



Une école de l'IMT



GPAC Licensing

GPAC: delivery of VR/360 videos using Tiles

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What is GPAC?

- **Multimedia Packagers, Streamers and Player**
 - Multi-platform: all desktops, mobile (iOS, Android), embedded linux
 - Features
 - Any codec, any protocol
 - Graphics & Interactivity
- **Advocating Multimedia Standards**
 - MPEG, W3C, IETF
 - Reference and Utility Software for various MPEG Standards
- **Open Source Software**
 - Dual LGPL v2.1 / Commercial Licensing
 - 600000+ lines of C code
 - Hosted on GitHub
 - Per month: 17000+ visits, 4000+ dl
 - gpac.io
 - gpac-licensing.com
- **Academic Dissemination**
 - 100+ academic references
 - 300+ publications using GPAC
 - IBC '14, '16, NAB '13, '15, '16
- **Collaborations**
 - 8 EU funded projects
 - 18 French funded projects
 - Several industrial-funded projects
- **Teaching**
 - Labs session
 - Students projects
 - Corporate Training



Key GPAC Tools

■ Multimedia Packagers (MP4Box)

- MPEG-2 TS (Live Multicast, or DASH/HLS)
- ISOBMF Packager & Analyzer
- DASH Segmenter/Live simulator/Encoder
- Support HEVC(+layered HEVC), AVC, HE-AAC...



■ Multimedia Player (MP4Client)

- MPEG-2 TS, RTP, ISOBMF, DASH, HLS
- Multi-path delivery of layered coded data
- SVG/BIFS/VRML + JavaScript
- VR / 3D / Auto-stereoscopic output



GPAC NEWS

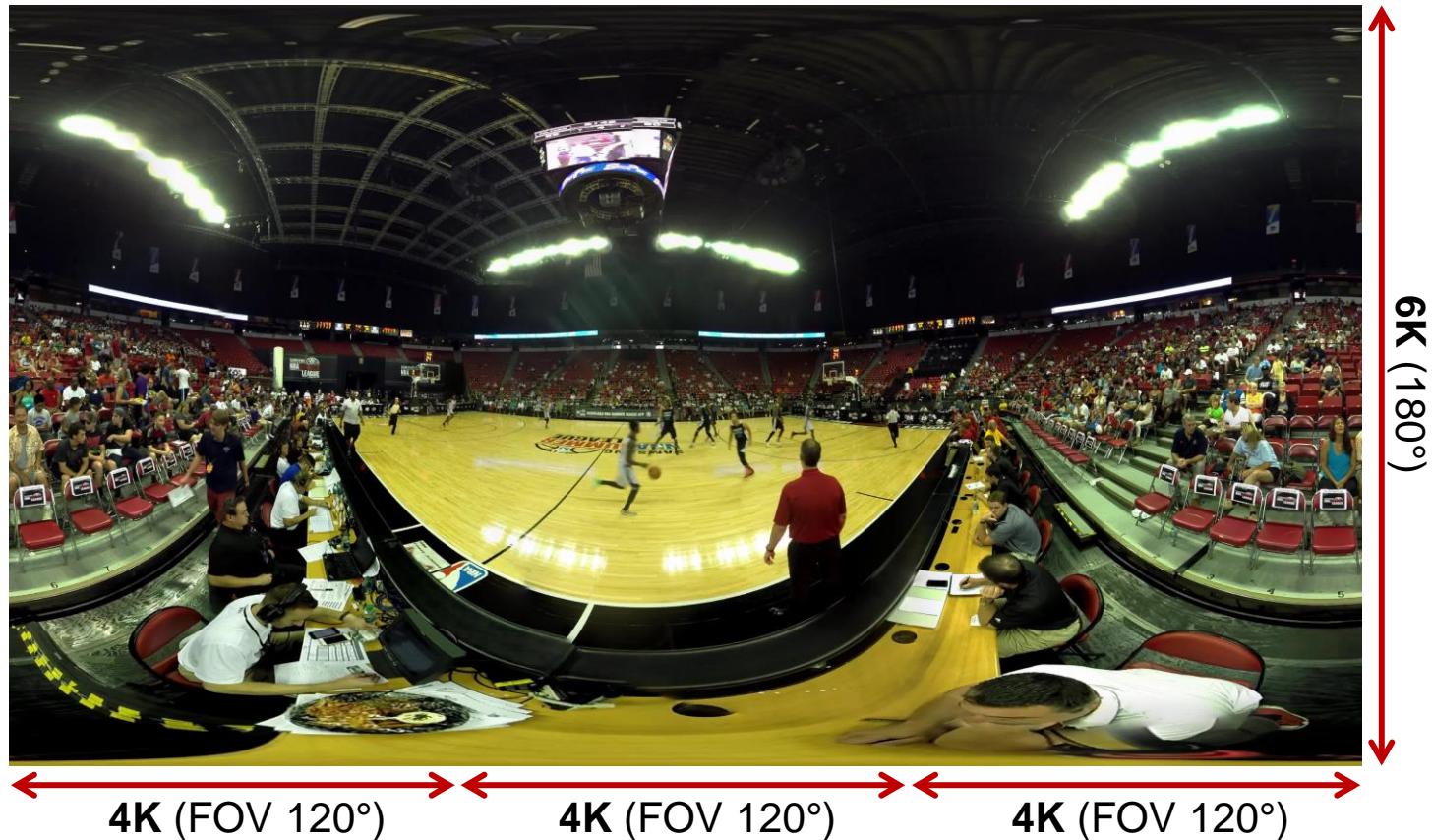
- **New public test infrastructure.**
- **Range extension support for AVC and HEVC.**
- **Improved TTML support.**
- **Support of VR/360 videos, including using Tiles => This Talk.**
- **Hardware decoding**
 - for OSX and iOS (VideoToolBox).
 - for Android (MediaCodec).
- **Coming soon:**
 - Support for more PIFF and Smooth Streaming file format (branch).
 - Hardware accelerated encryption (branch).
- **Other projects: check <https://github.com/gpac>**



Streaming of VR/360 content

■ Bandwidth is expensive

- 360 videos require at least 4K x 2K.
- Some claim: 12K x 6K for achieving 4k field of view resolution.

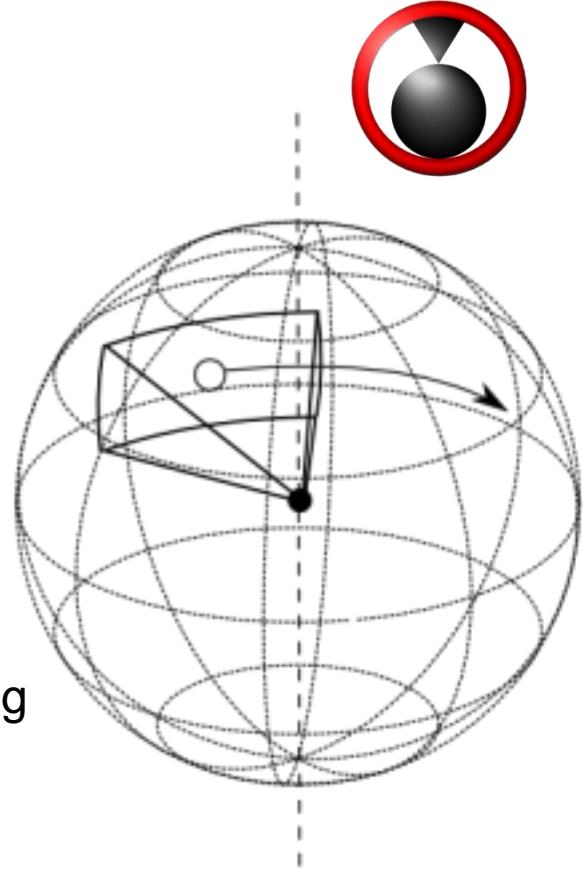




Streaming of VR/360 content

■ Necessity to reduce bandwidth

- Video Compression
 - of a 2D video after some projection
 - possibly after some shuffling & packing
- Adaptive delivery
 - Deliver parts of the video based on viewpoint/viewport
 - Lower quality outside the viewpoint/viewport
 - Necessary to react quickly to motion (motion-to-photon latency)



360 Projection & Packing Examples



Equirectangular Projection (ERP)



ERP with specific packing



Cube-map with packing

■ **Projected videos will probably be packed and compressed based on rectangular regions (Tiling)**

- MPEG Omnidirectional Media Application Format (OMAF)

*Text of ISO/IEC CD 23000-20
Omnidirectional Media Application Format,
MPEG N16636, Jan. 2017*

Tiling and Adaptive Streaming Principles



■ Stream tiles with different qualities



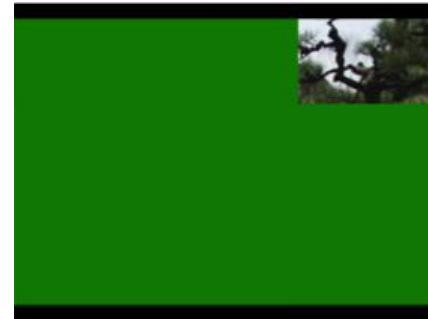
*Technologies under Consideration for DASH
MPEG N16659
Jan. 2017*



Tiling and Adaptive Streaming Principles



- Or stream some tiles or even only one tile

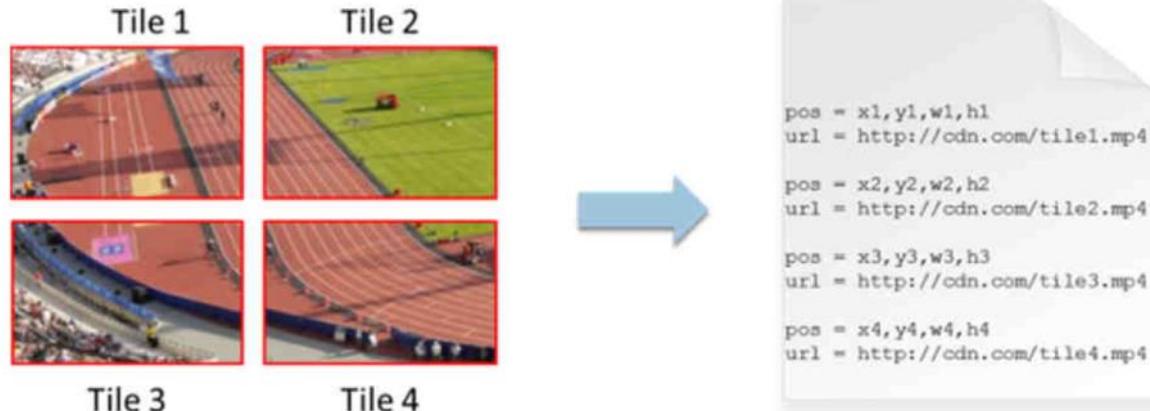


Tiling and Adaptive Streaming

MPEG-DASH SRD



- **Description of 2D relationships between videos**
 - In the source content (not a composition description)
 - X,Y,W,H (possibly in arbitrary units)
- **Codec agnostic**
 - No assumption of tiling coding tools
 - Can be used with multiple independent videos
- **Can already be used for projected videos**
 - MPEG discussions about extending it to 3D relationships

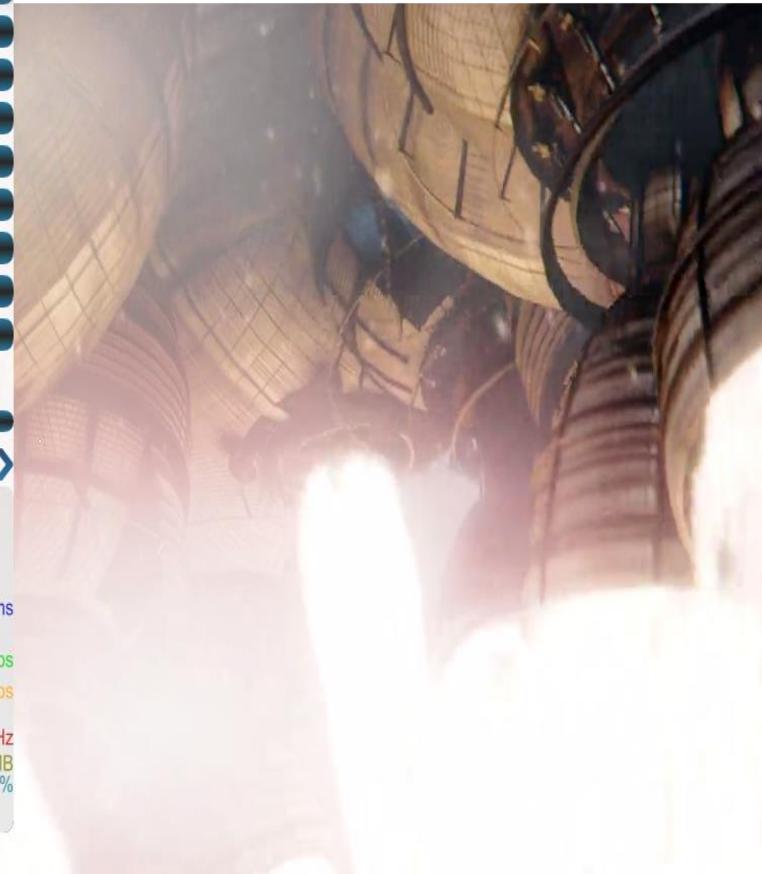
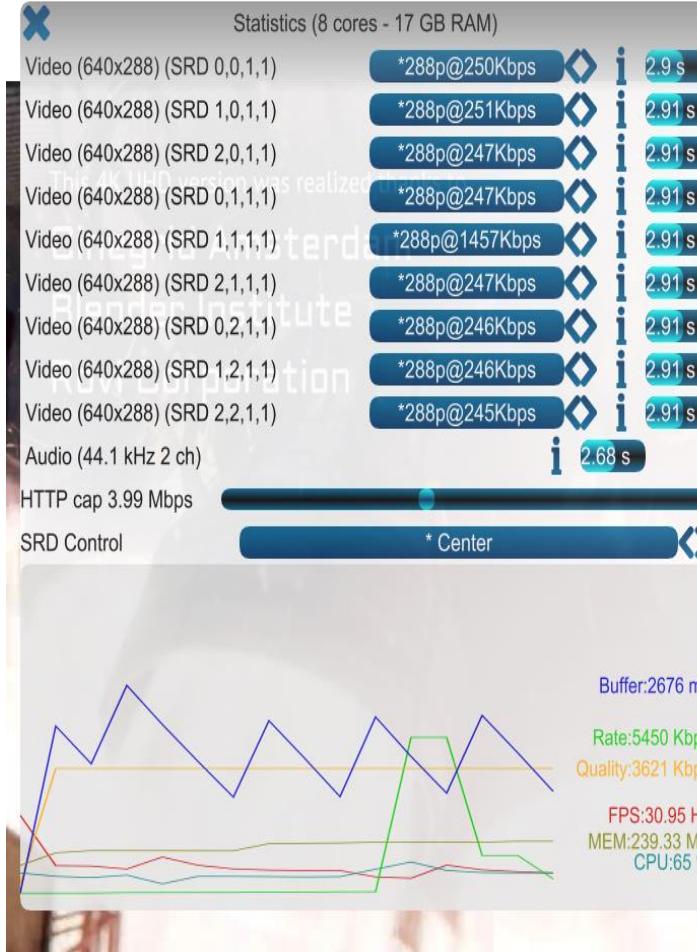


O. Niamut, E. Thomas, D. Mico, C. Concolato, F. Denoual and S. Y. Lim,
MPEG DASH SRD - Spatial Relationship Description,
ACM MMSys, Klagenfurt, Austria, May 2016

MPEG-DASH SRD and HEVC tiling for VR/360 videos



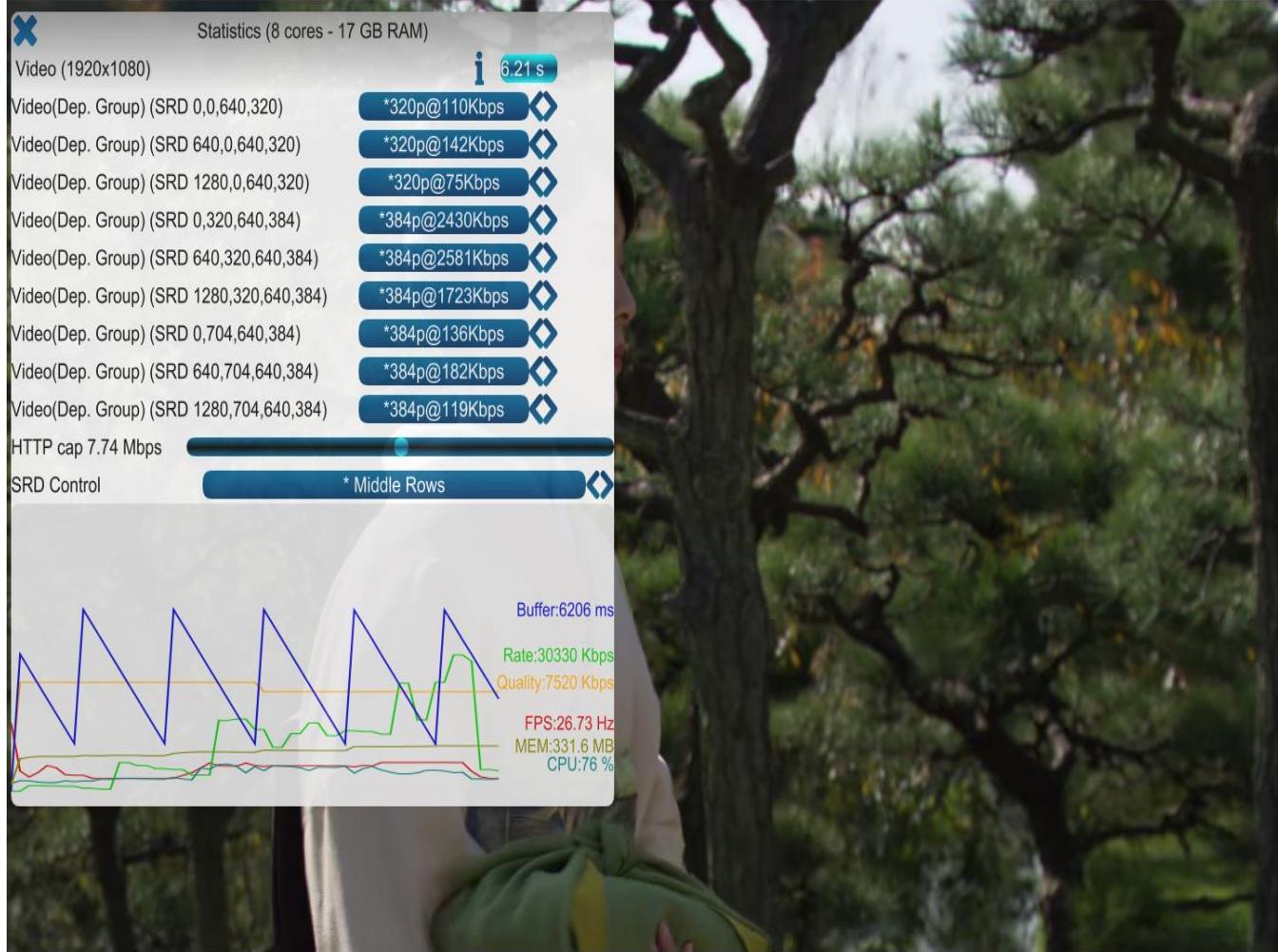
■ Tile-based adaptation using independent videos



MPEG-DASH SRD and HEVC tiling for VR/360 videos



■ HEVC Motion-constrained Tile-based adaptation



Tiling and Adaptive Streaming Using HEVC



■ HEVC Tiles

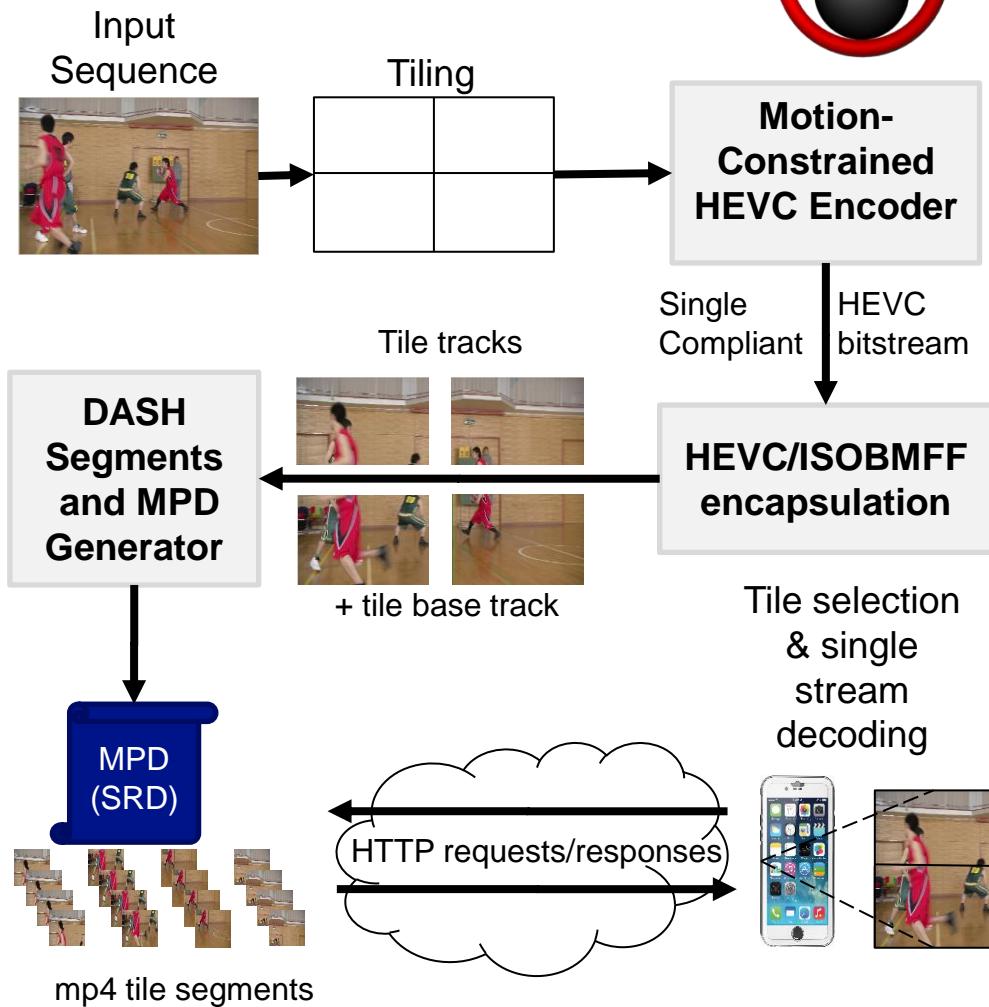
- Motion-Constrained
- Single Decoder

■ Extensions to ISOBMFF

- Independent access to tile data
 - HEVC tile tracks “hvt1”
- Reconstruction of the entire video
 - Track references “sabt”/“tbas”
 - Reconstruction Rules

■ MPEG-DASH

- SRD
- Use of @dependencyId



<https://gpac.wp.imt.fr/2017/02/01/hevc-tile-based-adaptation-guide/>

Tiling and Adaptive Streaming Streaming Strategies



- Which tiles to favor (region of interest)?
- What is the acceptable quality degradation btw. tiles?



Uniform Priority



Row-based Priority



Center-based Priority



Column-based Priority

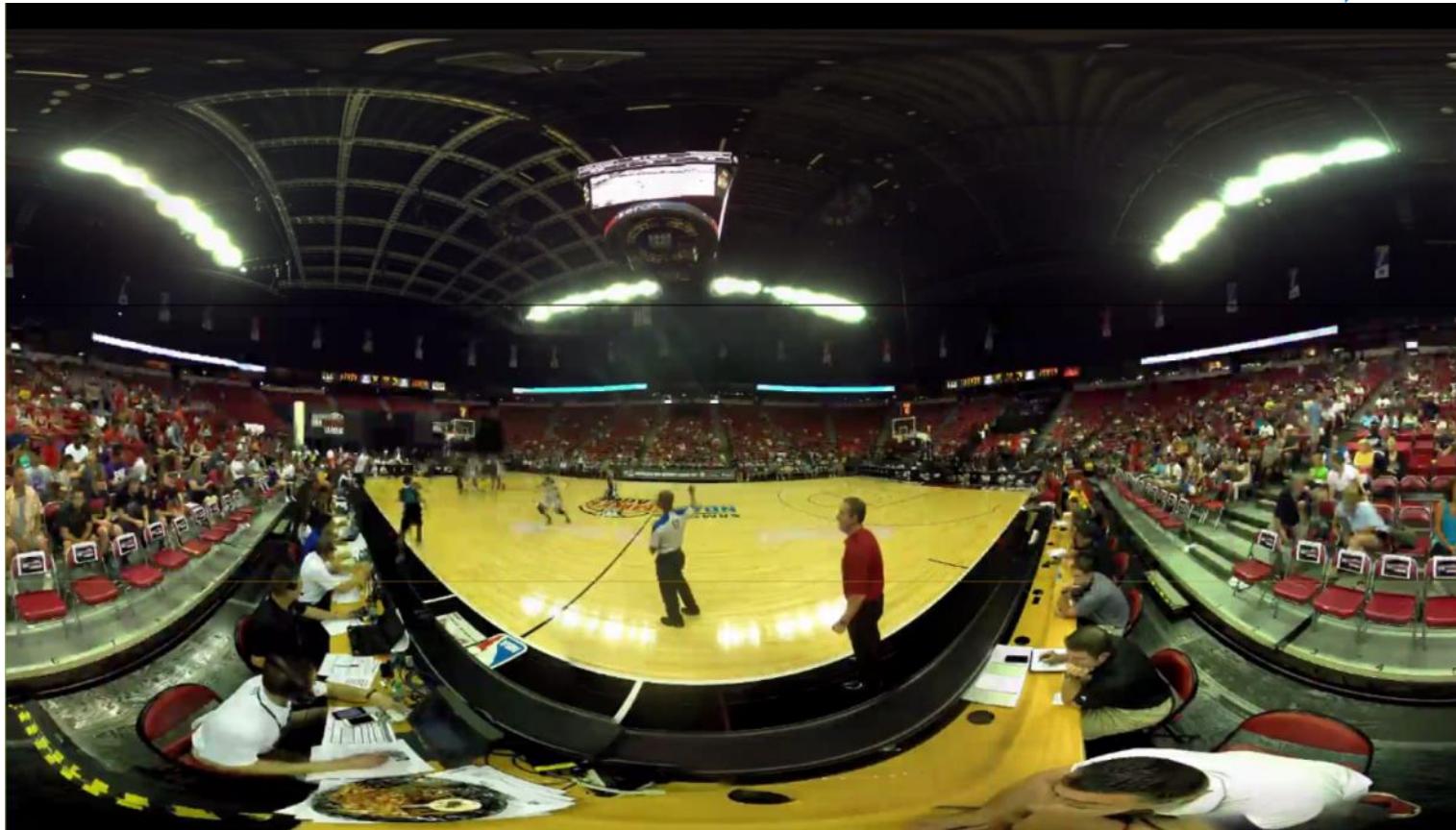
J. Le Feuvre and C. Concolato,
Tiled-based Adaptive Streaming using MPEG-DASH,
ACM MMSys, Klagenfurt, Austria, May 2016

Tiling and Adaptive Streaming 360° video



Demo using GPAC

LIVE  TV

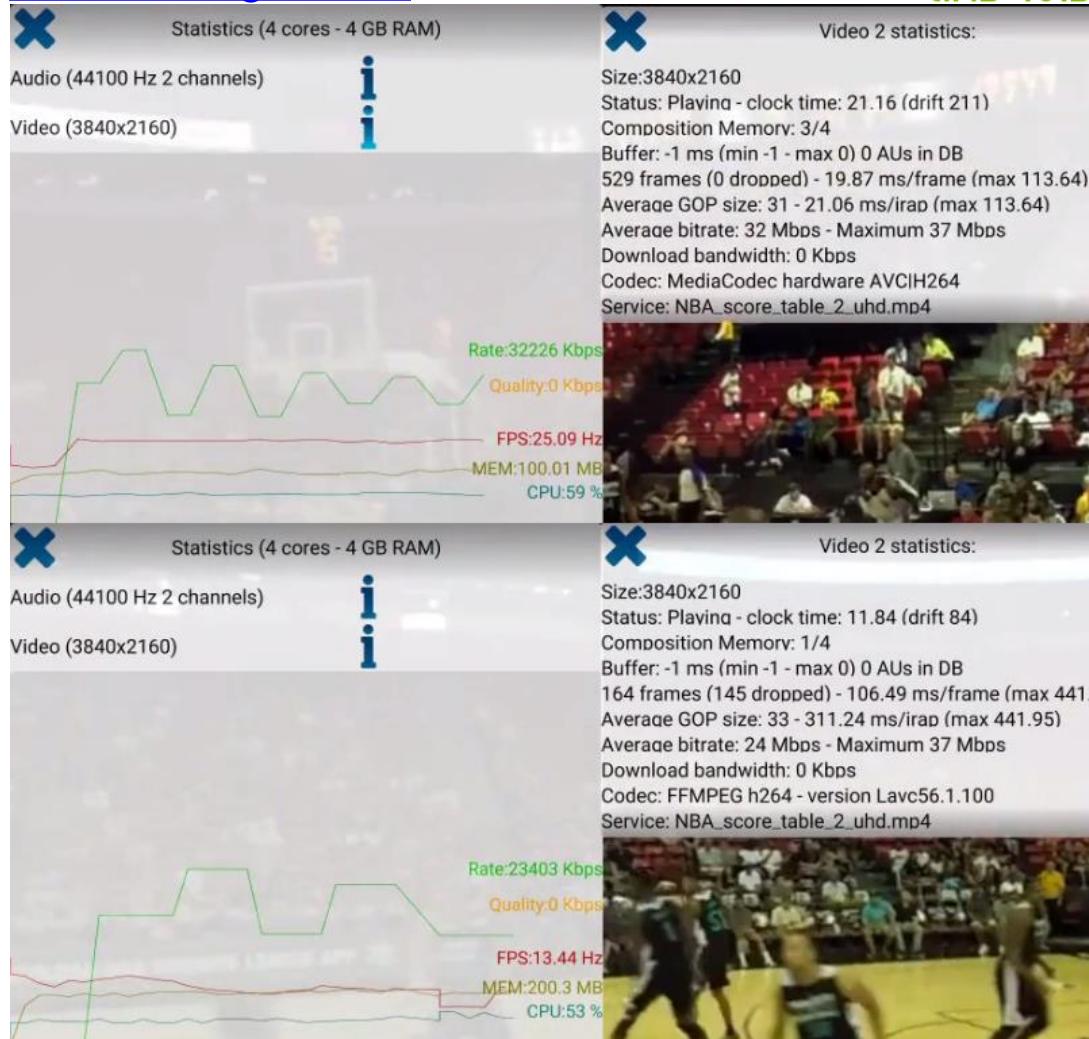


<https://gpac.io/2016/05/25/srd/>



MediaCodec statistics

Demo using GPAC





Questions ?