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| *Title:* | **Improved Bitstream Characteristics in VPS and SEI message** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
| *Author(s) or Contact(s):* | Truong Cong Thang  Tsuruga, Ikki-Machi, Aizu-Wakamatsu, Japan 965-8580  JungWon Kang, Hahyun Lee, Jinho Lee, Jin Soo Choi 218, Gajeong-no, Yuseong, Daejeon, Korea | Tel: Email: | [thang@u-aizu.ac.jp](mailto:thang@u-aizu.ac.jp)  {jungwon, hanilee, jinosoul, jschoi}@ etri.re.kr |
| *Source:* | ETRI, University of Aizu | | |

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# Abstract

In the last meeting, information of bit rate and picture rate of a sub-layer representation are provided in the Video Parameter Set. This information can be used by a middle box to adapt a bitstream according to the network and terminal capabilities. However, the current description of bit rate and picture rate is still not flexible. In this contribution, some improvements to this characteristic description are proposed as follows.

1. Providing multiple time windows to calculate the highest bit rate. This will support different applications or devices with information in different timescales.
2. Describing the bit rate and picture rate information for different temporal periods. This provides network devices more acurate information when the video is encoded in variable bit rate mode.

# Introduction

In the last meeting, information of bit rate and picture rate of a sub-layer representation are provided in the Video Parameter Set. This information can be used by a middle box to adapt a bitstream according to the network and terminal capabilities. However, the current description of bit rate and picture rate is still not flexible. Sepecifically, the highest bit rate is computed by a fixed window size of 1s. Also, this information is provided only in VPS, which is for the whole coded sequence. In this contribution, some improvements to this characteristic description are proposed as follows.

1. Providing multiple time windows to calculate the highest bit rate. This will support different applications or devices with information in different timescales.
2. Describing the bit rate and picture rate information for different temporal periods. This provides network devices more acurate information when the video is encoded in variable bit rate mode.

In the following Section, the detailed description of each proposed item is provided

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# Proposal

## Time window for maximum bitrate definition

Currently, the maximum bitrate of a scalable representation is defined with a 1-second time window. However, different applications would need peak bitrate information in different timescales. For example, one application may be interested in the largest-burst (or peak bitrate) in 10s windows, while another application may need the info in windows of 30s. So, we propose to include the possibility of describing specifically one or more time window for this purpose.

The syntax of bit\_rate\_pic\_rate\_info( TempLevelLow, TempLevelHigh ) in HEVC draft is revised as follows.

|  |  |
| --- | --- |
| bit\_rate\_pic\_rate\_info( TempLevelLow, TempLevelHigh ) { | **Descriptor** |
| **num\_max\_bit\_rate\_windows\_minus1** | **u(3)** |
| for( j = 1; j <= num\_max\_bit\_rate\_windows\_minus1; j++ ) |  |
| **max\_bit\_rate\_calc\_window**[ j ] | **u(16)** |
| for( i = TempLevelLow; i <= TempLevelHigh; i++ ) { |  |
| **bit\_rate\_info\_present\_flag**[ i ] | **u(1)** |
| **pic\_rate\_info\_present\_flag**[ i ] | **u(1)** |
| if( bit\_rate\_info\_present\_flag[ i ] ) { |  |
| **avg\_bit\_rate**[ i ] | **u(16)** |
| for( j = 0; j <= num\_max\_bit\_rate\_windows\_minus1; j++ ) |  |
| **max\_bit\_rate** [ i ][ j ] | **u(16)** |
| } |  |
| if( pic\_rate\_info\_present\_flag[ i ] ) { |  |
| **constant\_pic\_rate\_idc**[ i ] | **u(2)** |
| **avg\_pic\_rate**[ i ] | **u(16)** |
| } |  |
| } |  |
| } |  |

The semantics of the new/revised elements are as follows:

* **bit\_rate\_info\_master\_flag:** equal to 0 indicates that the bitrate information for sub-layers is not specified.
* **num\_max\_bit\_rate\_windows\_minus1**: plus 1 specifies the number of time windows that are used for calculating the maximum bitrate.
* **max\_bit\_rate\_calc\_window**[ j ] specifies a size of the jth time window that is used for calculating upper bounds for the bit rates of the representations of the sub-layers in units of 1/100 second. The default value of **max\_bit\_rate\_calc\_window**[ 0 ] is 100.
* **max\_bit\_rate** [ i ][ j ]: indicates an upper bound for the bit rate of the representation of the i-th sub layer as computed in SVC specification [3] with the time window specified by max\_bit\_rate\_calc\_window[ j ].

## Bitrate and picture rate information for different temporal periods

Currently, the bitrate and picture rate information is provided only in VPS. However, encoded video may have very different bitrates and/or picture rates in different temporal periods. So, we propose to describe bitrate and picture rate for temporal periods. The bitrate and picture rate in VPS are valid for the whole coded sequence, while our additional information can be used to better match the local characteristics of video content.

For this purpose, a new SEI message called “period\_characteristics” is proposed as follows.

|  |  |
| --- | --- |
| period\_characteristics( payloadSize ) { | **Descriptor** |
| **duration\_flag** | u(1) |
| if( duration\_flag ) |  |
| **period\_duration** | u(32) |
| bit\_rate\_pic\_rate\_info( 0, vps\_max\_sub\_layers\_minus1 ) |  |
| } |  |

The semantics of the new SEI message is as follows:

This SEI indicates the characteristics of a temporal period of a video sequence. This message shall be contained in the first access unit in decoding order of the period to which the period characteristics SEI message applies.

**- duration\_flag**: equal to 0 indicates that the duration of the target temporal period is not specified.

- **period\_duration:** specifies the duration of the target temporal period in clock ticks of a 90-kHz clock.

# Conclusions

In this contribution, some improvements to bit rate and picture rate information of sub layer representation were proposed. It is claimed that providing multiple time windows to calculate the highest bit rate would support different applications or devices with information in different timescales. Also, describing the bit rate and picture rate information for different temporal periods will provide more acurate information when the video is encoded in variable bit rate mode.. We propose to adopt these items into the next version of HEVC specification draft.

# References

1. JCTVC-K1003 “High Efficiency Video Coding (HEVC) text specification draft 9”
2. JCTVC-K1007 “Solutions considered for NAL unit header and video parameter set for HEVC extensions”
3. Annex G of ISO/IEC 14496-10 “Advanced Video Coding for Generic Audiovisual Services,” 2012.

# Patent rights declaration(s)

**ETRI may have current or pending patent rights relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**

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