Audio Video Quality @ YouTube

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VIDEO INFRASTRUCTURE
https://www.youtube.com/yt/press/statistics.html

- 2K 4K 8K
  - 2010 2015

- High Frame Rate
  - 2014

- VR 360 Stereo-3D
  - 2015
What do we care about?

- **Media**
  - VR
  - 8K
  - HDR
  - HVC

- **Scale**
  - Latency
  - Reliability
  - Bandwidth
  - Adaptivity

- **Measurement**
  - QoE
  - AVQ
Pipeline and using AVQ Measurements

**Ingest**

**Universal**
- Xcode
- Xcode
- Xcode
  - 1080p
  - 720p
  - 480p

**Playout**

**Measurement**

*Popularity*
*Partner Identity: High Value Content*
*Media Modeling*
*Defect Analysis*
*Device Information*
Some Ingest Trends
Some Ingest Trends
AVQ Measurement

SUBJECTIVE ASSESSMENT

IN-PROD

OBJECTIVE ASSESSMENT
Measurement: Subjective Evaluation

- Choosing bitrates for H.264, VP9 @ 4K
- Choosing DASH bands
- Calibrating new perceptual metrics

![Graph showing Banding Score vs. MOS]

Median Banding Score per participant
Correlation Coef = 0.85, 2nd Order Poly Fit
Machine Learning for Clip Optimised Encoding

Optimizing transcoder quality targets using a neural network with an embedded bitrate model, Michele Covell¹, Martin Arjovsky², Yao-Chung Lin¹, and Anil Kokaram¹; ¹Google, Inc (United States) and ²University of Buenos Aires (Argentina); SPIE Conference on Visual Information Processing and Communication, Electronic Imaging Symposium 2016, San Francisco, USA, Feb 2016

Multipass encoding for reducing pulsing artefacts in cloud based video transcoding, Yao Chung Lin, Hugh Denman and Anil Kokaram; Google, Inc (United States); IEEE International Conference on Image Processing, Quebec, Canada, Oct 2015
HDR Video

- VP9 Profile 2 [10 bits] in Matroska container (WebM and Frank Galligan)
- Advocating HLG and PQ for all compliant TVs
- Metadata signalling is still in flux
  - Device capability signalling
  - Standards for consumer devices
- Reliability of TV displays to be tested
- Bitrates: 25% rule of thumb; optimisation for HDR; banding has not gone away
- Broadcast Content mezz: what’s up with ProRes? What’s the chance that studios supply two colour grades?
- How pervasive will 10bit HDR TV be in 2017?
Overall

**Media**
- Compression Enhancement
- Device Capabilities

**Scale**
- Compression Enhancement
- Parallel Processing
- Efficiency

**Measurement**
- Perceptually relevant QoE
- Standardised AVQ?
- Contributing to standard datasets