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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 N16803**

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| --- | --- |
| **Source:** | **Leonardo Chiariglione**  |
| **Title:** | **MPEG work plan** |
| **Purpose:** | **Work plan management** |

**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 | MotivationsHEVC misses a profile for applications that use 10 bit 4:2:0 progressive-scan video content. |
|  |  |  |  | Objectives1. 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 | MotivationsAVC misses an SEI message for colour remapping information, which exists in HEVC, to enable remapping of the decoded colour samples of the output pictures |
|  |  |  |  | ObjectiveSpecification 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 |  | MotivationsOld 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. |
|  |  |  |  | ObjectivesA 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 |
|  |  |  |  | ObjectivesSpecification 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 |
|  |  |  |  | ObjectivesSpecification 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 |
|  |  |  |  | Objectives:SEI messages for:* Content colour volume characteristics
* Motion-constrained tile sets extraction information
* Omnidirectional 360° projection indication
* Region nesting of other SEI messages
 |

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
|  |  |  |  | Motivations:Industry needs guidance on the application of ICtCp, HLG, and SEI messages in the coding of HDR/WCG video |
| H | 15 | T1 |  16504 | ObjectivesGuidelines 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 |
|  |  |  |  | Objectives1. 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*

### *Immersive video – 3DoF+*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | ? | E1 |  | MotivationTechnology 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. |
|  |  |  |  | ObjectivesTo 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 |  | MotivationLight 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.  |
|  |  |  |  | ObjectivesTo 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** |
|  |  |  |  | MotivationsMany data used in MPEG standards are widely scattered or defined by MPEG in its individual standards |
| CI | 2 | E1 | ? | ObjectiveTo 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. |

# Audio coding

## Advanced Audio Coding

### Levels and Downmixing Method for 22.2 Channel Programs

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

## Unified Speech and Audio Coding

### Stream ID and FF group

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| D | 3 | A4 |  | MotivationsA DASH delivery needs to know when it has to re-configure the USAC decoder because of a stream configuration change. |
|  |  |  |  | ObjectivesTo 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** |
|  |  |  |  | MotivationsThere is a need to offer flexible DRC gain sequence mapping for multi-band DRC and DRC target characteristics provided by the encoder |
| D | 4 | A3 | 15256 | ObjectivesTo specify DRC gain generation at the decoder. Metadata based equalization can be applied and support for loudness equalization is built in. |

## *Immersive Audio*

### *Audio Coding for AR/VR*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 3 | A? |  | MotivationsMPEG-H 3D Audio may need to be extended to support initial forms of immervice experiences |
|  |  |  |  | ObjectivesTo 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 |  | MotivationsImmersive experiences may need more sophisticated immersive audio technologies |
|  |  |  |  | ObjectivesTo 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 | ? | MotivationsMany data used in MPEG standards are widely scattered or defined by MPEG in its individual standards |
|  |  |  |  | ObjectivesTi 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 |  | MotivationsTechnologies 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. |
|  |  |  |   | ObjectivesTo 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 | MotivationsOFF needs to support complex layouts and new layout features |
|  |  |  |  | ObjectivesTo 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. |

# 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 |  | MotivationsMVCO 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. |
|  |  |  |  | ObjectivesTo specify such extension to MVCO. |

# Media context and control

## Media Context and Control – Control Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| V | 2 |  E4 |  | MotivationsMPEG-V must support capabilities and preferences for such new sensors and actuators as 3D printer, E-nose, Camera array, and Radar |
|  |  |  |   | ObjectivesTo 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 |  | MotivationsMPEG-V must support new sensory effects related to color models of 3D printing. |
|  |  |  |   | ObjectivesTo 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 |  | MotivationsVirtual World Object Characteristics must be extended to account for additions to other MPEG-V parts where new actuators and sensors have been introduced. |
|  |  |  |   | ObjectivesTo 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 |  | MotivationsMPEG-V needs additional Data Formats for new actuators and sensors such as 3D printer, E-nose, Camera array, and Radar. |
|  |  |  |  | ObjectivesTo specify such new data formats. |

## Media Context and Control – Common Types and Tools

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

# *Genome compression*

## *Genomic Information Representation*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
|  |  |  |  | MotivationsThe 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 |
| G | 2 | E2 |  | ObjectivesCompression of aligned genomic data |

# 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 for such applications as video retriev­al, computer vision, automotive, security and where many video streams need to be evaluated. |
|  |  |  |  | ObjectivesWhile traditional implementations com­press many video streams and analyze the decoded video at a central site, this activity will enable the “Analyze-Then-Compress” (ATC) paradigm where descriptors are extracted at the source, compressed and evaluated at a central site. |

# Media Composition

## Customization in Composition Information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 11 | A1 | 16655 | 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? |  | MotivationsRMC needs support to Scalable and Main10 profiles of HEVC |
|  |  |  |   | ObjectivesTo 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 |  | MotivationsModern video compression standards require metrics to improve complexity prediction model |
|  |  |  |  | Objectives1. 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 |  | MotivationsMany data used in MPEG standards are widely scattered or defined by MPEG in its individual standards |
|  |  |  |  | ObjectiveTo 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
 |

\

## Support of sample variants in MPEG-2 TS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A? |  | MotivationsSample (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 | A? |  | 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. |

# 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.  |

## ISO Base Media File Format

### DRC file format extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 12 | A1 | 15637 | Motivations1. 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 for 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.
 |

### Support for CTA 708 captioning in SEI message

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
|  |  |  |  | Motivations |
| 4 | 30 | A1 | 16283 | 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: |
|  |  |  |  | Objectives1. 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 | ? | Motivations: |
|  |  |  |  | Objectve:To define two brands, 'hvti' and 'lhte'  |

### Partial File Storage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 14 | A? | ? | 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** |
|  |  |  |  | MotivationsNeed to support Virtualized Network Function environment including virtualized MANE |
| H | 1 | A? |  | Objectives: |

### MMT Implementation Guidelines

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| H | ? | E1 | 16357 | Motivations |
|  |  |  |  | Objectives:To describe the usage of MMT for multipath delivery, layer aware FEC and so on. |

### Image file format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| H | 12 | A1 |  | 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 |  | 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.   |

### DASH with Server Push and WebSockets

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 6 | E1 | 15992 | Motivations:To take advantage of the features of HTTP/2 and WebSockets to improve delivery performance, while still maintaining backwards compatibility |
|  |  |  |  | Objectives:Carriage of MPEG-DASH media presentations over full-duplex HTTP-based protocols, particularly HTTP/2 and WebSockets. |

### Delivery of CMAF content with DASH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 7 | T1 |  | 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 |
|  |  |  |   | 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. |

## Genomic Information Transport

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| G | 1 | E1 |  | MotivationsThe 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. |
|  |  |  |  | ObjectivesTransport 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.  |

# Application Formats

## Common Media Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 19 | E1 |  | Motivations:There is a need for a common content format for delivery over different MPEG technologies such as DASH and MMT |
|  |  |  |   | Objectives:To define the media segment format. The description and delivery of presentations are out of scope because they belong to layers above the layer that defines the media format and the encoding and decoding of Media Segments. |

## 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.  |

# Media Systems

## MPEG-V Architecture

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

## MPEG-M Architecture

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| M | 1 | E3 |  | MotivationsMPEG 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 |

## Mixed and Augmented Reality Reference Model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| J | 1 | E1 |  | MotivationsThere 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 that1. 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.
 |

## *Immersive Media Architectures*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 23090 | 1 | E1 | ? | Motivations |
|  |  |  |  | ObjectivesTo investigate aspects of Immersive Media, which includes Virtual Reality, that are relevant to understand the needs for standardisation by WG11 |

## Internet of Media Things

### 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 |

### 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 |

## *Network distributed video coding*

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

## Genomic Information API

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| G | 3 | E |  | MotivationsThe 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. |
|  |  |  |  | ObjectivesTo 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.
 |

# Reference implementation

## Audio

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 3 | 43 |  | This AMD provides reference 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 |  | This AMD provides 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 |  | To provide a 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 |  | To provide a 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

## Systems support

## Transport

### Reference Software for File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | E1 |  | 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 |

## Application Formats

### Reference Software for ARAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 14 | 1 |  | To provide a reference implementation of the ARAF PROTOs. |

# 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 | To specify where and in which format the MPEG-D DRC metadata is carried in AAC. It also contains the specification of the SAOC DE profile and level indication. |

### Conformance for new levels of ALS Simple profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **Amd** | **Req** | **Short description** |
| 4 | 3 | ? |  | This AMD provides 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 |  | To provides the conformance of the XML and binary version of MPEG-V types. |

## Media description

## System support

## Transport

### Conformance for File Format

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

### Conformance for MMT

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

## Application Formats

### Conformance for ARAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | 14 | 1 |  | To provide examples validating the ARAF PROTOS. The examples are encapsulated in MPEG-4 files which can be played by an ARAF player. |

### 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 |