Best Practices for End-to-End Workflow Monitoring

SVA Measurement/QoE WG project update

Christopher Kulbakas
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Agenda

• Contributors
• Motivation
• Goals
• QoE definition
• Scope
• Framework
• Framework deployment example
• Outage detection example using the framework
• Q & A
Contributors

- Datazoom
- Disney
- OPTICOM
- Sky
- SSIMWAVE
- Telestream
- Touchstream

WG Chair: Thomas Edwards, Disney
Project Lead: Christopher Kulbakas, SVA
Project Lead: Brenton Ough, Touchstream
Motivation - What’s the cause?
What’s the viewer impact scope?

e.g. Frozen Screen

EN → TC → PA → OR → CDN → CPE
Motivation - CDN/Player Data Insufficient

Encoder loses input, ... but continues to generate **well-formed video stream** output with non-changing pixels!

Rest of the chain doesn’t know any better, happy to push the content along... and play it out!

Frozen Screen to Viewing Customers

How is my “OTT Streaming QoE” ? ... OK ?

- ABR Manifest Availability: OK
- ABR Manifest Response Time: OK
- ABR Manifest Bitrate: OK
- ABR Chunk Availability: OK
- ABR Chunk Response Time: OK
- ABR Chunk Bitrate: OK
- Player Video Startup Time: OK
- Player Re-buffering Ratio: OK
- Player Average Media Bit Rate: OK
- Player Video Start Failure: OK
Motivation - Network-Only Metrics Not Sufficient

Encoder Too Aggressive, i.e. “over-compresses” the video, ... but still produces well-formed video stream!

Rest of the chain doesn’t know any better, happy to push the content along... and play it out!

“CDN & Player metrics look OK”

Poor Video Quality, ex. “not as sharp”, “fuzzy”, “blocky”, etc.
Motivation - Transport Regeneration

Transcoder “masks” packet loss (not high enough to stop transcoding process), still produces **well-formed video stream**!

Packet losses!

Rest of the chain doesn’t know any better, happy to push the content along... and play it out!

“CDN & Player metrics look OK”

“Unwatchable” Audio / Video To Viewing Customers, ex. pixelating video, choppy audio
Motivation – Variety of Root Causes

Source QoE Metrics NOT OK
- Poor source quality
- Poor encode quality
- Packet losses / jitter
- Poor T-code quality
- EBP / IDR is NOT OK

Content Processing QoE Metrics NOT OK
- Packet losses / jitter

Publishing QoE Metrics NOT OK
- DRMs
- Packet losses / jitter

Delivery QoE Metrics NOT OK
- DRM issues
- Packet losses / jitter

CDN & Player metrics NOT OK
- Packet losses / jitter

Usage
- Ingest
- Distribution
- Hosting
- Cache
- Load
- Internet
- Wi-Fi
- Player
- SDK
- Device
- Last Mile

Source QoE Metrics
- Motivation – Variety of Root Causes

IETF
- + latency
- + compliance
- + cloud
- + loudness
- + advertising
- + advertising
Motivation –
Mixing of Root Causes
Goals

• create best practices on implementing a system to capture QoE and other measurement data at each monitoring point across the workflow;

• identify streaming video metrics to gather at each monitoring point;

• establish guidelines on how to calculate, or leverage existing, metrics at each monitoring point, and investigate potential for an end-to-end metric(s) across all monitoring points;
QoE definition

- the degree of delight or annoyance of the user of an application or service [ITU-T P.10]
Scope

- IPTV / OTT systems
- Live content workflows
- Sources to Device Output
- Both cloud-based and on-premises-based
- Operational use cases
- Monitoring instrumentation focus on Probes, Logs & Player-APIs
  - APM solutions not considered, e.g. node CPU load, e.g. memory utilization, e.g. temperature, etc.
Framework

1) Establish End-To-End Monitoring Scope

2) Decompose E2E scope into Monitoring Points (MP)

3) Decompose each MP into Monitoring Layers (ML)

4) For each (MP, ML): describe monitoring methodology

5) Aggregate MP monitoring results into: a) subsystem views; b) end-to-end view
Framework Deployment - Modular Ex. Service Operator

Third Party

EN

TC

PA

OR

CDN

CPE

MP1 Encoder Output

MP2 Transcoder Output

MP3 Packager Output

MP4 Player Output
Framework Deployment - Modular Ex. Service Operator

**WHERE**
- Encoder output
  - Centralized
  - On Prem
  - HW Probe
- Transcoder output
  - Centralized
  - In Cloud
  - VM Probe
- Packager Output
  - Centralized
  - In Cloud
  - VM Probe

**HOW**
- IGMP-join output of Encoder & Transcoder with Probe & measure content & transport quality
- HTTP-get output of Packager with Probe & measure transport quality
  - cannot monitor content (content is encrypted)
- other techniques are available
  - ex. packager passive tap for HTTP-post

**WHAT**
- collect player events & errors
  - e.g. via player API
- cannot monitor content (limited to what API provides)

**WHY**
- over-compression
- stream/comp fail
- performance
- over-compression
- stream/comp fail
- performance
- mft/prf/cha avail
- stream/comp fail
- performance

**PLAYERS**
- Geo-Dist
- On Cons. Dev.
- SW Embedded
# Framework Deployment - “Modules”

i.e. pick appropriate MP/ML subset

## Table of Framework Deployment

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Outage detection example - macroblocking due to packet loss

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| Stream Events  | OK         | OK         | BAD         | OK          |                    | OK         | OK              | BAD         |
| Delivery issues| OK         | OK         | OK          | OK          |                    | OK         | OK              | BAD         |
| Player API     | OK         | OK         | OK          | OK          |                    | OK         | OK              | BAD         |
Q & A

• Thank you!

email: christopher.kulbakas@gmail.com
Backup Slides
Framework Applications - Ex. Content Owner / Broadcaster
### Framework Applications - Ex. Content Owner / Broadcaster

**WHERE**
- Sources input: Centralized
- Encoder output: Centralized

**HOW**
- hook up SDI splitter to Probe & measure content & stream quality
- IGMP-join output of Encoder with Probe & measure content & transport quality

**WHAT**
- junk in / junk out
- stream/comp fail
- perf. baseline
- over-compression
- stream/comp fail
- performance

**WHY**
- Cons. Perc. Qual
- Device issues
- Performance

**DEVICE output**
- Geo-Dist
- HW Probe

**monitor device**
- HDMI out using Probe & measure content quality, cycle channels using remote control
Framework Applications - Ex. Cloud CDN Provider
Framework Applications - Ex. Cloud CDN Provider

other techniques are available
- ex. packager passive tap for HTTP-post

HTTP-get output of Packager with Probe & measure transport quality
cannot monitor content (content is encrypted)
- mtu/prf/chu avail
- stream/comp fail
- performance

HTTP-get output of Origin, CDN with Probe & measure transport quality
cannot monitor content (content is encrypted)
- mtu/prf/chu avail
- stream/comp fail
- performance

other techniques are available
- ex. origin & cdn log scraping
Outage detection example - frozen screen due to failed source

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- junk in / junk out
- stream/comp fail
- perf. baseline
- over-compression
- IBP/IDR alignment
- stream/comp fail
- performance
- mft/prf/chu avail
- stream/comp fail
- performance
- Device issues
- Delivery issues
- performance
- Cons. Perc. Qual
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Outage detection example - bad video quality due to over-compression

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