Fraunhofer
HHI

Tile Based DASH Streaming for Virtual Reality with HEVC

Enabler for high quality 360° video

Fraunhofer HHI's technique for Compressed Domain Tile Aggregation with HEVC allows VR video applications with drastically reduced video bitrates and decoder requirements. Tile Based DASH Streaming with our technique allows maintaining high video quality in the current viewport while streaming lower resolution outside the viewport. Our approach can adapt the video bitstream to the current user viewport on-the-fly without heavy transcoding or storage of a large number of pre-rendered viewports on the server. Using Tile Based DASH Streaming, individual tiles are offered to the client which selects a configuration suitable to his orientation, viewport and throughput budget. A single video decoder is used on client side.

Challenges

Ultra-high-resolution within the user viewport is required to achieve full immersion in VR video applications. Covering the full 360° video would easily lead to multiple times UHD resolution. Such large amount of data poses a major challenge to the whole chain of state-of-the-art video streaming. The throughput required for streaming of 360° video over the public Internet cannot be provided for many users. Furthermore, most VR relevant devices such as mobile phones contain hardware video decoders that are tailored to conventional FullHD and 4K resolution services. Due to these limitations, a new approach for adaptivity of bitrate and resolution in VR video applications is required.

Compressed Domain Tile Aggregation

Fraunhofer HHI's technique for Compressed Domain Tile Aggregation with HEVC overcomes the challenges of ultra high resolution content on limited decoder capabilities. In a traditional service design, per-user or per-viewport orientation streams would be offered which does not scale well and comes at significant storage and encoding cost. Using Fraunhofer HHI's technique, a tailored bitstream for each user can be easily generated on-the-fly without intensive processing on the server or client side. Video content outside the users current viewport is transmitted in low quality or resolution which allows a more efficient throughput and decoder utilization. Furthermore, Fraunhofer HHI's Compressed Domain Tile Aggregation solution enables usage of a single video decoder on end devices. Complete and market ready streaming solutions can be implemented based on well-established standard families such as ISO Base Media File Format and MPEG-DASH which are fully compatible to the Compressed Domain Tile Aggregation technique.

High resolution   Low resolution
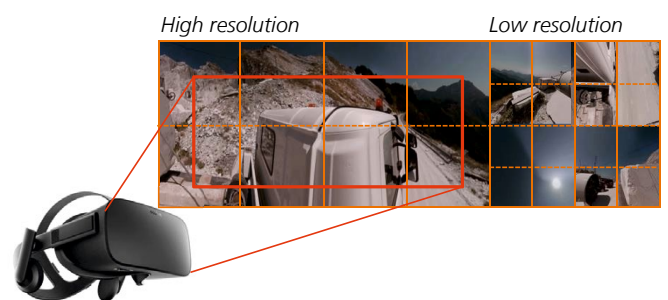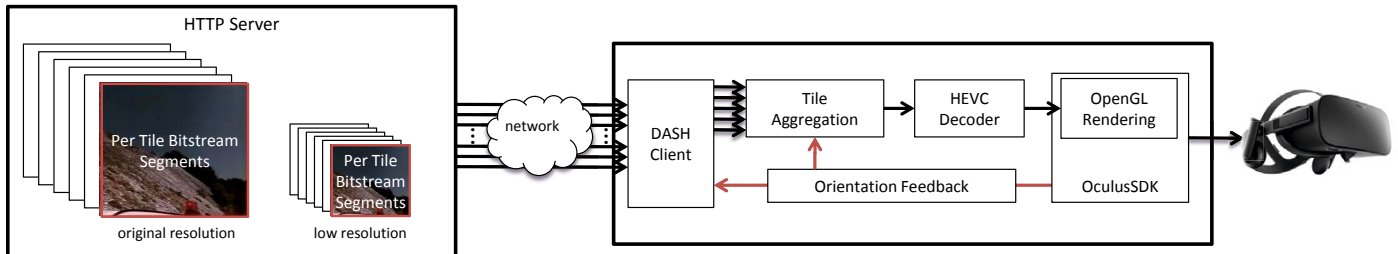
System overview: Tile Based DASH Streaming for Virtual Reality with HEVC.

Technical Background

- Lightweight merging of HEVC tiles through Compressed Domain Tile Aggregation

- Mixing of qualities and resolutions in one end user video stream

- Tile Based DASH Streaming with short buffer sizes to allow for responsive adaptation

- Selectively distribute Random Access Point (RAP) data over segments to overcome bitrate peaks

Benefits

- High video quality in current viewport, reduced resolution outside viewport

- On-the-fly viewport adaptation without transcoding

- Per-user or per-orientation encoding is not required

- Streaming bitrate and storage footprint reduction

- Reduced decoder level requirements

- Fully HEVC, MPEG ISOBMFF & MPEG DASH compliant

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