



Build a 360° Immersive Media Video Solution on AWS

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Workshop Agenda – 2.5 Hours

- Immersive Landscape
- Capture and Distribution
- Lab 1 – Live Streaming Service
- Lab 2 – VOD Recording
- Lab 3 – Caching and CDN



Where are immersive experiences?

- News
- Film
- Music & Sports
- Social Media
- Tourism
- Advertising
- Architecture
- Real Estate
- Education
- Healthcare

VR Industry Landscape

THE VR FUND Q1 2017 VR INDUSTRY LANDSCAPE

REALITY CAPTURE (360 VIDEO/NEXT GEN)



DISTRIBUTION (APPS/MEDIA)

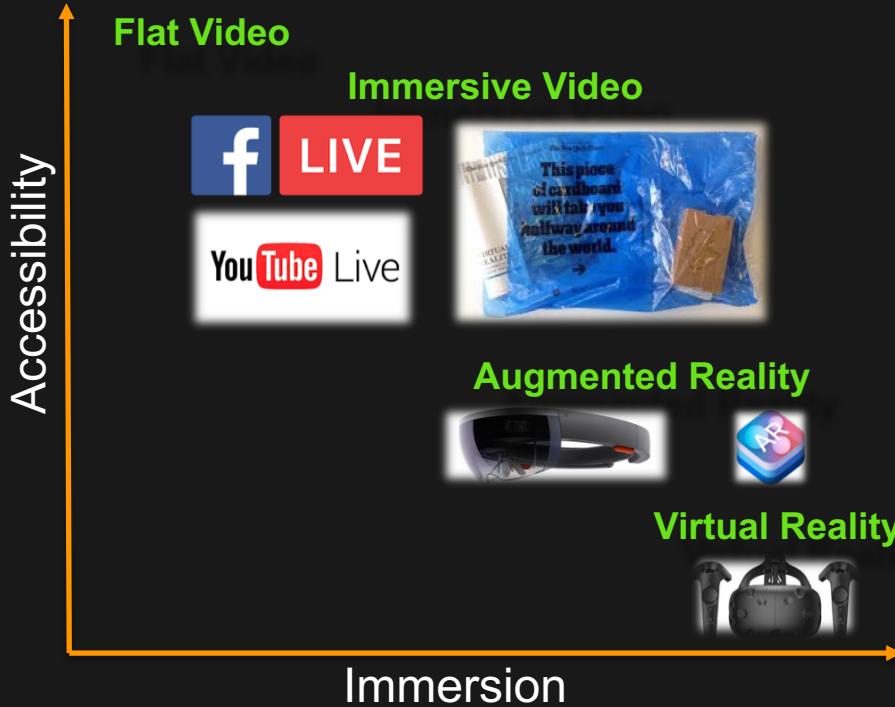


IMPRESSION PI | DOLBY | xiaomi.com | BEERUIN | ISAPING MOJING |

FUZE | SenseMotoric Instruments | SONY | Immersion |

BY TIPATAT@THEVRFUND.COM

Immersive Experiences

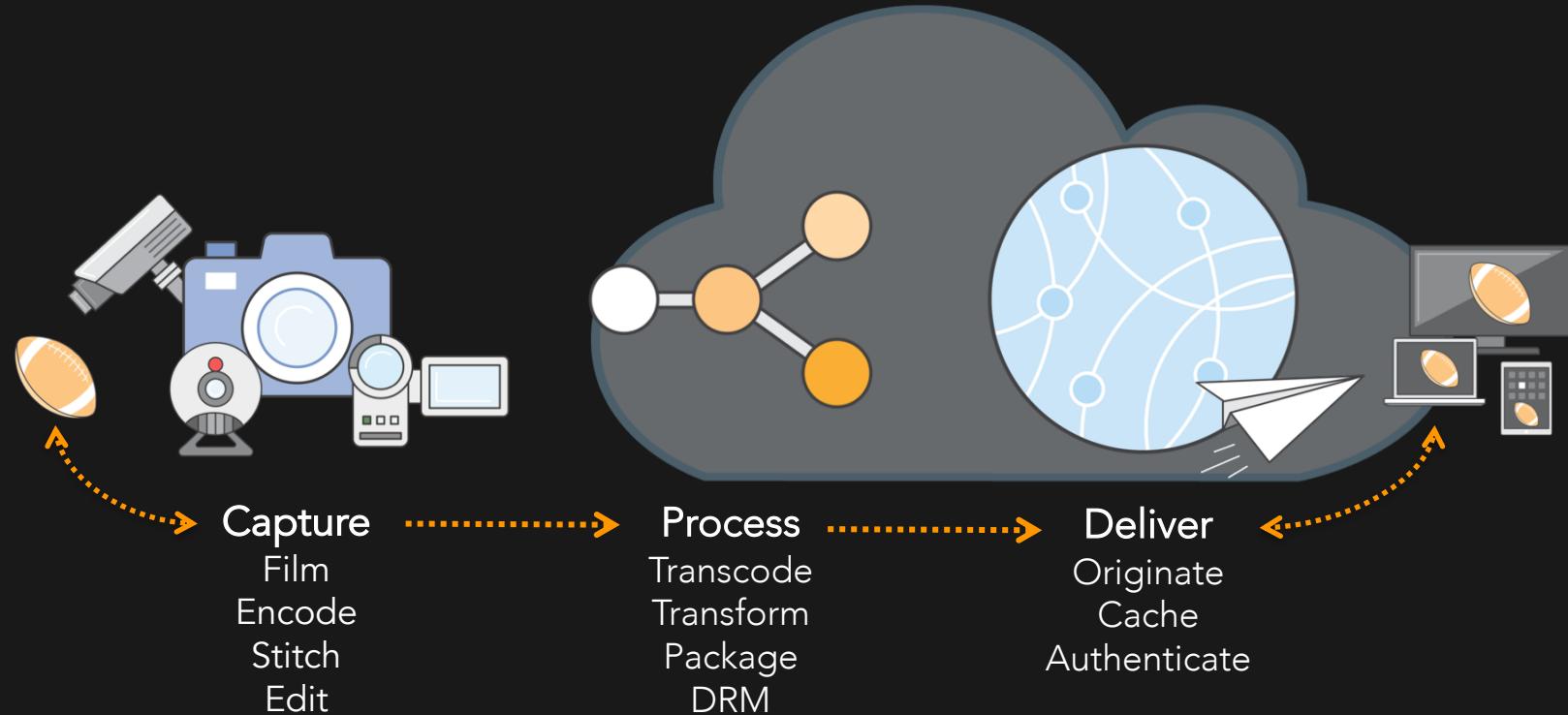


Immersive Video

- An emerging medium
- The first “VR” experience for many audiences
- A stepping stone to mass VR
- Easy to produce, challenging to distribute & monetize

Immersive Capture and Distribution

Stages of Streaming



Omnidirectional Capture

- Number of sensors
- Mono (2D) and/or Stereo (3D)
- Resolution / FPS / Field-of-Vision
- Stitching / Encoding / Streaming
- Image Stabilization
- Audio Capture Capabilities
- Battery Life / Drain
- Onboard Storage

~\$300 USD



\$30,000+



Got Depth?

Monoscopic (2D)

- Single recording per FoV
- Most common
- Cost-effective

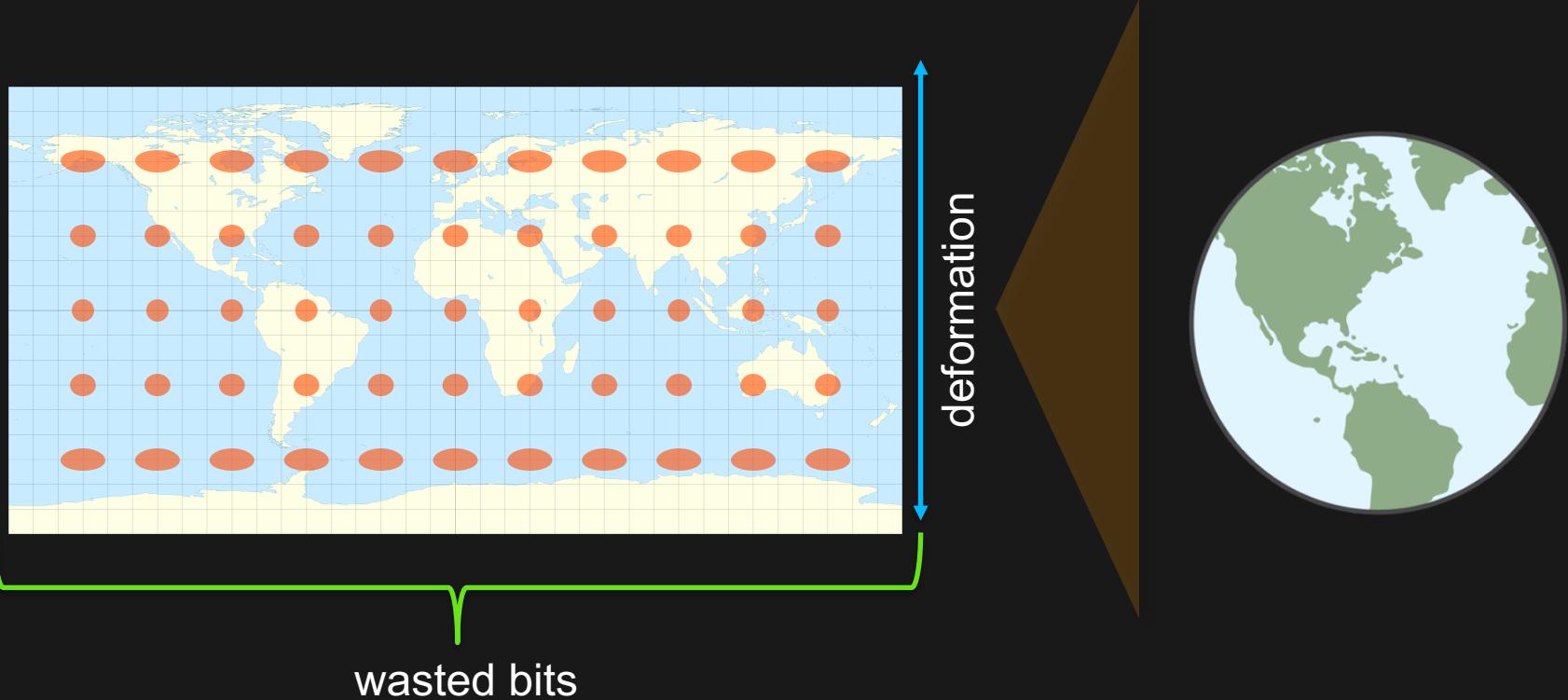
Stereoscopic (3D)

- Two recordings per FoV
- Gives sense of depth
- Often Lower resolution
- More expensive

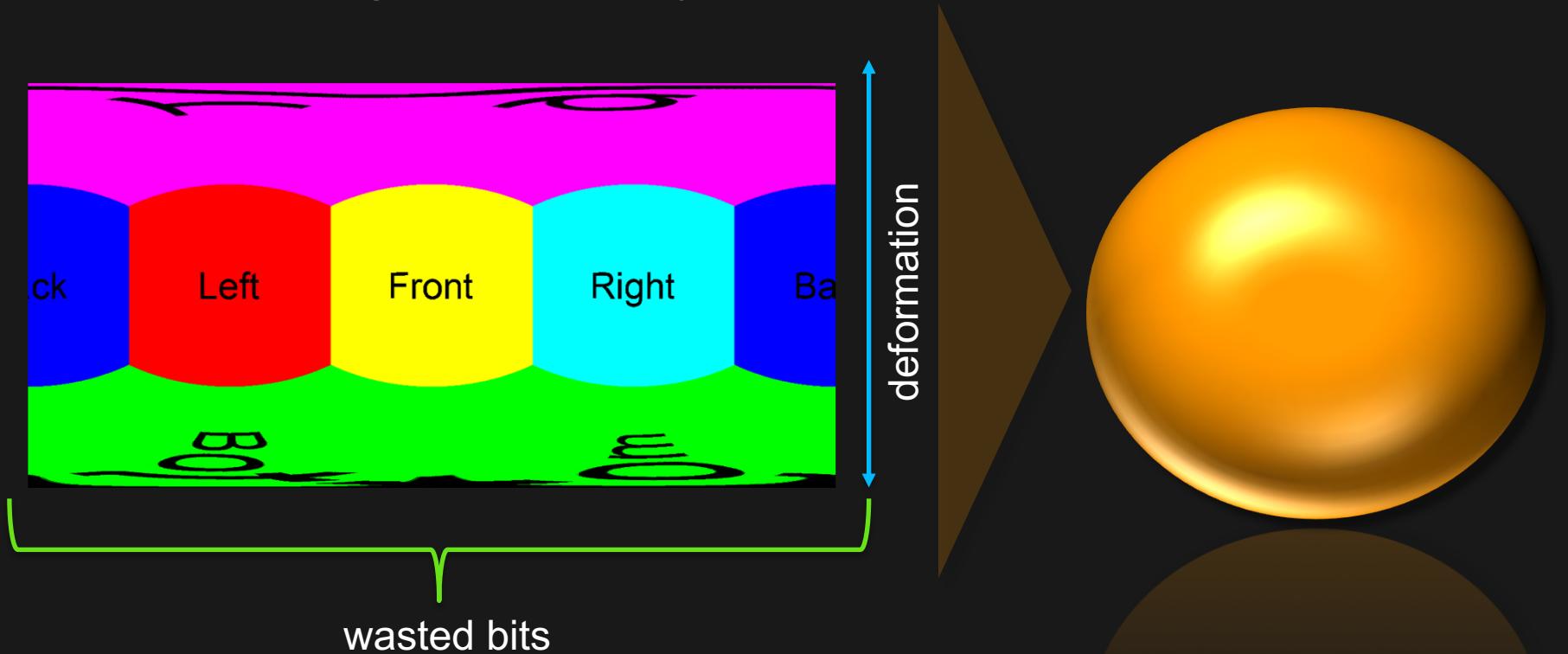


"The early bird catches the worm" – 1900 E.R.
McCollister

Equirectangular Projection



Equirectangular Projection



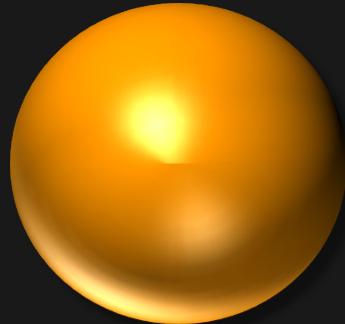
360° Stitching & Transformation

Equirectangular

Widely used and supported

Easy to process

Low pixel density where it counts



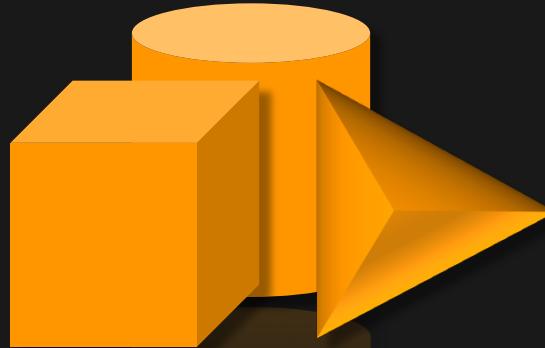
Cubemap, Pyramid, Barrel

Smaller file sizes

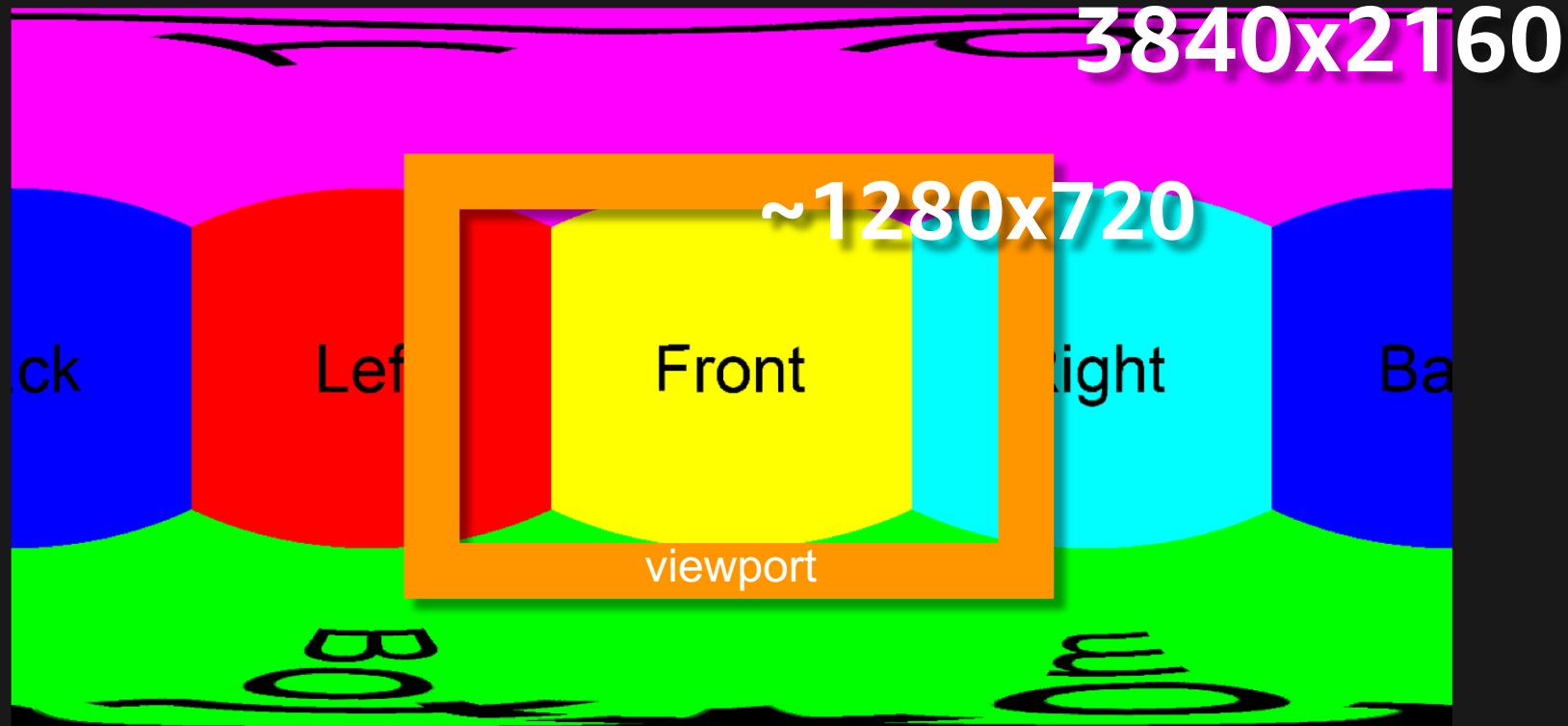
Streaming Optimizations

Higher Resolution = HMD viewing

Poor ecosystem support



Resolution Considerations

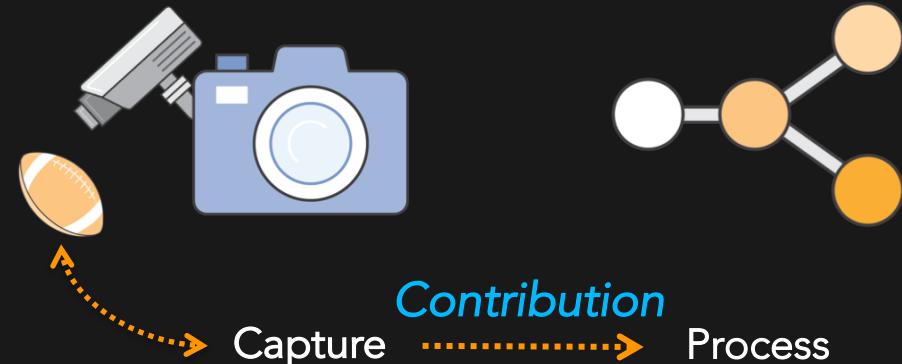


What about audio?



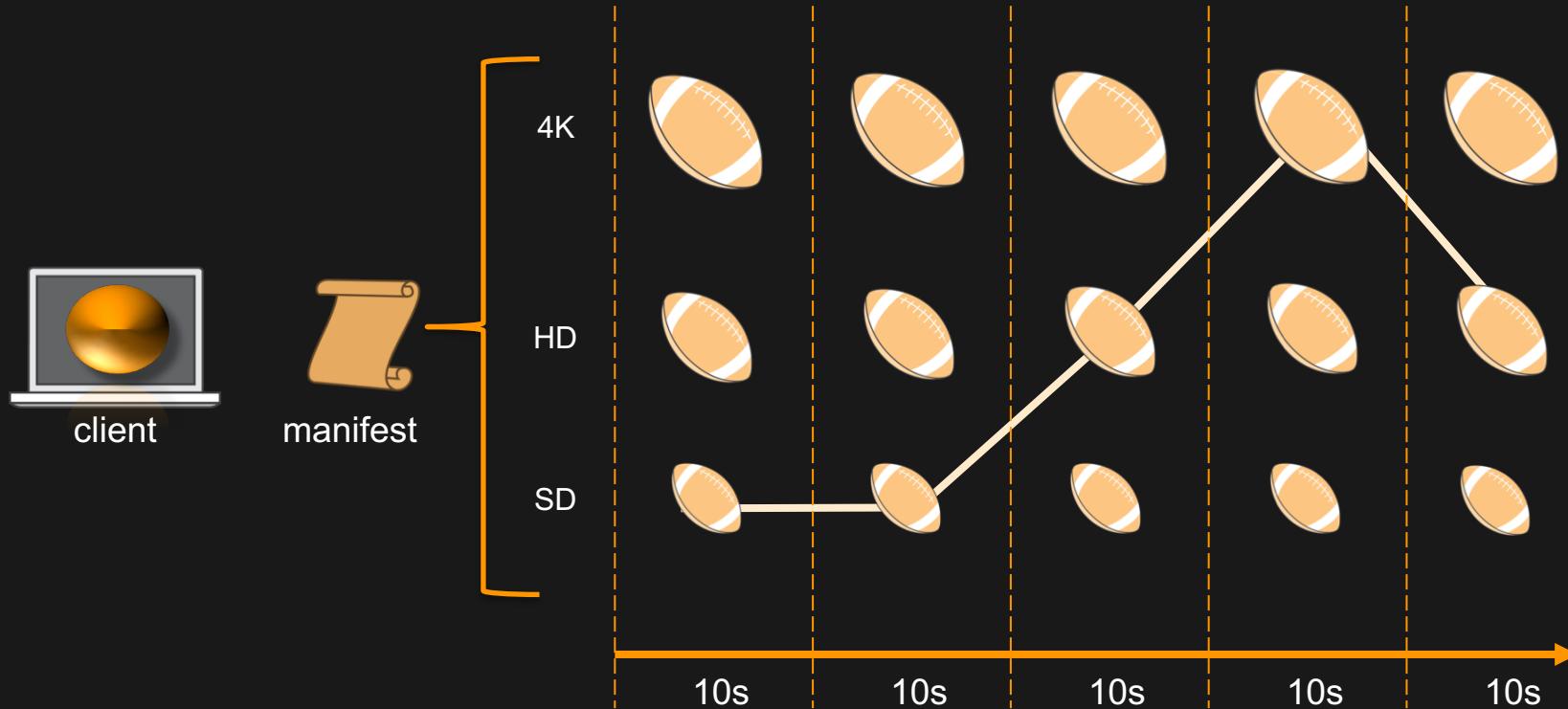
Contribution Considerations

- Bandwidth Constraints?
- Managed or Un-managed Network?
- Packet Loss? Alternate Paths?
- Latency a consideration?
- Cost?
- Codec Support?



Protocol	Ecosys	Latency	Commercials
RTMP (TCP)	High	Med	“Free”
HLS (TCP)	Med	High	“Free”
RTP (UDP + FEC)	Low	Low	Open

Adaptive Bitrate Streaming



Live Media Processing on AWS



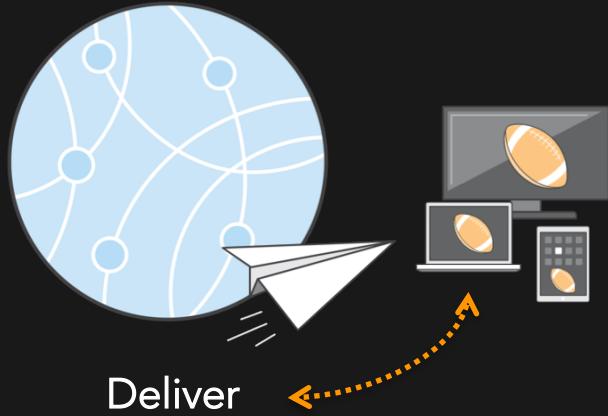
- Web/App Server
- Reverse Proxy
- NGINX-RTMP



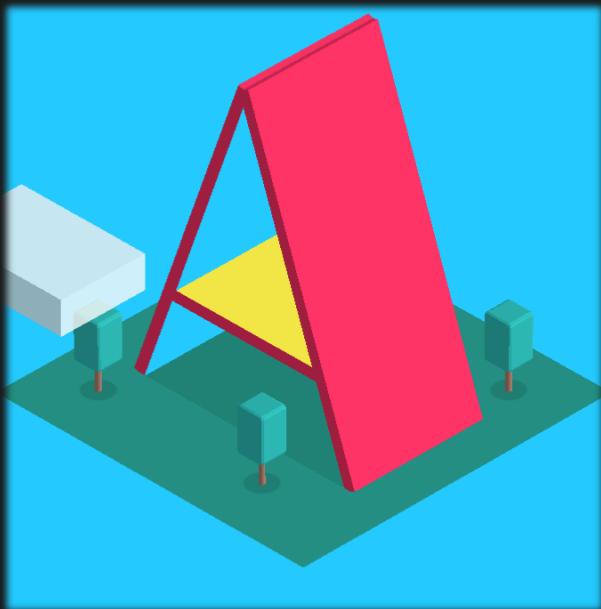
- Swiss-army encoder
- Live / VOD
- Transmux / re-package

Delivery

- High resolution = high bandwidth
- View-dependent adaptive streaming can help
- Strongly consider your own cache tier
- Always use a CDN
- Always use HTTP protocols (HLS/DASH)



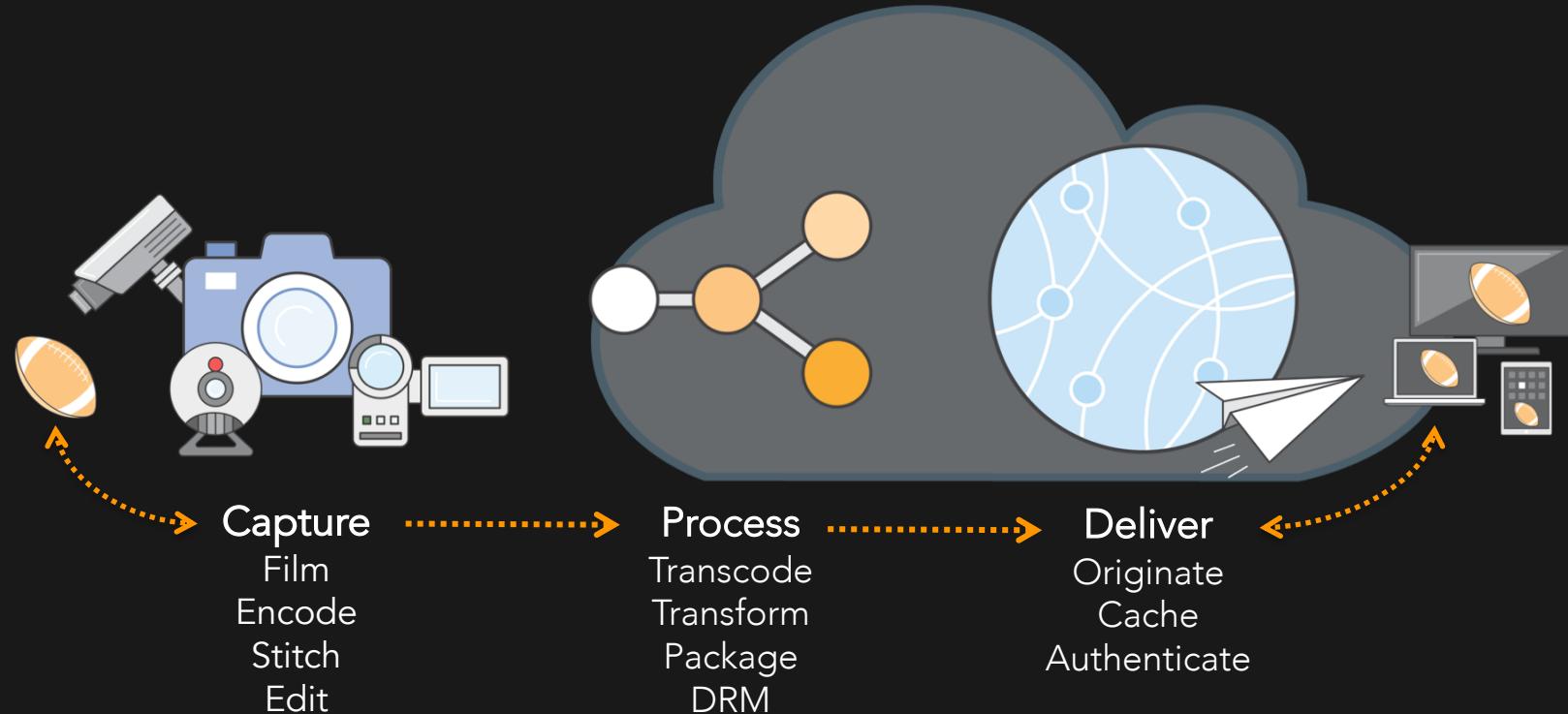
Client – Mozilla A-Frame and hls.js



```
...
<a-scene>
  <a-assets timeout="10000">
    <video id="video" src="autoplay loop"></video>
  </a-assets>
  <a-videosphere src="#video"></a-videosphere>
</a-scene>
```

...

Stages of Streaming



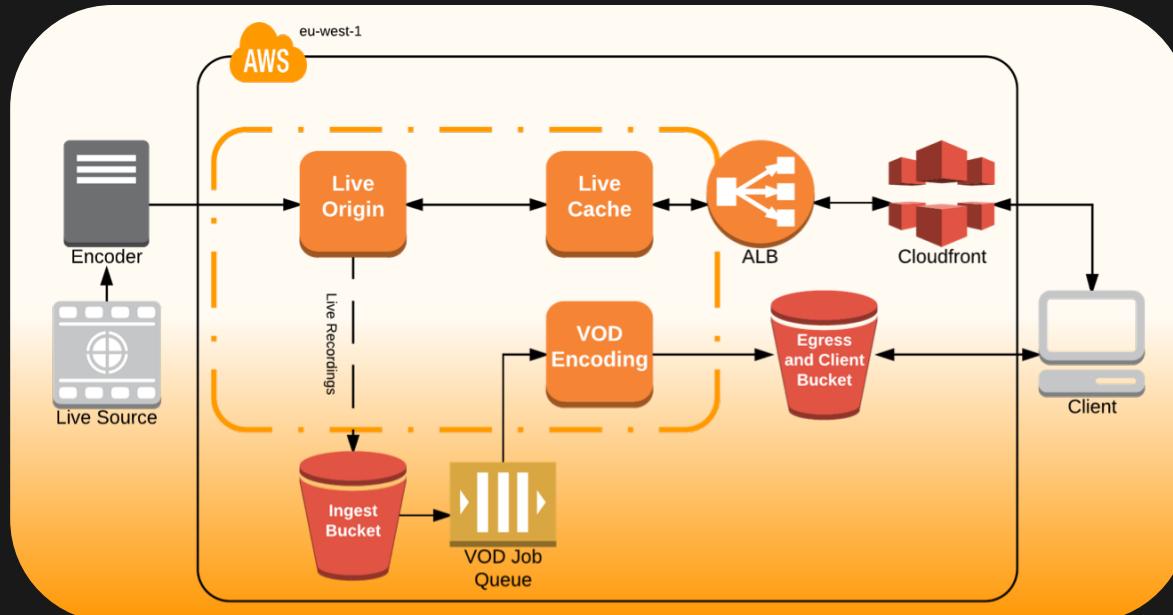
Hands-on Lab

What are we building?

*360 ° Monocular Live Streaming Service with
Sphere Projection Client*

<http://amzn.to/immersive>

Lab 0 – Launch Architecture



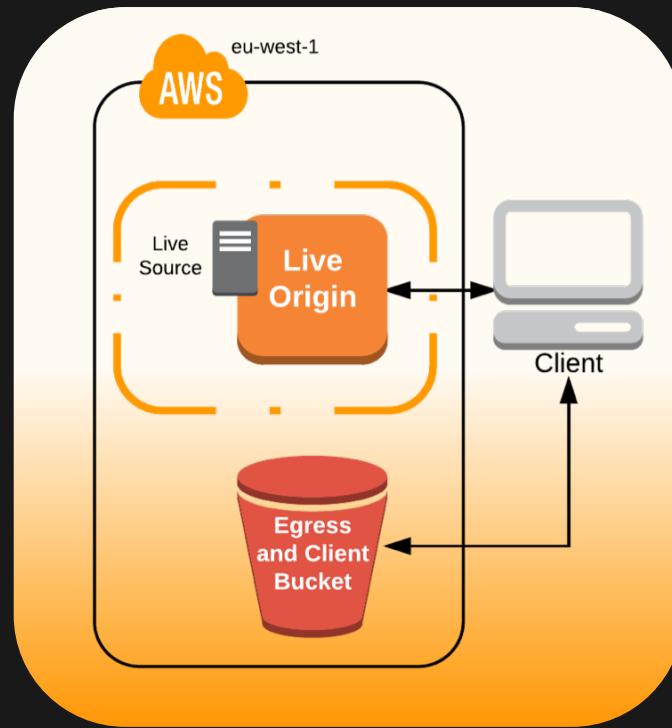
<http://amzn.to/immersive>

Demo While We Wait

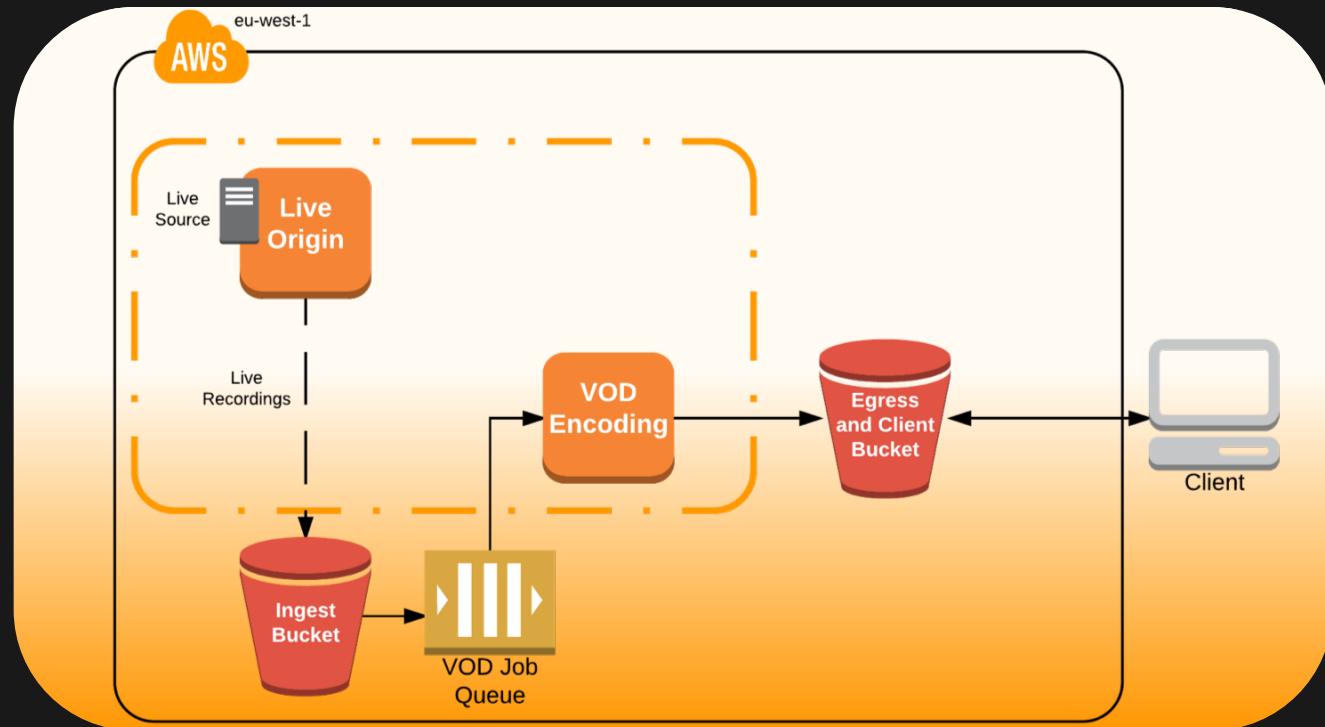


<http://amzn.to/immersive>

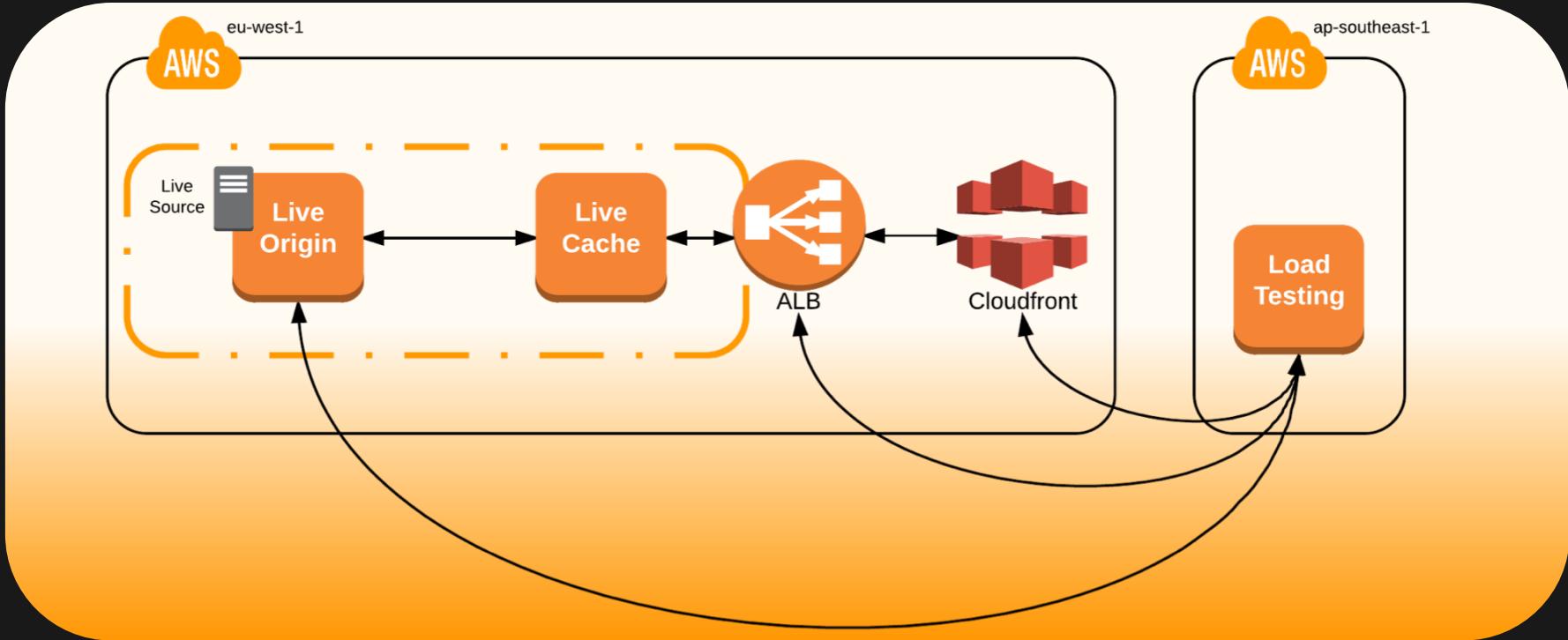
Lab 1 – Live Streaming Service



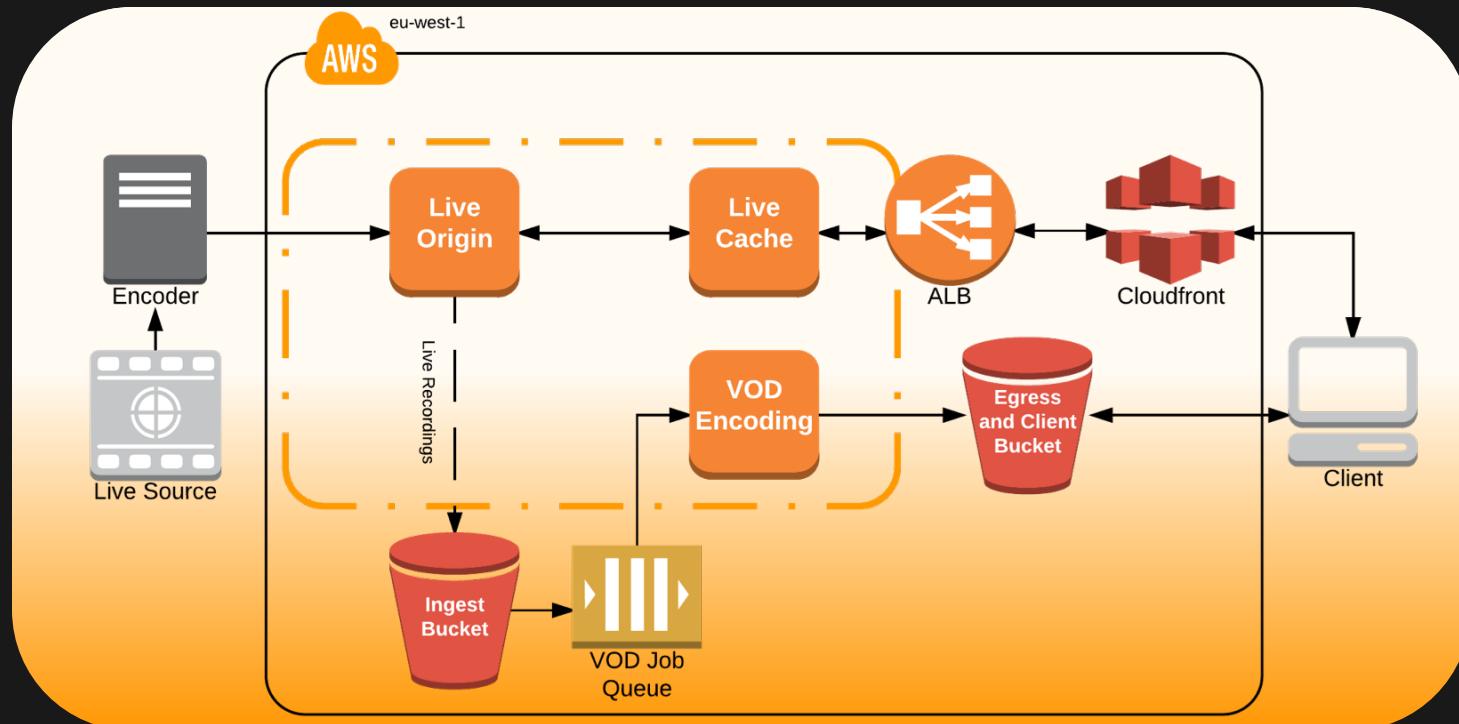
Lab 2 – Video-on-Demand



Lab 3 – Reliability and Load Testing



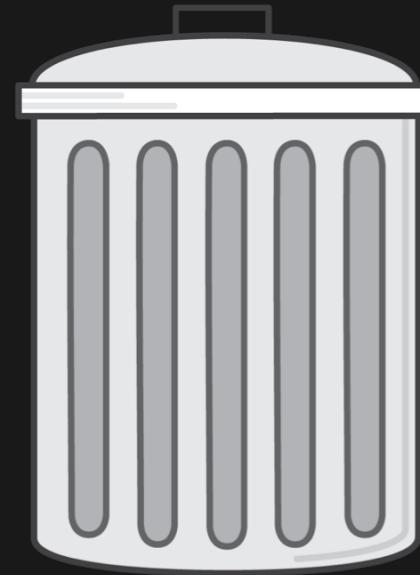
Full Architecture



Cleanup Steps

1. Delete Objects in S3 Buckets
2. Delete stack in CloudFormation

Please fill out your survey!



Key Takeaways – Immersive Video

- Stepping stone on the road to mass Virtual Reality adoption
- Unique experience that has wide-ranging application, not just within the entertainment industry
- Challenges in capture, projection, and distribution domains
- Combines well-known technologies in a new way
 - La Carte Projection Map c.100AD
 - Stereoscopic Image c.1838
 - Ambisonic Audio c.1970
 - Video Streaming

