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# Scope

This document collects information on the MPEG Systems Exploration on Systems Functionalities for Video Conformance.

# Background and Justification

MPEG and ITU‐T have just completed two new codecs, namely VVC and EVC. In addition, other codecs are under development. Hence, there is the question on what would be needed on a functionality basis to advantageously add such codecs into systems and applications, in particular in adaptive streaming services. For previous codecs such as AVC and HEVC, adaptive streaming system design has been limited by what is supported on hardware devices and the streaming applications needed to deal with the functionalities and limitations of hardware devices, in particular to create “seamlessness” when switching and splicing. While some of this discussion may be deferred to application and system standards, more and more devices included codecs are used for many different services. Hence, consistent decoder implementations also for systems functionalities should be a major concern for the organization that has developed the codec.

Decoder implementations for these new codecs are expected to be designed over the coming months based on conformance bitstreams. Hence, it is important that conformance streams and test cases related to adaptive streaming and systems aspects are provided to hardware and SOC decoder implementers for robust VVC/EVC hardware decoders to deal with efficient and feature‐rich streaming functionalities.

Potential Functionalities include:

* Codec initialization: What is sufficient to initialize the codec?
* Codec configuration change: Once initialized, what parameters can be changed without decoder reinitialization?
* Random access, content splicing, and content switching
  + Random access: What kinds of random access can be done (without decoder reinitialization)?
  + Content splicing: What kinds of content can be spliced together (without decoder reinitialization)?
  + Content switching: What kinds of content can be seamlessly switched back and forth (without decoder reinitialization)?
* Coding efficiency: How can we maintain high coding efficiency while enabling the streaming
* functionalities?
* Suitable target latencies: How can we operate at target latencies while maintaining high coding efficiency?
* SEI message placement and handling: How does the SEI messages affect streaming functionalities? Initialization? Same SEIs across all CMAF Tracks?
* Cross‐stream switching: For example support fast join or switching, how can this be achieved?

This is issue was also recognized by DASH-IF, who provided an LS to MPEG#132 stating among others:

*DASH-IF has initiated a work item on “Streaming functionalities for new codecs”, for details please refer to here: https://dash-industry-forum.github.io/docs//Work-Item-Proposal-Streaming-Next-Gen-Codecs-r3.pdf. In the context of this work item, DASH-IF has initiated work to create some test cases for use of the new codecs in adaptive streaming environments, including cases related to video decoder initialization and reinitialization to a different level of the same codec profile or a different profile of the same codec or the different codec in streaming operations like random access, switching, splicing, ad insertion, etc. The goal of this work is to specify, among others, a list of conforming video bitstreams corresponding to these test cases, which, after discussion and confirmation with JVET for VVC and MPEG Video (ISO/IEC JCT1 SC29 WG 4) for EVC, can be generated and included in the sets of conformance bitstreams. The hope is that through this activity, hardware implementations of these new video codecs can work properly in adaptive streaming environments, or generally for systems related functionalities.*

*On the DASH-IF side, this is a work-in-progress. However, since the next meetings of JVET and MPEG Video are coming soon, DASH-IF would like to*

1. *share the status of this work (a snapshot of this work-in-progress is attached),*
2. *know JVET’s and MPEG Video’s interests on such inputs from DASH-IF,*
3. *know the schedule of the VVC and EVC conformance work regarding elementary bitstreams,*
4. *know the schedule of the VVC and EVC system-level work on ISO BMFF and CMAF, and*
5. *hear any other feedback on the snapshot of this work-in-progress.*

# Existing work and timelines

|  |  |  |
| --- | --- | --- |
| Organization | Work Item or Specification | Status |
| SC29 WG5 (JVET) | ITU-T H.266 | ISO/IEC 23090-3: VVC | FDIS (N19470/[JVET-S2001](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=10399)) |
| SC29 WG5 (JVET) | ITU-T H.274 | ISO/IEC 23002-7: VSEI | FDIS (N19472/[JVET-S2007](http://phenix.int-evry.fr/jvet/doc_end_user/current_document.php?id=10407)) |
| SC29 WG5 (JVET) | ISO/IEC 23090-15: Conformance Testing for VVC | VVC conformance will be a CD at the current meeting and will be in document WG 5 N 9 (JVET-T2008). DIS ballot is planned in January, with FDIS in July. |
| SC29 WG4 (MPEG Video) | ISO/IEC 23094-1: EVC | FDIS (WG11 N19229) |
| SC29 WG (MPEG Video) | ISO/IEC 23094-4: Conformance and Reference Software of EVC | CDAM (N19497) |
| SC29 WG3 (MPEG Systems) | ISO/IEC 14496-15: Carriage of NAL unit structured video in the ISOBMFF | DAM (WG11 N19454)  Potential improvements on Carriage of VVC and EVC in ISOBMFF (WG3 N00035) |
| SC29 WG3 (MPEG Systems) | ISO/IEC 23000-19: CMAF | WD of ISO/IEC 23000-19:2019 AMD 2 CMAF Media Profiles for MPEG-H 3D Audio, EVC, VVC and other technologies  (WG 03 N00061) |

# Proposed way forward

Based on the discussion above, MPEG Systems (SC29 WG3) initiates an exploration work to collect systems and in particular adaptive streaming related functionalities to support the conformance program in MPEG and JVET for new codecs. In particular, the following aspects are addressed:

1. Collect systems-relevant use cases and functionalities that need support in video codec implementations based on the justification and background in in this document.
2. Define bitstream conformance requirements based on these functionalities
3. Provide input the VVC and EVC conformance work
4. Collaborate and solicit input from external organizations, in particular including DASH-IF, CTA WAVE and DVB.
5. Collaborate with MPEG video and JVET on this matter

For this purpose, a public AHG is formed.