Fourth Session

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Bash Scripting for Audio-Visual Preservation
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Handouts

- the presentations
- the code of the scripts
- a bibliography

→ reto.ch/training/2022/202202/
→ avpres.net/Bash/

Intermediate level's goals

→ to write Bash scripts
→ to chain scripts together
→ to use configuration presets

"Generate derivates"

- customising the programming environment
- flow control: looping with **while** and **until**
- arrays
- file processing
- flow control: branching with **case**
- process handling and redirections

Contents

- Bash syntax
- FFmpeg
- transform, encode and mux AV files

Working space

Set the working space

Linux/Mac/Windows Terminal or WSL:

```
cd ~/Desktop
```

Windows locally:

```
cd Desktop
```

Windows on OneDrive Cloud:

```
cd OneDrive
```


Edit and run a script

```
nano script

chmod +x script
sudo chmod +x script

./script
drag-and-drop_script
```

Bash syntax

Command structure

```
  $0          $1                    ${n}
command   argument_1   ...   argument_n
```

common syntaxes of arguments include:

```
--parameter
--parameter=value
-p
-p value
```


Shebang

```
#!path_to_shell
#!path_to_programming_language

#!/bin/sh
#!/bin/bash
#!/usr/local/bin/bash

#!/usr/bin/env bash
```


Built-in commands (1)

```
cd [options] [path]

echo [options] [string]

exit [integer]

read [options] [variables]
```

Built-in commands (2)

getopts *string name* [*arguments*]

External commands (1)

ffmpeg [*global_options*]
[*input_options_n*] **-i** *input_file_n*
[*output_options_n*] *output_file_n*

ffplay [*input_options*] *input_file*

ffprobe [*input_options*] *input_file*

External commands (2)

grep [*options*] *pattern file_n*

mkdir [*options*] *directory_n*

Syntax for an if statement

```
if condition ; then
  command
elif condition_n ; then
  command_n
else
  command
fi
```

Syntax for a **case** statement

```
case variable in
  value_n )
    commands_n
    ;;
esac
```

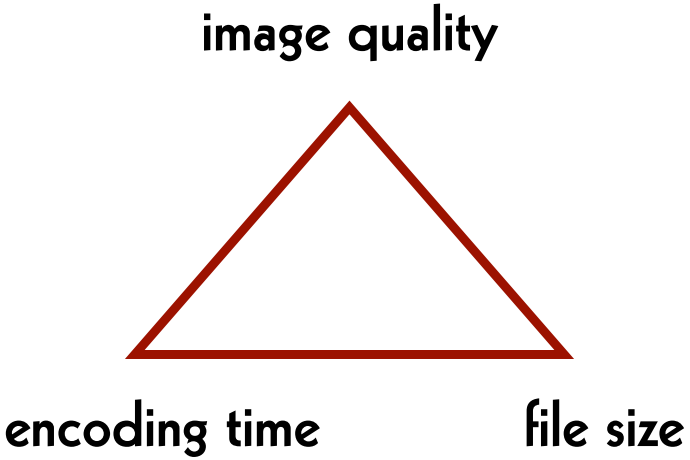

Syntax for a **while** statement

```
while condition ; do
  commands
done
```


AV files

Digital video

- resolution
- bit depth
- linear, power, logarithmic encoding
- colour model
- chroma subsampling and compression
- illuminant



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Compression

- uncompressed
- lossless compression
- lossy compression
- chroma subsampling
- born compressed

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Uncompressed

+ data simpler to process
+ software runs faster
− bigger files
− slower writing, transmission and reading

Examples: TIFF, DPX, DNG, OpenEXR

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Lossless compression

+ smaller files
+ faster writing, transmission and reading
− data processing complexer
− software runs slower

Examples: JPEG 2000, FFV1

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	avantages	disavantages
TIFF DPX DNG OpenEXR	data easier to process	bigger files
JPEG 2000 FFV1	smaller files	data complexer to process

Lossy compression

- optimised for image acquisition and/or postproduction
- optimised for access

Examples (mezzanine): ProRes 422, ProRes 4444; DNxHD, DNxHR

Examples (access): H.264 (AVC), H.265 (HEVC), H.266 (VVC); AV1

Chroma subsampling

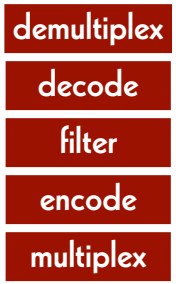
- 4:4:4
- 4:2:2
- 4:2:0 / 4:1:1

Born compressed

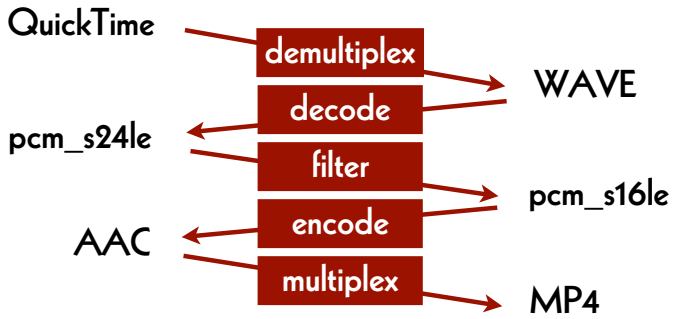
- optimised for both image acquisition and postproduction

Examples: CineForm RAW, ProRes RAW, Blackmagic RAW

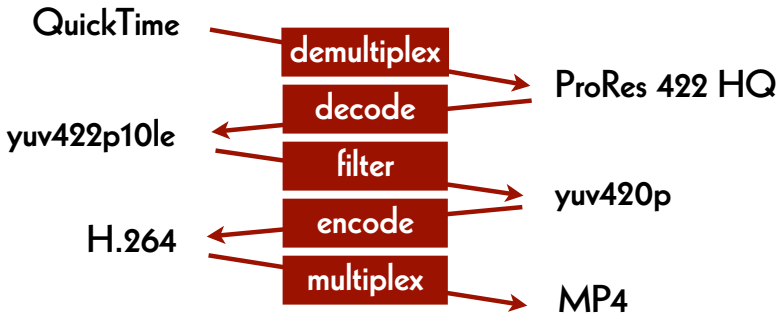
Data transformations



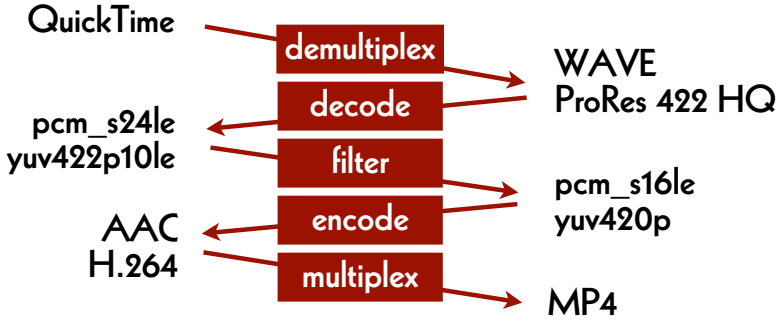
Audio exemple



Video exemple



Audio-visual exemple



FFmpeg

The FFmpeg Family

Tools

- ffmpeg
- ffprobe
- ffplay

Libraries

- libavutil
- libavcodec
- libavformat
- libavdevice
- libavfilter
- libswscale
- libswresample
- libpostproc

Data Transformations

demultiplex: libavformat

decode: libavcodec

filter: libavfilter

encode: libavcodec

multiplex: libavformat

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