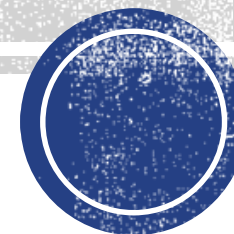


SUMMARY WORKSHOP

MEDIA STREAMING & 5G

Thomas Stockhammer



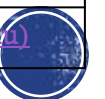
PROGRAM AND SLIDES

Day 1 – Monday Dec 9, 2019

12.30	Registration
13.00	Welcome (Iraj Sodagar, Tencent)
	Introductory Talks (30 mins + 10 mins questions)
13.10	Overview of 5G Systems and Technology (Thomas Stockhammer, Qualcomm)
13.50	Overview of User Studies/Analysis (Amir Gomroki, Ericsson)
	Deep Dives (5 mins introduction plus 25 mins interactive discussion)
14.30	New codecs (Thierry Fautier, Harmonic)
15.30	Content-Aware Encoding (Yuriy Reznik, Brightcove)
16.00	Low-Latency streaming challenges and opportunities (Nicolas Weil, AWS Elemental)
16.30	Impact of New Protocols: What Happens When Everybody DASHes? (Ali Begen, Comcast)
17.00	Ingest technologies (Imed Bouazizi, Qualcomm)
17.30	Ad Insertion (Iraj Sodagar, Tencent)
19.00	Networking event at Rogue Hall

Day 2 – Tuesday Dec 10, 2019

8.30	Coffee
	Introductory Talks
9.00	Overview of latest Media Streaming Developments (John Simmons, Microsoft)
9.20	What's happening in DASH (Iraj Sodagar, Tencent)
	Deep Dives (5 mins introduction plus 25 mins interactive discussion)
9.40	Content Protection (Laurent Piron, Nagra)
10.30	Broadcast/multicast and hybrid delivery (Thomas Stockhammer, Qualcomm)
11.00	Cloud computing, edge computing, and media on cloud (Imed Bouazizi, Qualcomm)
11.30	AR/VR/MR and other interactive applications (Thierry Fautier, Harmonic , Emmanuel Thomas)
12.00	Device platform diversity and hybrid DASH/HLS (Cedric Thienot, Enesys)
12.30	Workshop Summary (Thomas Stockhammer, Qualcomm)
19.00	Portland Video Meetup: DASH Live Streaming at Scale (Zach Cava, Hulu)



INTRODUCTION TO 5G

- [Overview of 5G Systems and Technology \(Thomas Stockhammer, Qualcomm\)](#)
- [Overview of User Studies/Analysis \(Amir Gomroki, Ericsson\)](#)
- 5G is reality – launches are happening as we speak
- Video will account for 75% of traffic by 2024 and will grow grow grow
- 5G is an innovation platform that will stick around for at least one decade
- Important functionalities under development in 3GPP/5G
 - Flexible air interface sub6 + mmWave
 - 5G Core and System
 - Slicing, QoS, Service Based Architecture, API exposure, edge processing
 - 5G Media Streaming - a first step towards a collaboration platform
 - 5G enTV and MBS – broadcast and multicast approaches
 - Extended Reality: VR and AR



INTRODUCTION TO MEDIA STREAMING

- Overview of latest Media Streaming Developments (John Simmons, Microsoft)
- What's happening in DASH (Iraj Sodagar, Tencent)
- Any actions?
 - Not for now



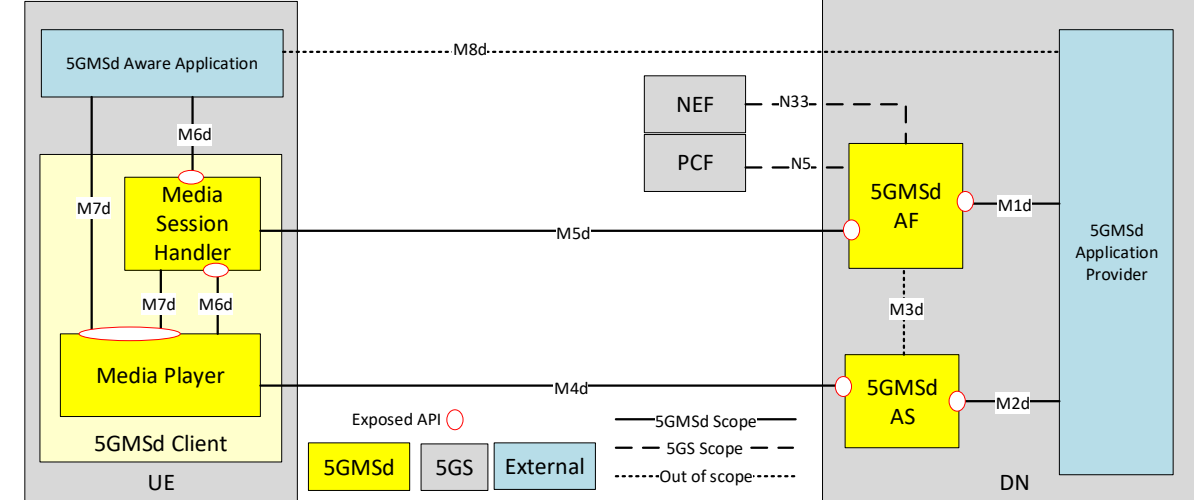
CODECS AND ENCODING

- New codecs ([Thierry Fautier, Harmonic](#))
 - No actions for DASH-IF – codecs are independent to delivery. ISO BMFF/CMAF bindings
 - In 3GPP, a comprehensive technical evaluation similar to the one in the slide is considered useful. Several companies (Harmonic, Beamr, Brightcove, Ateme, ...) are interested in providing supporting material information.
 - Action: **Thomas** will include interested parties into the discussion of Study Item
- Content-Aware Encoding ([Yuriy Reznik, Brightcove](#))
 - CAE/VBR in the combination with constrained/low latency is unclear
 - Also CAE/VBR contradicts to existing QoS Model and existing models (Zero Rating)
 - A simplified well understood framework for enabling CAE/VBR/StatMux is likely necessary to establish this end-to-end
 - Action: **Thomas** to identify interested parties for analyzing this in detail
 - May result in work in DASH-IF and then also be part of 3GPP.



LOW-LATENCY LIVE

- [Low-Latency streaming challenges and opportunities](#) (Nicolas Weil, AWS Elemental)
- [Impact of New Protocols: What Happens When Everybody DASHes?](#) (Ali C. Begen, Comcast, [personal page](#))
- Low Latency as designed by DASH is established and working
- Potential work to be done:
 - DASH-IF:
 - Player Requirements for good streaming behavior.
 - Player APIs for consistent usage in 5G services.
 - Interest in defining a good player for 5G? Several companies are interested ... Thomas will start
 - 3GPP
 - Can 5G provide APIs like QoS support that are beneficial for low latency
 - Support Low-Latency DASH in 5G in general as it is an established protocol



UPSTREAM TECHNOLOGIES

- Ingest technologies (Imed Bouazizi, Qualcomm)
- Ad Insertion (Iraj Sodagar, Tencent)
- Content Protection (Laurent Piron, Nagra)
- Issues identified:
 - 3GPP and DASH-IF collaborating on guidelines for deploying DASH-IF-based services over 5G, especially on the ingest.
 - DASH-IF Ad Insertion interfaces are a good starting point for Ingest/Operator Ad Insertion
 - Nothing specific on content protection. CPIX relevancy for backend needs to be checked.
- Potential Actions: Improved Ingest interfaces for 5GMS – Interest?



BROADCAST AND HYBRID

- Broadcast/multicast and hybrid delivery (Thomas Stockhammer, Qualcomm)
 - 3 main tracks: (i) Broadcaster TV (ii) Operator Mixed Mode (iii) Fixed Wireless Access
 - Combination with Service Layer such as done in DVB-I relevant
- Hybrid DASH/HLS (Cedric Thienot, Enensys)
 - General issue – one production workflow and late manifest generation?
- DASH-IF
 - Nothing needs to be done for now for Multicast. Monitoring the work in DVB and 3GPP on this and potentially add specific enablers, for example for DRM or fast access.
 - **Should** we create a single DASH/HLS ingest format that can be pushed into the network?



CLOUD AND VR

- Cloud computing, edge computing, and media on cloud (Imed Bouazizi, Qualcomm)
- AR/VR/MR and other interactive applications (Thierry Fautier, Harmonic, Emmanuel Thomas)
- **Conclusions:**
 - Telco CDN is simplest version, more complex processing needs to be monetized
 - Roadmap towards 8K, 5G and 6DOF
- 3GPP does analyze the distribution of resources, latencies, etc. TR26.928 looks at the details. Continue providing flexible architecture for different business models
- DASH-IF may look in the context of the NBMP on the media workflow interoperability. This would be independent of the actual control APIs (NBMP, OVP)
 - Iraj will bring forward at appropriate time



LIVE STREAMING IN SCALE

- [Portland Video Meetup: DASH Live Streaming at Scale \(Zach Cava, Hulu\)](#)
- **Basics of a Live Stream**
 - Live Streaming with DASH
 - Optimizing for Scale
 - MPD Patch Updates
- **Dynamic Ad Replacement**
 - Requirements of Ad Targeting
 - Server-Guided Ad Insertion
 - Returning from a Replacement
- Actions for DASH-IF: Complete Patch and Ad Insertion features
- Make these technologies compatible with 5G Media Streaming



GENERAL NEXT STEPS

- Do a condensed version of the slides for MWC – Thierry will initiate
- Provides a summary of the workshop to DASH-IF and possibly initiate new work
 - This was done in the closing plenary of the IOP at DASH-IF IOP
- Provides a summary of the workshop to 3GPP and possibly initiate new work
 - An input contribution will be provided to 3GPP SA4 and may also be provided to other 3GPP groups.
- Collaboration and outreach



An aerial night photograph of a city square. A large, brightly lit Christmas tree stands in the center, surrounded by a dense crowd of people. In the background, a large, ornate building with a dome is visible. To the left, a stage with a sign that says "Merry" is set up. The scene is festive and celebratory.

THANK YOU AND HAPPY HOLIDAYS