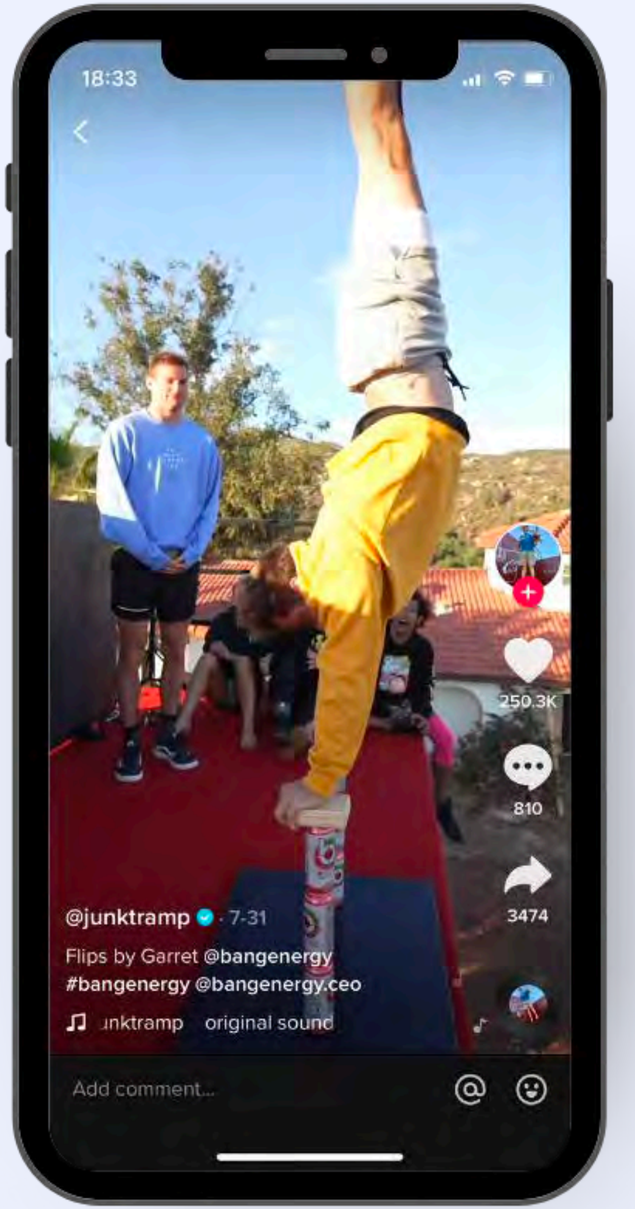
The art of **programmatic** video with **rust**

BY THEGOOSE

Videos

are the most used type of content on the internet

more than 10 hours per week



Technologies

are completely outdated

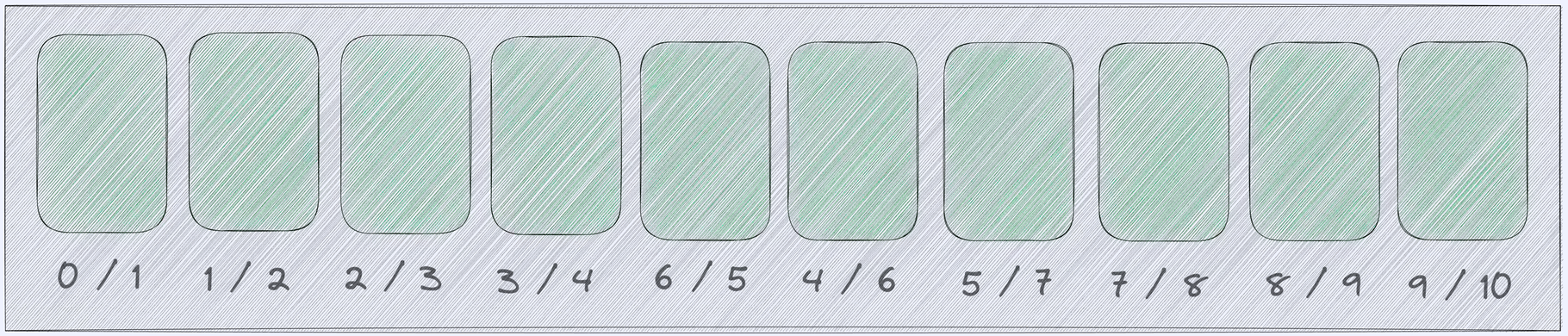
It’s time for Rust

and always has been

What is a video?

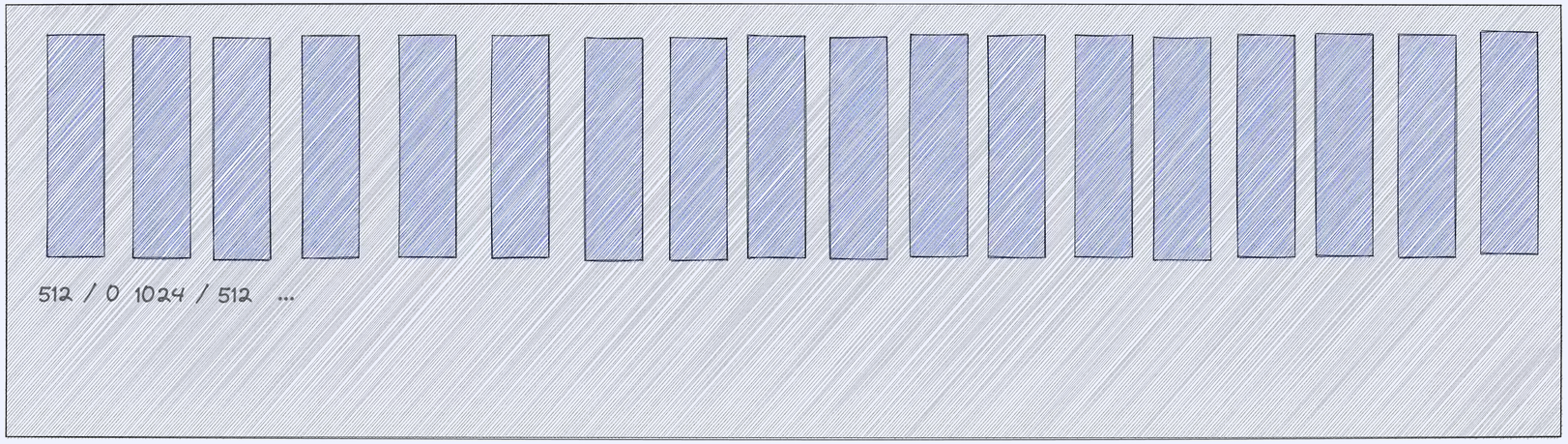
MyVideo.mp4

Images Stream

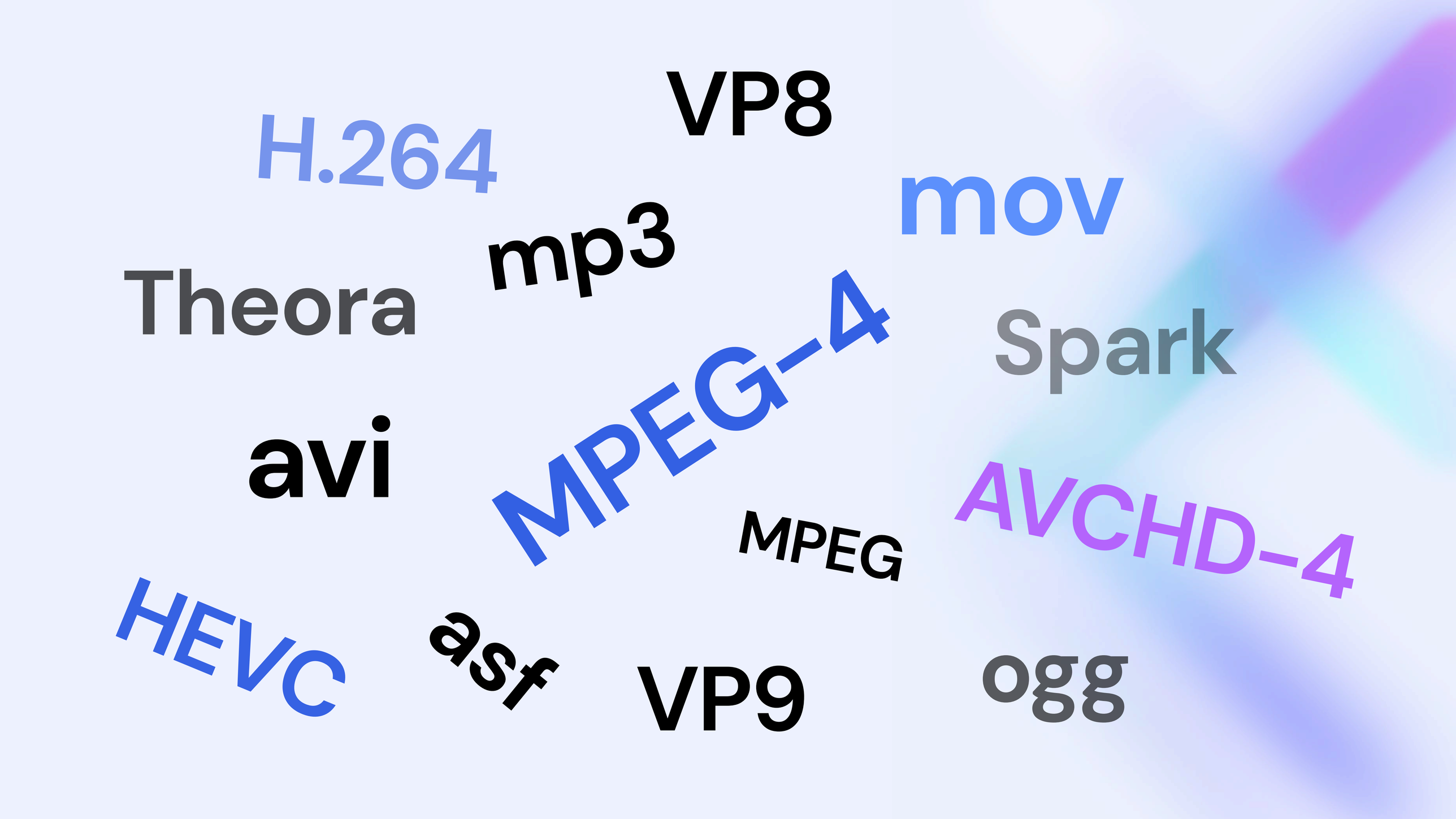


in 1/fps

Audio Stream

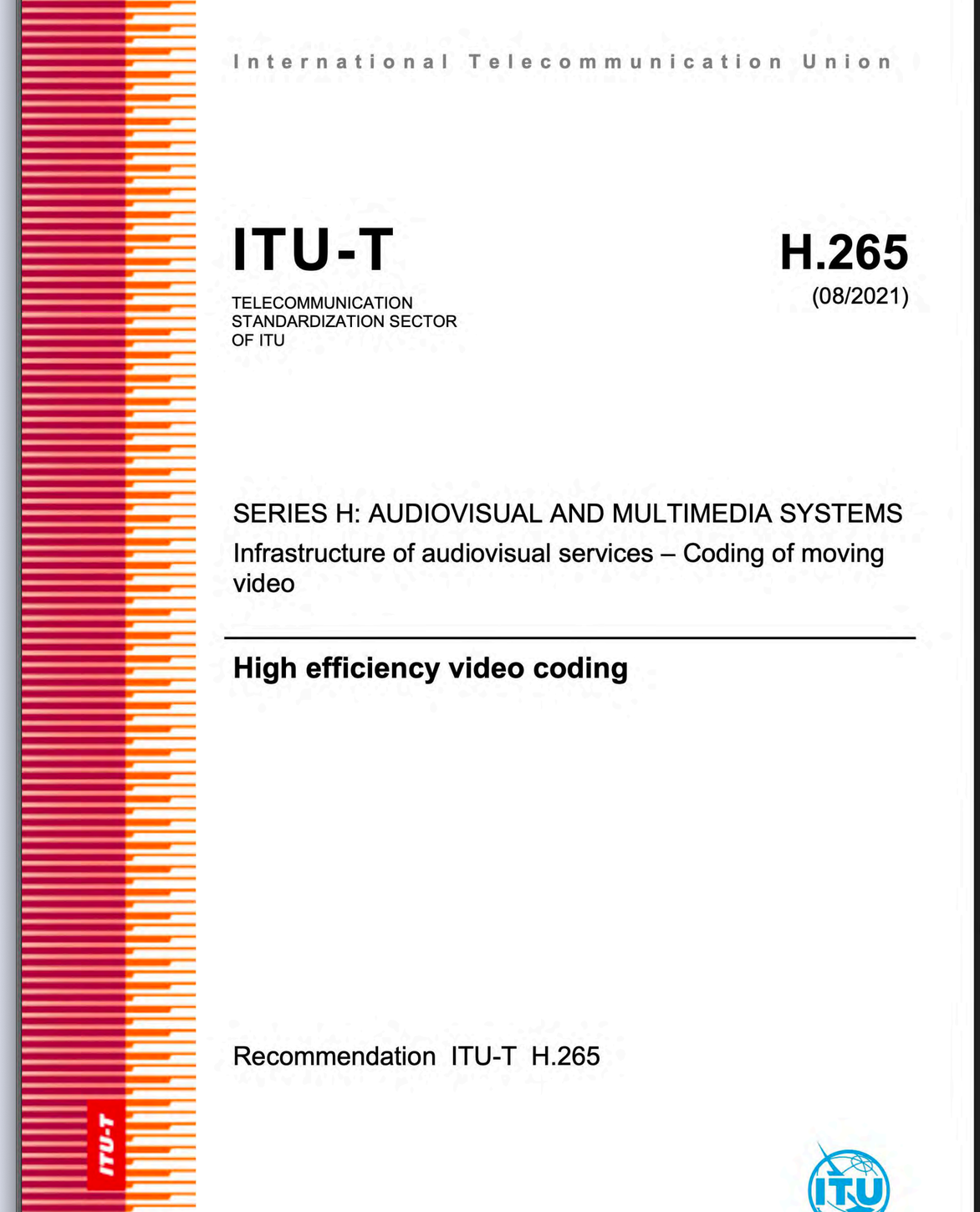


in 1/sample_rate


VP8
H.264
mov
mp3
Theora
MPEG-4
Spark
avi
AVCHD-4
MPEG
HEVC
asf
VP9
ogg

HEVC 🤯

specification 700 pages



International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.265
(08/2021)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Coding of moving video

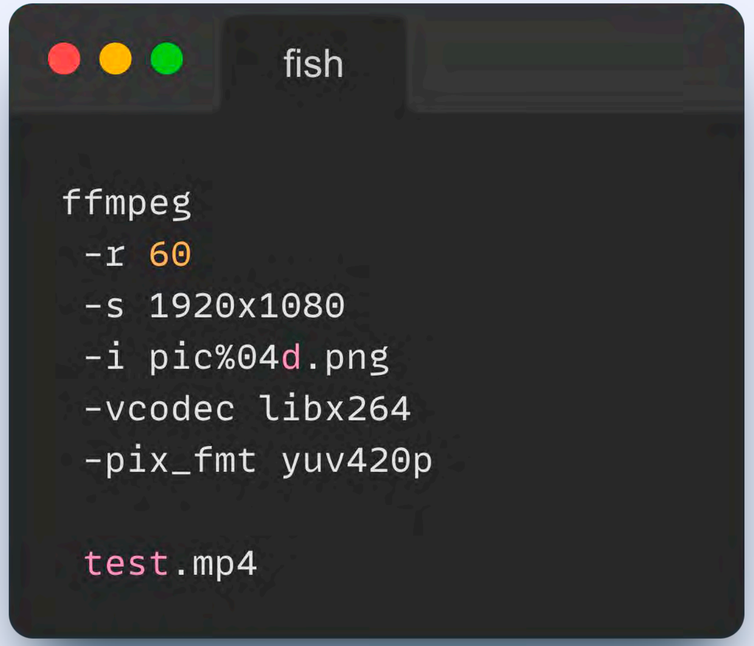
High efficiency video coding

Recommendation ITU-T H.265

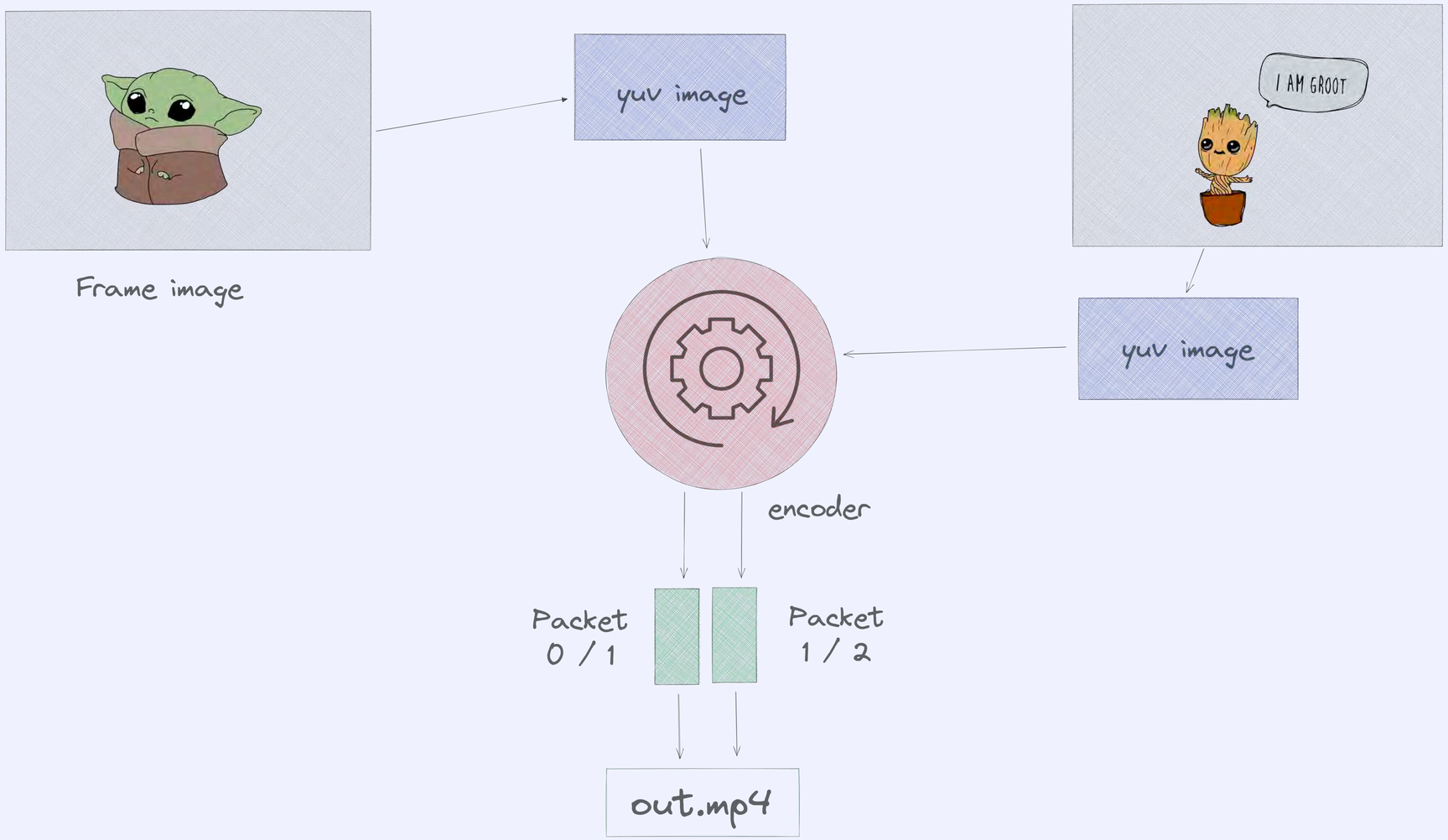
ITU-T

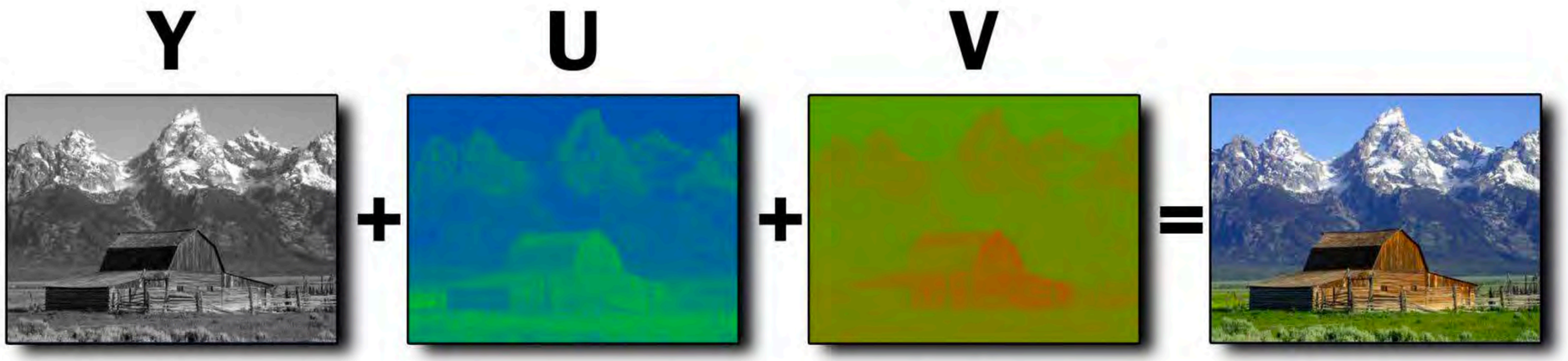
and no problems

video generation



Manual encoding





physical linear-space brightness

blue projection

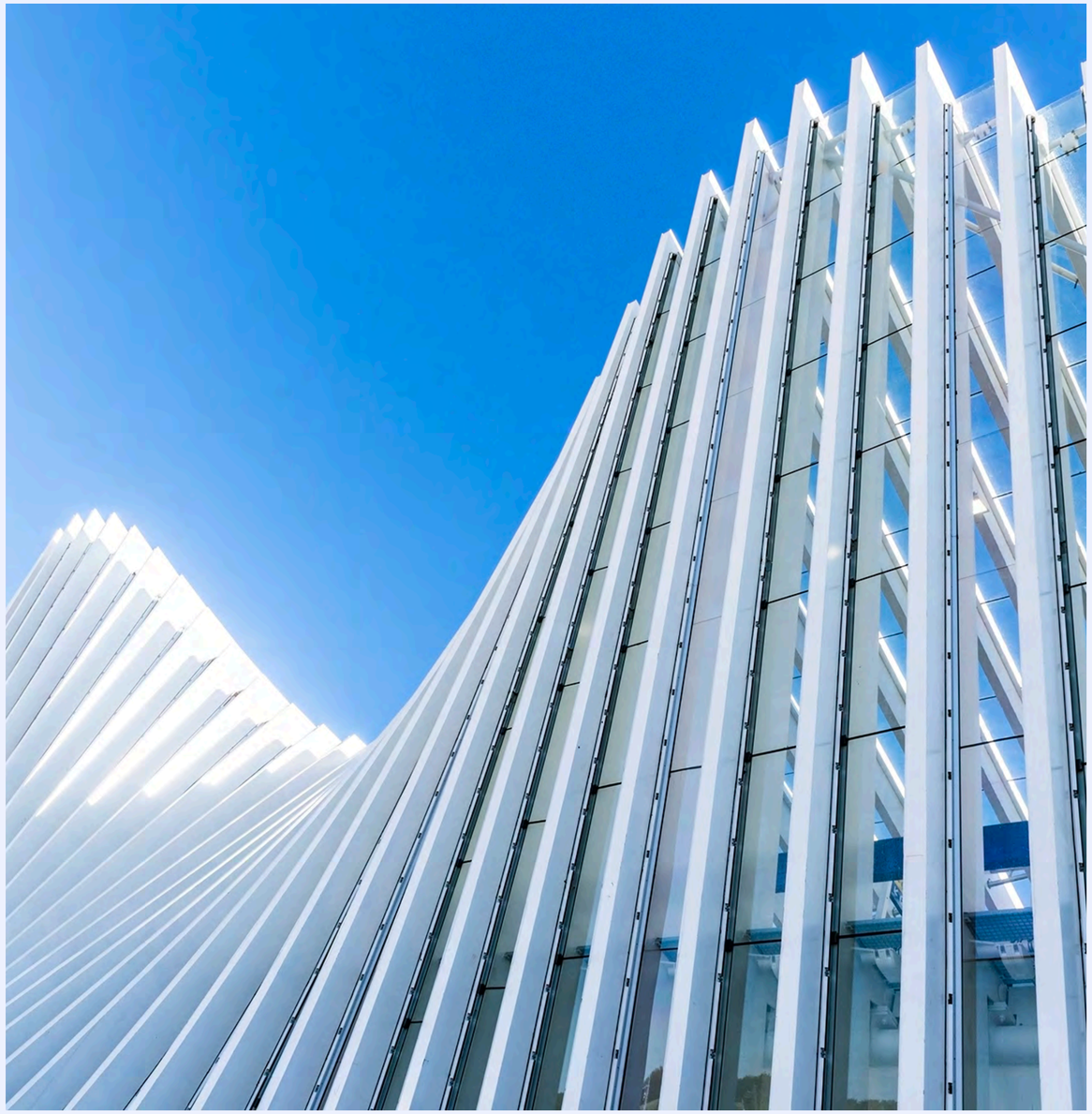
red projection

encoder.rs

```rust
let frame_size: usize = height * (*av_frame).linesize[0] as usize + width;

let y_pixels = std::slice::from_raw_parts_mut((*av_frame).data[0], frame_size);
let cb_pixels = std::slice::from_raw_parts_mut((*av_frame).data[1], frame_size / 4);
let cr_pixels = std::slice::from_raw_parts_mut((*av_frame).data[2], frame_size / 4);

for y in 0..height {
    for x in 0..width {
        let (r, g, b) = EncoderFrame::get_rgb(rgb_pixels, y * width + x);

        // use a linesize to get the correct index for the pixel as it can differ
        y_pixels[(y * (*av_frame).linesize[0] as usize + x) as usize] =
            (16 + (66 * r + 129 * g + 25 * b) >> 8) as u8;

        if y % 2 == 0 && x % 2 == 0 {
            // the bounds are 1/4 of the image size
            let x = x / 2;
            let y = y / 2;

            cb_pixels[(y * (*av_frame).linesize[1] as usize + x) as usize] =
                (128 + ((-38 * r - 74 * g + 112 * b) >> 8)) as u8;
            cr_pixels[(y * (*av_frame).linesize[2] as usize + x) as usize] =
                (128 + ((112 * r - 94 * g - 18 * b) >> 8)) as u8;
        }
    }
}
```

Images

render them or die trying



Browser

the most popular way to render static content

Find similarity

dmtrKovalenko/
odiff

The fastest pixel-by-pixel image visual difference tool in the world.

4 Contributors · 13 Issues · 2 Discussions · 1k Stars · 64 Forks

A format we need

Fixed

Animatable

DX ❤️‍🔥 Friendly

GPU First 🐌

Specificated

Debuggable </>

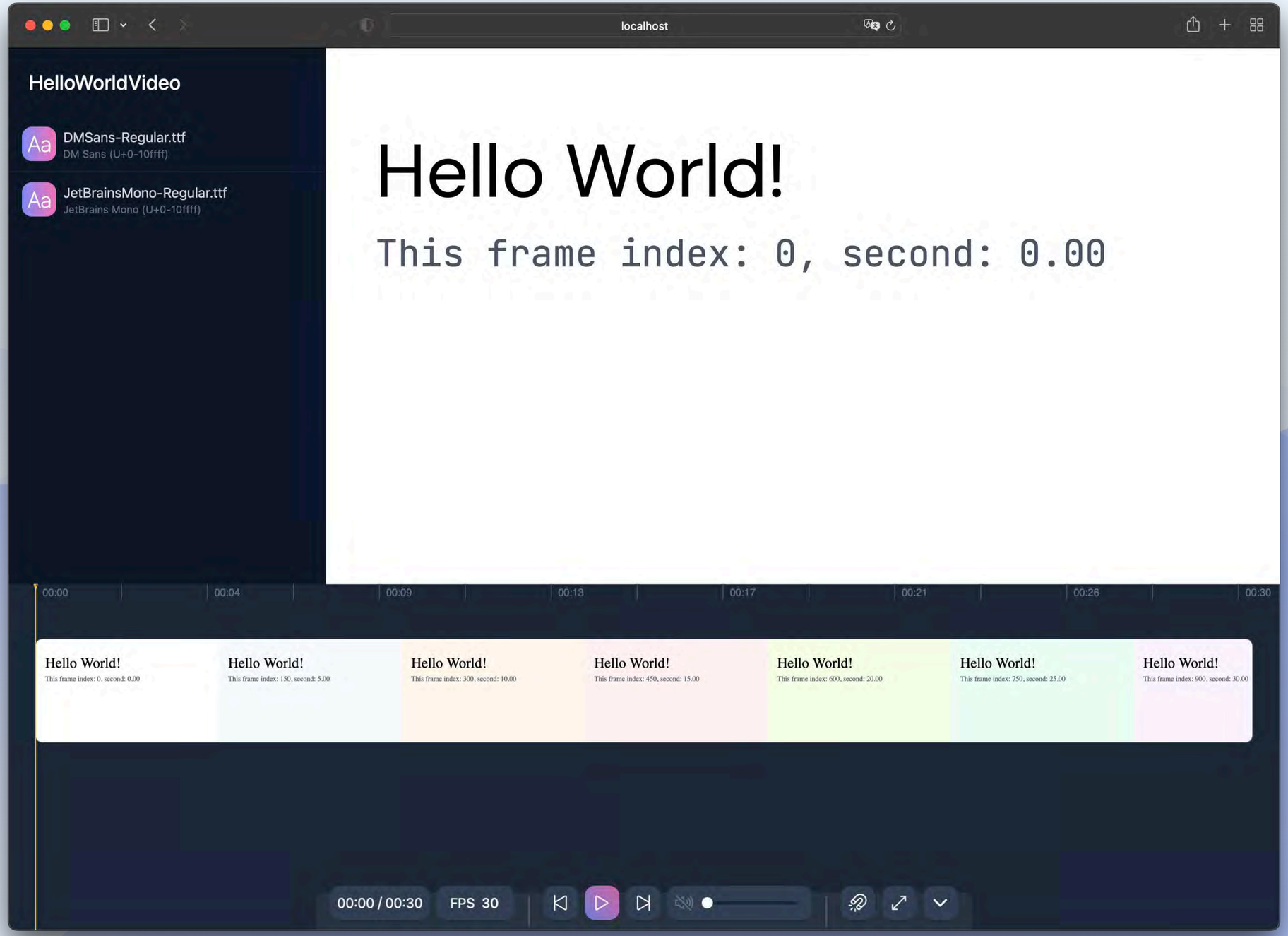
Clear

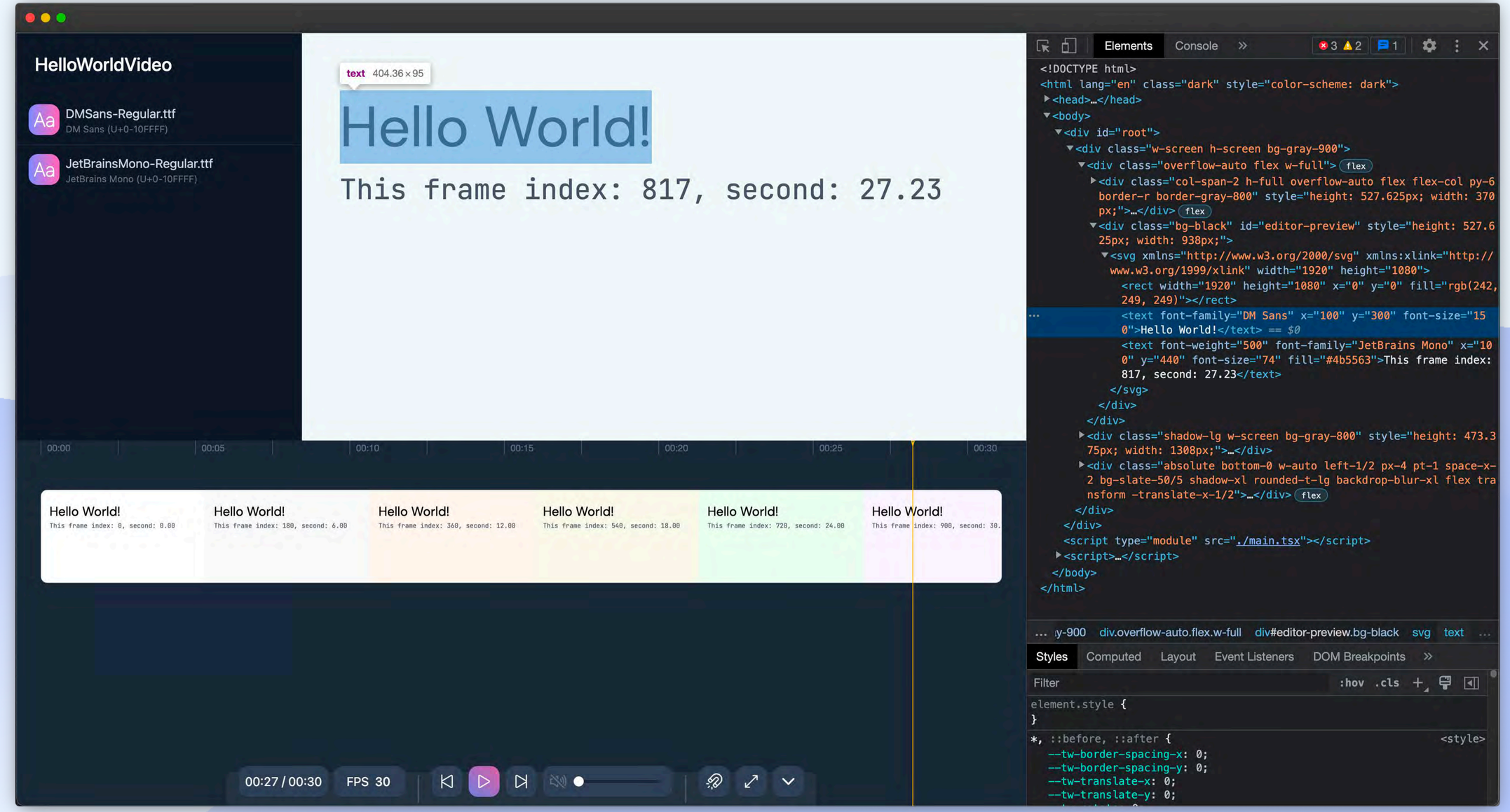
A format we need

SVG

encoder.rs

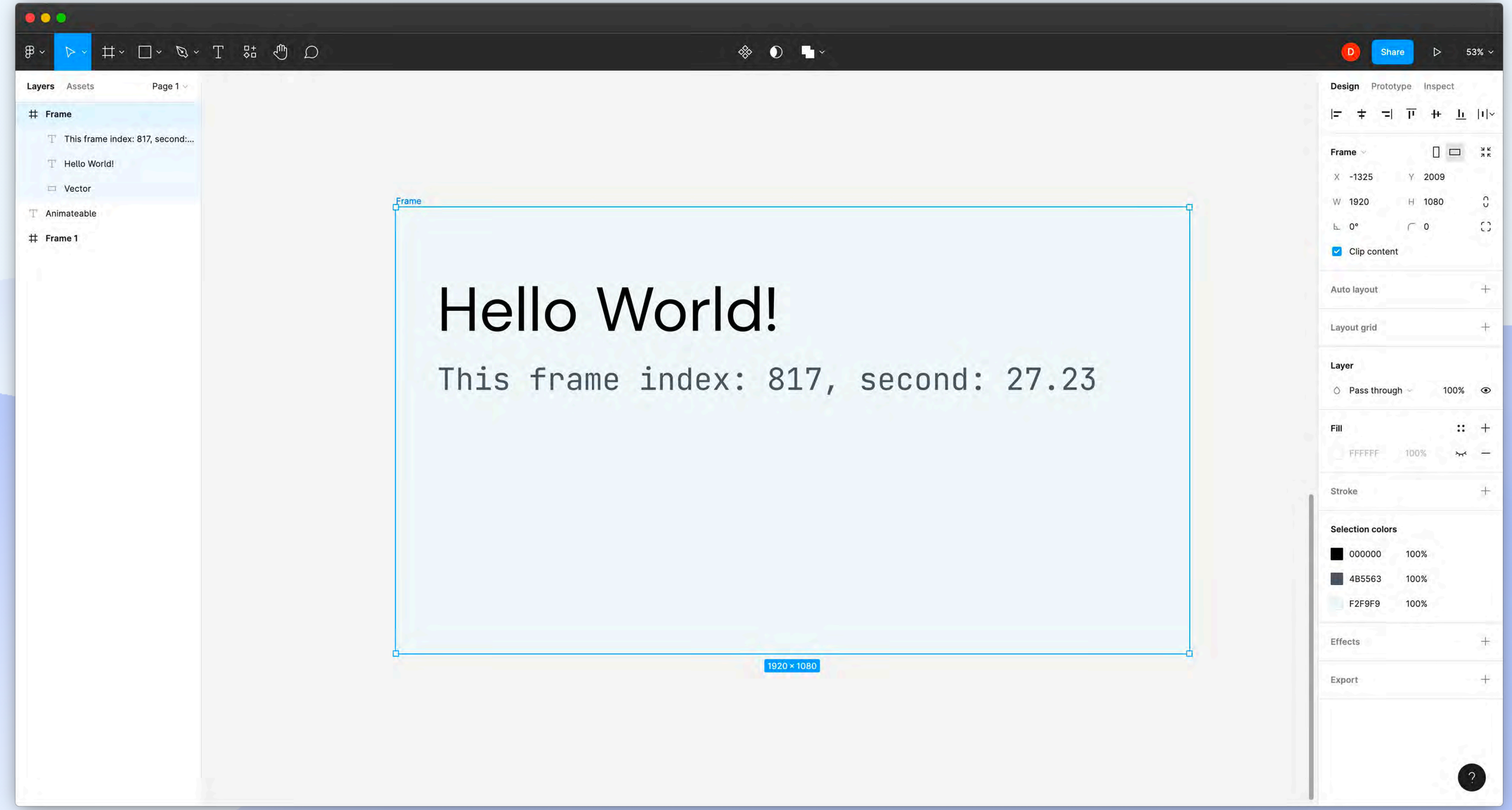
```rust
svgr!(
  <svg
    xmlns="http://www.w3.org/2000/svg"
    xmlns:xlink="http://www.w3.org/1999/xlink"
    width={Self::WIDTH}
    height={Self::HEIGHT}
  >
    <rect
      width={Self::WIDTH}
      height={Self::HEIGHT}
      x="0"
      y="0"
      fill={
        frame.animate(fframes::timeline!(
          on 0., val Color::hex("#fff") ⇒ Color::hex("#f8fafc"), &BACKGROUND_EASING,
          on 5., val Color::hex("#f8fafc") ⇒ Color::hex("#fff7ed"), &BACKGROUND_EASING,
          on 10., val Color::hex("#fff7ed") ⇒ Color::hex("#fef2f2"), &BACKGROUND_EASING,
          on 15., val Color::hex("#fef2f2") ⇒ Color::hex("#f7fee7"), &BACKGROUND_EASING,
          on 20., val Color::hex("#f7fee7") ⇒ Color::hex("#ecfdf5"), &BACKGROUND_EASING,
          on 25., val Color::hex("#ecfdf5") ⇒ Color::hex("#faf5ff"), &BACKGROUND_EASING
        ))
      }
    />

    <text font-family="DM Sans" x="100" y="300" font-size="150">
      "Hello World!"
    </text>

    <text font-weight="500" font-family="JetBrains Mono" x="100" y="440" font-size="74" fill="#4b5563">
      {format!("This frame index: {}, second: {:.2}", frame.index, frame.get_current_second())}
    </text>
  </svg>
)
```


localhost
HelloWorldVideo
DMSans-Regular.ttf
DM Sans (U+0-10ffff)
JetBrainsMono-Regular.ttf
JetBrains Mono (U+0-10ffff)
Hello World!
This frame index: 0, second: 0.00
00:00
00:04
00:09
00:13
00:17
00:21
00:26
00:30
Hello World!
This frame index: 0, second: 0.00
Hello World!
This frame index: 150, second: 5.00
Hello World!
This frame index: 300, second: 10.00
Hello World!
This frame index: 450, second: 15.00
Hello World!
This frame index: 600, second: 20.00
Hello World!
This frame index: 750, second: 25.00
Hello World!
This frame index: 900, second: 30.00
00:00 / 00:30
FPS 30


HelloWorldVideo
DMSans-Regular.ttf
DM Sans (U+0-10FFFF)
JetBrainsMono-Regular.ttf
JetBrains Mono (U+0-10FFFF)
text 404.36 × 95
Hello World!
This frame index: 817, second: 27.23
00:00
00:05
00:10
00:15
00:20
00:25
00:30
Hello World!
This frame index: 0, second: 0.00
Hello World!
This frame index: 180, second: 6.00
Hello World!
This frame index: 360, second: 12.00
Hello World!
This frame index: 540, second: 18.00
Hello World!
This frame index: 720, second: 24.00
Hello World!
This frame index: 900, second: 30.
00:27 / 00:30
FPS 30
Elements
Console
<!DOCTYPE html>
<html lang="en" class="dark" style="color-scheme: dark">
<head>…</head>
<body>

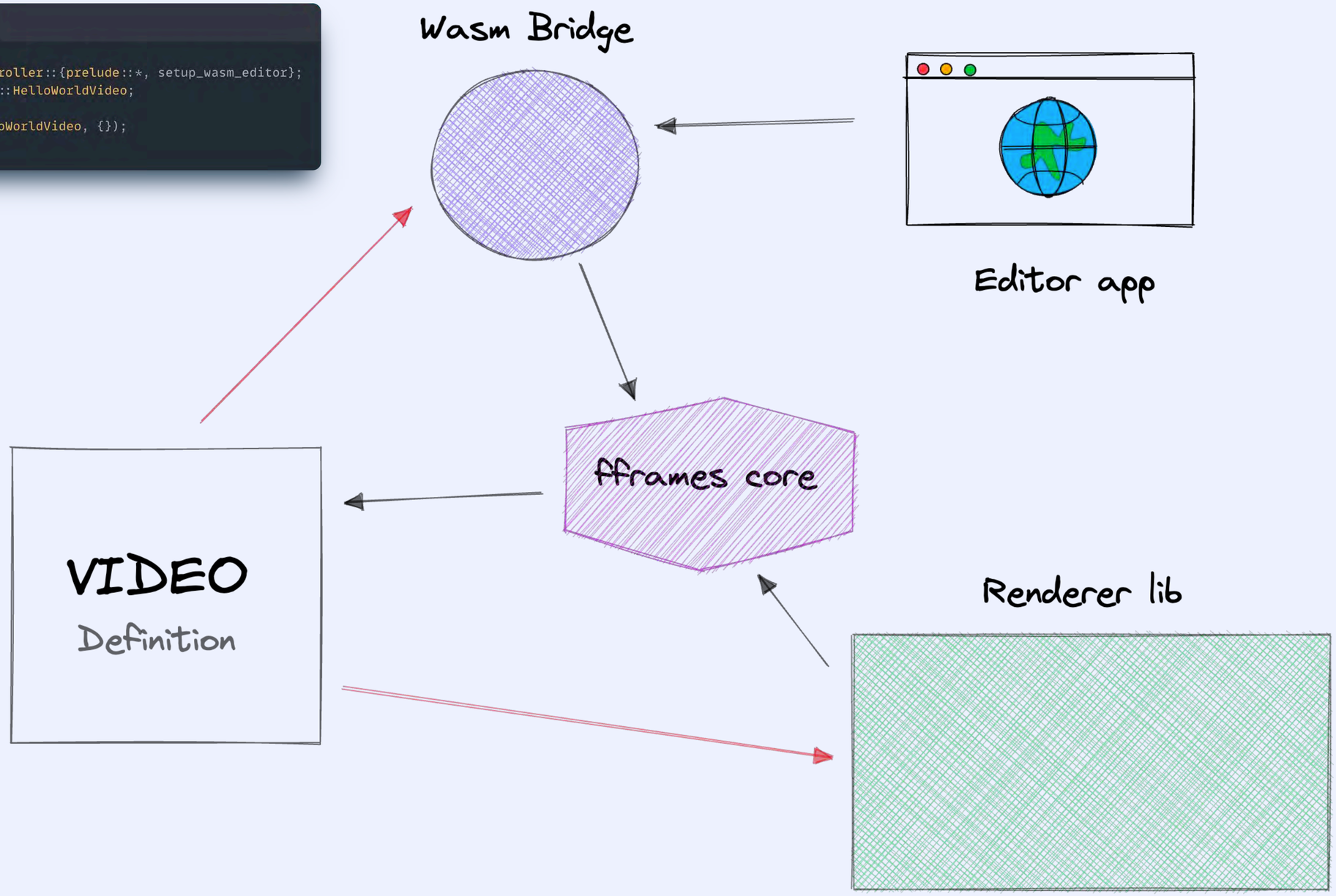
…

<svg xmlns="http://www.w3.org/2000/svg" xmlns:xlink="http://www.w3.org/1999/xlink" width="1920" height="1080">
<rect width="1920" height="1080" x="0" y="0" fill="rgb(242, 249, 249)"></rect>
<text font-family="DM Sans" x="100" y="300" font-size="150">Hello World!</text> == $0
<text font-weight="500" font-family="JetBrains Mono" x="100" y="440" font-size="74" fill="#4b5563">This frame index: 817, second: 27.23</text>
</svg>
<script type="module" src="./main.tsx"></script>
<script>…</script>
</body>
</html>
Styles
Computed
Layout
Event Listeners
DOM Breakpoints
Filter
:hov .cls
element.style {
}
*, ::before, ::after {
<style>
--tw-border-spacing-x: 0;
--tw-border-spacing-y: 0;
--tw-translate-x: 0;
--tw-translate-y: 0;


Layers
Assets
Page 1
Frame
This frame index: 817, second:...
Hello World!
Vector
Animateable
Frame 1
Share
53%
Design
Prototype
Inspect
Frame
X -1325
Y 2009
W 1920
H 1080
0°
0
Clip content
Auto layout
Layout grid
Layer
Pass through
100%
Fill
FFFFFF
100%
Stroke
Selection colors
000000
100%
4B5563
100%
F2F9F9
100%
Effects
Export
Frame
Hello World!
This frame index: 817, second: 27.23
1920 × 1080

encoder.rs

```rust
use fframes_editor_controller::{prelude::*, setup_wasm_editor};
use hello_world_example::HelloWorldVideo;

setup_wasm_editor!(HelloWorldVideo, {});
```

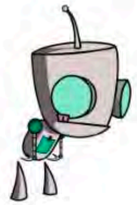


To be rendered

1500 tests

RazrFalcon/**resvg**

An SVG rendering library.

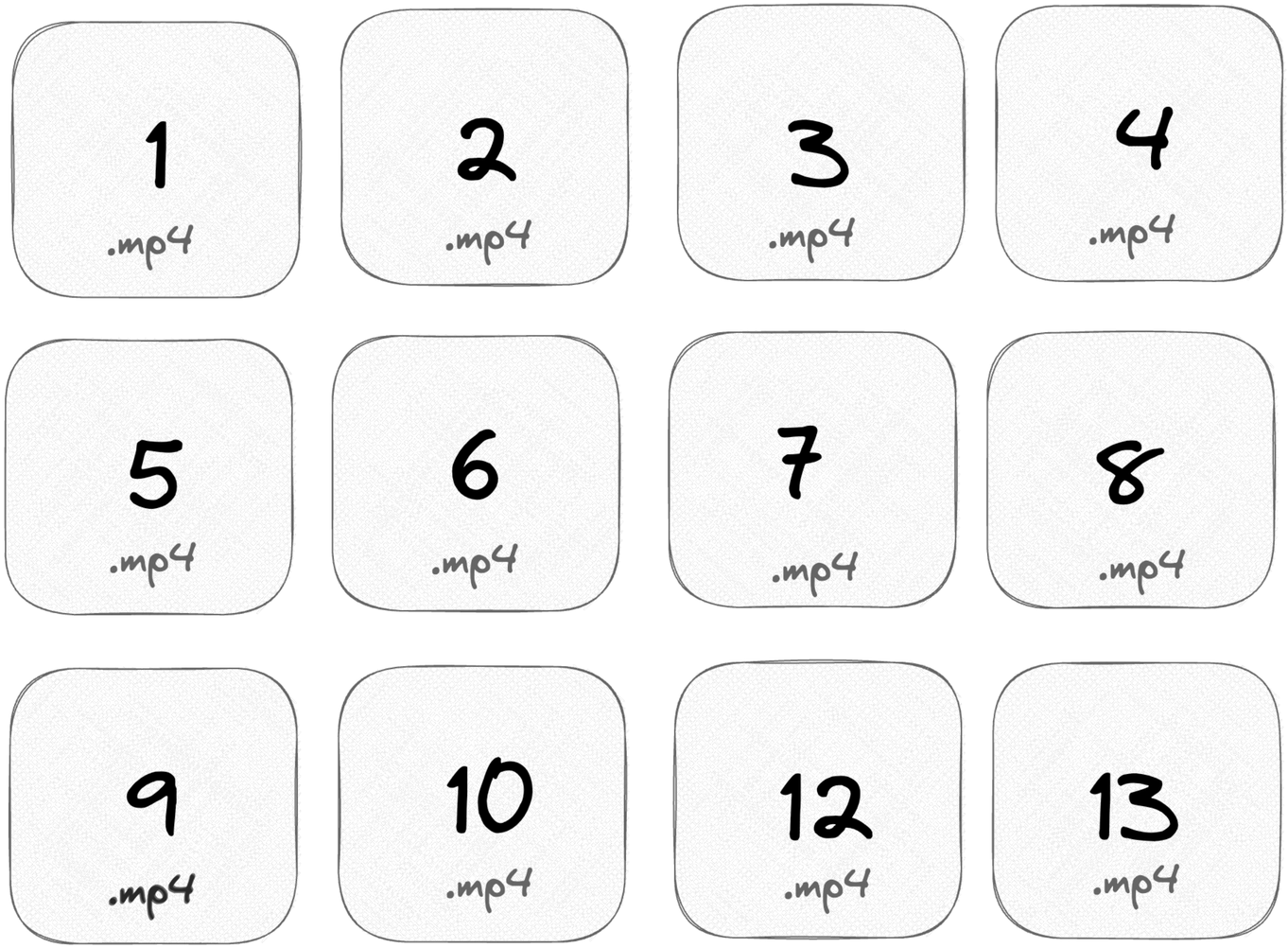


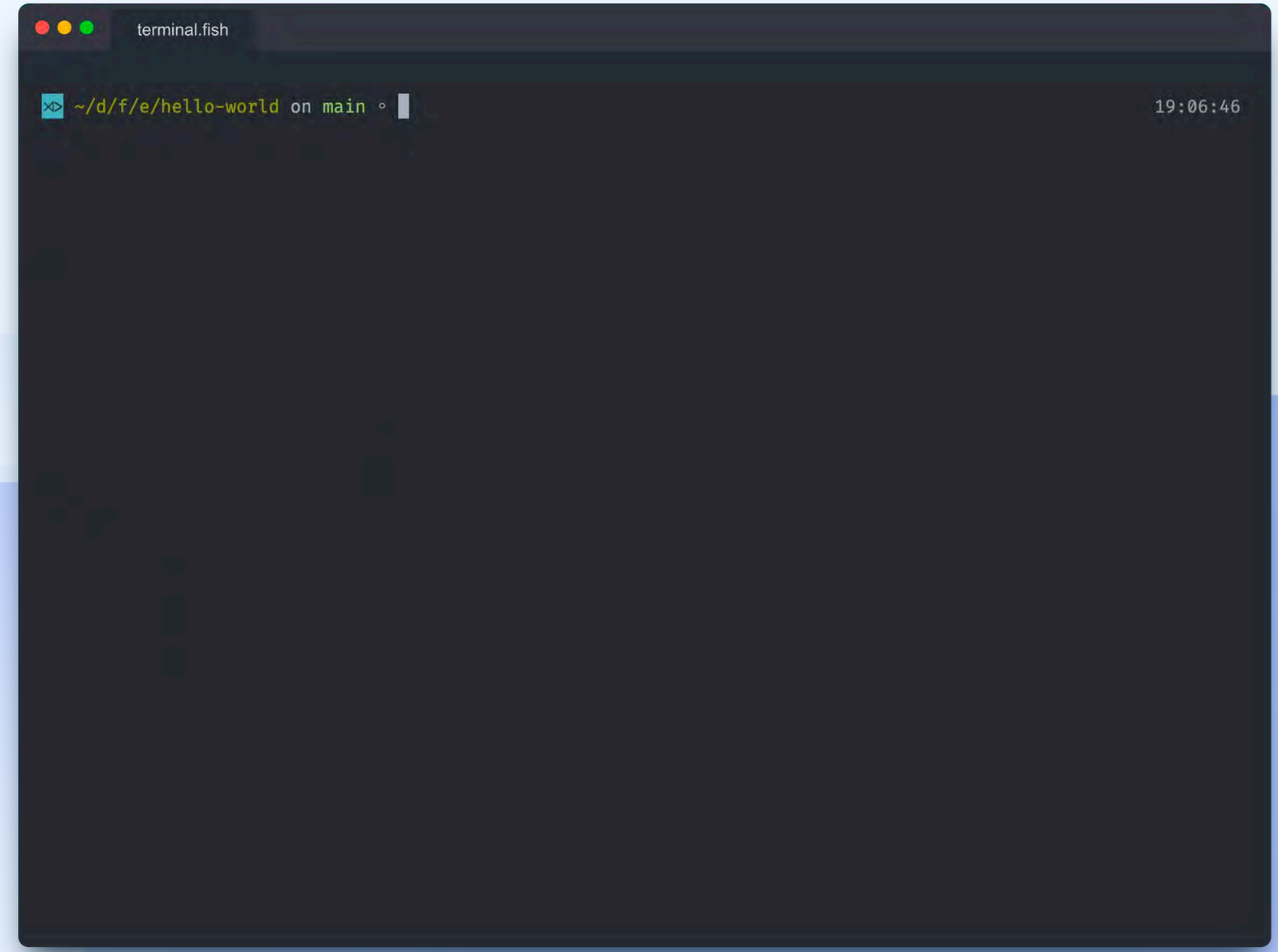
37 Contributors

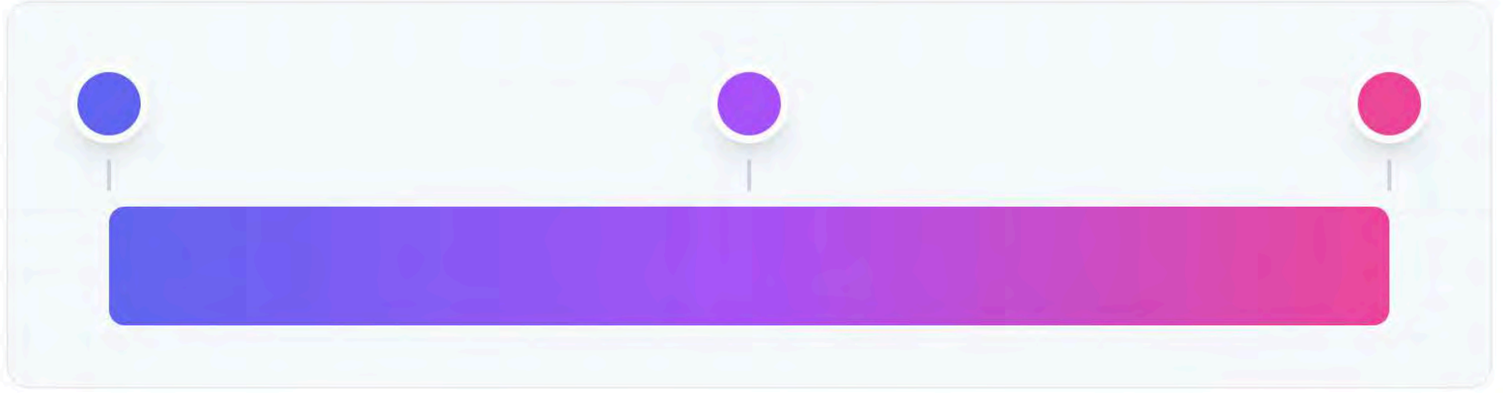
2k Used by

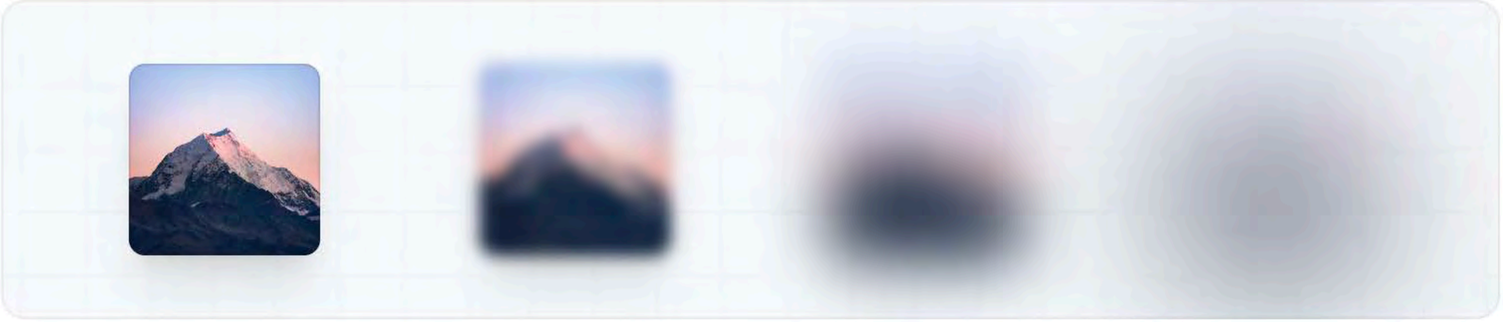
2k Stars

140 Forks


CPU
1
.mp4
2
.mp4
3
.mp4
4
.mp4
5
.mp4
6
.mp4
7
.mp4
8
.mp4
9
.mp4
10
.mp4
12
.mp4
13
.mp4


terminal.fish
~/d/f/e/hello-world on main ◦
19:06:46

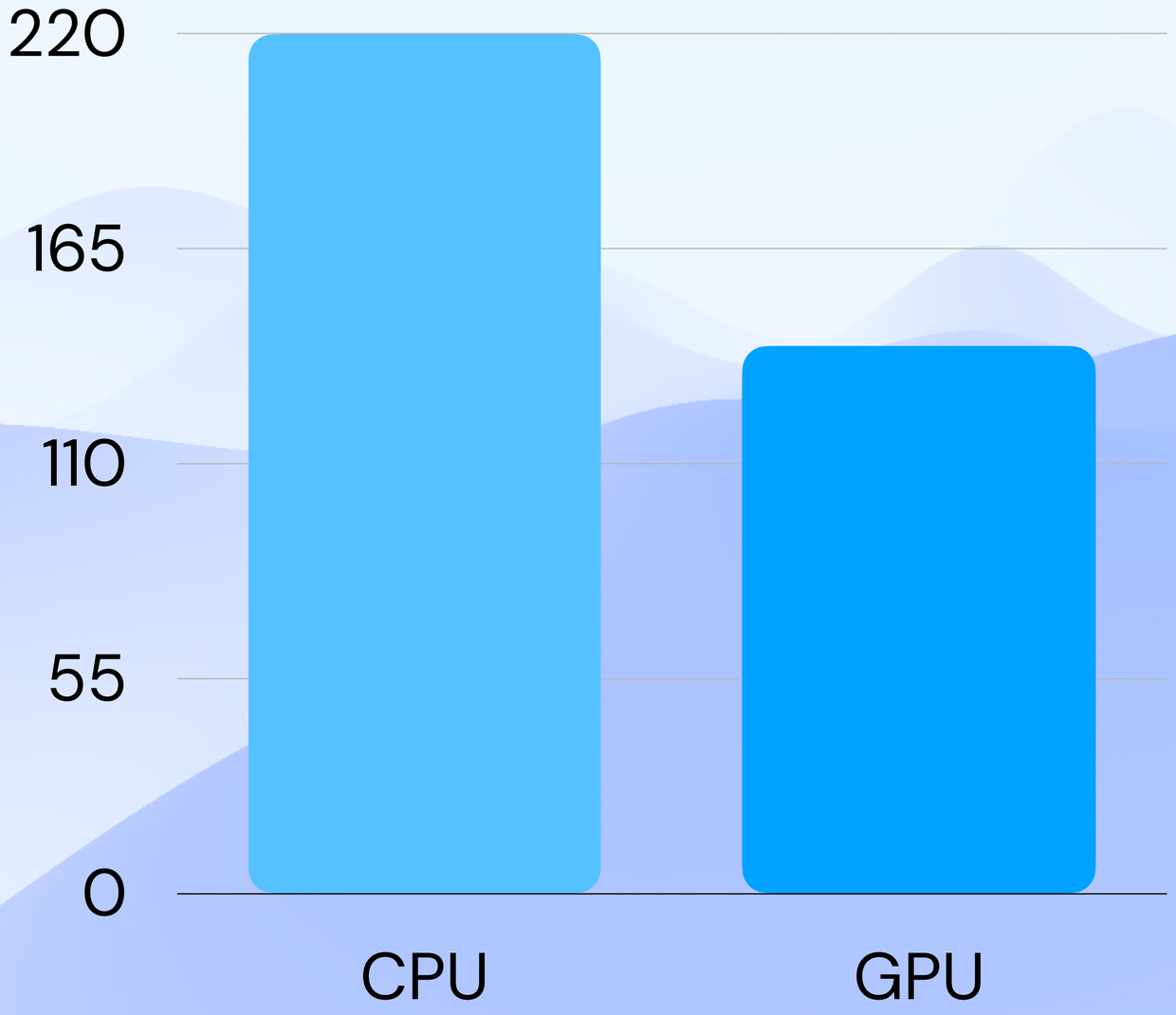




GPU

useless but gorgeous

Hello World

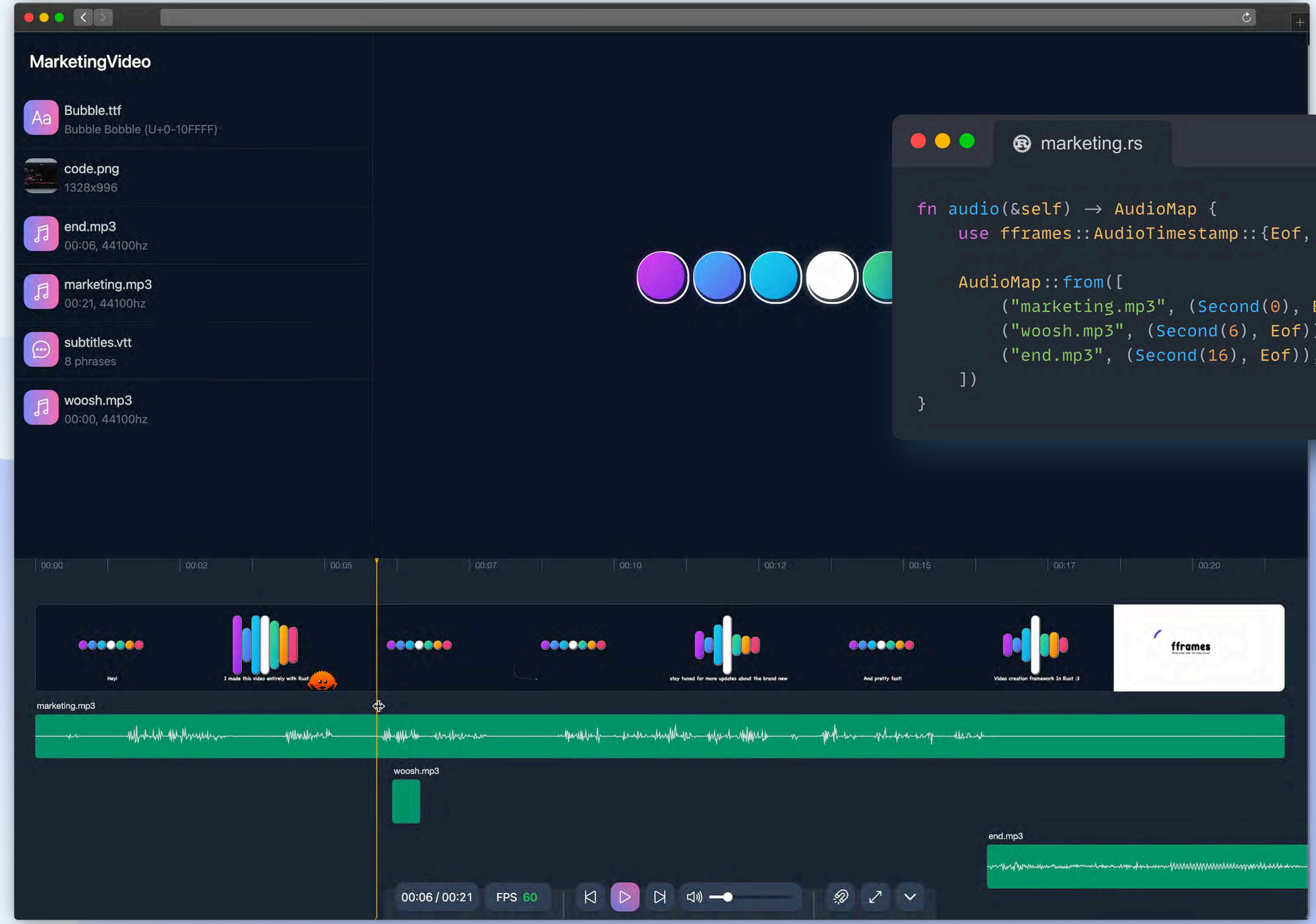


Audio

the most important part of a video

audio_encoder.rs

```rust
// increate the diff by 110haz each second
let diff_hz = 2.0 * PI * 110.0 / 44100.;

for (i, sample) in samples.iter().enumerate() {
    let sample = libm::sin(time * 1000.);

    (*frame).data[0][i] = sample;
    time += diff_hz;
}
```


MarketingVideo
Bubble.ttf
Bubble Bobble (U+0-10FFFF)
code.png
1328x996
end.mp3
00:06, 44100hz
marketing.mp3
00:21, 44100hz
subtitles.vtt
8 phrases
woosh.mp3
00:00, 44100hz
marketing.rs
fn audio(&self) -> AudioMap {
use fframes::AudioTimestamp::{Eof, Second};
AudioMap::from([
("marketing.mp3", (Second(0), Eof)),
("woosh.mp3", (Second(6), Eof)),
("end.mp3", (Second(16), Eof)),
])
}
00:00
00:02
00:05
00:07
00:10
00:12
00:15
00:17
00:20
Hey!
I made this video entirely with Rust
stay tuned for more updates about the brand new
And pretty fast!
Video creation framework In Rust :3
fframes
marketing.mp3
woosh.mp3
end.mp3
00:06 / 00:21
FPS 60

podcast.rs

```
let guest_vis = fframes::audio_data::visualize_audio_frame(
    frame,
    &audio_data::VisualizeFrameInput {
        smooth_level: 2,
        ctx,
        audio: ctx.get_audio_data("guest.mp3"),
        sample_size: audio_data::SampleSize::S32,
        window: None,
    },
);

svgr!(
  <svg>
  {
    guest_vis.iter().enumerate().map(|(i, fr)|  {
      // smooth raw frequencies to get decibels
      let db = 10.0 * libm::log10f(*fr);
      let db = db.max(10.0);

      svgr!(
        <rect
          y={(950) as f32 - db / 2.0}
          x={800 + (i * 20)}
          fill="#E7D850"
          height={db}
          width="16"
          rx="4"
          ry="4"
        />
      )})
   }
  </svg>
)
```

Videos

are interesting

fframes

Write some code. Get video. Enjoy!

Beta

starts right now

Discord

put your @githubName to the **#Beta** chat

https://fframes.studio/

Thank you for watching!

BY THEGOOSE