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**CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC 1/SC 29/WG 11 N** **17484**

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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

### Additional supplemental enhancement information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 10 | A1 | 166742 | Motivations  AVC is missing several SEI messages that have been defined in HEVC or are in the process of being defined in HEVC, including high-dynamic range colour related information, omnidirectional video related information, and manifest and prefix messages. |
|  |  |  |  | Objective  Specification of certain additional SEI messages in the AVC context that have been defined in HEVC or are in the process of being defined in HEVC. |

## HEVC

### HEVC Monochrome Profile and additional supplemental enhancement information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 2 | E4 |  | Motivations:  Motivations:  This activity will create a new profile of HEVC that that will have an encoding of a single (i.e. monochrome) colour plane 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. The specification of additional supplemental enhancement information will also be included, including fisheye video, SEI manifest, and SEI prefix messages. |
|  |  |  |  | Objectives  Specification of a profile of HEVC that that will have an encoding of a single (i.e. monochrome) colour plane 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. The specification of additional supplemental enhancement information will also be included, including fisheye video, SEI manifest, and SEI prefix messages. |

## Versatile 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  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 different viewpoints are presented to the user’s 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 |  | Motivations:  Computational imaging technology offers users ways for immersive experiences with six degrees-of-freedom in limited volume free navigation, providing more freedom of user movement than in 3DoF+. Eventually, full-6DoF will be achieved (any translation and rotation in space), synthesizing virtual viewpoints from multiple, fixed cameras set up in various arrangements (planar arrangement, cameras in an arc, 360 divergent, etc). |
|  |  |  |  | Objectives  To provide normative improvements on compression of 6DoF content on top of the state of the art anchor. The improvements are evaluated simultaneously on decoded views and synthesized views. |

### Compression of dense representation of light fields

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

## Video Coding Independent Code Points

### 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

### 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. |

## 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 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 | E4 | 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. |

# Digital Item Coding

## User Description

### User Description extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 21 | 22 | A1 |  | Motivations |
|  |  |  |  | Objectives  To support the new use cases, “Visual expression”, “Loudness control” and “Privacy protection”. |

# Sensors and Actuators Data Coding

# Genome coding

## 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. |

# Neural Network Coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | E1 | ? | Motivations  Recently (deep) neural networks (NNs) have become a widely applied method in many application areas, including signal processing and multimedia. Classification methods, feature extractors and encoding methods based on NNs often outperform hand-crafted approaches. In many applications the trained NNs (which may contain large amounts of data) need to be transmitted to other systems or terminal devices (with possibly limited computing capabilities), where they are used for inference and/or are updated with local data. Thus efficient representations for exchanging NNs are required. |
|  |  |  |  | Objectives  To study existing representations of NNs, the state of the art of NN compression methods, and the processing flows of training and deploying NNs to a range of (generic or dedicated) hardware platforms, to identify interfaces where a standard compressed NN representation is needed and the define the requirements for such a representation. |

# Media Description

## Compact Descriptors for Video Analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 7 | 15 | E1 | 17120 | 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. |

### *Scene description*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | ? | E | ? | Motivations  The need for scene description 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. |

# Systems support

## *Immersive Media Metrics*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 6 | E1 | 17237 | Motivation:  A consistent method to capture, measure and analyse such impact is essential to quantify and assess the VR product and application performance and effectiveness, maximize feelings of presence and enjoyment, and further optimize the product and experience design. While it is challenging to quantify the super accurate immersive level or emotional impact from the aggregate data, it is critically important to identify the basic objective metrics needed for a quality VR experience for MPEG-I use cases. |
|  |  |  |  | Objective:  MPEG-I part 6, Metrics, specifies the metrics and measurement framework to enhance the immersive media quality and experiences. It also includes a client reference model with observation and measurement points to define the interfaces for the collection of the metrics. |

## *Immersive Media Metadata*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 7 | E1 | 17240 | Motivation:  In MPEG-I several standards will require similar information such as description about a projection. So, instead of having duplicated information in many standards, this standard will provide a single consolidated reference of information |
|  |  |  |  | Objective:  This document defines common immersive media metadata focusing on immersive video (including 360° video), images, audio, and timed text. This metadata can be referenced by various other standards. |

## 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

## Common Encryption for ISO Base Media File Format Files

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 7 | A? |  | Motivations: |
|  |  |  |  | Objective:  This amendment brings multiple keys per sample support in 23001-7, useful for multi-objects audio, tile encryption or multi-layer encryption in single ISO Base Media File tracks. This amendment also provides a support for item protection using tools defined for tracks in 23001-7. This amendment finally defines a scrambling scheme for AVC and HEVC compliant with the video bitstream syntax, enabling decoding of a protected stream even in the absence of associated keys. |

## 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 for sample variants in the ISO Base Media File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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:   * Format-independent segment encryption and signalling mechanisms for use with any media segment format used in DASH (ISO/IEC 23009-1:2014). * Segment integrity and authenticity mechanisms for use with any segment used in DASH. |

# Transport

## MPEG-2 Transport Stream

### 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 associated CMAF boxes for audio-visual elementary streams in MPEG-2 TS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 2 | 1 | A? |  | Motivations:  Carriage of associated CMAF boxes for audio-visual elementary streams in MPEG-2 TS  Structures to carry ISO/IEC 23000-19 CMAF boxes (CMAF Fragments boxes and CMAF initialization header boxes, no ‘mdat’ box) over MPEG-2 transport stream along with associated audio-visual elementary stream that is designed to be transformed easily to CMAF delivery format.  Carriage of JPEG XS in MPEG-2 TS  MPEG Transport Stream can already carry JPEG 2000 (ISO/IEC 15444-1) for use in broadcast applications. In the meantime, WG1 has specified a new coding scheme, known as JPEG XS, that is more lightweight in terms of complexity, and focused on low-latency applications compared to JPEG 2000. |
|  |  |  |  | Objective:  Carriage of associated CMAF boxes for audio-visual elementary streams in MPEG-2 TS  The CMAF boxes are carried over MPEG-2 TS metadata stream and it carries only the CMAF metadata boxes and does not carry any audio-visual sample data (‘mdat’ box is not carried). The sample data for ‘mdat’ box will be derived from the associated audio-visual elementary stream.  Carriage of JPEG XS in MPEG-2 TS  This new standard, numbered ISO/IEC 21122-1, is also intended to be used in broadcast applications, mainly for video transport over IP. Consequently, this Amendment proposal aims at defining in ISO/IEC 13818-1 the necessary syntax to transport this newly specified WG1 standard ISO/IEC 21122-1. |

## ISO Base Media File Format

### 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. |

### Carriage of ROI coordinates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 12 | 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. |

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 12 | 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 |

### 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. |

### Interactivity Support in File Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| B | 15 | 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 NAL unit structured video in ISO BMFF

### Additional Brands

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

## MPEG Media Transport

### 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. |

## DASH

### Device information and other extensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| DA | 3 | E2 | 17212 | Motivations:  There are a number of technologies in DASH that have been under consideration for some time and the DASH subgroup plans to publish a new amendment to advance some of these technologies. In particular, device information and other extensions are planned to be included in this amendment. |
|  |  |  |  | Objectives: |

### 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

### Interactivity support for OMAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 2 | A1 |  | Motivations: |
|  |  |  |  | Objectives: |

## In-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: |

## 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. |

# Application Formats

## Common Media Application Format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| A | ? | A2 | 16949 | 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 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  These APIs for the media things facilitate for discovering other media things in the network. |

## 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  These APIs for the media things facilitate connecting and exchanging data between media things. The APIs also provide means for supporting media tokens and its wallet addresses to access functionalities, resources, and data from media things.  The data for media things consist of user commands (e.g., setup information) from a system designer, (raw or processed) sensed data, actuation information, and information for characteristics and discovery. ISO/IEC 23093 specifies data formats of input and output for media sensors, media actuators, media storages, media analyzers, etc.  Sensed data or analysed data can be processed further by media analyzers to extract semantic information. The standard does not specify how the process is carried out but only specifies the interfaces. |

## *Network-Based Media Processing*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| ? | ? | E1 | 17268 | Motivations:  Recent developments in multimedia have brought significant innovation and disruption to the way multimedia content is consumed. With the emergence of VR and AR/MR applications, users can interact and navigate the consumed content along multiple degrees of freedom. Advanced media processing technologies (e.g., network stitching for VR service, super resolution for enhanced visual quality, transcoding, viewport extraction for 360° video) require too much compute power to be executed on modern mobile devices. |
|  |  |  |  | Objectives:  Network-based Media Processing (NBMP) will be a framework that allows service providers and end users to describe media processing operations that are to be performed by the network. NBMP describes the composition of network-based media processing services out of a set of network-based media processing functions and makes these network-based media processing services accessible through Application Programming Interfaces (APIs). NBMP framework allows content and service providers to describe, deploy, and control media processing for their content in the network. The NBMP Framework will be interoperable with existing Cloud platforms and is designed to integrate with multiple network environments such as 5G. |

# 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-I Architectures

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 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. |

## MPEG-IoMT Architecture

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 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  The scope of this standard is to describe the architecture of systems for Internet of Media Things. Internet of Media Things (IoMT) is a particular case of IoT (that by definition has the communication capability and it may sense or act on a physical or virtual object), with the specificity that an IoMT has media related multi-sensorial capabilities such as audio, visual, haptics. |

# Reference implementation

## Audio

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

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

### Reference Software for 3D Audio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| H | 6 | A? |  | Motivations |
|  |  |  |  | Objectives |

## Genomic Information

### Reference software for Genomic Information Coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| G | 4 | E1 |  | Motivations |
|  |  |  |  | Objectives |

## 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 |

## Sensors and Actuators Data Formats

### 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

### Reference Software for Compact Descriptors for Video Analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | A4 | 17449 |  |

## 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 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 |

### Reference software for OMAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 2 | A? |  |  |

# 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 of ALS Simple profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 26 | 3 | A5 | 16746 | Conformance streams that test decoding of the new ALS Simple Profile levels specified in ISO/IEC 14496-3, Audio. |

### 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

## Sensors and Actuators Data Formats

### 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

### Conformance for Compact Descriptors for Video Analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| 4 | 32 | A4 | 17449 |  |

## 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 |

### Conformance for OMAF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| I | 2 | A? |  |  |

### Conformance for Genomic Information Coding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Std** | **Pt** | **E/A/T** | **Req** | **Short description** |
| G | 5 | E1 |  |  |

## 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 |