Requirements for Future Video Coding (H.FVC)

(Ref: Report SG16-R1, Annex I; Approved 2017-01-27)

This document contains requirements for the first phase of a potential Future Video Coding ("H.FVC", a.k.a. FVC) video coding standardization project. The "H.FVC" project is expected to develop a new Recommendation | International Standard or an extension of HEVC (ITU-T Rec. H.265 | ISO/IEC 23008-2), depending on which form of standardization is determined to be appropriate for the technology design.

1 Applications

Requirement:

– FVC should be capable of serving the needs of numerous applications, including:
  - Broadcast.
  - Digital cinema and large-screen digital imagery.
  - Low-delay interactive communication.
  - Mobile communication and entertainment.
  - Streaming, download-and-play, and storage-media-based applications.
  - Surveillance and smart home.
  - Video on demand.
  - Virtual, augmented and mixed reality for communication, interaction and entertainment.
  - User-generated images and video.
  - Screen content.
  - Gaming.
  - Multispectral content.
  - Automated analysis of video content.
  - Internet of Things, industrial applications, automotive, robotics, and digital medicine.

2 Compression Capability

Requirement:

– FVC should be capable of providing a bit rate reduction of approximately 50% at the same subjective quality compared to HEVC as used in these applications.

3 Complexity

Complexity refers to computational resource consumption (in terms of power consumption, computing cycles, memory capacity, memory bandwidth, etc.), including consideration of typical computing architectures and parallelization.

Requirements:

– FVC complexity shall allow for feasible implementation within the constraints of the available technology at the expected time of usage.

– FVC decoder complexity shall be considered. Real-time decoding shall be feasible within the constraints of the available technology at the expected time of usage. Applications with partial spatial region decoding of the bitstream (e.g. VR and AR) and the associated impact on decoder complexity should be considered.

- The encoder complexity that is necessary for achieving a desired compression efficiency shall be taken into consideration. FVC encoders should be capable of trading off complexity and coding efficiency. Real-time encoding with adequate coding efficiency shall be feasible within the constraints of the available technology at the expected time of usage. Non-real-time coding with further improvement of coding efficiency should also be considered.

4 Packet loss robustness

Transmission of FVC bitstreams over error-prone networks may be affected by packet losses that, for some video applications, cannot be repaired by the network.

Requirement:

- FVC shall be capable of robust operation in the presence of packet losses.

Remark:

Aspects of the system-level support, encoder optimization and decoder concealment behavior necessary to achieve this, may not be within the normative scope of FVC. Robustness capability similar to that of HEVC Main Profile is considered acceptable.

5 End-to-end delay

Encoder processing time is the time distance used by an encoder starting from the input of the first video sample and ending with the output of the last bit representing that picture.

Decoder processing time is the time distance used by a decoder starting from the input of the first bit and ending with the output of the last video sample representing that picture.

Low end-to-end delay is a minimized time distance that is equal to the sum of the minimum encoder processing time and minimum decoder processing time, while representing the video signal at a desired coding efficiency.

Ultra-low end-to-end delay is a minimized time distance that is shorter than the sum of the minimum encoder processing time and minimum decoder processing time, while representing the video signal at a desired coding efficiency.

Requirements:

- FVC shall be capable of low end-to-end delay operation, efficiently enabling interactive and conversational applications.
- FVC should be capable of ultra-low end-to-end delay operation, efficiently enabling the corresponding applications.

Remark:

FVC should be capable of trading off computational complexity, compression efficiency, and loss robustness with delay characteristics.

6 Random access and "Trick mode" support

Requirements:

- FVC shall have support for random access points in the video bitstream for functionality such as channel switching and program chapter access.
- FVC shall have support for pause, fast forward, normal speed reverse, and fast reverse access to a stored video bitstream.

7 Interface to systems layer

Requirements:

– FVC should be designed to permit efficient adaptation and integration with a broad variety of system and delivery layers relevant to the intended applications. Buffer models, including hypothetical reference decoders (HRDs), should be specified as necessary for target applications.

– FVC should support bit rate adaptivity over a range of at least one order of magnitude within a coded video sequence or equivalent.

8 Bit depth and colour sampling

Requirements:

– FVC shall be capable of representing video signals with bit depths 8 and 10. FVC should be capable of representing video signals with bit depths ranging from 8 to 16.

– FVC shall be capable of representing video signals with 4:2:0 colour sampling. FVC should be capable of representing video signals with colour samplings ranging from monochrome to 4:4:4.

– FVC may be capable of representing multispectral imagery, multiview imagery, and supplemental picture representations.

9 Resolutions, scanning methods, and frame rates

Requirements:

– FVC shall be capable of coding progressively scanned video signals. FVC may support the coding of other scanning formats.

– FVC shall be capable of representing still pictures.

– FVC shall be capable of representing video signals with temporal resolutions ranging up to 120 fps. FVC should be capable of representing video signals with temporal resolutions higher than 120 fps.

– FVC shall be capable of representing pictures and video signals with spatial resolution up to 8Kx4K. FVC should be capable of representing pictures and video signals with spatial resolution larger than 8Kx4K.

– FVC shall be capable of representing pictures with wide colour gamut and high dynamic range (e.g., ITU-R BT.2100) as well as conventional colour formats (e.g., ITU-R BT.709).

– FVC shall support picture and video formats of arbitrary size and temporal sampling rates, within limits specific to each operating configuration.

– FVC shall support at least the same range of progressive scan picture formats and frame rates as supported by HEVC.

– FVC should support panoramic picture and video formats.

10 Picture fidelity range

Requirements:

– FVC shall be capable of operation in a quality range from low fidelities up to subjectively visually lossless.

– FVC should support a mathematically lossless representation of the video signal.

11 Hierarchical/layered coding

Requirement:

– FVC should support extraction of decodable subsets of a bitstream.

Remark:

Scalability modalities (such as temporal, spatial, and SNR scalability) can be considered in a first version of a future codec specification.

12 Support for Adaptive Streaming

– FVC should support representation switching in the case of adaptive streaming services that offer multiple representations of the same content, each having different properties (e.g. spatial resolution or picture fidelity).

– FVC shall enable the use of efficient prediction structures without compromising fast and seamless representation switching capability between representations of different properties, such as different spatial resolutions.

13 Possible extensions

– Extensions of FVC may include the following:
  - 3D video.
  - Additional scalability modes.
  - Multi-channel operation, including alpha support.
  - Bit depths beyond 10 bits.
  - Distributed processing operation.
  - Multispectral imagery.

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