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**ISO/IEC JTC 1/SC 29/WG 11**

**CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC 1/SC 29/WG 11 N17203**

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| --- | --- |
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**MPEG work plan**

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# Video coding

## Advanced Video Coding

### Progressive High 10 Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 10 | A4 | 16032 | Motivations  HEVC misses a profile for applications that use 10 bit 4:2:0 progressive-scan video content. |
|  |  |  |  | Objectives   1. Definition of a "Progressive High 10" 2. Specification of additional VUI code points for video colour interpretation 3. Specification of an SEI message for transfer characteristics. |

### Additional supplemental enhancement information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 10 | A1 | 166742 | Motivations  AVC misses an SEI message for colour remapping information, which exists in HEVC, to enable remapping of the decoded colour samples of the output pictures |
|  |  |  |  | Objective  Specification of an AVC SEI message for colour remapping information, which enables remapping of the decoded colour samples of the output pictures. |

## Internet Video Coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 33 | E1 |  | Motivations  Old MPEG video compression standards, such as MPEG-1 and MPEG-2 have become Type 1, but their performance is not comparable with newer standards. There is room to create a standard that is intended to be Type 1 and has significantly superior performance compared to MPEG-1 and MPEG-2. |
|  |  |  |  | Objectives  A Type 1 video coding standard with a performance as good as possible under the given constraints. |

## HEVC

### Additional colour representation code point

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A1 |  | Motivations  Introduction of an additional representation code point in HEVC, to indicate the use of the ICTCP colour representation as specified in the ITU-R Recommendation BT.2100. |
|  |  |  |  | Objectives  Specification of additional Video Usability Information (VUI) code points for video colour interpretation, in particular the ICtCp colour space. |

### Main 10 Still Picture Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A2 | 16496 | Motivations  Specification of an additional profile for 10 bit 4:2:0 still picture coding, which is intended to be simple to support by devices complying to the HEVC Main 10 Profile. |
|  |  |  |  | Objectives  Specification of a profile for the coding of still pictures with 4:2:0 format and bit depths of 8-10 bits per sample. |

### Content Colour Volume SEI Message et al.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A3 | 16687 | Motivations  This additional SEI is intended to assist in processes related to decoding, display or other purposes |
|  |  |  |  | Objectives:  SEI messages for:   * Content colour volume characteristics * Motion-constrained tile sets extraction information * Omnidirectional 360° projection indication * Region nesting of other SEI messages |

### HEVC Monochrome Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | A? |  | Motivations:  This activity will create a new profile of HEVC that that will have an encoding of a single (i.e. monochrome) colour plan and will be restricted to a maximum of 10 bits per sample. This profile will complement other 10 bit profiles, such as the Main 10, Main 10 Still Picture, and Main 4:4:4 10 profiles. It is expected to be used in a variety of applications that may require signalling of 10 bit monochrome auxiliary information, such as depth information and alpha planes. |
|  |  |  |  | Objectives  Specification of a profile of HEVC that that will have an encoding of a single (i.e. monochrome) colour plan and will be restricted to a maximum of 10 bits per sample, in a manner otherwise consistent with the prior specified “range extensions” profiles of HEVC. |

### Signalling, backward compatibility and display adaptation for HDR/WCG video

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 15 | T1 | 16504 | Motivations:  Industry needs guidance on the application of ICtCp, HLG, and SEI messages in the coding of HDR/WCG video |
|  |  |  |  | Objectives  Guidelines on the application of ICtCp, HLG, and SEI messages in the coding of HDR/WCG video complementing and extending ISO/IEC 23008-14 “Conversion and Coding Practices for HDR/WCG Y′CbCr 4:2:0 Video with PQ Transfer Characteristics”. |

## *Future Video Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 3 | E1 |  | Motivations:  Industry needs more video compression and new features |
|  |  |  |  | Objectives   1. Study 2D video coding technology which could improve the compression performance or give new functionality, as compared to HEVC including the development of test cases and evaluation methodologies for assessment of such benefits are investigated. 2. Study how video compression can be applied to 360ᵒ Video (3DoF) |

## *Immersive Video Coding*

### *Immersive video – 3DoF*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | ? | E1 |  | Motivation  3DoF is the ability to look around (3 rotations), while 6DoF supports also translations along the three spatial directions. 3DoF+ is a tiny version of 6DoF allowing to slightly move the head in sitting position. Even when rotating the head, the eyes actually undergo a small translation that also create movement parallax that should be properly accounted for in order to avoid cyber sickness.  More advances 6DoF scenarios correspond to letting the VR-user walk a few steps from his/her anchor position, without necessarily the need to fully turn around the objects in the scene. These constrained versions of 6DoF are called omnidirectional-6DoF (cameras looking outward the scene) and windowed-6DoF (cameras converging to the central part of the scene); the latter giving the VR-user a windowed view to the scene with rotational and translational navigation freedom.  These constrained versions of 6DoF can be supported with depth image-based rendering techniques. |
|  |  |  |  | Objectives  To reach a high degree of realism in Virtual Reality (VR), these 6DoF Immersive Video scenarios capture and process high resolution color images of the scene (hence multiview), using depth estimation, view synthesis, image fusion and panoramic stitching. The main challenge consists in developing good depth estimation and view synthesis tools for good rendering (even though rendering is not part of the standard). Additionally, view synthesis may also be used to predict views in the encoder, hence rendering tools will possibly also be integrated into the normative parts of the multicamera video encoder. |

### *Immersive video – 3DoF+*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | ? | E1 |  | Motivation  Technology is making available different ways of offering a user an immersive experience surrounding him/her with a large field of view video (up to 360 degrees) through Virtual Reality goggles or large 3D video walls. |
|  |  |  |  | Objectives  To study immersive video where the user is presented different viewpoints to his/her surroundings, corresponding to rotational head movements only (so-called Three Degrees of Freedom, 3DoF), possibly augmented with a virtual or physical translational body/head movement in a limited volume around a central position (referred to as 3DoF+). |

### *Immersive video – 6DoF*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | ? | E1 |  | Motivation |
|  |  |  |  | Objectives |

### *Light Field Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | ? | E1 |  | Motivation  Light field cameras are a new technology with the potential to dramatically increase the sense of immersion that can be achieved by images and video captured by cameras, and arrays of cameras focused on a particular scene, for use in content capture, production, and distribution ecosystem, display manufacturers, and service providers. |
|  |  |  |  | Objectives  To study of existing devices, applications, and use cases for light fields and light field applications with the goal to develop new technologies that can be used to compress light field data.  A key issue with the technology is the incredibly large amount of data necessary to achieve the desired sense of immersion, without unwelcome impacts on the user (i.e. motion sickness, viewer fatigue, and eye strain). |

## Video Coding Independent Code Points

### Video CICP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| CI | 2 | E1 | ? | Motivations  Many data used in MPEG standards are widely scattered or defined by MPEG in its individual standards |
|  |  |  |  | Objective  To define a set of coding-independent code points for indicating properties of video content such as colour type identifiers, aspect ratio, and frame packing types. |

### Usage of video signal type code points

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| CI | 4 | E1 | ? | Motivations  This document will help industry avoid common content processing mistakes due to lack of understanding of approporiate combinations of video properties used, such as colour indication code points. With the increased usage of high-dynamic range and the increased use of look-up tables in television systems, these content processing mistakes could increasingly become magnified. |
|  |  |  |  | Objective  This a non-normative document providing guidance on combinations of video properties that are widely used in industry production practices. It will document the usage of colour-related code points and description data for video content production. |

# Audio coding

## Advanced Audio Coding

### Levels and Downmixing Method for 22.2 Channel Programs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 3 | A6 | 15827 | Motivations  There is a need to enable the Dynamic Range Control to be used with e.g. the AAC family of codecs |
|  |  |  |  | Objective  To define signalling and carriage of Dynamic Range Control data in MPEG-4 Audio elementary streams |

### SBR Enhancements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 3 | A7 | 16873 | Motivations  In geographic area with only 2G cellular capability, some additional compression is needed for streaming of audio/visual content. |
|  |  |  |  | Objective  Additional compression can be provided by incorporating the eSBR tool of ISO/IEC 23003-3:2012 (MPEG-D USAC) into ISO/IEC 14496-3:2009 (MPEG-4 Audio). This specifies how the enhanced SBR (eSBR) tool of ISO/IEC 23003-3:2012 (MPEG-D USAC) is used within ISO/IEC 14496-3:2009 (MPEG-4 Audio) in a backwards compatible way. |

## Unified Speech and Audio Coding

### Stream ID and FF group

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 3 | A4 | 16874 | Motivations  A DASH delivery needs to know when it has to re-configure the USAC decoder because of a stream configuration change. |
|  |  |  |  | Objectives  To specify a stream identifier (stream ID) that shall uniquely identify a configuration of a stream within a set of associated streams that are intended for seamless switching. |

## Dynamic Range Control

### Support for MPEG-D DRC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 4 | A3 | 15256 | Motivations  There is a need to offer flexible DRC gain sequence mapping for multi-band DRC and DRC target characteristics provided by the encoder |
|  |  |  |  | Objectives  To specify DRC gain generation at the decoder. Metadata based equalization can be applied and support for loudness equalization is built in. |

### DRC Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 4 | A4 |  | Motivations  MPEG does not wish interoperability points for MPEG-D DRC to be set in a defacto manner in the marketplace. |
|  |  |  |  | Objectives  The Amendment specifies profiles and levels to address current industry needs for guidance on which tools of MPEG-D DRC shall be implemented and to ensure interoperability. |

## MPEG-H 3D Audio

### Audio Metadata Enhancements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 3 | A5 | 17031 | Motivations  Marketplace needs require that MPEG-H 3D Audio support all metadata used by 3D audio production tools. |
|  |  |  |  | Objectives  The Amendment specifies technology to deliver and process metadata from 3D audio production tools. |

## *Immersive Audio Coding*

### *Audio Coding for AR/VR*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 3 | A? |  | Motivations  MPEG-H 3D Audio may need to be extended to support initial forms of immervice experiences |
|  |  |  |  | Objectives  To explore how MPEG Audio technology, including MPEG-H 3D Audio, can be extended to support AR and VR use cases. When concrete use cases and requirements are established, new work will begin. |

### *Audio Wave Field Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 3 | E1 |  | Motivations  Immersive experiences may need more sophisticated immersive audio technologies |
|  |  |  |  | Objectives  To explore audio wave field capture, coding and presentation use cases and requirements. |

## Audio Coding Independent Code Point

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| CI | 3 | E1 | ? | Motivations  Many data used in MPEG standards are widely scattered or defined by MPEG in its individual standards |
|  |  |  |  | Objectives  Ti define various code-points and fields which document aspects that are bit-rate and compression independent, of an audio stream. They describe the characteristics of the signal before the signal is actually compressed by any encoder that is suitable for compressing such an input signal, or after decompressing the signal. |

# 3D Graphics Coding

## *Point Cloud Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| CI | 5 | E1 |  | Motivations  Technologies allow the capure of 3D point clouds typically with multiple cameras and depth sensors in various setups producing thousands up to billions of points when realistically reconstructed scenes are represented. Point clouds can have attributes such as colors, material properties and/or other attributes and are useful for real-time communications, for GIS, CAD and cultural heritage applications. |
|  |  |  |  | Objectives  To specify lossy compression of 3D point clouds employing efficient geometry and attributes compression, scalable/progressive coding, and coding of point clouds sequence captured over time with support of random access to subsets of the point cloud. |

# Font Coding

## Updated text layout features and implementations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 22 | A2 | 15930 | Motivations  OFF needs to support complex layouts and new layout features |
|  |  |  |  | Objectives  To specify changes in complex layout support and of the additional support for new layout features necessitate corresponding updates to the functionality of the existing layout features and definition of new ones. |

# Media context and control

## Media Context and Control – Control Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 2 | E4 |  | Motivations  MPEG-V must support capabilities and preferences for such new sensors and actuators as 3D printer, E-nose, Camera array, and Radar |
|  |  |  |  | Objectives  To specify such capabilities for MPEG-V Control Information. |

## Media Context and Control – Sensory Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 3 | E4 |  | Motivations  MPEG-V must support new sensory effects related to color models of 3D printing. |
|  |  |  |  | Objectives  To specify such capabilities for MPEG-V Sensory Information. |

## Media Context and Control – Virtual World Object Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 4 | E4 |  | Motivations  Virtual World Object Characteristics must be extended to account for additions to other MPEG-V parts where new actuators and sensors have been introduced. |
|  |  |  |  | Objectives  To specify such characteristics in MPEG-V Virtual World Object Characteristics. |

## Media Context and Control – Data Formats for Interaction Devices

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 5 | E4 |  | Motivations  MPEG-V needs additional Data Formats for new actuators and sensors such as 3D printer, E-nose, Camera array, and Radar. |
|  |  |  |  | Objectives  To specify such new data formats. |

## Media Context and Control – Common Types and Tools

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
|  |  |  |  | Motivations  MPEG-V needs additional classification schemes and tools because new actuators and sensors have been added |
| V | 6 | E4 |  | Objectives  To specify such new classification schemes and tools. |

# *Genome compression*

## *Genomic Information Representation*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| G | 2 | E2 |  | Motivations  The development of Next Generation Sequencing (NGS) technologies enable the usage of genomic information as everyday practice in several fields, but the growing volume of data generated becomes a serious obstacle for a wide diffusion. The lack of an appropriate representation and efficient compression of genomic data is widely recognized as a critical element limiting its application potential. ISO/TC 276 and MPEG have combined their respective expertise and missions to develop a compression standard capable of providing new effective solutions for genomic information processing applications |
|  |  |  |  | Objectives  The objectives of the standard are to provide:  - A transport format specification that supports a file format for storage scenarios and a packet format for streaming scenarios that are mutually convertible.  - A compressed representation for sequence reads, quality values and alignment information that enable efficient selective access to genomic regions, data classes and associated information.  - Standard APIs for selective access to the compressed genomic information and the conversion to and from MPEG-G files of commonly used genomic data formats.  - Reference SW for the normative decoding process and informative encoding, conformance methodology. |

# Media Description

## *Compact Descriptors for Video Analysis*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 7 | 15 | E1 |  | Motivations  Industry needs a video description standard to enable scalable instance search in applications such as media production, archiving and security, and other applications that need to match content across many video sequences. |
|  |  |  |  | Objectives  CDVA exploits the temporal redundancy of video by extracting a single compact descriptor to represent a segment rather than individual frames. This enables more compact descriptions for efficient matching of large sets of video, which is robust against changes of view, imaging conditions and transformations (e.g., transcoding, overlays) of video sequences. |

# Media Composition

## MMT Composition Information

### Customization in Composition Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 11 | A1 | 16655 | Motivations |
|  |  |  |  | Objectives  To enable the customization of presentations that are described by n HTML5 and MPEG Composition Information documents. |
|  |  |  |  | Objective  The customized presentation is controlled by a script and as a result the transmission and reception schedules are adjusted. |

# Digital Items

## Media Value Chain Ontology

### MVCO Extensions on Time Segments and Multi-Track Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 21 | 19 | E1 |  | Motivations  MVCO must support description of composite IP entities in the audio domain, whereby the components of a given IP entity can be located in time and, for the case of multi-track audio, associated with specific tracks. |
|  |  |  |  | Objectives  To specify such extension to MVCO. |

## User Description

### User Description extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 21 | 22 | A1 |  | Motivations |
|  |  |  |  | Objectives |

# Systems support

## Reconfigurable Media Coding

### FU and FN extensions for SHVC and Main10 Profiles of SHVC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| C | 4 | A? |  | Motivations  RMC needs support to Scalable and Main10 profiles of HEVC |
|  |  |  |  | Objectives  To specify additional RMC functional unit (FU) and functional network (FN) descriptions as required to support the motivations. |

## Green Metadata

### Metrics for complexity prediction model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 11 | A2 |  | Motivations  Modern video compression standards require metrics to improve complexity prediction model |
|  |  |  |  | Objectives   1. To enrich standardized AVC metrics to improve complexity prediction model. 2. To specify the HEVC metrics. 3. To extend AVC and HEVC metrics granularity to slice/tile/multi-layers. |

## Media orchestration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 13 | E1 |  | Motivation:  The proliferation of capture and display devices combined with ever-increasing bandwidth, including mobile bandwidth, necessitates better and standardized mechanisms for coordinating such devices, media streams and available resources, like media processing and transmission. |
|  |  |  |  | Objective:  Development of a Media Orchestration standard to create new integrated experiences by managing multiple, heterogeneous devices over multiple, heterogeneous networks. |

## Systems CICP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| CI | 1 | E1 |  | Motivations  Many data used in MPEG standards are widely scattered or defined by MPEG in its individual standards |
|  |  |  |  | Objective  To define various systems code points and fields that establish properties of a multimedia stream that are independent of the compression encoding and bit rate. These properties may describe the appropriate interpretation of decoded multimedia data or may, similarly, describe the characteristics of such signals before the signal is compressed by an encoder that is suitable for compressing such an input signal. |

# IPMP

## Support for multi-keyed samples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 7 | A? |  | Motivations:  There are cases where it may be desirable or needed to have multiple keys, with their associated Ivs, for a single sample. For example, when a scalable or tiled media bitstream was represented by multiple tracks in a file, each of the tracks protected with its own keys, multiple keys per sample description is required to re-package the bitstream as a single track in the file. |
|  |  |  |  | Objective:  To support multiple keys per sample using the following tools:   1. extension of the seig sample group 2. extension of the sample auxiliary info data for CENC |

## Common encryption format for ISO base media file format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 7 | A? |  | Motivations  There are cases where it may be desirable or needed to have multiple keys, with their associated IVs, for a single sample. For example, when a scalable or tiled media bitstream was represented by multiple tracks in a file, each of the tracks protected with its own keys, multiple keys per sample description is required to re-package the bitstream as a single track in the file. |
|  |  |  |  | Objective:  Support for multiple keys per sample using the following tools:  1- extension of the seig sample group  2- extension of the sample auxiliary info data for CENC |

## Support of sample variants in MPEG-2 TS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A? |  | Motivations  Sample (access unit) variants are assembled samples (or access units) that replace the original samples (or access units). In MPEG-TS they are streams typically used to normalize the multiple (CBC/CTR) encryption schemes for common encrypted MPEG-TS streams. |
|  |  |  |  | Objective:  To define the carriage of sample (access unit) variants in MPEG-TS streams.  The variant framework is intended to be completely compatible with the ISO/IEC 13818-1 [MPEG-TS] and ISO/IEC 23001-9 [CENC-TS] specification.  The sample variant framework uses three core constructs to define and carry sample (access unit) variant data in MPEG-TS streams: variant constructors, variant byte ranges and variant samples. |

## Support for sample variants

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 12 | E2 | 16832 | Motivations:  To support use case where ISOBMFF files/segments carry sample data with more than one encryption schemes. |
|  |  |  |  | Objective:  In the use case, CENC ‘cbcs’ and ‘cens’ encryption schemes are used. These two schemes use subsample pattern based encryption of the video streams. In this use case every sample in the main track there is an associated sample variant data (only encrypted blocks) in the sample variant track. The sample variant may have the same KID as the main track samples. It may have different KID than the main track. The encryption schemes are different between samples from the main track and samples from the sample variant tracks. |

## Segment encryption and authentication

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 4 | A9 | E1 | Motivations: |
|  |  |  |  | Objectives:  This document specifies:   * format-independent segment encryption and signalling mechanisms for use with any media segment format used in DASH (ISO/IEC 23009-1:2014). * Mechanisms to ensure segment integrity and authenticity for use with any segment used in DASH (ISO/IEC 23009-1:2014). |

# Transport

## MPEG-2 Transport Stream

### Ultra-Low-Latency mode and higher resolution support for transport of JPEG 2000 video

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A9 |  | Motivations: |
|  |  |  |  | Objectives:   1. To enable JPEG 2000 Ultra-Low Latency (ULL) encoding and transport of professional video, audio and data over Internet Protocol networks 2. To enable transport of 4K or higher resolution JPEG 2000 video 3. To correct defects from ISO/IEC 13818-1:2007/Amd.5:2012. |

### Carriage of HEVC Tiles

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A? |  | Motivations:  If the whole bitstream including encoded data for all tiles is sent to a receiver via a broadcast channel, a receiver that is capable to decode a smaller RoI may not be able to handle the large amount of data corresponding to the full panorama.  MPEG-2 TS currently provides signaling for an HEVC encoded video bitstream sent in an Elementary Stream (ES) that contains a complete panorama. However, the signaling included in the TS indicates the Profile/Tier/Level needed to decode the whole bitstream. If the capabilities of the decoder are not sufficient to decode a bitstream with such a high Level, which is very probable if the targeted display resolution is much smaller than the whole panorama, the receiver will not start decoding. |
|  |  |  |  | Objective:  To split the bitstream into separate Ess, called a subregion, of which the client can select a subset needed to decode the RoI. The MPEG-2 Systems standard uses a Program Map Section to signal the properties of the ESs that belong to a program. However, these sections are limited to 1021 bytes for the description of all ES, which typically include video and probably multiple audio streams or subtitling information, thus substream and subregion information must be very compact. |

### Support of Media Orchestration and sample variants in MPEG-2 TS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A10 | 16778 | Motivations:  Sample (access unit) variant is an assembled sample (or access unit) that replaces the original sample (or access unit). Sample variants in MPEG-TS streams are typically used to normalize the multiple (CBC/CTR) encryption schemes for common encrypted MPEG-TS streams.  The variant framework is intended to be completely compatible with the ISO/IEC 13818-1 [MPEG-TS] and ISO/IEC 23001-9 [CENC-TS] specification. |
|  |  |  |  | Objective:  Carriage of sample (access unit) variants in MPEG-TS streams.  The sample variant framework uses three core constructs to define and carry sample (access unit) variant data in MPEG-TS streams: variant constructors, variant byte ranges and variant samples.  The sample variant is an assembled media access unit (sample) that replaces the original access unit (sample). |

### Carriage of HEVC Tiles

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A11 | 16780 | Motivations:  If the whole bitstream including encoded data for all tiles is sent to a receiver via a broadcast channel, a receiver that is capable to decode a smaller RoI may not be able to handle the large amount of data corresponding to the full panorama. MPEG-2 TS currently provides signaling for an HEVC encoded video bitstream sent in an Elementary Stream (ES) that contains a complete panorama. However, the signaling included in the TS indicates the Profile/Tier/Level needed to decode the whole bitstream. If the capabilities of the decoder are not sufficient to decode a bitstream with such a high Level, which is very probable if the targeted display resolution is much smaller than the whole panorama, the receiver will not start decoding. |
|  |  |  |  | Objective:  Consequently, it would be beneficial to split the bitstream into separate ESs of which the client can select a subset needed to decode the RoI. In this amendment, such set of substreams is called a subregion. The MPEG-2 Systems standard uses a Program Map Section to signal the properties of the ESs that belong to a program. However, these sections are limited to 1021 bytes for the description of all ES, which typically include video and probably multiple audio streams or subtitling information, thus substream and subregion information must be very compact. |

## ISO Base Media File Format

### DRC file format extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 12 | A1 | 15637 | Motivations   1. To increase the available range of downmix coefficients 2. To enhance the loudness metadata to support the EQ extension of MPEG-D DRC. |
|  |  |  |  | Objective:  To support DRC configuration extensions in MPEG-D DRC |

### Support for Image File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
|  |  |  |  | Motivations |
| 4 | 12 | A2 | 16164 | Objectives:   1. To add general tools currently defined in Image File Format (23008-12) 2. To support Dependent Random Access Point (DRAP) sample grouping 3. To support an optional MIME type box for media. |

### Carriage of Web Resource in ISOBMFF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 12 | A2 |  | Motivations: |
|  |  |  |  | Objectives  This document specifies the use of ISOBMFF tools for the storage and delivery of web data. The specified storage is designed to enable enriching audio/video content, as well as audio-only content, with synchronized, animated, interactive web data, including overlays. |

### Compact Sample-to-Group, new capabilities for tracks, and other improvements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 30 | A1 | 16934 | Motivations  Sample groups are increasingly heavily used and there is an opportunity to reduce the size of the mapping box and make files smaller. The file format is being used to carry more diverse kinds of media, and that media needs richer support. There are also various small improvements to be made in various parts of the specification. |
|  |  |  |  | Objective:  This admendment will specify following items   * Stereo pairs in video * Compact sample to group * Basic multiplexed metadata (but not the advanced stuff) * Compatible schemes * Parts of MIME signaling * Spatial track relationships * Track groups and IDs |

### Support for CTA 708 captioning in SEI message

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 30 | A1 | 16283 | Motivations |
|  |  |  |  | Objective:  To specify how CTA-708 timed text in SEI messages in a video stream is carried in files based on the ISO base media file format. |

### Interactivity Support in File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 30 | 1 |  | Motivations:  Generally, different types of clients and services exist and it may be desirable to provide a service to different types of clients some of which may only support a basic functionality, whereas others support advanced functionality.  A main requirement for the service provider is the ability to send media time synchronized graphics, overlay, interactive data, any type of web data etc. while not defining the application environment for itself. |
|  |  |  |  | Objectives:   1. Data carriage and synchronization 2. Definition of the syntax and semantics of the data |

### Carriage of ROI coordinates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 10 | A1 |  | Motivations: |
|  |  |  |  | Objectives   1. Storage format for spatial coordinates 2. A new type of timed metadata metrics that relate to the position of media track with respect to another media track in the ISO BMFF. |

## Carriage of NAL unit structured video in ISO BMFF

### Layered coding of images

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 15 | A? | ? | Motivations:  To enable the Still Image file format to carry images and image sequences coded in AVC (ISO/IEC 14496-10), JPEG (ISO/IEC 10918-1), and layered coding including layered HEVC (ISO/IEC 23008-2). |
|  |  |  |  | Objectives: |

### Handling of Unspecified NAL Unit Types and other improvements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 15 | A? | 16548 | Motivations: |
|  |  |  |  | Objectives:  To specify the required management mechanism for the nal\_unit\_type fields that are defined in ISO/IEC 14496-10 (AVC), clause 7.4.1 and ISO/IEC 23008-2 (HEVC), clause 7.4.2.2 for use 'as determined by the application'. Some values are defined in this standard and some (marked as 'user definable' in Tables 13, 14, 15, and 16) are available for use under other conditions. |

### Additional Brands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 15 | A2 | 16788 | Motivations: |
|  |  |  |  | Objectve:  To define two brands, 'hvti' and 'lhte' |

### Partial File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 14 | E1 | 16837 | Motivations:  Need for a storage and exchange format for other file formats delivered over lossy channels. |
|  |  |  |  | Objectives:   1. Reception data, which provides means to store the received data and document transmission information such as lost byte ranges or whether the corrupted/lost bytes are present in the file. 2. Repair information, such as location of the source file, possible byte offsets in that source, byte stream position at which a parser can try processing a corrupted file; depending on the communication channel, this information may be setup by the receiver or through out-of-band means. 3. File format specific information, which depend on the type of file stored as a partial file; this specification only defines additionnal tools for files based on ISO/IEC 14496-12. |

## MMT

### Use of MMT Data in MPEG-H 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 1 | A1 | 15670 | Motivations: |
|  |  |  |  | Objective:  To define the normative behavior of using the system data carried over MPEG-H 3D Audio |

### MMT Enhancements for Mobile Environments

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 1 | A2 | 15995 | Motivations;  TRUFFLE has identified and documented use cases requiring MMTB enhancements |
|  |  |  |  | Objectives:  To adds such capabilities as: session setup and control, QoS and consumption reporting, multi-path delivery, and other technologies. |

### CDN support

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 1 | A3 | 16841 | Motivations  Need to support Virtualized Network Function environment including virtualized MANE |
|  |  |  |  | Objectives: |

### Additional FEC codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 10 | A? | 16972 | Motivations |
|  |  |  |  | Objectives:  This amendment describes that the two-stage FEC scheme may be implemented as one stage FEC or two stage FEC by one entity, and may be cascaded and added by two or more (if more than two stages) entities on the delivery path if needed. Similarly, the layer aware FEC may be implemented as one layer FEC or two layer FEC by one entity, and may be cascaded and added by two or more (if more than two layers) entities on the delivery path. |

### MMT Implementation Guidelines

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| H | 13 | E3 | 16851 | Motivations  To extend the MMT Implementation Guidelines because MMT has added more technologies |
|  |  |  |  | Objectives:  The MMT Implementation Guidelines describe the usage of MMT for multipath delivery, layer aware FEC and so on. |

### Support for AVC and JPEG in image file format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| H | 12 | A1 | 16912 | Motivations: |
|  |  |  |  | Objectives:   1. To support multi-layered image and AVC, JPEG in the image file format 2. To register MIME type. |

## DASH

### Authentication, Access Control and Multiple MPDs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 1 | E3 |  | Motivations:   * To establish trust in a client (e.g., a player) to ensure only clients that obey a specific set of requirements (e.g. ones imposed by advertisers or MVPDs) have access to content. * To point to media components in other MPDs to provide a relation that enables seamless transition between such MPDs (a specific example is mosaic channels in combination with Spatial Relation Description). * Consumption and ad tracking * To break content into multiple Periods with a seamless playout across Period boundaries to support such use cases as providing robust live services and ad insertion. |
|  |  |  |  | Objectives:   * Authentication and authorization of a client * MPD linking * Callback event * Period continuity |

### MPEG-DASH Implementation Guidelines

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 3 | E2 | 16860 | Motivations: |
|  |  |  |  | Objectives:  Guidelines for design and deployment of streaming media delivery systems using ISO/IEC 23009 (MPEG-DASH) including content generation, client implementation, and examples of deployment scenarios. |

### Delivery of CMAF content with DASH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
|  |  |  |  | Motivations:  The CMAF specification defines an encoding format for the content. Each media component of the content may be encoded in multiple tracks, grouped in one or more CMAF Switching Sets. However there is no description of how these tracks are related, and how various media components should be delivered and played.  The DASH specification defines segment formats for media content. But it also defines a manifest, Media Presentation Description (MPD) which expresses the relationship of tracks and segments as well as how they are identified as URI resources. While CMAF delivery entities can be identical to DASH segments, there are multiple ways to package them and/or identified them as resources and described by a MPD. These guidelines recommend some of the most popular delivery schemes for such mapping and delivery. |
|  |  |  |  | Objectives:  Guidelines for delivering content generated based on CMAF (ISO/IEC 23000-19) using DASH (ISO/IEC 23009-1). |

## Immersive media

### Omnidirectional MediA Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 2 | E1 |  | Motivations:  VR is widely used by industry but there is no standard |
|  |  |  |  | Objectives:  To define storage, distribution and playback of omnidirectional video contents. Some metadata useful for conversion from projected 2D image to sphere 3D image are contained in the OMAF stream. If the OMAF stream is fed into an OMAF parser, the 3D model and projection metadata will be parsed and shared to 3D projector. The 3D projector will map the projected 2D image onto the surface of a specific 3D model, using the shared projection metadata. Note that the illustrated solution can be enabled by adding minimum metadata on top of legacy file format, such as ISO BMFF, without changes in CODEC or System level. |

### Hybrid natural/synthetic scene data container

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | ? | E | ? | Motivations  HNSS is motivated by MPEG’s objectives to support 6 Degrees of Freedom (and higher) including 6 DoF for MR/AR for rich immersive services, and light field displays.  For the timeframe supported by MPEG-I Phase 2, industry will need support for immersive visual technologies that enable users to fully navigate into a volume of audio visual information, including realistic movement around objects within that volume. Moreover, to support AR/MR applications, objects in that volume may be real-world (captured from a camera) or computer-generated. This scenario anticipates a use case for 6 Degrees-of-Freedom simultaneously and seamlessly for both real-world and synthetic content along the complete continuum of the Milgram scale. |
|  |  |  |  | Objectives:  Define an application layer data model (scene graph) and corresponding container in which all assets referenced by the model are packaged and transmitted for subsequent processing (e.g. rendering to adjust for the characteristics of the display or the characteristics of the network) for ultimate display on a plethora of devices including light field displays, head-mounted displays, free-standing legacy displays, and mobile devices. |

## Genomic Information Transport

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| G | 1 | E1 |  | Motivations  The development of Next Generation Sequencing (NGS) technologies enable the usage of genomic information as everyday practice in several fields, but the growing volume of data generated becomes a serious obstacle for a wide diffusion. The lack of an appropriate representation and efficient compression of genomic data is widely recognized as a critical element limiting its application potential. ISO/TC 276 and MPEG have combined their respective expertise and missions to develop a compression standard capable of providing new effective solutions for genomic information processing applications. |
|  |  |  |  | Objectives  Transport and storage of genomic sequencing data and associated metadata with the capability of accessing these data sets efficiently, e.g. selective fast browsing, searching and access capabilities directly in compressed form. |

## Advance signalling of MPEG containers content

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? | ? | Motivations  MPEG defines several container formats, in particular ISOBMFF and MPEG-2 TS. Files conformant to these formats may contain multiple media streams, each of which may conform to different media formats, with different profiles and levels. There are several file consumption scenarios under which the full content of the file is not available to a player but under which the player has nevertheless to take a decision to retrieve the file or not. These scenarios include progressive file download, adaptive streaming, etc. In such scenarios, the player needs to have sufficient information to determine if it has or not the capabilities of playing the entire content or only a part of the container content, and when multiple container files are provided, to enable a player to choose the most appropriate file(s) to process. The practice to send information about the container content, together with URL(s) to the content and prior to its retrieval, is called hereafter "in-advance signaling". |
|  |  |  |  | Objectives: |

# Application Formats

## Common Media Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | ? | A1 |  | Motivations: |
|  |  |  |  | Objectives: adding support of SHVC media profile and additional audio media profiles |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | ? | A2 | 6949 | Motivations: |
|  |  |  |  | Objectives: xHE-AAC and other media profiles |

## Multi-Image Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | ? | E1 | 16957 | Motivations: |
|  |  |  |  | Objectives:   * a set of additional constraints on ISO/IEC 23008-12 (HEIF) specification, to simplify its file format options * specific depth map and alpha plane input formats * a set of specific profiles/levels for the supported coding formats. * a set of specific metadata formats * a set of brands and file format extensionsa set of rules for extending MIAF format to support additional coding formats, profiles, levels and metadata |

## Visual Identity Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | ? | E1 |  | Motivations  There are widespread concerns on user privacy arising from sharing pictures in social media services. People can be on a picture taken by someone else, either intentionally or by mistake, and such picture can be posted on a social media service without any permission of the person captured on the picture and possibly without the person even being aware to be on the picture. Social media service operators try to provide some ways to manage such cases but it seems quite limited. Same happens for various video capturing devices such as CCTVs. |
|  |  |  |  | Objective:  To specify a framework for managing privacy of users on the pictures or videos when pictures or videos are being shared among users. |

# API

## Genomic Information API

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| G | 3 | E |  | Motivations  The development of Next Generation Sequencing (NGS) technologies enable the usage of genomic information as everyday practice in several fields, but the growing volume of data generated becomes a serious obstacle for a wide diffusion. The lack of an appropriate representation and efficient compression of genomic data is widely recognized as a critical element limiting its application potential. ISO/TC 276 and MPEG have combined their respective expertise and missions to develop a compression standard capable of providing new effective solutions for genomic information processing applications. |
|  |  |  |  | Objectives  To specify the API to access genomic informatiom to   1. Simplify the usage and manipulation of sequencing data sets for genomic analysis applications 2. Ensure interoperability of transport and storage formats at all levels of the various processing pipelines. |

## IoMT Discovery and Communication API

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 23093 | 2 | E1 |  | Motivations  Industry considers the Internet of Things (IoT) and SDOs make plans for related standards.  MPEG has defined a specific instance of Thing called Media Thing (MThing), defined as a Thing able to sense and/or act on physical or virtual objects  MThings may be connected to form complex distributed systems – called Internet of Media Things (IoMT) – where MThings interact between them and humans. |
|  |  |  |  | Objectives |

## IoMT Media Data Formats and API

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 23093 | 3 | E1 |  | Motivations  Industry considers the Internet of Things (IoT) and SDOs make plans for related standards.  MPEG has defined a specific instance of Thing called Media Thing (MThing), defined as a Thing able to sense and/or act on physical or virtual objects  MThings may be connected to form complex distributed systems – called Internet of Media Things (IoMT) – where MThings interact between them and humans. |
|  |  |  |  | Objectives |

# Media Systems

## MPEG-V Architecture

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 1 | E4 |  | Motivations  New use cases for such actuators and sensors as 3D printer, E-nose, Camera array, and Radar, have been identied |
|  |  |  |  | Objectives  To extend MPEG-V Architecture as appropriate. |

## MPEG-M Architecture

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| M | 1 | E3 |  | Motivations  MPEG does not define a (High Level) API between middleware and Applications. |
|  |  |  |  | Objective:  To extend the MPEG-M Architecture to include the specification of a High Level Application API |

## MPEG-I Architectures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 23090 | 1 | E1 | ? | Motivations: To investigate aspects of Immersive Media, which includes Virtual Reality, that are relevant to understand the needs for standardization by WG1 |
|  |  |  |  | Objectives:   * Define a body of terminology - a vocabulary to be used across the Project.Define the qualitative elements of an immersive experience in the production and the consumption. * Provide one or more integrated and architectural views on how these elements contribute to an overall immersive experience and how they are combined. * Define an architectural view on the compression and coded representation of elements of immersive experiences as well as the coded representation and delivery of a full media experience, taking into account the individuality of the experience, while enabling scalable and efficient individual delivery as well as mass distribution. * Document standardization requirements to create interoperability in end-to-end systems. Such aspects are expected to include Audio, Video, Graphics and Systems with capture and rendering, as well as appropriate interfaces with sensors that record navigation in the immersive audiovisual space, as well as suitable formats for cost-conscious delivery to mass markets. |

## IoMT Architecture

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 23093 | 1 | E1 |  | Motivations  Industry considers the Internet of Things (IoT) and SDOs make plans for related standards.  MPEG has defined a specific instance of Thing called Media Thing (MThing), defined as a Thing able to sense and/or act on physical or virtual objects  MThings may be connected to form complex distributed systems – called Internet of Media Things (IoMT) – where MThings interact between them and humans. |
|  |  |  |  | Objectives |

## *Network Distributed Video Coding*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | ? |  | Motivations  More and more often a video stream generated by an encoder is delivered to en end user after it has undergone a process of transcoding.  Processing is distributed across three or more processing units interconnected through links with individual bandwidth con­straints, and each unit has an individual processing capability. One of the units is the “original” encoder and one of the processing units is the “fin­al” decoder. |
|  |  |  |  | Objectives:  Identify and evaluate the benefits of video trans coding processes located in the network/cloud that provide advantages over currently deployed technologies in terms of complexity, storage and bandwidth. The special focus of this activity is guided transcoding. |

## Network Based Media Processing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | E1 | ? | Motivations |
|  |  |  |  | Objectives |

## Mixed and Augmented Reality Reference Model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| J | 1 | E1 |  | Motivations  There is a need for a mixed and augmented reality (MAR) reference model (RM) for use by developers of applications, components, systems, services, or specifications to describe, compare, contrast, and communicate their architectural design and implementation. |
|  |  |  |  | Objectives:  To develop a MAR-RM that   1. Contains a list of representative system classes and use cases with respect to its reference model 2. Can be applied to MAR systems independently of specific algorithms, implementation methods, computational platforms, display systems, and sensors or devices used   The standard does not specify   1. How a particular MAR application, component, system, service, or specification shall be designed, developed, or implemented 2. The bindings of those designs and concepts to programming languages, or the encoding of MAR information through any coding technique or interchange format. |

# Reference implementation

## Audio

### Reference Software for new levels of ALS Simple profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 3 | 43 | 16745 | Rference software that implements decoding of the new ALS Simple Profile levels specified in ISO/IEC 14496-3, Audio. |

### Reference Software for MPEG Surround Extensions for 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 1 | 4 |  | Reference software that implements decoding of Text of ISO/IEC 23003-1:2007/FDAM 3 MPEG Surround Extensions for 3D Audio |

### Reference Software for DRC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 4 | 1 |  | Reference implementation of MPEG-D Part 4, Dynamic Range Control. |

### Reference Software for 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 6 | E1 |  | Reference implementation of 3D Audio (23008-3) |

## Digital Items

### Reference Software and Implementation Guidelines of User Description

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 21 | 22 | 1 | 15921 | Reference implementation of the User Description standard |

## Media context and control

### Reference Software for MPEG-V

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 5 |  |  | To provide a reference implementation of XML and binary version of MPEG-V types |

## Media Description

## Digital Item

### Reference Software for MVCO Extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | A4 | 16798 |  |

## Systems support

### Reference Software for Media Orchestration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 13 | A? |  |  |

## Transport

### Reference Software for File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | E1 | 16796 | To specify conformance bitstreams for |

### Reference Software for MMT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 4 | E1 |  | To provide a reference implementation of MMT version 1 (23008-1) |

### Reference Software for MMT with Network Capabilities

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 4 | A1 | 15966 | To provide a reference implementation of MMT with Network Capabilities |

### Reference software for SRD, SAND and Server Push

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 2 | A1 | 16857 | To provide a reference implementation for SRD, SAND and Server Push |

# Conformance

## Video

### Conformance for HEVC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 8 | A1 | 14983 | To provide a conformance test set for the SCC profile of HEVC |

## Audio

### Conformance for New levels for AAC profiles and uniDRC support

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 26 | ? | 14447 | Specifies   * Where and in which format the MPEG-D DRC metadata is carried in AAC * SAOC DE profile and level indication. |

### Conformance for new levels of ALS Simple profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| 4 | 3 | ? | 16746 | Conformance streams that test decoding of the new ALS Simple Profile levels specified in ISO/IEC 14496-3, Audio. |

### Conformance for DRC

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| D | 4 | 1 | 16294 | This AMD provides conformance streams for ISO/IEC 23003-4, MPEG-D Dynamic Range Control. |

### Conformance for 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 10 | E1 |  | To specify conformance bitstreams for 3D Audio (23008-3) |

## 3D Graphics

## Digital Items

## Media context and control

### Conformance for MPEG-V

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 4 | E4 |  | Conformance of the XML and binary version of MPEG-V types. |

## Media description

## System support

### Conformance for Media Orchestration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 13 | A? |  |  |

## Transport

### Conformance for File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | E1 | 16796 | Conformance bitstreams for file format |

### Conformance for MMT

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 4 | E1 | 16845 | Conformance bitstreams for MMT version 1 (23008-1) |

### Conformance for SRD, SAND and Server Push

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 2 | A1 | 16857 | Conformance for SRD, SAND and Server Push |

## Application Formats

### Conformance for CMAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 19 | 1 |  |  |

# Maintenance

## Systems coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the systems coding area |

## Video coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the video coding area |

## Audio coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the audio coding area |

## 3DG coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the 3DG coding area |

## Systems description coding standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
|  |  |  |  | Collection of defect reports and development of corrigenda in the description coding area |

## MPEG-21 standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| 21 |  |  |  | Collection of defect reports and development of corrigenda for MPEG-21 standards |

## MPEG-A standards

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Cor** | **Req** | **Short description** |
| A |  |  |  | Collection of defect reports and development of corrigenda for multimedia application standards |