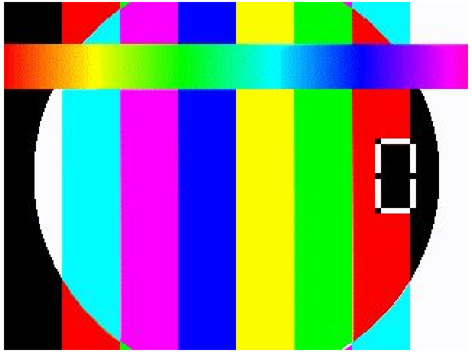
He-Man script

```
ffmpeg -f lavfi -i testsrc -vf vflip -r 10 -t 5 ~/desktop/power.gif
```

Applies the vflip (vertical flip) filter

Tells FFmpeg you will be applying a filter, and what type. -vf is for a video filter. -af is for an audio filter. -filter_complex is for complex filters (for example manipulating separate sources/streams)

FFmpeg filters page:
https://ffmpeg.org/ffmpeg-filters.html



He-Man script

```
ffmpeg -f lavfi -i testsrc=500x500 -i https://github.com/privatezero/NDSR/raw/master/heman.tiff -filter_complex
"[0:v][1:v]overlay=-30:55" -r 10 -t 5 ~/desktop/power.gif
```

Tells FFmpeg you will apply a complex filter

Applies the ‘overlay’ filter with the parameters of shifting the image -30 pixels on the X axis and 55 on the Y.

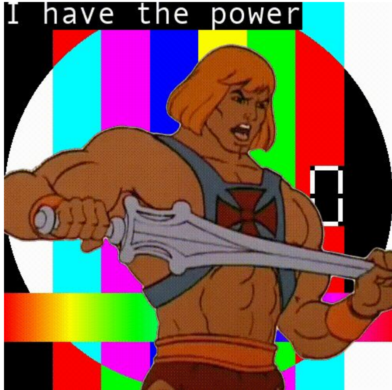
Selects the first video stream from the first input [0:v] and the first video stream from the second input [1:v]. If you were selecting audio streams it would be something like [0:a].

He-Man script

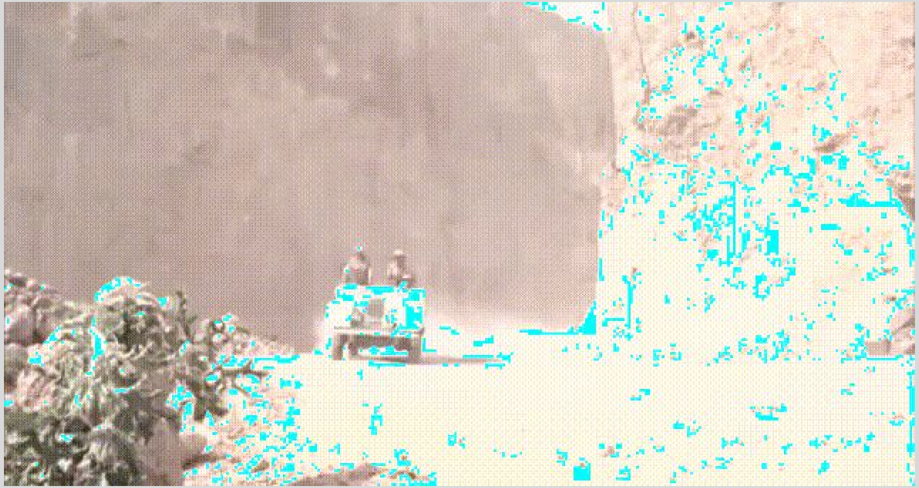
```
OSX
ffmpeg -f lavfi -i testsrc=500x500 -i https://github.com/privatezero/NDSR/raw/master/heman.tiff -filter_complex
"[0:v][1:v]overlay=-30:55,drawtext=fontfile=/Library/Fonts/Andale Mono.ttf:text='I have the
power':fontcolor=white:fontsize=40:box=1:boxcolor=black" -r 10 -t 5 ~/desktop/power.gif
```

```
Windows (Thanks @MadamImAdamLott!!):
ffmpeg -f lavfi -i testsrc=500x500 -i https://github.com/privatezero/NDSR/raw/master/heman.tiff -filter_complex
"[0:v][1:v]overlay=-30:55,drawtext=fontfile=/Windows/Fonts/lucon.ttf:text='I have the
power':fontcolor=white:fontsize=40:box=1:boxcolor=black" -r 10 -t 5 ~power.gif
```

Applies the ‘drawtext’ filter to the output of the previous filter! Note the comma separating the filters as well as the setting of parameters within the filter using = and : symbols.



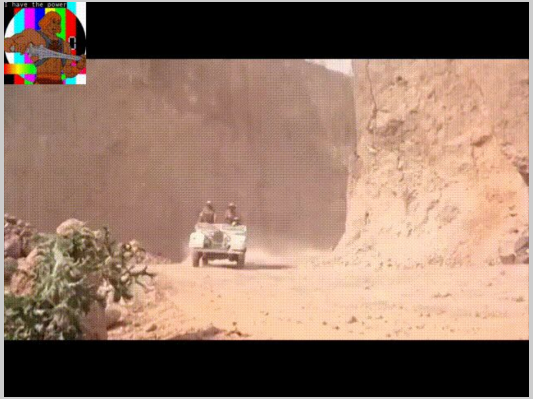
signalstats



```
ffplay -i input.mp4 -vf signalstats=out=brng:color=cyan
```

A last brief GIF aside (this one’s for Lorena)

GIF on Video to GIF



```
ffmpeg -i shark.mov  -ignore_loop 0 -i power.gif  -filter_complex overlay -r 10 -t 10
~/desktop/shark_heman.gif
```

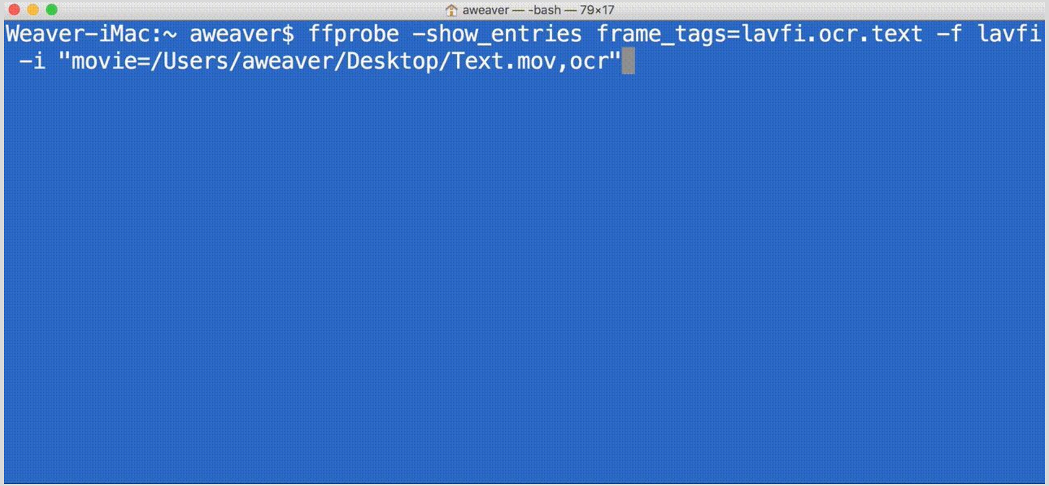
ocr

```
ffplay input.mp4 -vf "ocr,drawtext=fontfile=/Library/Fonts/Andale Mono.ttf:text=%{metadata\\\:lavfi.ocr.text}:fontcolor=white"
```

Real world application of FFmpeg for OCR

Adam’s script: https://github.com/SirBumble/pytesser

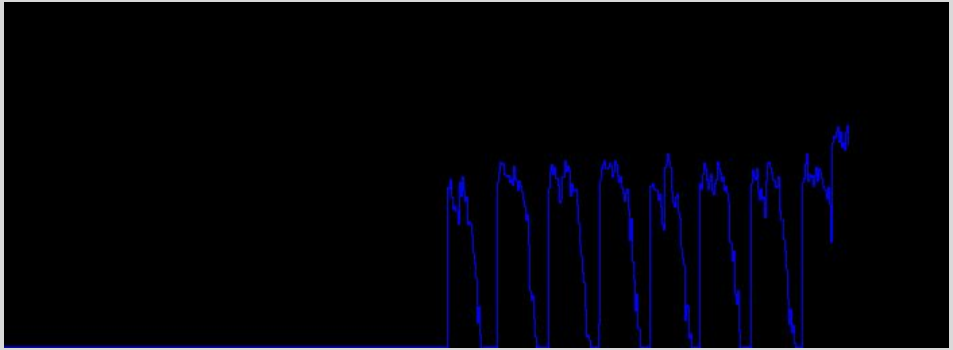
ocr



```
Weaver-iMac:~ aweaver$ ffprobe -show_entries frame_tags=lavfi.ocr.text -f lavfi
 -i "movie=/Users/aweaver/Desktop/Text.mov,ocr"
```

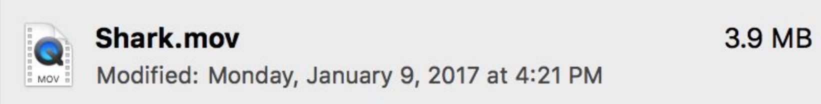
```
ffprobe -show_entries frame_tags=lavfi.ocr.text -f lavfi -i "movie=input.mp4,ocr"
```

astats



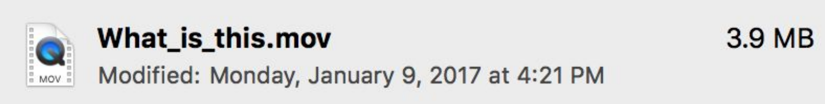
```
ffplay -f lavfi "amovie='input.mp3',astats=metadata=1:reset=1,adrawgraph=lavfi.astats.Overall.Peak_level:max=0:min=-30.0:size=700x256:bg=Black[out]"
```

Video Signatures



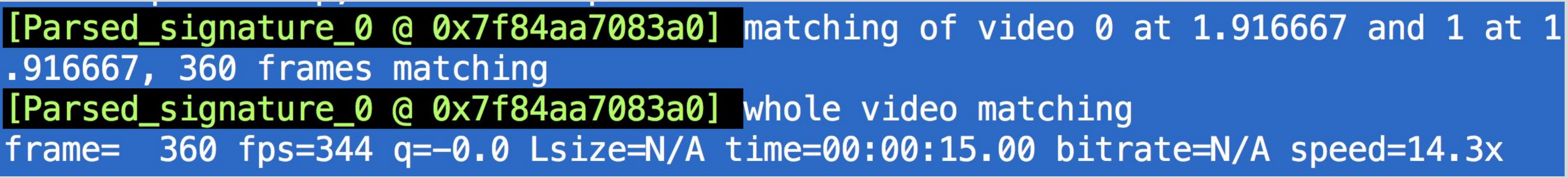
Shark.mov 3.9 MB

Modified: Monday, January 9, 2017 at 4:21 PM



What_is_this.mov 3.9 MB

Modified: Monday, January 9, 2017 at 4:21 PM



```
[Parsed_signature_0 @ 0x7f84aa7083a0] matching of video 0 at 1.916667 and 1 at 1
.916667, 360 frames matching
[Parsed_signature_0 @ 0x7f84aa7083a0] whole video matching
frame=  360 fps=344 q=-0.0 Lsize=N/A time=00:00:15.00 bitrate=N/A speed=14.3x
```

```
ffmpeg -i input.mp4  -i input_2.mp4  -filter_complex "[0:v][1:v]
signature=nb_inputs=2:detectmode=full:format=xml:filename=signature%d.xml" -map :v -f null -
```

HELPFUL RESOURCES

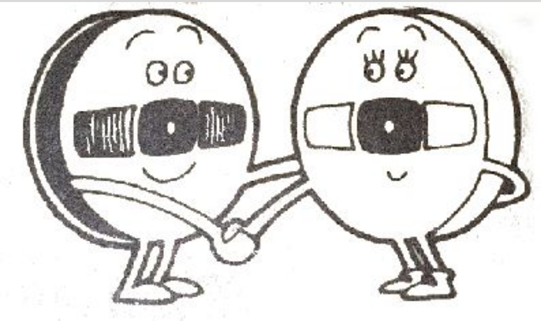
ffmprovisr: https://amiaopensource.github.io/ffmprovisr/

Filtering Examples:
https://trac.ffmpeg.org/wiki/FancyFilteringExamples

FFmpeg docs: https://ffmpeg.org/ffmpeg.html

In FFmpeg help:

```
ffmpeg -h filter=filter name
ffmpeg -h encoder=codec name
```



February 9: Tressa Graves

February 23: Adam Lott

March 9: Kate McManus

March 23: Selena Chau

April 6: Lorena Ramirez-Lopez