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TECHNICAL CORRIGENDUM 2

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Information technology — Generic coding of moving pictures and associated audio information: Part 1: Systems

TECHNICAL CORRIGENDUM 2: STD buffer sizes for HEVC and miscellaneous editorial issues

Technologies de l'information — Codage générique des images animées et du son associé: Partie 1: Systèmes

RECTIFICATIF TECHNIQUE 2

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – Generic coding of moving pictures and associated audio information: Systems

Technical Corrigendum 2

STD buffer sizes for HEVC and miscellaneous editorial issues

1) Clause 2.4.2.3, Extensions for single layer HEVC

In clause 2.4.2.3, replace:

NOTE 2 – In the following equations, unit conversion should be implicitly performed as appropriate.

With:

NOTE 2 – In the following equations, unit conversion should be implicitly performed as appropriate. Values expressed in bits are implicitly converted into values expressed in bytes by: *number_of_bytes* = (*number_of_bits* +7) / 8.

2) Clause 2.17.2, Extensions for single layer HEVC

In clause 2.17.2, replace:

- There is exactly one multiplexing buffer MB_n for the HEVC video stream or HEVC temporal video sub-bitstream, where the size MBS_n of the multiplexing buffer MB is constrained as follows:

$$MBS_n = BS_{mux} + BS_{oh} + CpbBrNalFactor \times MaxCPB[tier, level] - cpb\_size$$

where BS_{oh}, packet overhead buffering, is defined as:

$$BS_{oh} = (1/750) \text{ seconds} \times \max\{ CpbBrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s}\}$$

and BS_{mux}, additional multiplex buffering, is defined as:

$$BS_{mux} = 0.004 \text{ seconds} \times \max\{ CpbBrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s}\}$$

MaxCPB[tier, level] and MaxBR[tier, level] are taken from Annex A of Recommendation. ITU-T H.265 | ISO/IEC 23008-2 for the tier and level of the HEVC video stream or HEVC temporal video sub-bitstream. Cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or HEVC temporal video sub-bitstream.

- There is exactly one elementary stream buffer EB_n for all the elementary streams in the set of received elementary streams associated by hierarchy descriptors, with a total size EBS_n

$$EBS_n = cpb\_size \text{ (measured in bytes)}$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or the HEVC temporal video sub-bitstream.

With:

- There is exactly one multiplexing buffer MB_n for the HEVC video stream or HEVC temporal video sub-bitstream, where the size MBS_n of the multiplexing buffer MB is constrained as follows:

$$MBS_n = BS_{mux} + BS_{oh} + CpbNalFactor \times MaxCPB[tier, level] - cpb\_size$$

where BS_{oh}, packet overhead buffering, is defined as:

$$BS_{oh} = (1/750) \text{ seconds} \times \max\{ BrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s}\}$$

and BS_{mux}, additional multiplex buffering, is defined as:

$$BS_{mux} = 0.004 \text{ seconds} \times \max\{ BrNalFactor \times MaxBR[tier, level], 2\,000\,000 \text{ bit/s}\}$$

MaxCPB[tier, level] and MaxBR[tier, level] are taken from Annex A of Rec. ITU-T H.265 | ISO/IEC 23008-2 for the tier and level of the HEVC video stream or HEVC temporal video sub-bitstream, where rates are expressed in bit/s. cpb_size is taken from the HRD parameters, as specified in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or HEVC temporal video sub-bitstream, where the size is expressed in bits. Implicit conversion is carried out according to Note 2 in 2.4.2.3.

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- There is exactly one elementary stream buffer EB_n for all the elementary streams in the set of received elementary streams associated by hierarchy descriptors, with a total size EBS_n

$$EBS_n = cpb\_size$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC video stream or the HEVC temporal video sub-bitstream, where the size is expressed in bits. Implicit conversion is carried out according to Note 2 in 2.4.2.3.

Further, replace:

When there is no data in TB_n then Rx_n is equal to zero. Otherwise:

$$Rx_n = bit\_rate$$

where bit_rate is CpbBrNalFactor/CpbBrVclFactor x BitRate[SchedSelIdx] of data flow into the CPB for the byte stream format and BitRate[SchedSelIdx] is as defined in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2 when NAL hrd_parameters() is present in the VUI parameters of the HEVC video stream.

With:

When there is no data in TB_n then Rx_n is equal to zero. Otherwise:

$$Rx_n = bit\_rate$$

where bit_rate is BrNalFactor/BrVclFactor x BitRate[SchedSelIdx] of data flow into the CPB for the byte stream format and BitRate[SchedSelIdx] is as defined in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2 when NAL hrd_parameters() is present in the VUI parameters of the HEVC video stream.

Further, replace:

Otherwise, the leak method shall be used to transfer data from MB_n to EB_n as follows:

$$Rbx_n = CpbBrNalFactor \times MaxBR[tier, level]$$

with:

Otherwise, the leak method shall be used to transfer data from MB_n to EB_n as follows:

$$Rbx_n = BrNalFactor \times MaxBR[tier, level]$$

3) Clause 2.17.3, Extensions for layered transport of HEVC temporal video subsets

In clause 2.17.3, replace:

- There is one multiplex buffer $MB_{n,k}$ for each received elementary stream $ES_{n,k}$, where the size $MBS_{n,k}$ of the multiplex buffer $MB_{n,k}$ is constrained as follows:

$$MBS_{n,k} = BS_{mux} + BS_{oh} + CpbBrNalFactor \times MaxCPB[tier, level] - cpb\_size \text{ (measured in bytes)}$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC highest temporal sub-layer representation associated with $ES_{n,H}$.

with

- There is one multiplex buffer $MB_{n,k}$ for each received elementary stream $ES_{n,k}$, where the size $MBS_{n,k}$ of the multiplex buffer $MB_{n,k}$ is constrained as follows:

$$MBS_{n,k} = BS_{mux} + BS_{oh} + CpbNalFactor \times MaxCPB[tier, level] - cpb\_size$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Rec. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC highest temporal sub-layer representation associated with $ES_{n,H}$. In the HRD parameters, cpb_size is expressed in bits, and its value is implicitly converted into a value expressed in bytes according to Note 2 in 2.4.2.3.

Further, replace

- There is exactly one elementary stream buffer EB_n for the H + 1 elementary streams in the set of received elementary streams $ES_{n,0}$ to $ES_{n,H}$, with a total size EBS_n

$$EBS_n = cpb\_size \text{ (measured in bytes)}$$

where cpb_size is taken from the HRD parameters, as specified in Annex E of Recommendation. ITU-T H.265 | ISO/IEC 23008-2, included in the HEVC highest temporal sub-layer representation associated with $ES_{n,H}$.

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