

# Delivering premium live VR360

**Deep integration with CDN is only cost effective way if you need scalability**

Disclaimer: this presentation was written in  
November 2017 and has a short shelf life!

# Why it's important

VR is here to stay, in gaming at least

We're at top of the hype cycle, so you'll hear more and more slack, resist!

- No money yet, just another living room 3D, gloom, gloom , gloom, ...
- Users want a pro to point the camera, ...
- Current V360 quality (resolution) is still sub-par

but it's improving fast, a great UX is available in the labs, can be with users within a year or two

However much bandwidth it ends up needing (10-1000Mbps), live V360 will leverage the best networks

It will add something, be-it small or large, to your product portfolio and differentiation

Even if it stays on the sidelines, it will affect how we think of user experience, and may well influence content production

## What they're saying\*

*SKY Italia: "We've been setting up temporary VR demos at points of sales for two years now. The queues haven't diminished, Italians are still eager to try this"*

*Orange: "Even the most hardened journalists were in tears at this year's Cannes film festival after crossing the US border illegally from Mexico in a VR experience created by Birdman director [Alejandro G. Iñárritu](#)"*

*BBC: "VR is next step in mass market storytelling"*

*BT: "We're looking at ways to deliver higher resolution 360-degree video beyond 4K, which should enable additional features such as zoom"*

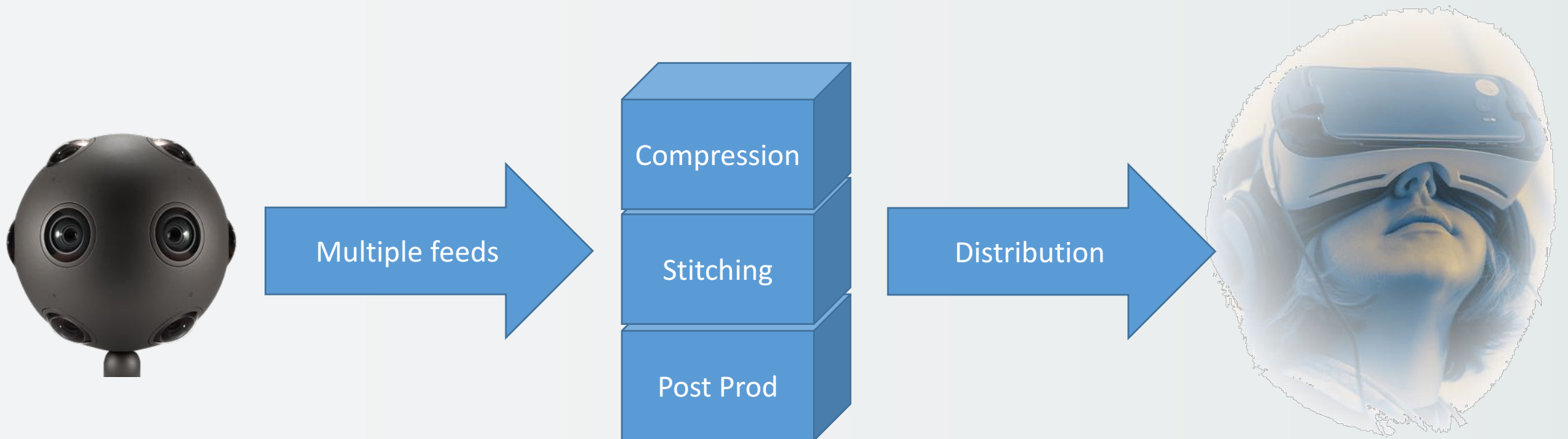
*PCCW: "VR360 gives users front row experiences for events they couldn't otherwise go to"*

# Key elements for a definition, VR, AR & live V360

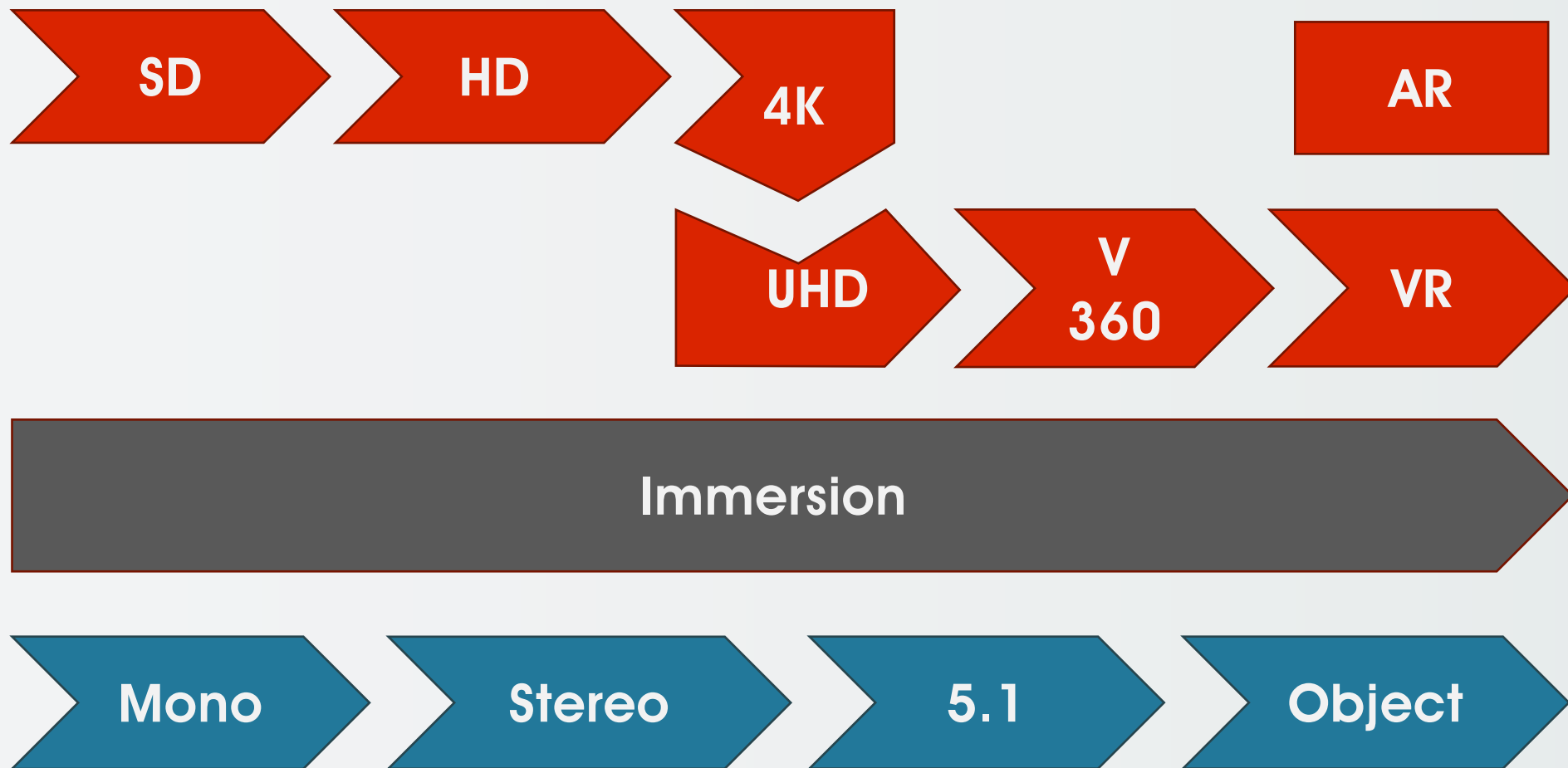
Video 360 is video presented in 360° requiring a head-mounted display for premium experiences.

Less immersive experience on 2D displays (mobile phone, TV), some operators are experimenting 180° video.

Motion to photon latency is the time taken between head movement and the image displayed being updated.



# Natural progression of video entertainment as it gets more immersive and more realistic



# Live VR360 delivery concepts

Today's most "premium" 360 requires 20-30Mbps with a brute-force approach (similar to UHD).

Yet delivered resolution today isn't enough

- Delivery up 2k per eye at any time is needed

With current HMD technology only 15 to 18% of whole video is ever consumed at one time.

- So a brute force approach would require over 150 Mbps to deliver that 2k per eye.
- Quality improvements would be noticeable up to 4 times that!

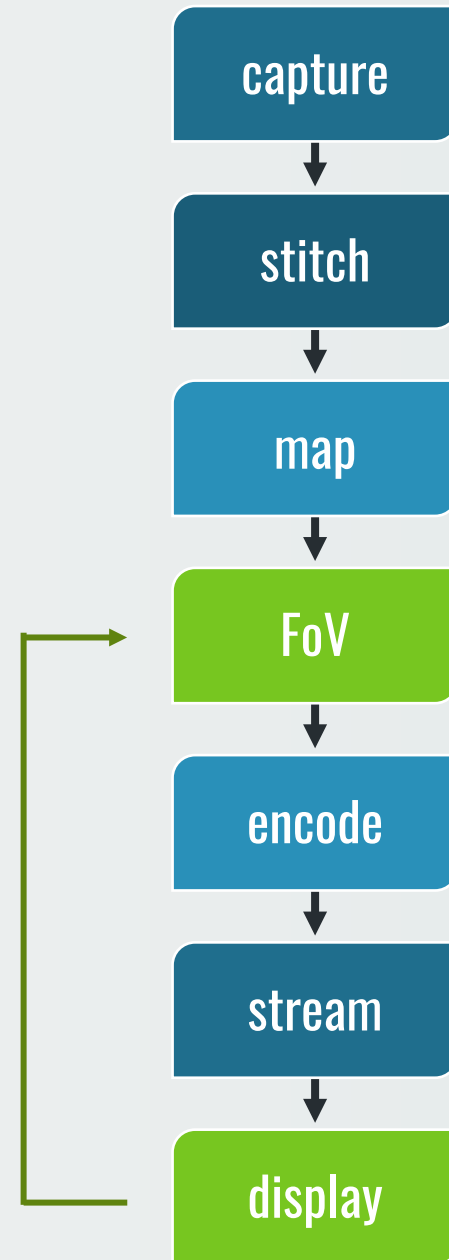
Operators want to add zoom effect needing even more resolution.

Content coming out of a stitching device looks just like any other video

If not all content is delivered, virtually instant retrieval of the right streaming video is required in response to head motion

We need a clever solution for this...

# So, how to deliver live premium V360 in 2018?



# Light clients with server based rendering?

Full 360 video sent to edge server

Lightweight clients just track head movement

All movement data sent to edge server

Edge server creates dedicated stream for each device

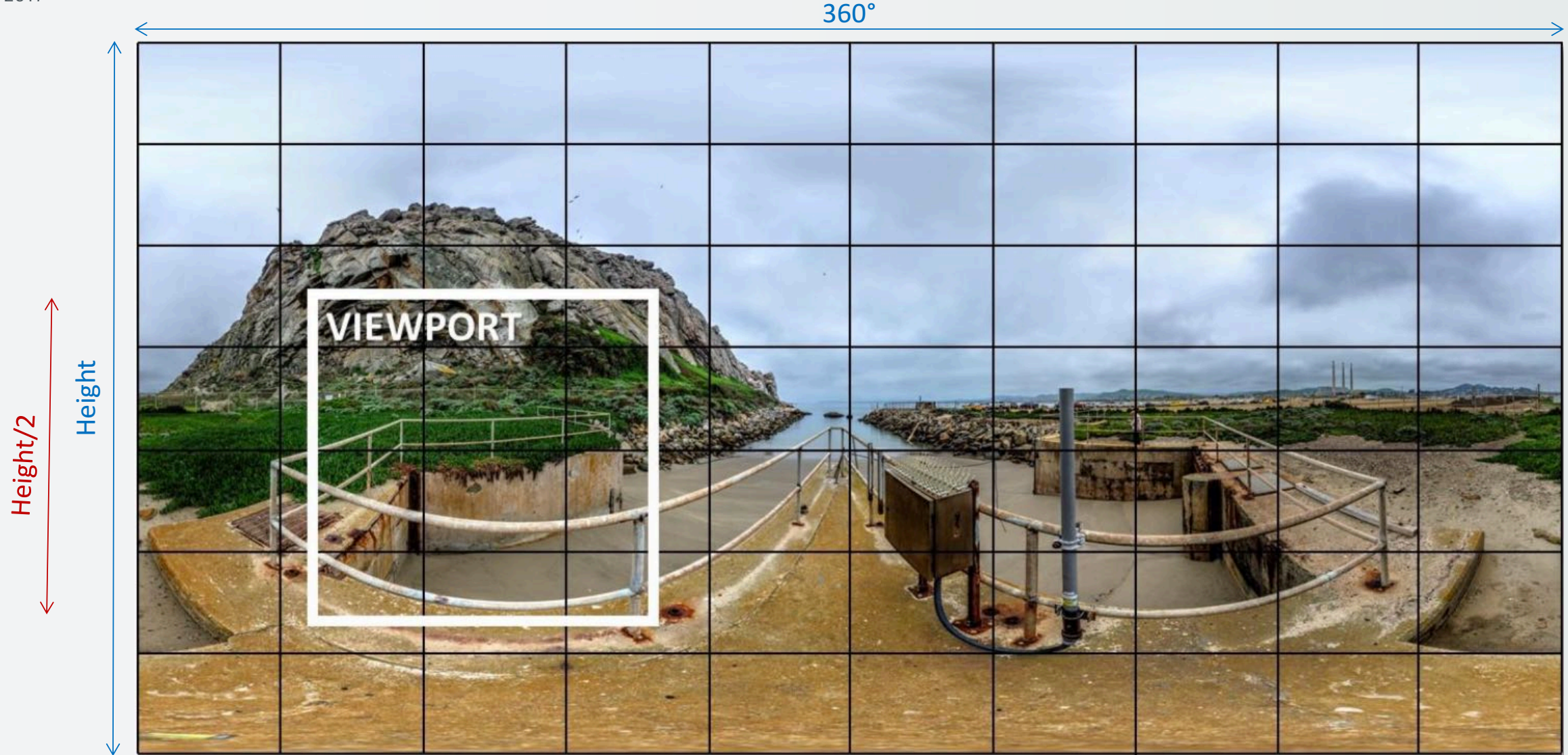
Elegant looking cloud-based solution, great for trials, but

- doesn't scale beyond the hundreds or a few k
- requires a dedicated network resource instance per user

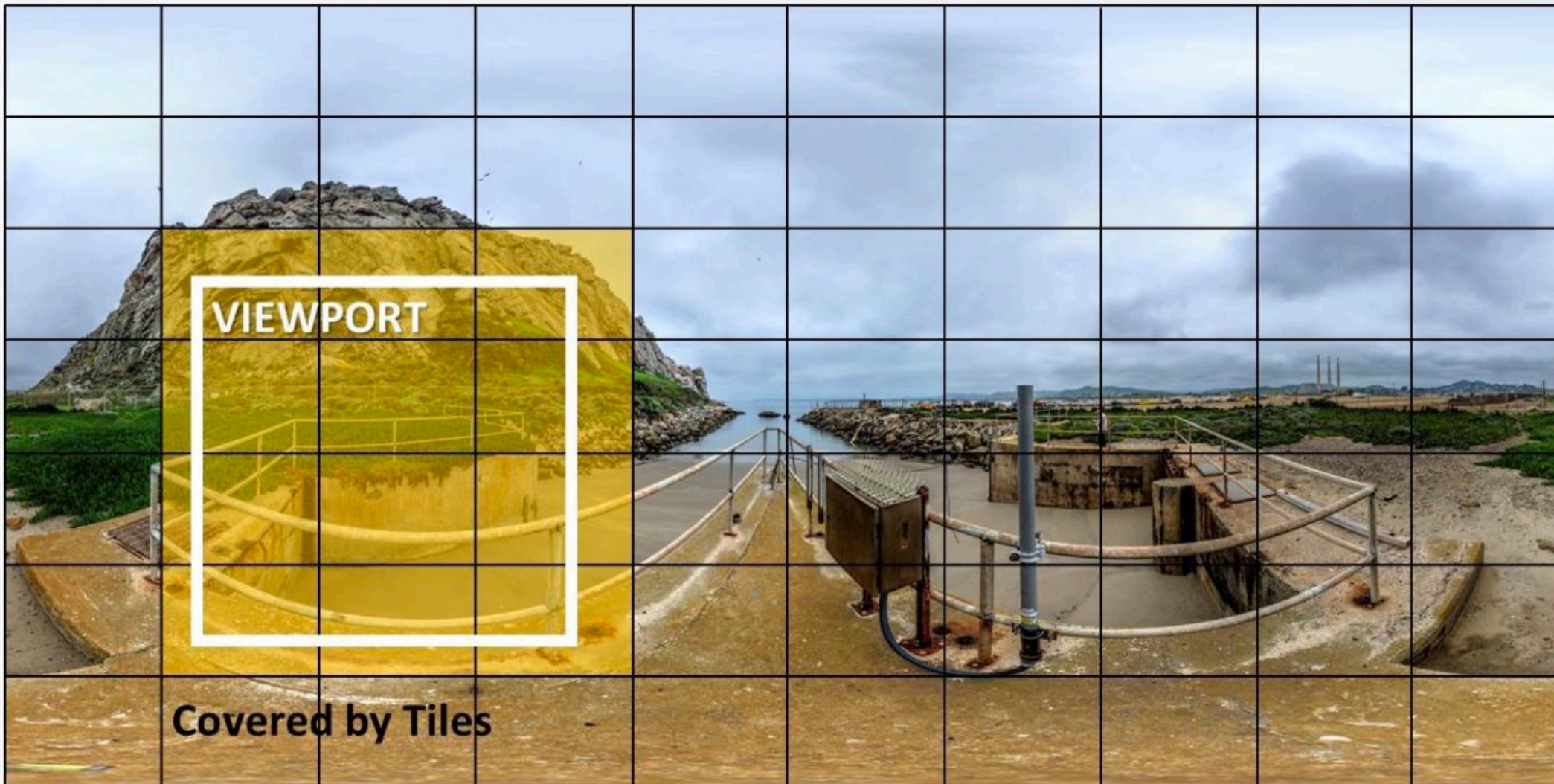


**Or ...**

# Split stitched video into tiles



# Select only tiles within viewport



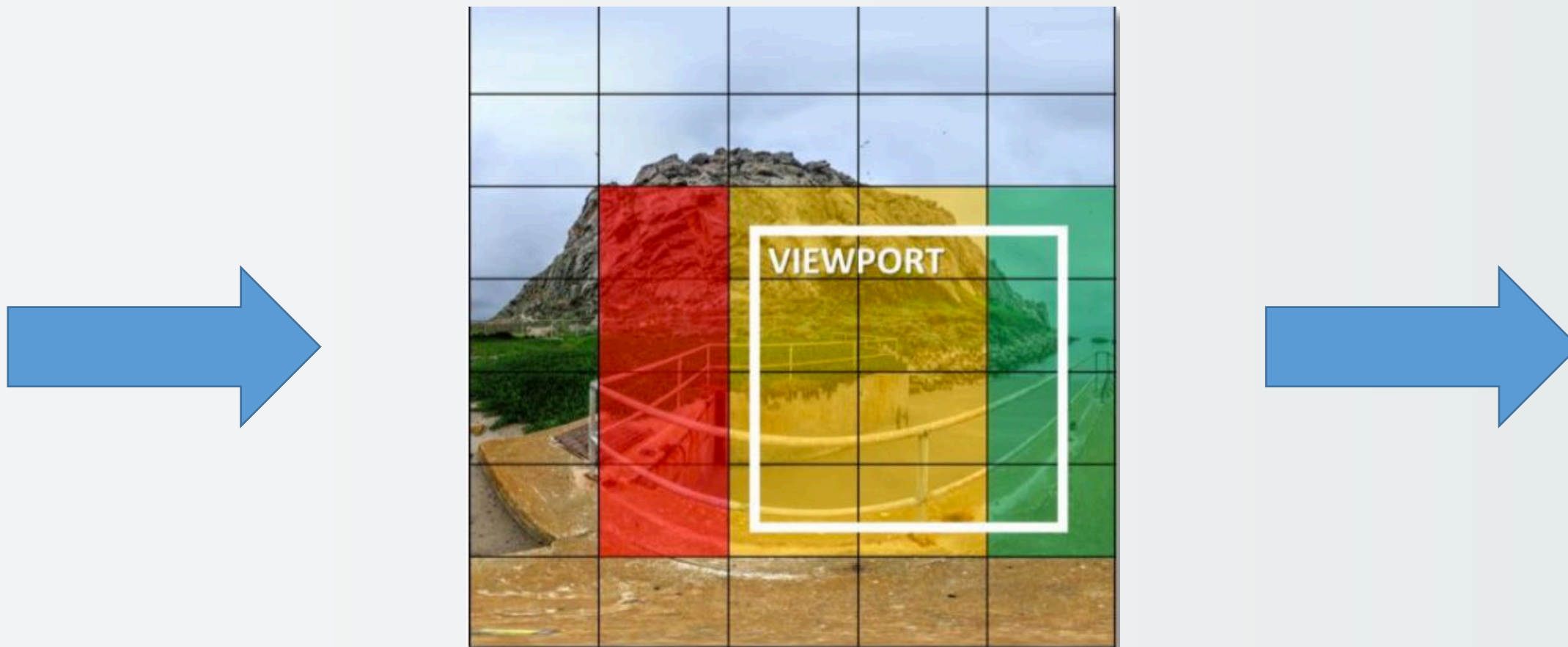
# Sending only them uses ~15% of bandwidth



# Low-res background for fast head movements



# Slow head-movements are anticipated



# But there's a hitch ...

And you thought live OTT TV latency was a challenge today!

- > 30s = first generation ABR
- 10 – 30s = most common
- 2 – 10s = good
- 1-2s = todays best demos
- <1s = the future

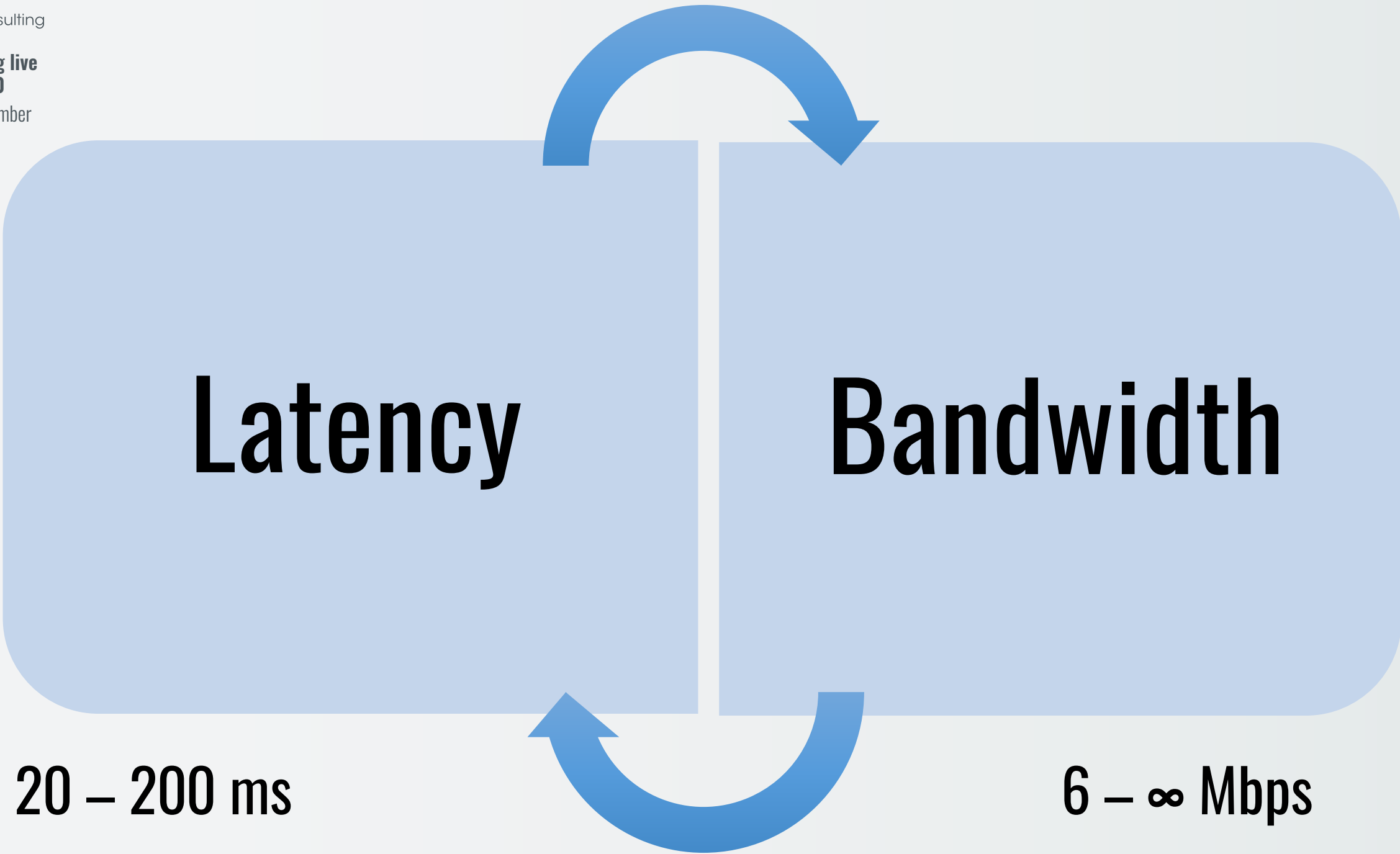


Market-dependent empirical data → opinion

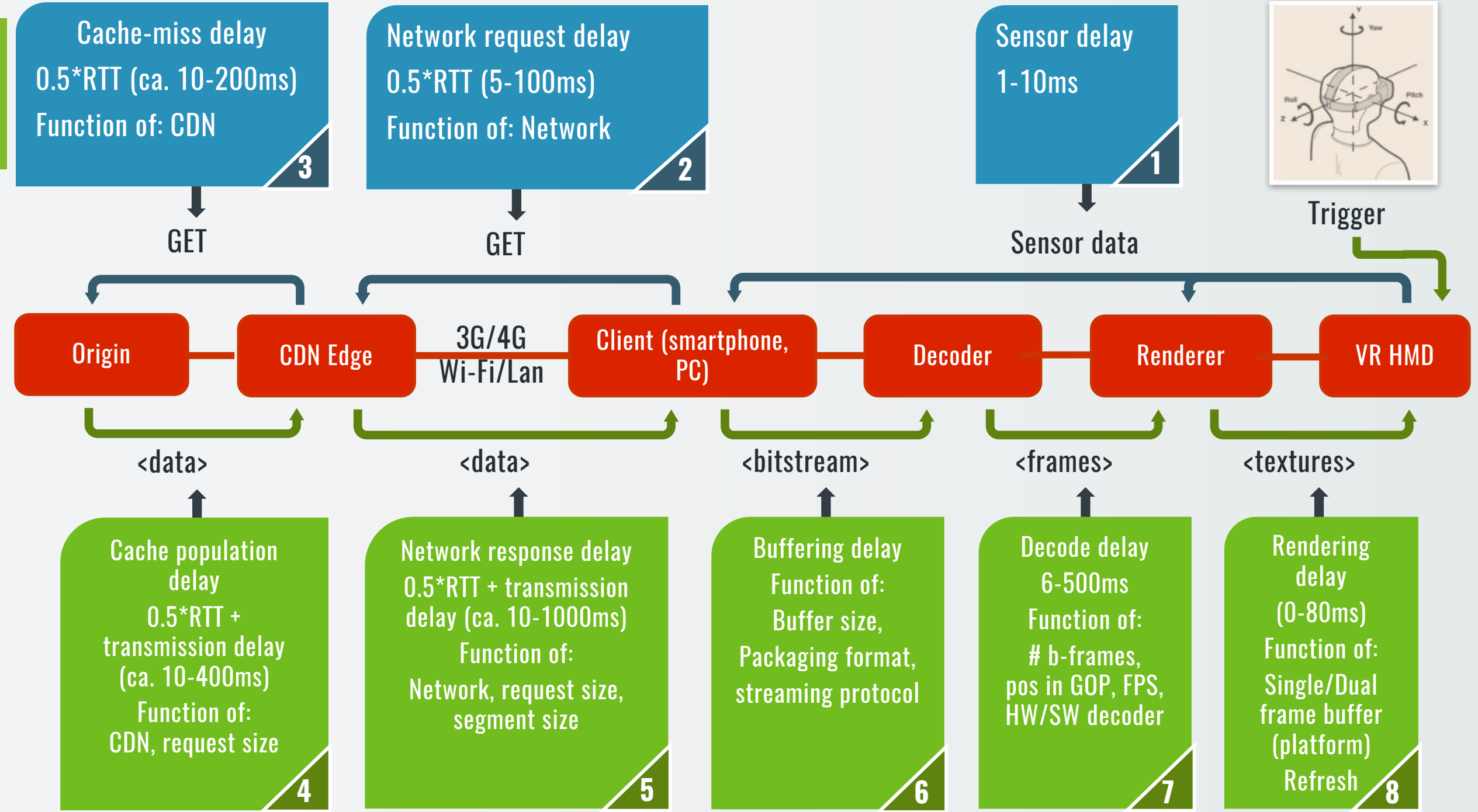
Motion to photon response in HMD is noticeable, above 20 ms

...

Motion to photon response time above 200 ms creates motion sickness







# Some ingredients for a scalable solution

## QUIC UDP Internet Connections

- Reduce number of round trips

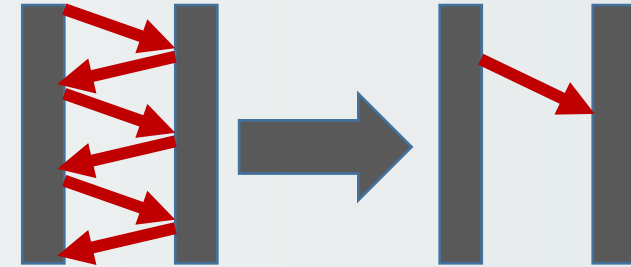
## Leverage HTTP/2

- HTTP/2's improves data transport and reduce latency over HTTP 1.1
- **Byte Range** underpins tiling approach by delivering parts of the Stream, further reducing number of round-trips

Edge server pre-fetches tiles after having delivered requested ones

Just like with ABR, the Video Player is responsible for orchestration

In the end, delivering live Video 360 can be achieved within an extension of the multicast ABR architecture



# Thanks

Despite having only seen early demos, as of November 2017, tiling:

- Offers a scalable way to deliver premium live V360
- Is a natural extension of ABR architecture

This area is still under investigation,

- My thanks to the following companies for bringing me up to speed:
  - Harmonic, Viaccess Orca, Broadpeak, Akamai, Tiledmedia
- And the following operators
  - BT, SKY Italia, Orange, PCCW

Stay tuned for an eBook in December

[bs@ctoic.net](mailto:bs@ctoic.net)

Skype/twitter: nebul2



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