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CODING OF MOVING PICTURES AND AUDIO**

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**Source** Fraunhofer HHI, Canon Research Centre France\*,Telecom ParisTech'  
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**Title** DASH tile based streaming with unequal quality  
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## 1 Introduction

During the 116th meeting a contribution (m39255) was discussed that proposed signalling that would allow clients to mix tiles of different qualities, allowing thus, the client to use that information for its rate control. With such information, a client could download a RoI with a higher quality but not surpassing a suggested maximum quality difference between the downloaded tiles. This way, the content creator could inform the client about the maximum quality difference that would be acceptable for a service.

During the discussion 2 points were raised. The first one was about the fact that when mixing tiles of different quality, the acceptance of it is sometimes bound to the time the content is shown to the user. For instance, tiles with a big quality difference could be shown to the user for a couple of hundreds of milliseconds, while tiles with a small quality difference could be shown for seconds or even without time limitations. The second point was that since @qualityRanking is defined for an Adaptation Set, a general solution should be found that works also for non-tiled content and made generic. The second issue will be solved in another contribution (see m39935)

## 2 Use-case description

The figure 1 below illustrates the case of a video split into spatial tiles, with several quality levels per tile. The issue for the client is to select a good set of tiles: e.g. good quality for a user-selected region of interest but also acceptable quality for surrounding tiles so as to avoid unpleasant visual effects at tiles borders.

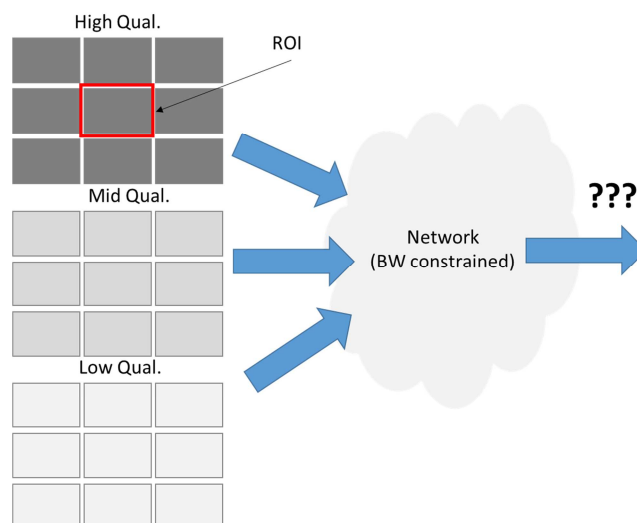


Figure 1: Video encoded for tile-based streaming

Since the acceptable quality difference is dependent on the content and how it has been encoded, letting the client do the adaptation by itself without any knowledge about what is acceptable and what is not, does not seem to be a good solution. We therefore think some signalling in the MPD can be useful to help the client automatically select a good set of tiles: more concretely about the acceptable quality difference and how long this difference is acceptable.

A motivation for this time duration is shown in the figure below where switching of tiles is performed gradually. When a switch was decided at the client, instead of switching up all tiles synchronously (requiring a RAP), tiles were switched up gradually. In [2] subjective quality experiments were carried out where 2 seconds is the signaled switching duration after which all tiles should be at the same quality level. During the configuration of the system we observed that longer time periods for the gradual switching were having a negative effect.

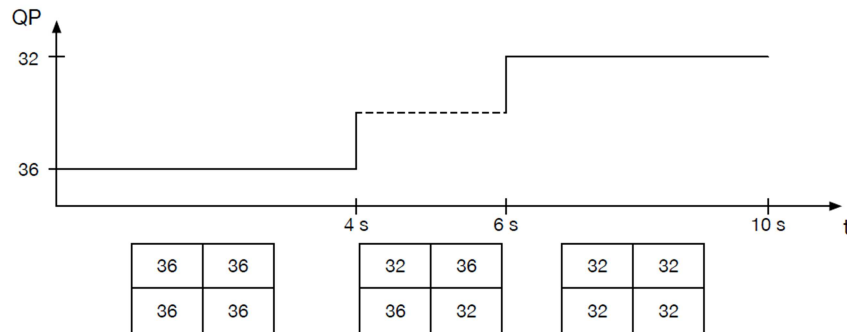


Figure 2: *Max Quality Difference* duration <2 for 2 quality levels QP=36 and QP=32

This information can be also used in a Panorama streaming scenario, where some additional tiles not belonging to the RoI are downloaded at a lower quality and only for the case that the RoI changes. With the information about how long the different quality content can be shown at an acceptable quality, the DASH receiver can dimension the length of the buffer of the prefetch tiles at lower quality.

### 3 Proposal

In order to guarantee a consistent user experience across DASH clients, the content creator needs to indicate some guidance on the selection of spatially related content, especially in terms of quality. For that, based on m39255, the proposal has been extended to tackle the issues discussed during the 116<sup>th</sup> meeting.

To express the acceptable quality difference and time that this different quality content can be shown, we propose to use a `SupplementalProperty` descriptor with `@schemeIdUri` equal to "urn:mpeg:dash:max\_quality\_difference". It shall be contained exclusively in these two MPD elements (**MPD** and **Period**).

The `@value` of the **SupplementalProperty** elements using the `MaxQualityDifference` scheme is a comma separated list of two values as defined in the following table.

## SupplementalProperty@value attributes for the MaxQualityDifference scheme

SupplementalProperty@value parameter	Use	Description
quality_difference	M	non-negative integer providing maximum difference of the values of @qualityRanking of different Representations for which the content can be simultaneously consumed with an acceptable quality.
duration	O	non-negative integer expressing the time duration in milliseconds that it is considered acceptable to consume simultaneously Representations with a maximum difference of quality_difference in their value of @qualityRanking.  If not present, this value is considered to be infinite.
<b>Legend:</b> M=Mandatory, O=Optional		

When a SupplementalProperty descriptor is present with a schemeIdUri equal to "urn:mpeg:dash:max\_quality\_difference", the quality ranking expressed by @qualityRanking also applies for Representations across different AdaptationSets. That is, @qualityRanking specifies a quality ranking of the Representation relative to other Representations of the same content type in any AdaptationSet.

## 4 Recommendation

We recommend MPEG DASH group to consider this additional signalling to help client selection when content components from multiple Adaptation Sets are selected to be displayed at the same time.

## 5 References

- [1] m39255, “Quality adaptation for tile based streaming in DASH”, MPEG#115, Chengdu, October 2016.
- [2] Y. Sanchez et al., “Shifted IDR Representations for Low Delay Live DASH Streaming using HEVC Tiles, Proceedings of the IEEE International Symposium on Multimedia (ISM), San Jose, CA, USA, December 2016.