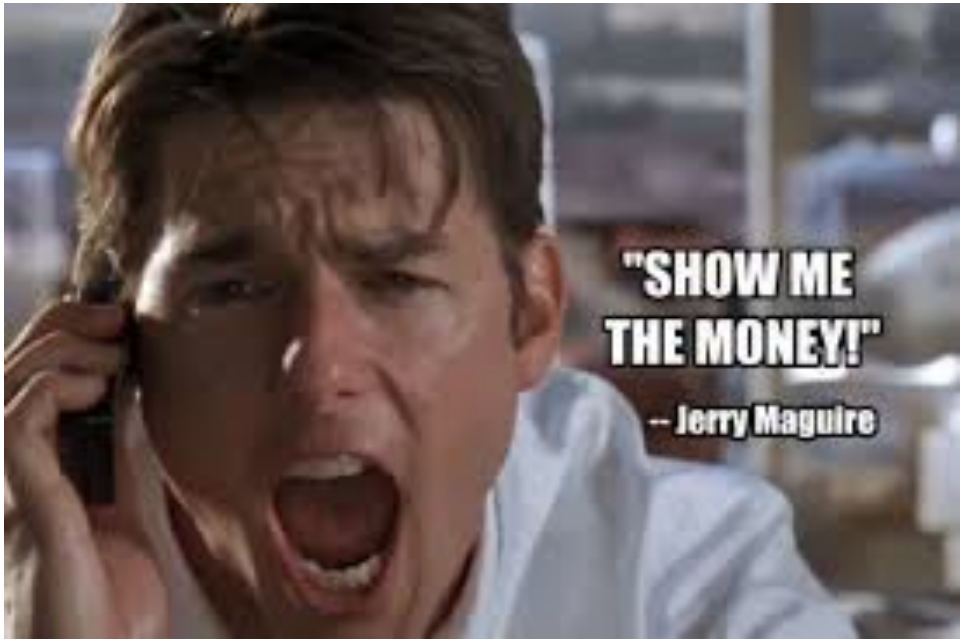
AV1

High Quality, Secure, Scalable WebRTC

Dr Alex, Dr Ludo, CoSMo Software

Show me the Money !

The AV1 hardcore tech. pres. will be tomorrow same time ;-)



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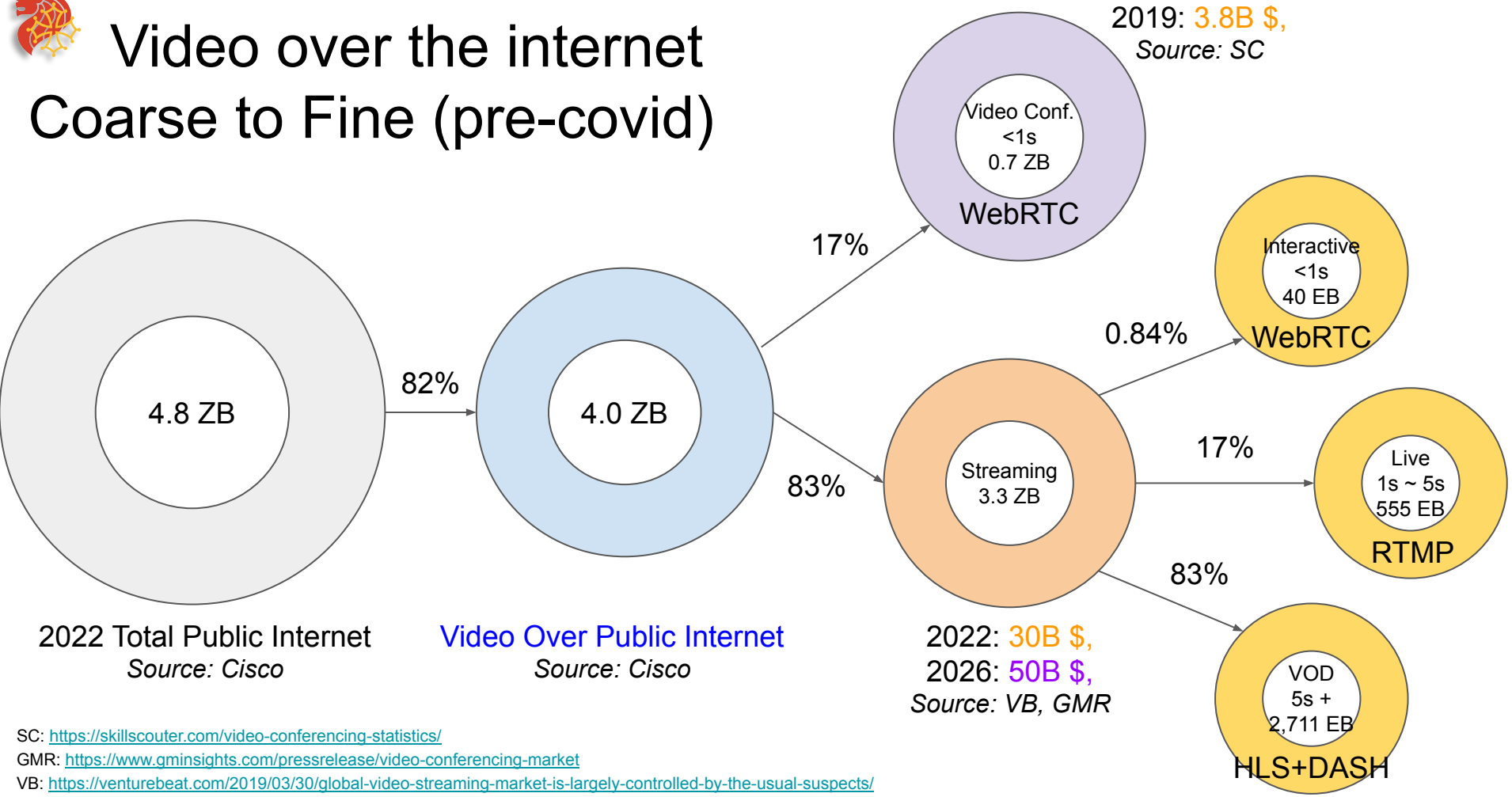
Video over the internet Coarse to Fine (pre-covid)



SC: https://skillscouter.com/video-conferencing-statistics/
GMR: https://www.gminsights.com/pressrelease/video-conferencing-market
VB: https://venturebeat.com/2019/03/30/global-video-streaming-market-is-largely-controlled-by-the-usual-suspects/

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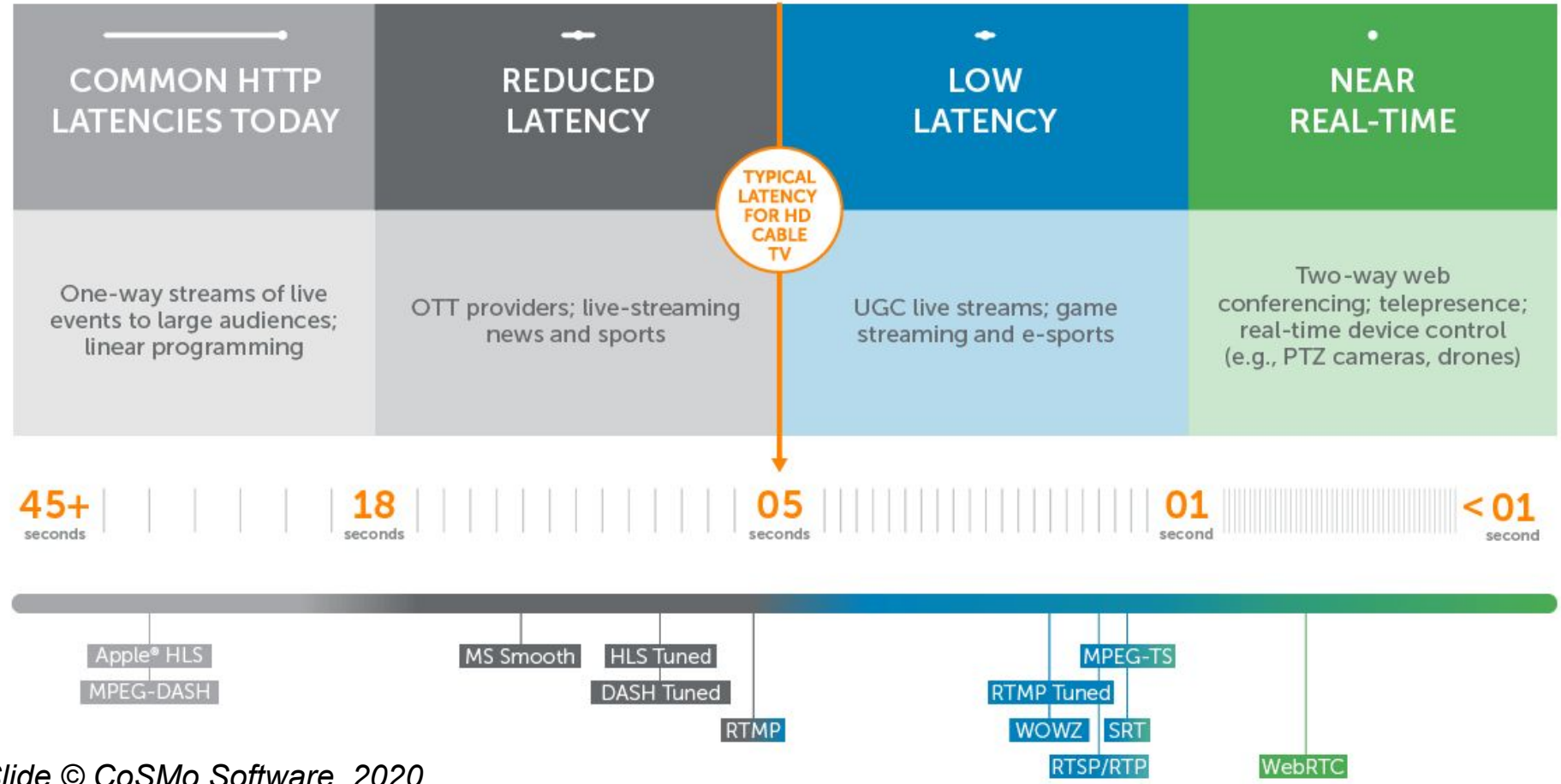
How The Streaming Industry used to see it



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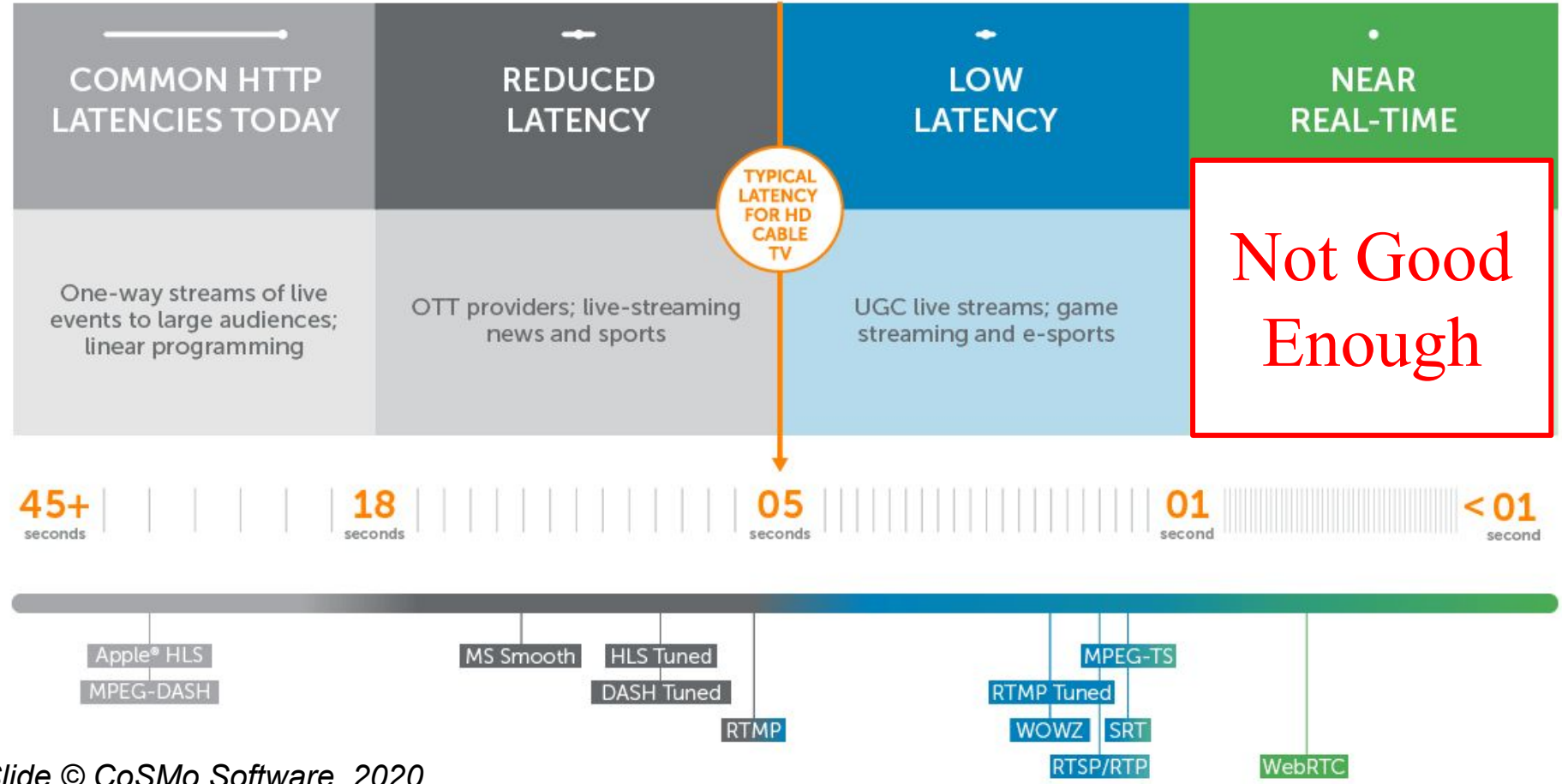
How The Streaming Industry used to see it



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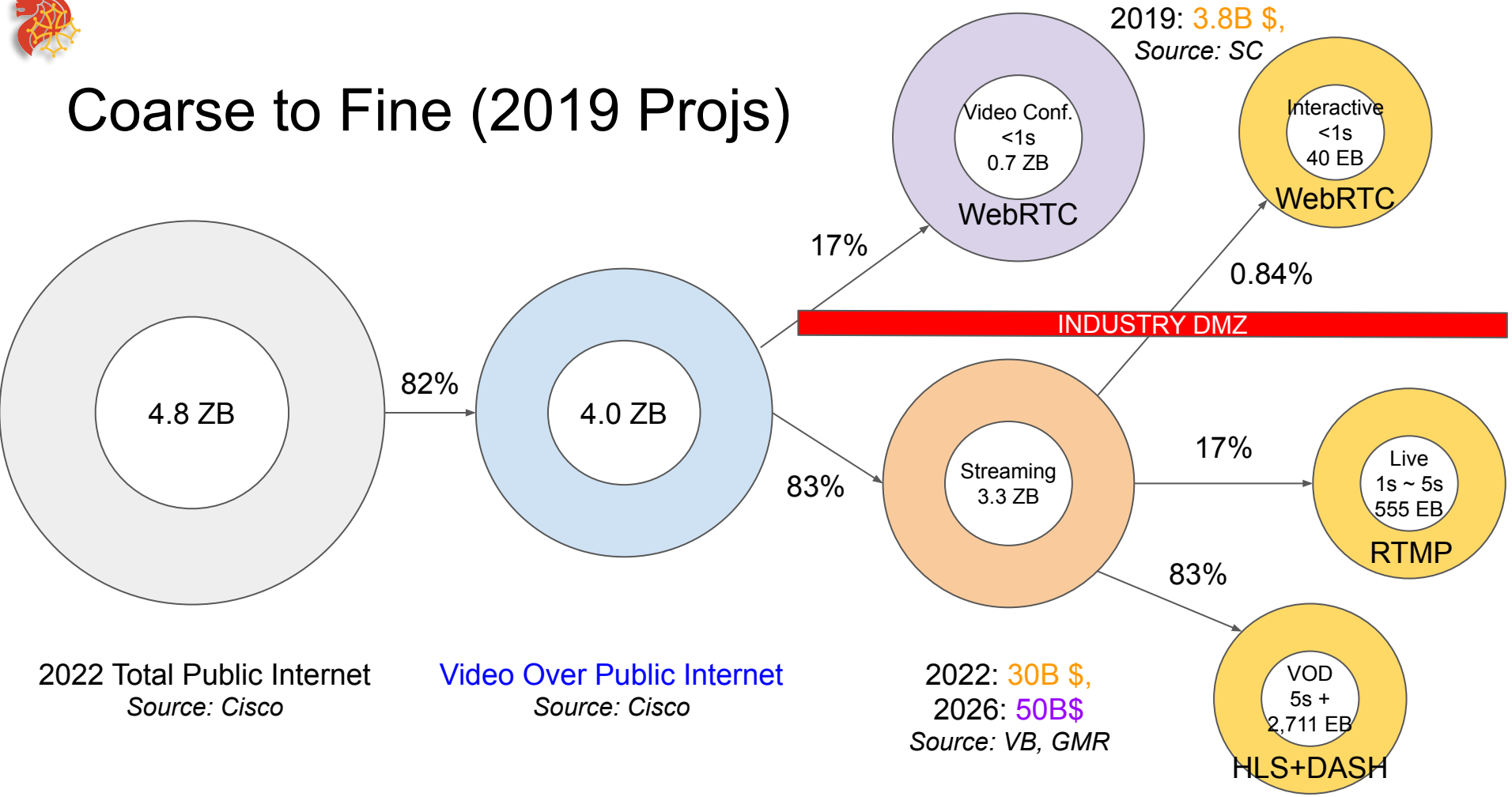
Coarse to Fine (2019 Projs)



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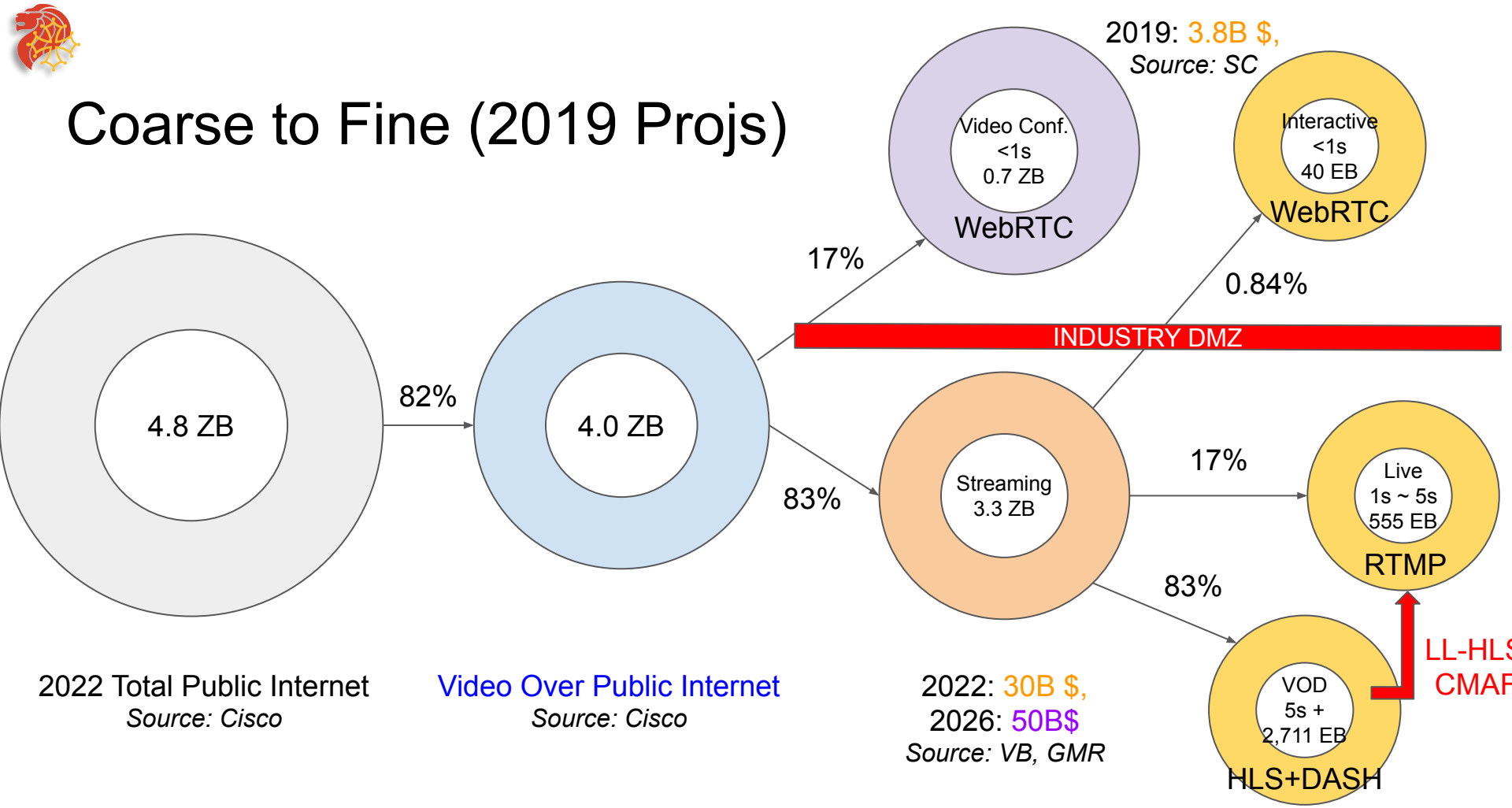
Coarse to Fine (2019 Projs)



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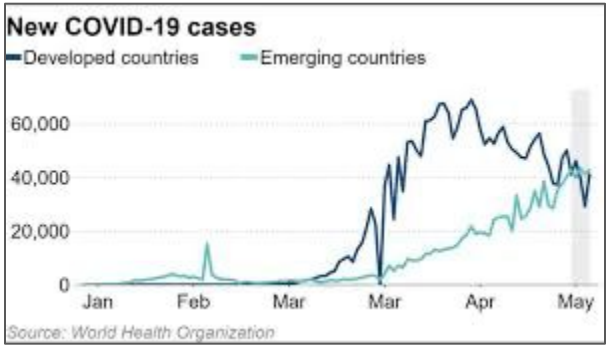
Then, S….. (*) happened.



(*) Something

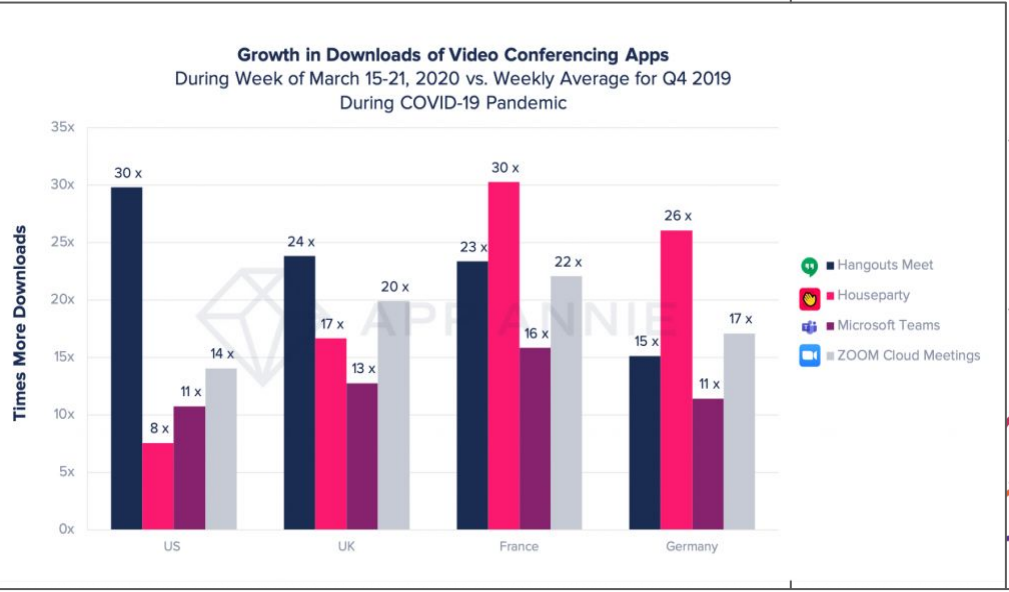
Slide © CoSMo Software, 2020

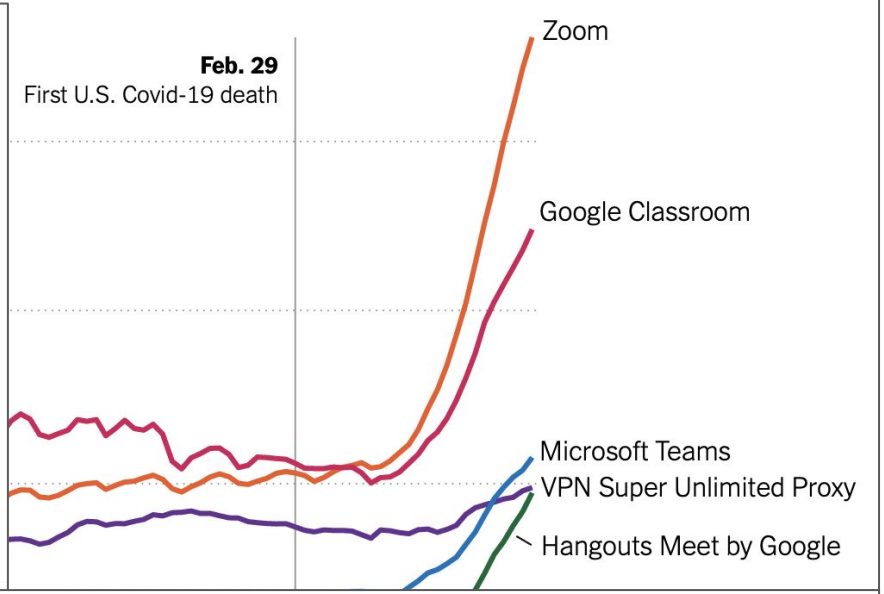
The new normal:

Work ...

We have suddenly become reliant on services that allow us to work and learn from home

Daily app sessions for popular remote work apps



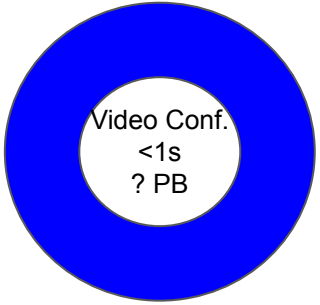


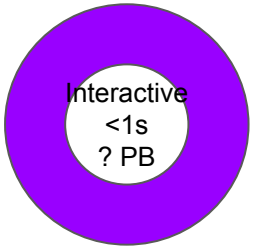
Netflix more than doubled its subscriber growth expectation for Q1

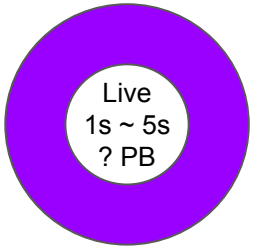
The new normal:

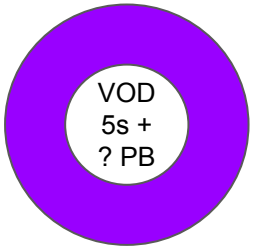
Work … from Home

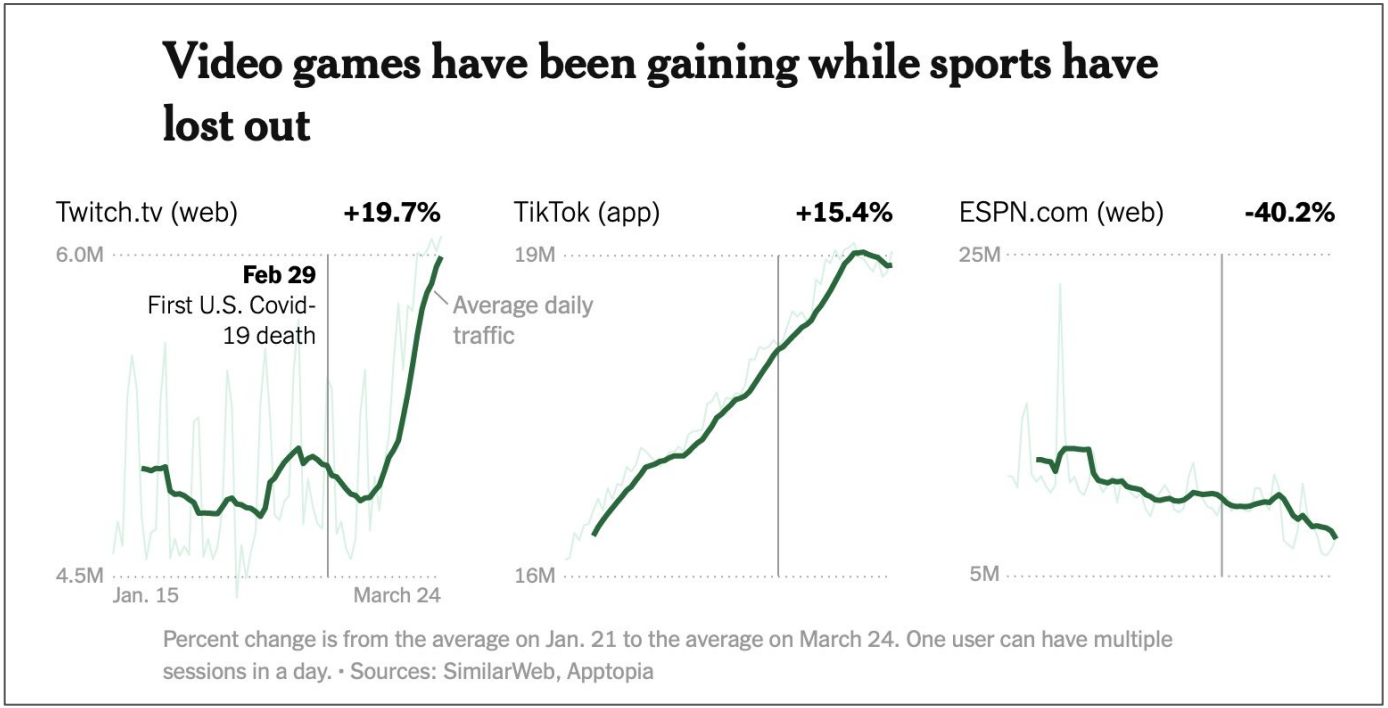
Value now comes from **Interactions**











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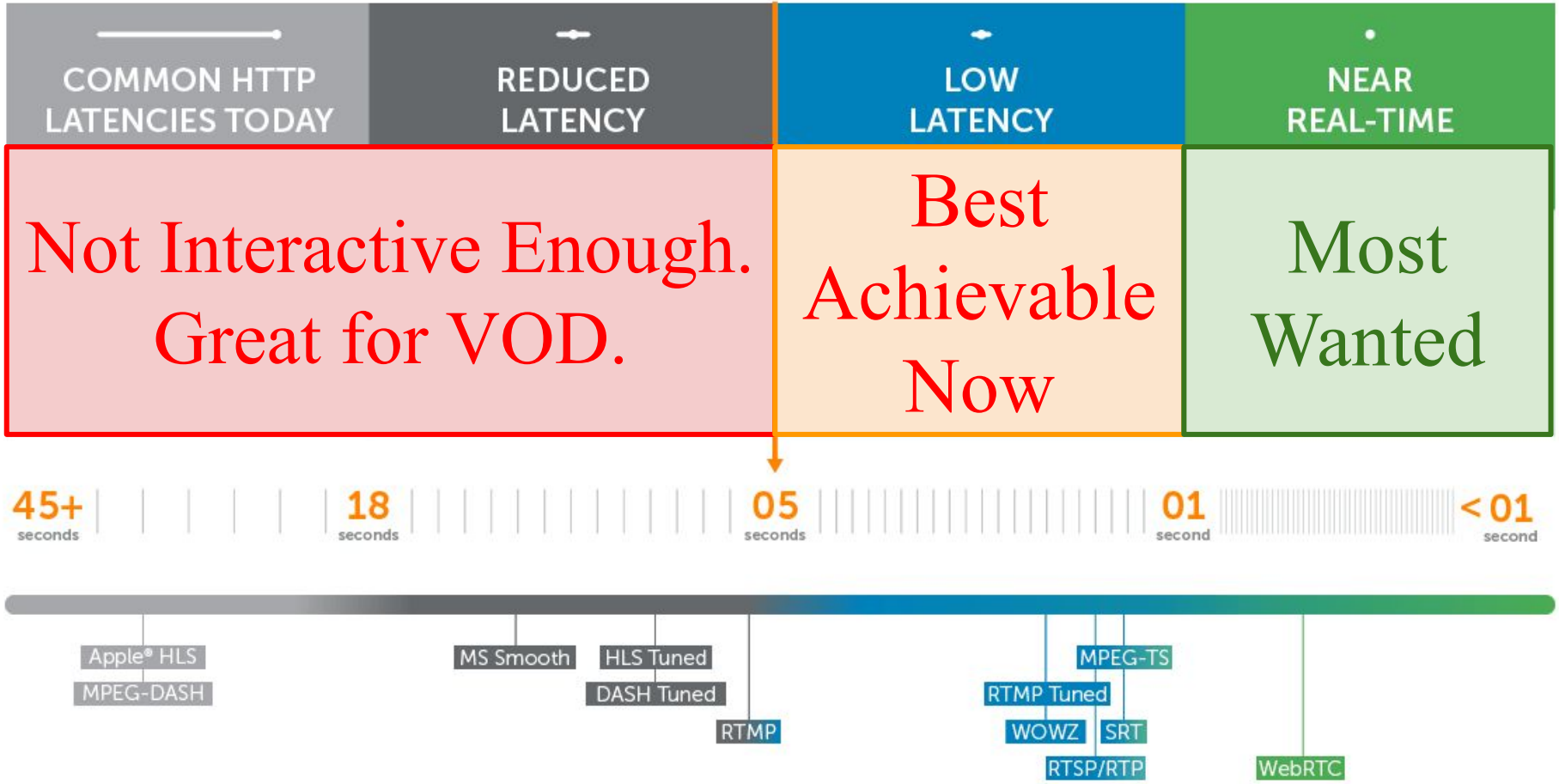
the industry perception changed radically!



Radical changes
Also show in pools

Bitmoving, no horse in the race.

TNN Challenge #1: Bandwidth costs

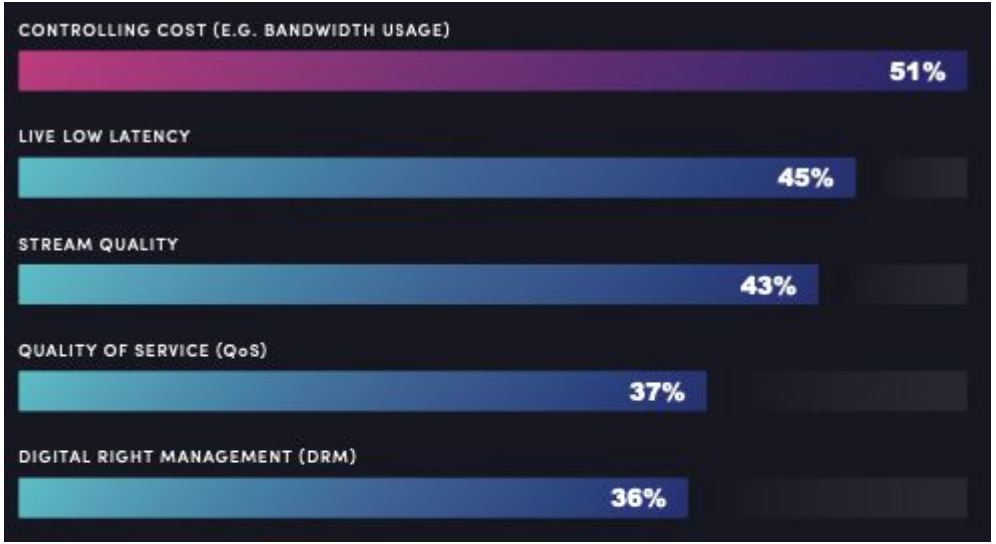
Need better codecs =>

Need real time protocol =>

Need better codec =>

Need resilience & Adapt =>

Need End-To-End Encryp. =>

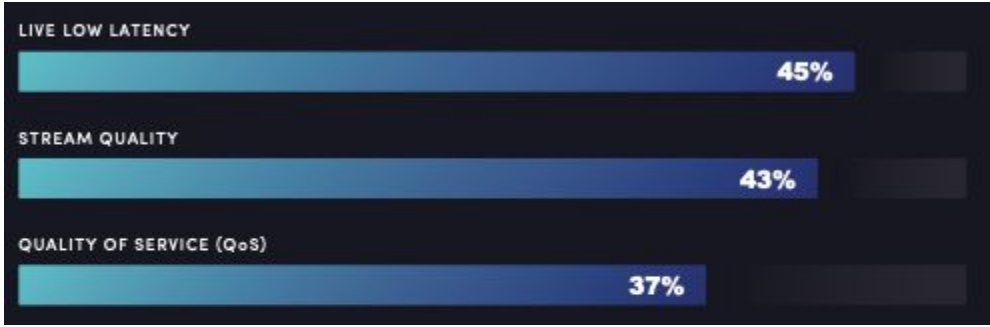


Biggest Challenges in 2020,
Shared problem for all media types: VOD, Live …

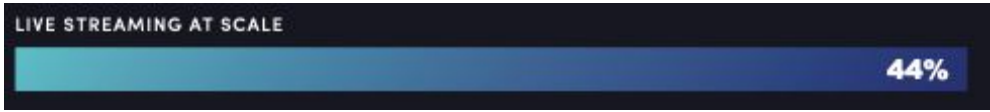
TNN Challenge #2:
Interactions and Engagements

The Streaming industry rediscovers the challenges of

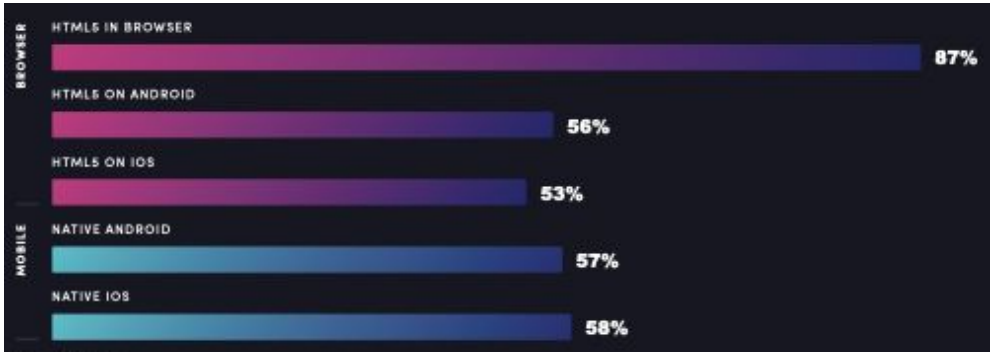
- live streaming,
- at scale,
- delivered to a browser.
- public internet quality issues



Biggest Challenges in 2020



Needed Innovation 2020

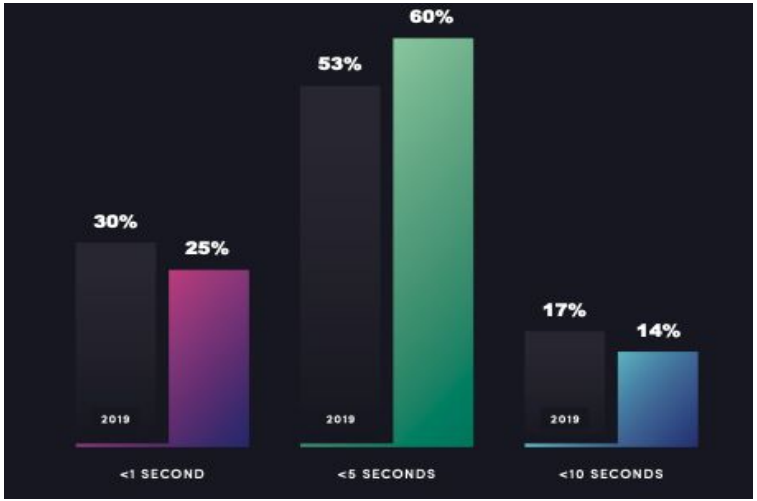


Most popular Devices and OSes 2020

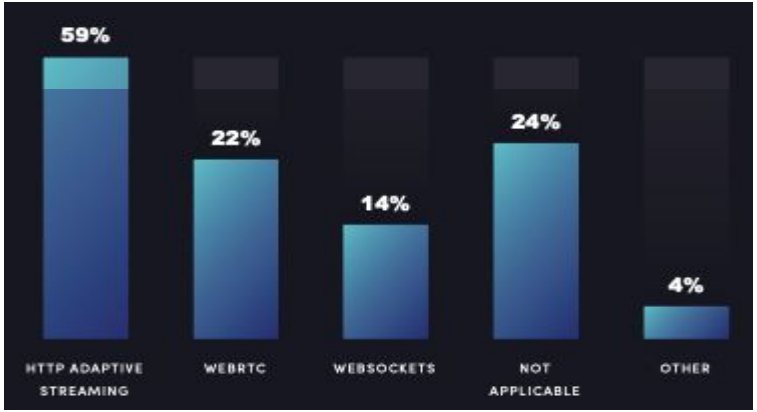
TNN Live & Real Time

Live streaming, delivered to a browser, that screams WebRTC to me … The industry agrees.

We're left with "***at scale***" and managing the "***public internet quality***" ...



Latency Expectation for "Live" 2020



Protocols distribution for "Live"

The tech part starts here, brace yourself.

Webrtc at (broadcasting) scale

Solved Problem in the Lab

SOLEIL: Streaming of Large-Scale Events Over Internet Clouds

July 2018

DOI: 10.1109/COBCOM.2018.8443989

Conference: 2018 International Conference on Broadband Communications for Next Generation Networks and Multimedia Applications (CoBCom)

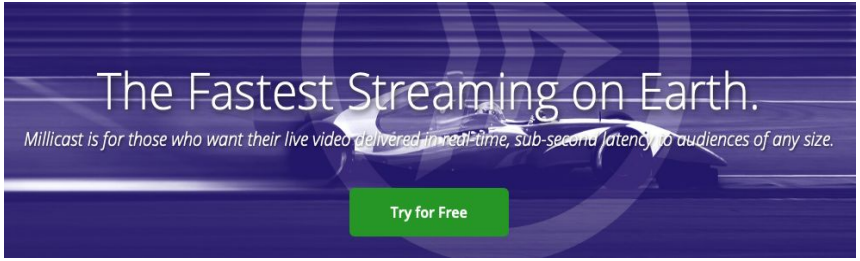
Authors:

A. Amirante **T. Castaldi**

Lorenzo Miniero
11.21 · University of Naples Federico II

Simon Pietro Romano
26.66 · University of Naples Federico II

Solved Problem in the Field



millicast

Scale

Global infrastructure, intelligent scaling, load tested with KITE

Slide © CoSMo Software, 2020

Public Internet Quality: Resilience and Adaptation

1. WebRTC Adaptation: Client Side ABR
   a. Simulcast or SVC codecs,
   b. Halves latency,
   c. End-to-end encryption ready

2. WebRTC Resilience (coming from RTP decades of innovation)
   a. BWE
      => enables CC
   b. NACK (4585)
      => enables error management FEC / RED / RTX
   c. with SVC Codecs
      => Makes resilience easier and better (more efficient RTX)
      => Faster adaptability

Slide © CoSMo Software, 2020

SVC Codecs => “Quality” and QoS

- SVC versions of codecs exists since H264.
- Not all encoders support them because it’s optional
  - In turn application do not support them to be usable by most
- AV1 is the first codec with SVC by default !
  - All encoders, hardware or software MUST support it
  - No reason not to leverage it.
- AV1 has a specific mode for Screen sharing! (Ask B. A. for details)
- AV1 RTP Payload format and annex
  - Specifically tailored for RT
  - Optimized to be used in an SFU / webrtc based environment
  - End-to-end encryption capable by default.

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Default AV1 : checking all the tech boxes

Need better codecs => AV1 (4K native, better compression, HDR10 …)

Need real time protocol => RTP Payload => WebRTC

Need resilience & Adapt => AV1 SVC

Need End-To-End Encryp. => SFrame

Slide © CoSMo Software, 2020

Nice tech, but practically …. ?

- **January 2018**, Apple joins AOMedia.
- **March 2018**, AOMedia announced the release of AV1
- By **September 2018**, chrome 70 and Firefox nightly had added support, as did netflix and youtube.
- **October 2018**, CoSMo Software announced the first AV1 integration in RTP and WebRTC.
- **December 2018**, AOMedia Sponsored dav1d encoder has been released, included e.g. in Firefox 67.
- **January 2019**, CoSMo Software joins AOMedia.
- **March 2019**, Samsung joins AOMedia.
- **April, 2019**, INTEL & NETFLIX, announced their collab. around the SVT-AV1 open-source codec.
- **April 2019**, Allegro DVT announced its AL-E210 multi-format video encoder hardware IP.
- **May 2019**, Realtek announced the RTD2893, its first IC with AV1 decoding, up to 8K.
- **June 2019**, Cisco makes a public demo of the first Real-Time AV1 integration in RTP and WebRTC.
- **July 2019**, CoSMo releases a demo of Real-Time AV1 integration in RTP and WebRTC.

…

Slide © CoSMo Software, 2020

Nice tech, but practically …. ?

- **Jan 2020, @CES,** Samsung was one of several manufacturers that announced full hardware support for AV1 at CES in select 2020 TVs and set-top boxes. Consumers will be able to enjoy AV1 encoded videos in resolutions up to 8K on Samsung QLED 8K TVs. Samsung is working with partners like YouTube to stream AV1 8K content through the native app.
- **Feb 2020**, Netflix announced streaming AV1 to its Android app, using 20% less bandwidth than VP9.
- And so on, and so forth,

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HW acceleration

AMD joins NVIDIA and Intel with enabling AV1 hardware acceleration on the Radeon RX 6000 series

The Radeon RX 6000 series will support the new AV1 hardware acceleration, Microsoft has confirmed. AMD joins NVIDIA and Intel in supporting the AV1 video codec, which promises to offer up to 50% better compression than H.264 and 20% better than VP9.

Alex Alderson, 10/13/2020 AMD Desktop Gaming

AMD will join NVIDIA and Intel by

Here are the components required to experience hardware accelerated AV1 video on Windows 10:

- One of these new GPUs or CPUs:
  - 11th Gen Intel Core processors with Intel Iris Xᵉ Graphics
  - NVIDIA GeForce RTX 30 Series GPUs
  - AMD Radeon™ RX 6000 Series Graphics (coming soon)
- Windows 10 build 1909 or later
- The AV1 Video Extension
- A web browser or other application with hardware acceleration support for AV1, including apps built on top of Media Foundation
- As is common with new features like this, you may need to update your graphics driver from time to time to get the latest features and improvements.

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I’m not going to let you win this argument

For most discussion, and for people that are looking for hard data and truths, the previous slides are usually enough.

Alas, once upon a time, I used to go on discuss-webrtc …… where discussions are not always about finding a solution or the truth.

*“Whatever you say, [webrtc and AV1] do not have **Hardware encoder**, so it’s doomed.”*

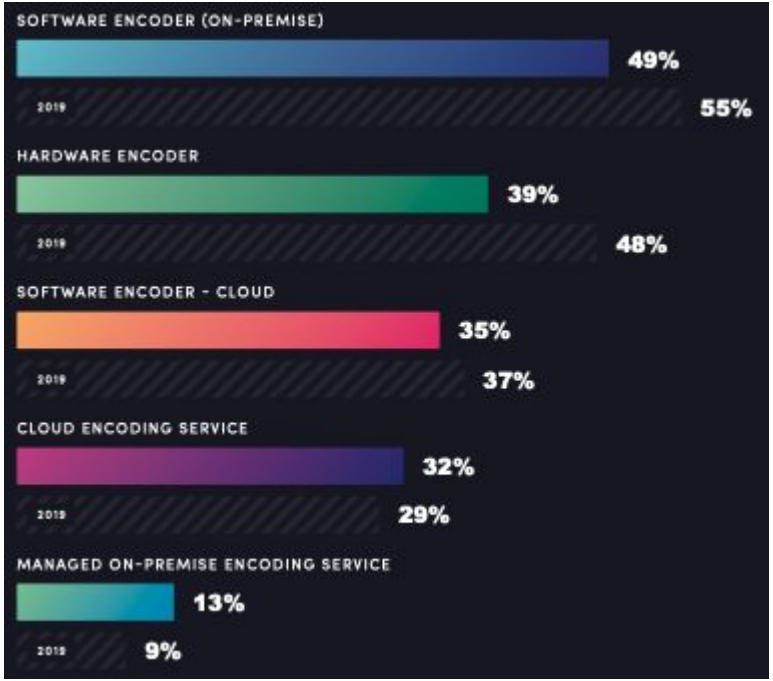
Slide © CoSMo Software, 2020

Hardware Encoders are a plus, not a blocker.

Less people will use software encoders in 2020 compared to 2019.

However, this is not because they moved to an hardware encoder, but because they moved to hosted encoders.

Proof is, on-premises HW encoder usage as also reduced this year by almost 10%.



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Hardware Encoders are a plus, but not a blocker.

The problem with Hardware encoder is that, to date, none of them are written for real-time encoding.

Most observers are focussed on the VOD use case, where the pre-recorded content all exists before any encoding happens, and can be access at disk I/O speed. Live streams are completely different as the encoder is now paced by the media capture itself.

The streaming platform war, just like game of throne, is over. Time for the new normal, time for real-time streaming.

Most codecs benchmark out there do not apply.

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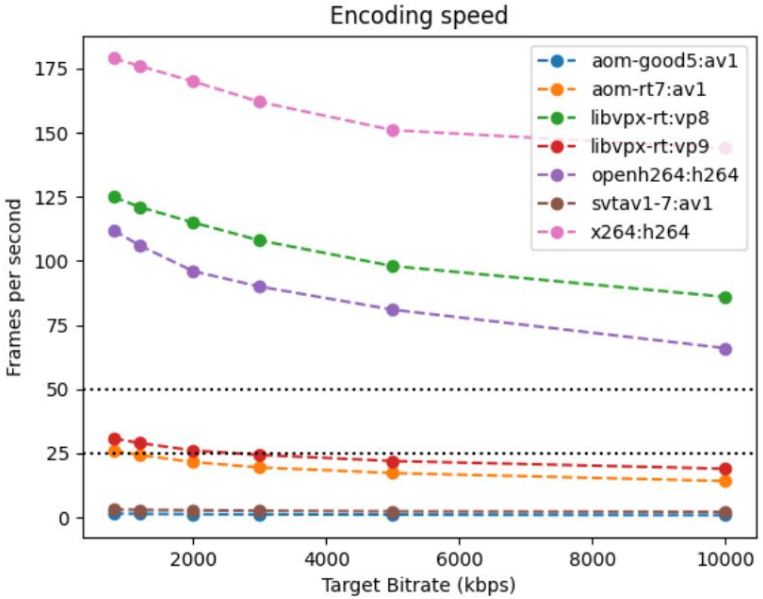
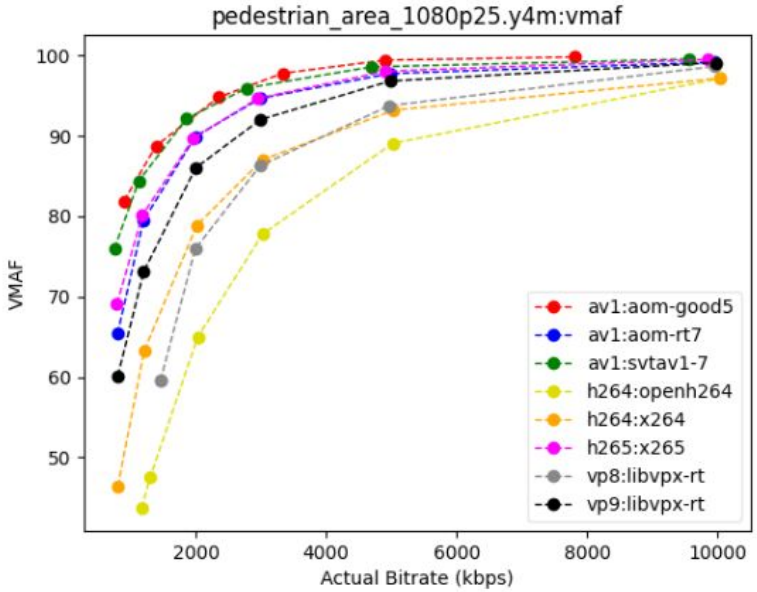
Comparison of Real-Time Software Encoders

Tomorrow, at this time, you will be able to hear about comparison of codecs in a real time environment, by Dr Ludo. How do they compare against each other, and how do they compare about their best quality, slow versions of themselves.





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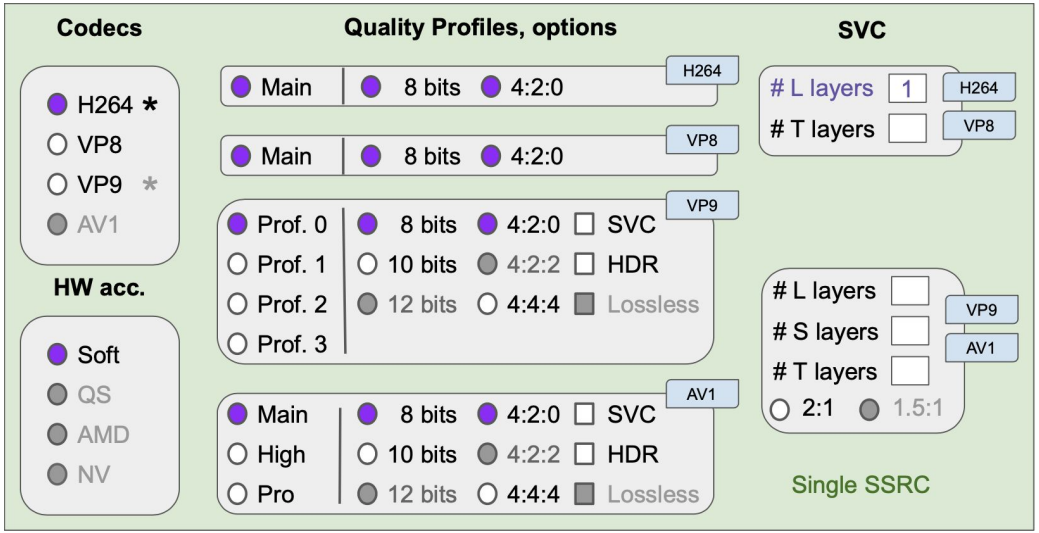
In 30mn you really only scratch the surface.

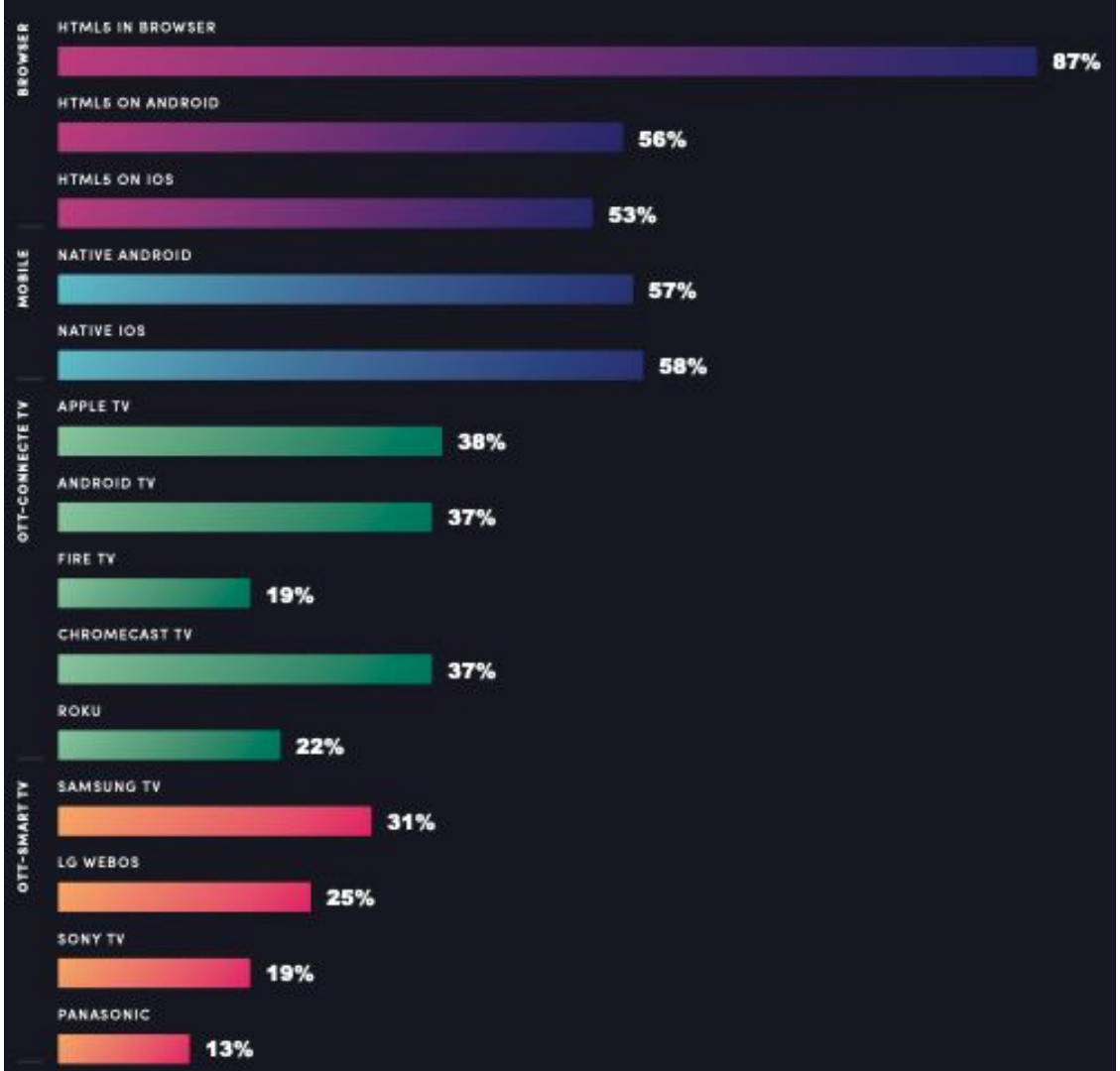
There are much more to say about codecs, video quality in webrtc.

This for example, is a screenshot of the Advanced Video Codec management panel of the Millicast studio native app. You can see the codecs, their bit depth, chroma sampling, and SVC options,
many things we have not touched here.



If you are interested, Contact me.

ANNEXES



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