MUX

How Libre can you go?

Reaching as many viewers as possible using only libre video technologies.

Phil Cluff, February 2019

“Reaching as many viewers as possible using only libre video technologies.”

“Reaching as many web viewers as possible with the best user experience possible using only libre video technologies.”

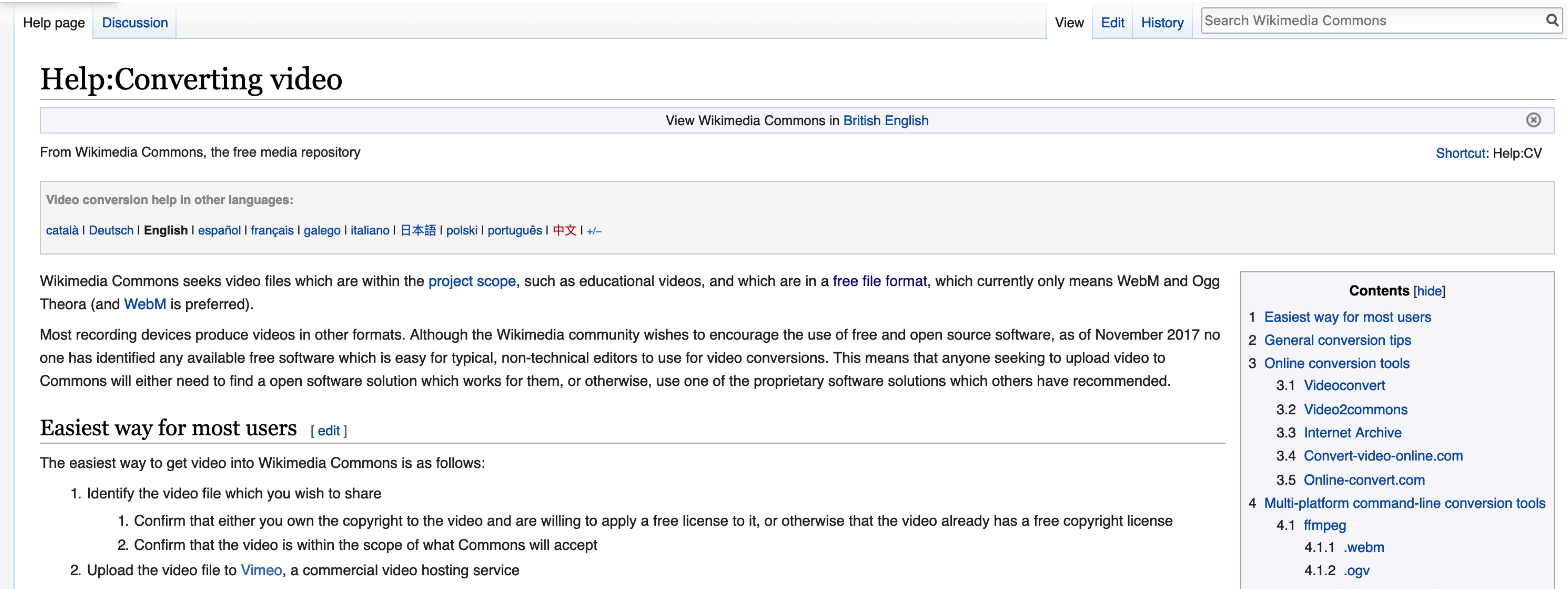
“libre” video technologies?

- Avoid patent encumbered technologies
- Prefer technologies that are developed in the open

“No-one wants that”

Wikipedia wants that...

“Wikimedia Commons seeks video files which are within the project scope, such as educational videos, **and which are in a free file format, which currently only means WebM and Ogg Theora (and WebM is preferred).”**



Help:Converting video

View Wikimedia Commons in British English

From Wikimedia Commons, the free media repository

Shortcut: Help:CV

Video conversion help in other languages:

català | Deutsch | **English** | español | français | galego | italiano | 日本語 | polski | português | 中文 | +/−

Wikimedia Commons seeks video files which are within the project scope, such as educational videos, and which are in a free file format, which currently only means WebM and Ogg Theora (and WebM is preferred).

Most recording devices produce videos in other formats. Although the Wikimedia community wishes to encourage the use of free and open source software, as of November 2017 no one has identified any available free software which is easy for typical, non-technical editors to use for video conversions. This means that anyone seeking to upload video to Commons will either need to find a open software solution which works for them, or otherwise, use one of the proprietary software solutions which others have recommended.

Contents [hide]

Easiest way for most users [edit]

The easiest way to get video into Wikimedia Commons is as follows:

1. Identify the video file which you wish to share
   1. Confirm that either you own the copyright to the video and are willing to apply a free license to it, or otherwise that the video already has a free copyright license
   2. Confirm that the video is within the scope of what Commons will accept
2. Upload the video file to Vimeo, a commercial video hosting service

Components of Media Playback

- Encoder
- Codec
- Container
- Delivery Technology
- Player

Components of Media Playback

- Encoder
- **Codec**
- **Container**
- **Delivery Technology**
- **Player**

Codecs

MUX

Codecs

Libre

- Video:
  - VP8
  - VP9
  - AV1
- Audio:
  - Vorbis
  - Opus

Patent Encumbered

- Video:
  - H.264 (AVC)
  - H.265 (HEVC)
  - VVC
- Audio:
  - AAC
  - AC3
  - eAC3

Codecs

Libre

- Video:
  - **VP8**
  - **VP9**
  - ~~AV1~~
- Audio:
  - **Vorbis**
  - **Opus**

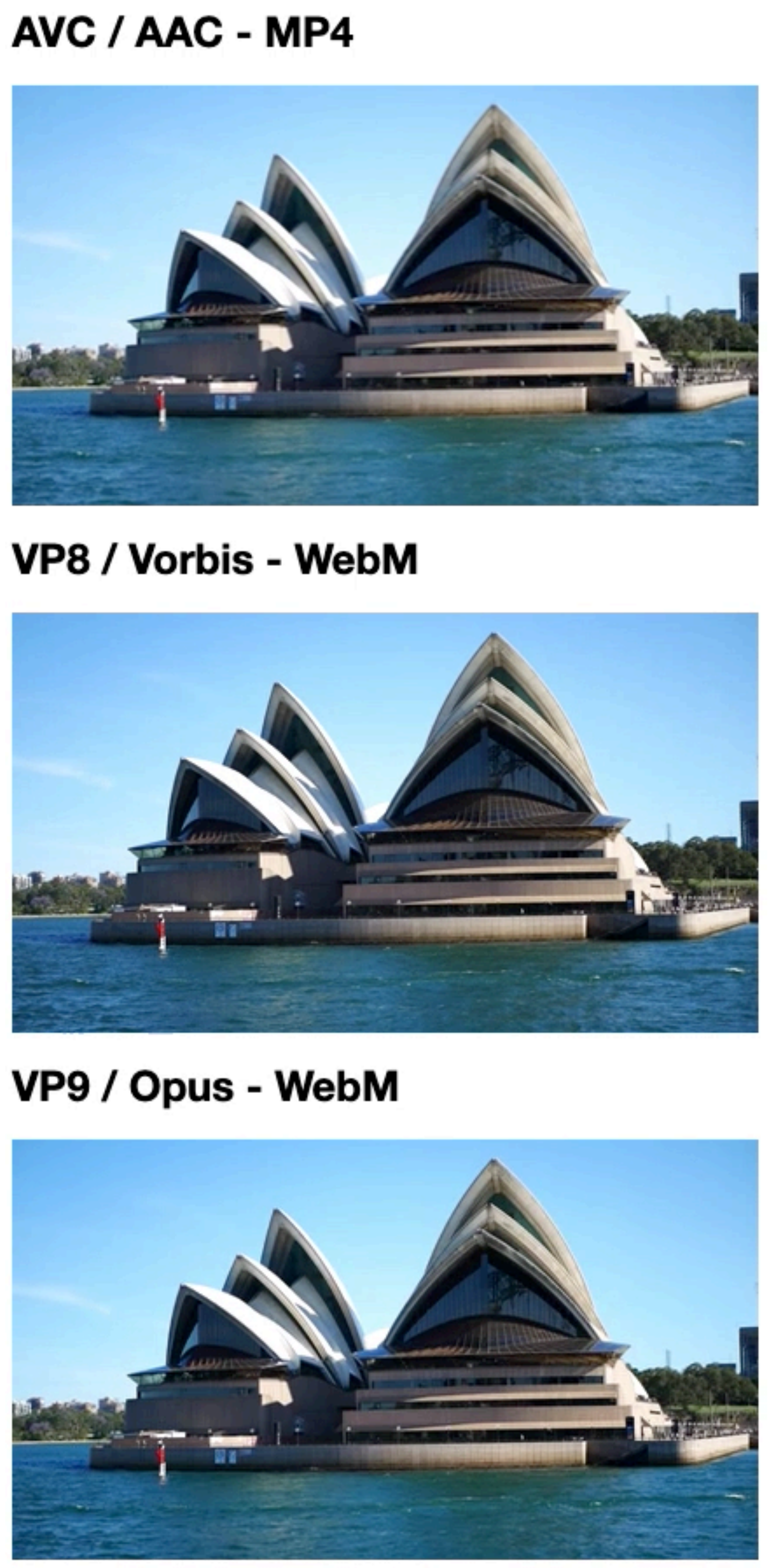
Patent Encumbered

- Video:
  - **H.264 (AVC)**
  - ~~H.265 (HEVC)~~
  - ~~VVC~~
- Audio:
  - **AAC**
  - ~~AC3~~
  - ~~eAC3~~

Let’s test those codecs!

(on evergreen browsers)

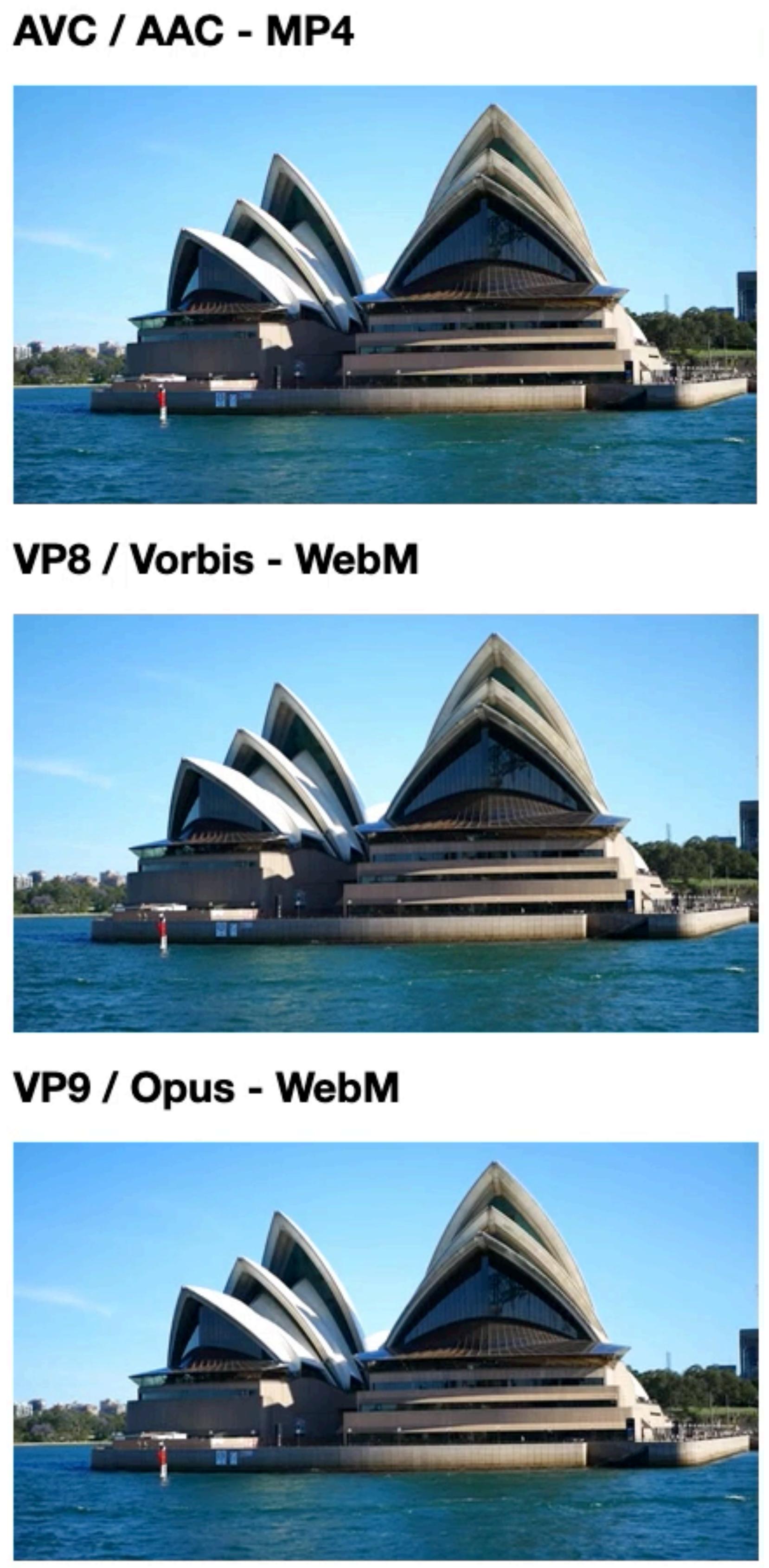
Demo: Desktop browser codec support



AVC / AAC - MP4

VP8 / Vorbis - WebM

VP9 / Opus - WebM



AVC / AAC - MP4

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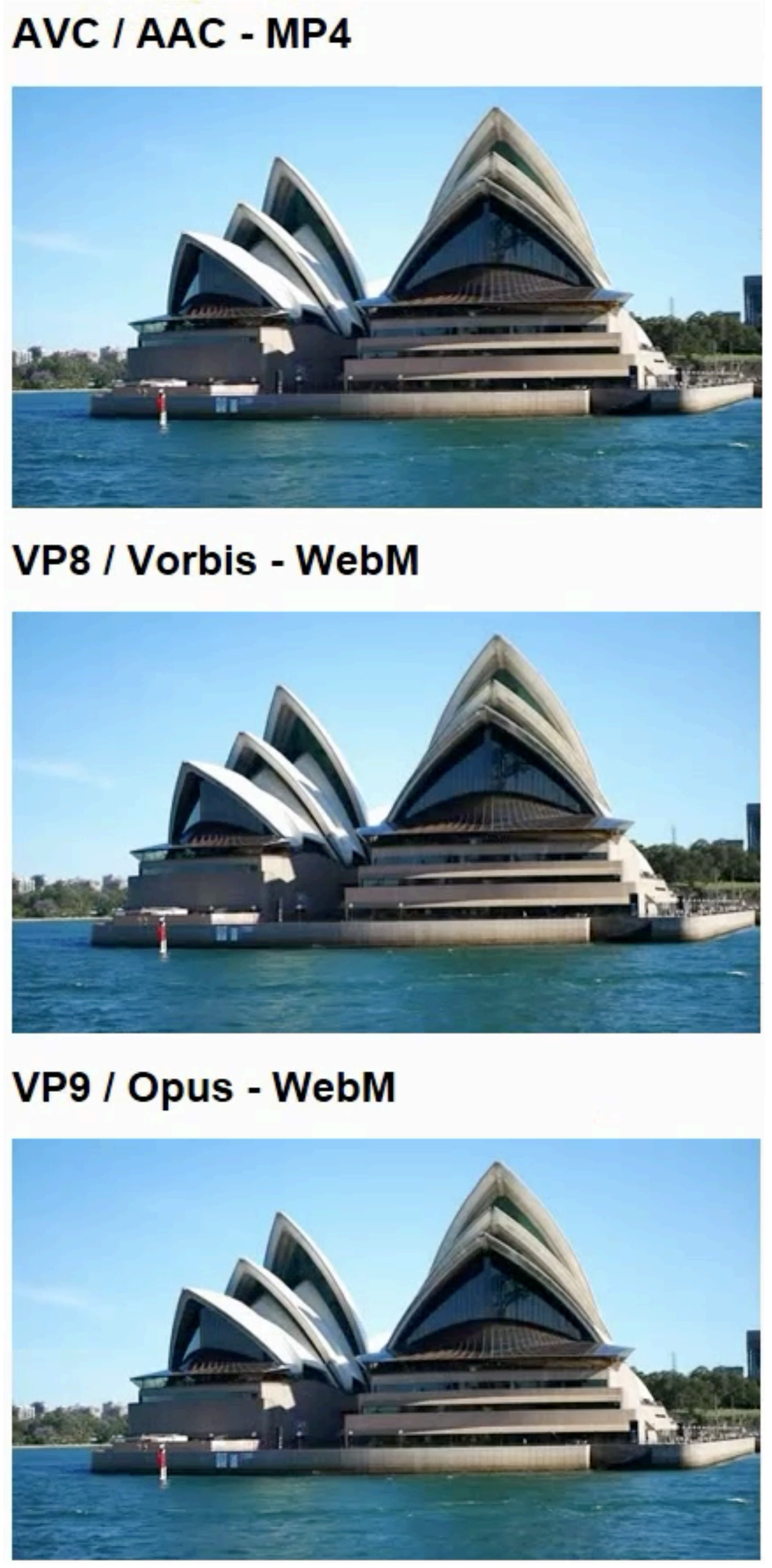

AVC / AAC - MP4

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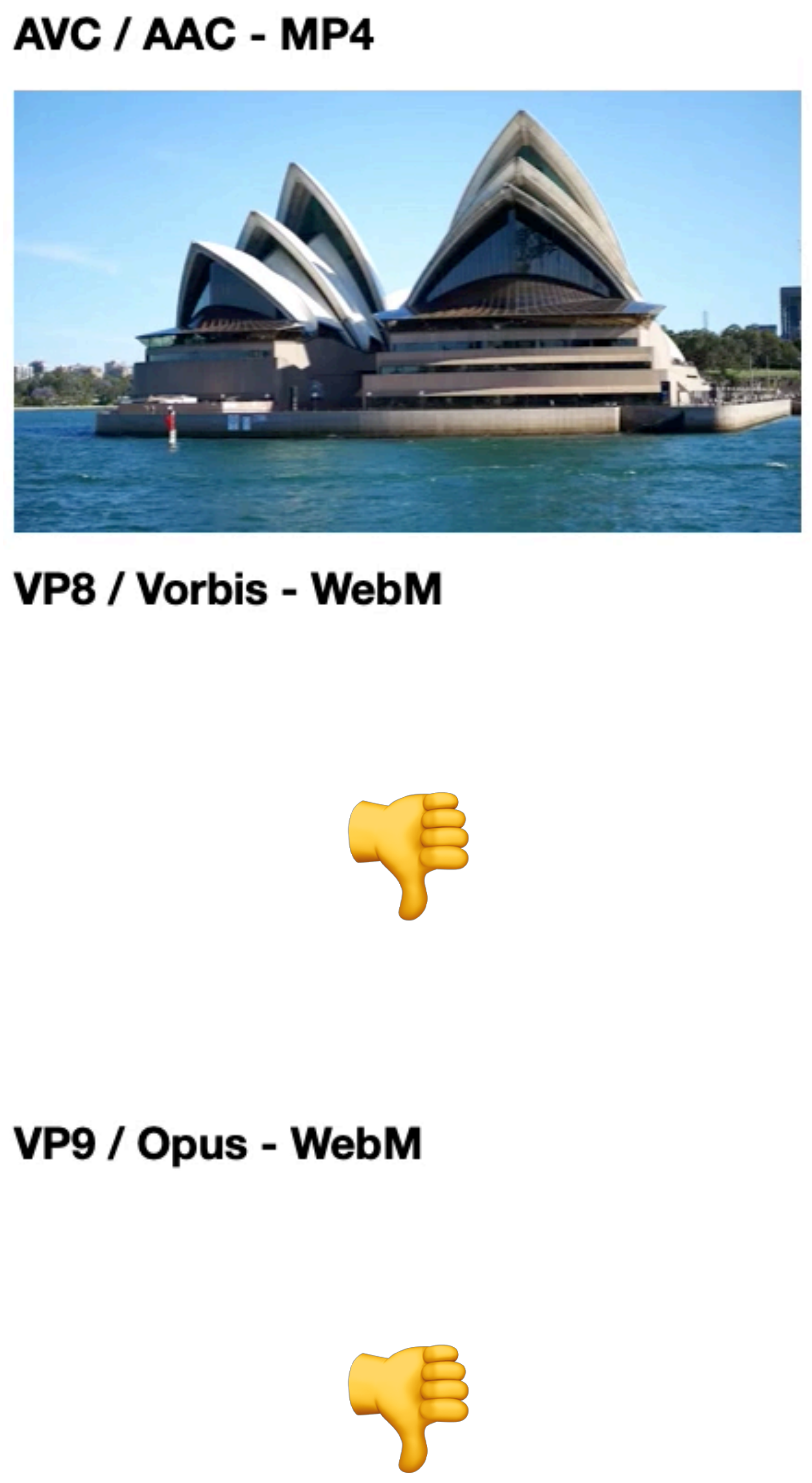


AVC / AAC - MP4

VP8 / Vorbis - WebM

👎

VP9 / Opus - WebM

👎

Desktop 😀

- Coverage Stats
  - ✅ Chrome: 71%
  - ✅ Firefox: 10%
  - ❌ Safari: 5%
  - ✅ Edge: 4%

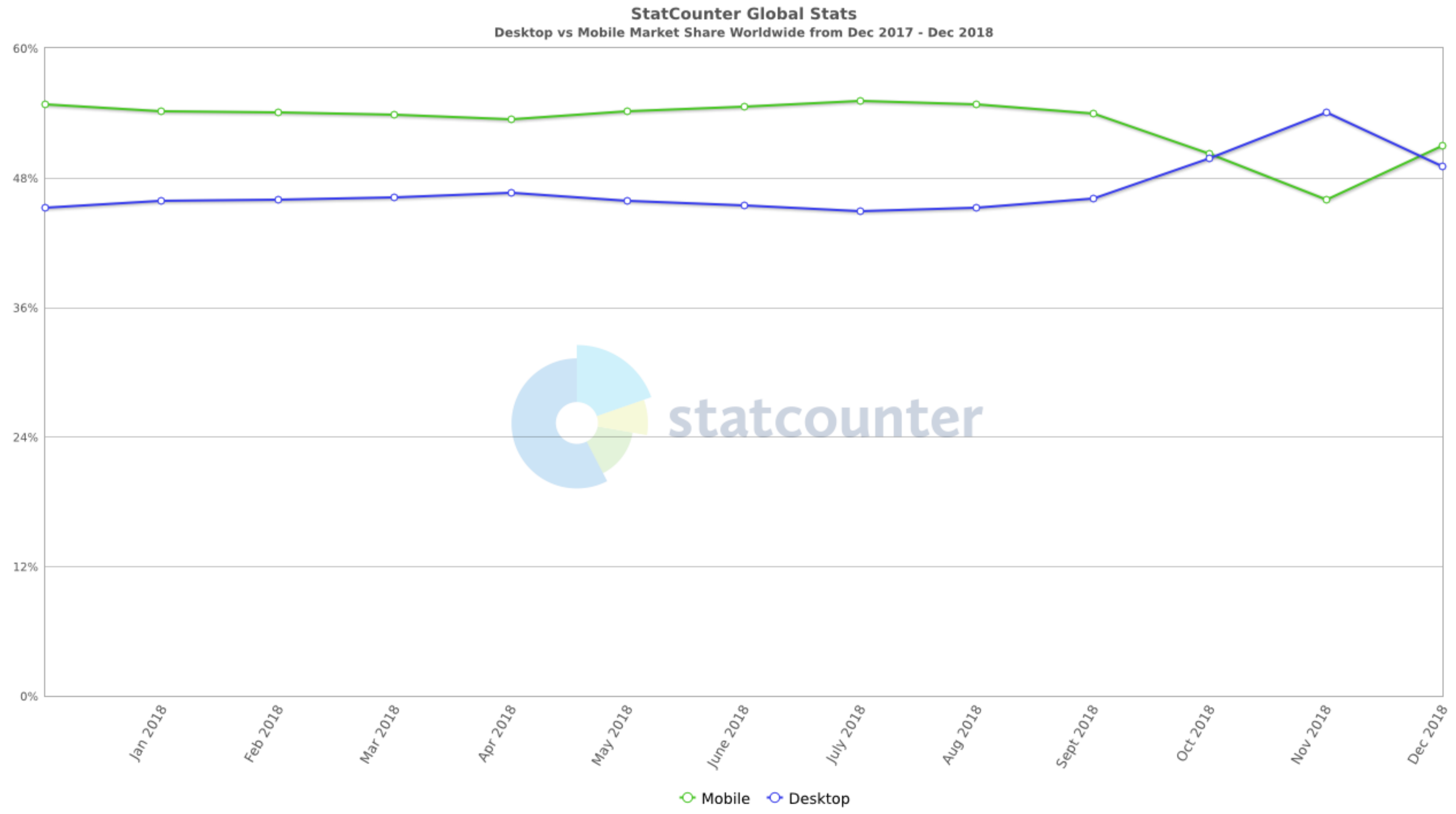
- ~ **85%** coverage on Desktop
  - Approximate AVC + AAC in MP4 coverage: >95%

- Problems: Safari: 5%, Internet Explorer: 5%

Stats: Statcounter Global, Dec 2018.

But…

49% of Web traffic is Mobile



StatCounter Global Stats

Desktop vs Mobile Market Share Worldwide from Dec 2017 - Dec 2018

Stats: Statcounter Global, Dec 2018.

Demo: Mobile browser codec support

iOS

AVC / AAC - MP4

VP8 / Vorbis - WebM

👎

VP9 / Opus - WebM

👎

iOS

AVC / AAC - MP4

VP8 / Vorbis - WebM

👎

VP9 / Opus - WebM

👎

AVC / AAC - MP4

VP8 / Vorbis - WebM

VP9 / Opus - WebM

Mobile 😞

- Coverage Stats
  - ✅ Android Chrome: 41%
  - ❌ iOS Chrome: 14%
  - ❌ iOS Safari: 23%
- ~ **41%** coverage on Mobile
  - Approximate AVC + AAC in MP4 coverage: >90%
- Problems: iOS: 37%

Stats: Statcounter Global, Dec 2018.

Workarounds?

- Various polyfills are available
- Polyfills can render unsupported codecs in browsers by using a combination of Canvas and WebAudio
- OGV.js is a great example
- Drawbacks?
  - CPU heavy, non-native experience, no MSE/sourcebuffer support

Demo: OGV.js

OGV.js - VP8 / Vorbis - WebM

OGV.js - VP9 / Opus - WebM

iOS

OGV.js - VP8 / Vorbis - WebM

OGV.js - VP9 / Opus - WebM

iOS

OGV.js - VP8 / Vorbis - WebM

OGV.js - VP9 / Opus - WebM

“Since August 2015, OGV.js can be seen in action on Wikipedia and Wikimedia Commons in Safari and IE/Edge where native Ogg and WebM playback is not available.”

OGV.js README.md

Containers

Containers

Codecs and Containers commonly come as pairs.

Libre

- Matroska / WebM
  - VP8 / VP9 / AV1 / Opus / Vorbis

Patent Encumbered

- MPEG MP4 / ISOBMFF
  - H.264 / H.265 / AAC / AC3 / VP9*
- MPEG Transport Stream

* Netflix have a spec for this, not used widely

Delivery Technologies

Delivery Technologies

- What’s wrong with a progressive WebM?
- Viewer’s bandwidth is changing all the time
- We could just progressively stream one file, but some users would encounter buffering, and some users would sacrifice quality
- Known as “Adaptive Bitrate” or ABR
- Encode at multiple bitrates and resolutions, segment the output files, and switch between renditions based on available bandwidth

Adaptive Bitrate Technologies

HTTP Live Streaming (HLS)

- M3U8 manifest file
- Separate “Master” and “Rendition” manifests

Dynamic Adaptive Streaming over HTTP (DASH)

- XML manifest file
- Single manifest file for everything

Common ABR Technologies

Libre

Patent Encumbered

- MPEG DASH
  - An XML file with a patent pool...

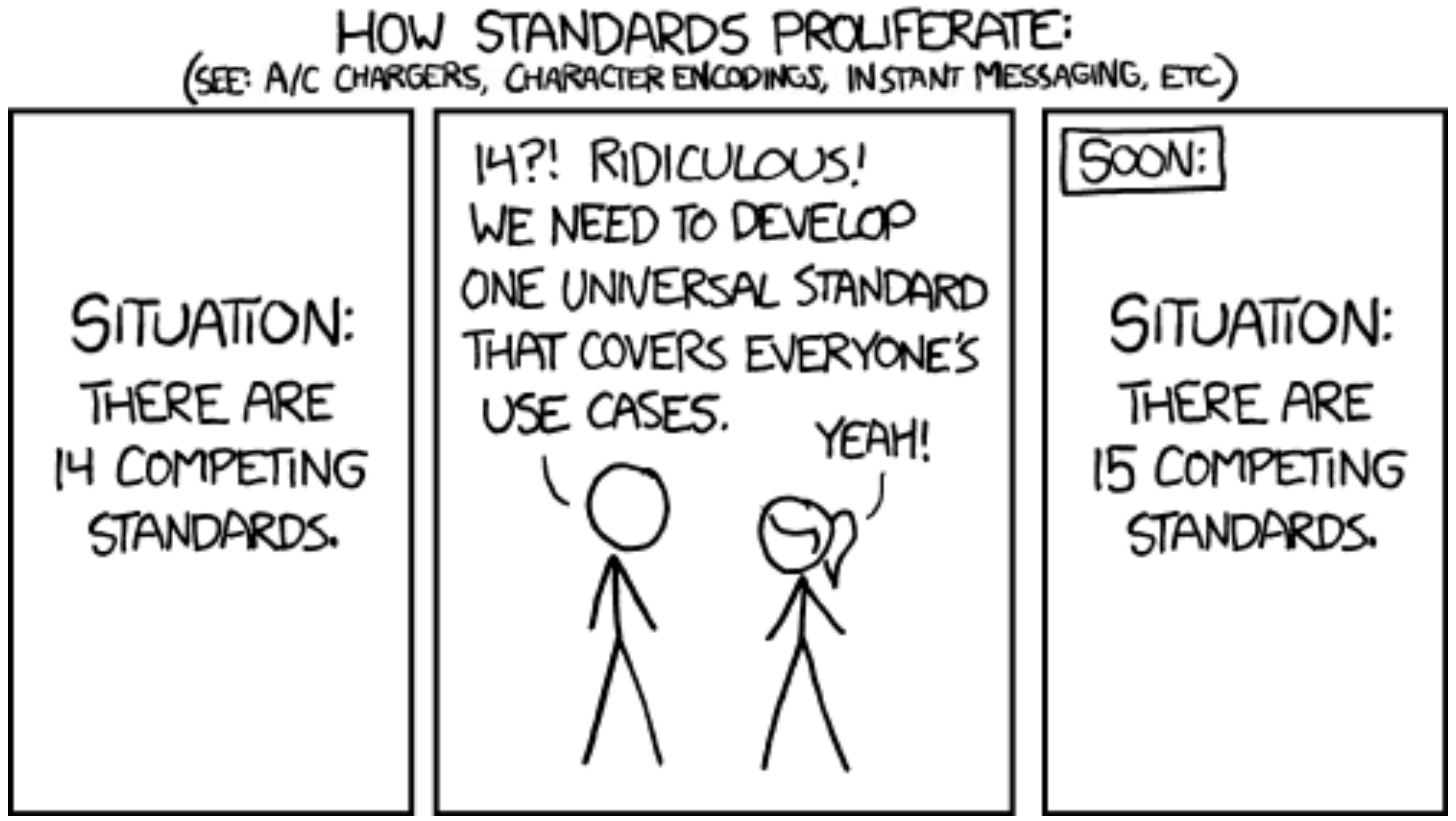
???

- Apple HLS
  - Also ITEF RFC 8216

Ah…

We don’t have a libre ABR technology…

Solutions?


HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)
SITUATION: THERE ARE 14 COMPETING STANDARDS.
14?! RIDICULOUS! WE NEED TO DEVELOP ONE UNIVERSAL STANDARD THAT COVERS EVERYONE'S USE CASES.
YEAH!
SOON:
SITUATION: THERE ARE 15 COMPETING STANDARDS.

- Create an open ABR standard?
  - Moving Picture Amateurs Group Simple Adaptive Streaming over HTTP
  - MPAG-SASH https://github.com/sfvideo/sash
  - Simple, JSON, Browser friendly

- Use HLS?
  - While not an open standard, there's no patents for it, and there's an ITEF snapshot…
  - HLS with WebM, VP8/9, Opus/Vorbis isn't supported anywhere, and is unlikely to be added to the specification

But...

ABR needs Player Support

and...

Polyfills need sourcebuffer like APIs

Speaking of...

Players

Open source player components

- Video.JS
  - Comprehensive open source Player framework
  - Has DASH and HLS support built in
  - Would be feasible to add plugins with SASH support, or WebM in HLS support
  - Has a OGV.js integration
  - Apache 2 License

- Hls.js
  - Adds HLS Playback to the HTML video element on browsers that don’t support it natively
  - Could be extended to support WebM + HLS
  - Apache 2 License

Libre delivery chain proposal

Today:

- VP9 / Vorbis in WebM
- Video JS with OGV.JS polyfill
- Coverage: ~90% Desktop, ~80% Mobile

Next:

- ABR - HLS manifests or develop something new
- Polyfills with ABR capabilities

Does AV1 help?

- Maybe! (Hopefully!)
- Chrome, Firefox already support AV1 🎉
- Apple & Microsoft joined AOM
  - Microsoft have a beta AV1 decoder in the app store which works in Edge
  - Apple also just announced they're removing VP8/9 support from Quicktime…
  - Apple would need an ABR solution if they push AV1 support
  - Apple: AV1 in fMP4 with HLS?

Code

- Codec Test & OGV.js Test
  - Code: https://github.com/GeneticGenesis/codec-tests
  - Hosted: https://geneticgenesis.github.io/codec-tests
- MPAG SASH proposal
  - Code: https://github.com/sfvideo/sash
- Players playground
  - Code: https://github.com/GeneticGenesis/phils-players
  - Hosted: http://philcluff.co.uk/players

Community - Video Dev Slack

https://video-dev.org

2,200 video engineers in one place

#libre for chat about this talk

#mpag-sash for libre ABR debate

Community - DEMUXED

https://demuxed.com

Community of video engineers

2 day conference in San Francisco in October

500+ video engineers in one place

Also a Podcast!