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Description

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Draft JTC 1/SC 29 Business Report

Coding of Audio, Picture, Multimedia and Hypermedia Information

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1.0 Executive summary

SC 29 has been developing and delivering the international standards which are basis of digital media services and applications. Those standards are designed to represent, package, record, preserve and convey digital media information. The standards support functionalities such as coding, composition, transport, filing and archiving of media and their control, interface, middleware for general and/or specific applications.

Following an 18-month, thorough evaluation of its structure, SC 29 approved a reorganization of its working groups which will enable the committee to work with greater agility as it develops the next generation of JPEG and MPEG standards. At the meeting in June that approved the reorganization, SC 29 members expressed strong support for the plan which organizes the work into 8 working groups. The new structure was determined considering continuity of the ongoing projects and conformity with the revised scope, which was approved by JTC 1 in November 2019. In this documents, the activities are summarized as previous WG's activities, not as new structure.

2.0 Chairman's Remarks

2.1 Market Requirements, Innovation

For both WGs, Immersive applications, including virtual and augmented reality, 360° image/video, 3D audio and 3D representations (e.g. point clouds), are emerging. To avoid fragmentation in the market and to ensure interoperability, standards are required for such applications.

Media data is expected to be more machine or system-friendly as rich sensory data in the aspect of Cyber Physical Systems or IoT-type applications. Standardized mechanism to support such systems and applications is required.

For WG 1, an example of leading-edge innovation, the legacy JPEG format has remained one of the leading still image formats for 27 years, enabling the world to use and share billions of images every day. The ISO/IEC Joint Photographic Expert Group of ISO/IEC JTC1 subcommittee 29, Coding of audio, picture, multimedia and hypermedia information, and ITU-T SG 16 have now been recognized for their contribution to engineering developments, with a Prime Time Engineering Emmy award. In receiving the award, the ISO, IEC and ITU JPEG group was given 'special recognition for developing the image compression standard that has been universally adopted to preserve high-quality imagery in television production and its tangential yet essential workflows.'

ISO/IEC 21122 JPEG XS (Low-latency lightweight image coding system) provides significant improvements in compression of Bayer image sensor data. Video transport over professional video links, real-time video storage in and outside of cameras, and data compression onboard of autonomous cars are among the targeted use cases for raw-Bayer image sensor compression. Amendment of the Core Coding System, together with new profiles targeting raw-Bayer image applications are ongoing and expected to be published by the end of 2020.

ISO/IEC 18181 JPEG XL Image Coding System continues its progression towards a final specification. This new coding technique allows storage of high-quality images at one-third the size of the legacy JPEG format. Moreover, JPEG XL can losslessly transcode existing JPEG images to about 80% of their original size simplifying interoperability and accelerating wider deployment. The JPEG XL has produced an open source reference implementation available on the JPEG Gitlab repository (https://gitlab.com/wg1/jpeg-xl). The software is available under Apache 2, which includes a royalty-free patent grant. Speed tests indicate the multithreaded encoder and decoder outperforms libjpeg-turbo. The File Format has been defined for JPEG XL codestream, metadata and extensions. The file format enables compatibility with ISOBMFF, JUMBF, XMP, Exif and other existing standards. Standardization has now reached the Committee Draft stage and the DIS ballot is ongoing.

Media “snacking”, the consumption of multimedia in short bursts (less than 15 minutes) has become globally popular. JPEG recognizes the need for standardizing how snack images are constructed to ensure interoperability. A first version of JPEG Snack use cases and requirements is now complete and publicly available on JPEG website inviting feedback from stakeholders.

Fake news, copyright violations, media forensics, privacy and security are emerging challenges in digital media. WG 1 has determined that blockchain and distributed ledger technologies (DLT) have great potential as a technology component to address these challenges in transparent and trustable media transactions. However, blockchain and DLT need to be integrated closely with a widely adopted standard to ensure broad interoperability of protected images. Therefore, the WG 1 has organized several workshops to engage with the industry and help to identify use cases and requirements that will drive the standardization process.

In the last few years, several efficient learning-based image coding solutions have been proposed, mainly with improved neural network models. These advances exploit the availability of large image datasets and special hardware, such as the highly parallelizable graphic processing units (GPUs). Recognizing that this area has received many contributions recently and is considered critical for the future of a rich multimedia ecosystem, WG 1 has created the JPEG AI AhG group to study promising learning-based image codecs with a precise and well-defined quality evaluation methodology. The exploration studies with deep learning-based image compression solutions, typically with an auto-encoder architecture are carried out.

DNA based storage of digital information is becoming increasingly mature and offers a set of attractive features for archival of media information. WG1 has initiated an exploration to better understand the media-centric applications that can benefit from such an emerging technological trend and to explore how an image standard can be created for DNA-based storage.

JPEG Pleno is working toward the integration of various modalities of plenoptic content under a single framework and in a seamless manner. Efficient and powerful light field, point cloud and holographic representations are -key feature within this vision. Plenoptic contents in light field, point cloud and holography under a unified framework support a wide range of applications including computer-aided manufacturing, entertainment, cultural heritage preservation, scientific research and advanced sensing and analysis.

For WG 11, In 30 years MPEG has become synonymous of excellent and successful standards that have changed the industry and made the life of billions of people better.

There is a constant demand for more efficient video coding technologies, however, coding efficiency is not the only factor which determines the industry choice of video coding technology for products and services. WG11 started new project ISO/IEC 23094 MPEG-5 General Video Coding Part 1 Essential Video Coding. ISO/IEC 23094-1 (MPEG-5 EVC) seeks to provide a standardized video coding solution to address business needs in some use cases, such as video streaming, where existing ISO video coding standards have not been as widely adopted as might be expected from their purely technical characteristics.

The objective of this new project is to develop video coding technology with a data stream structure defined by two component streams: a base stream decodable by a hardware decoder and an enhancement stream suitable for software processing implementation with sustainable power consumption. The enhancement stream will provide new features such as compression capability extension to existing codecs and lower encoding/decoding complexity.

Artificial neural networks have been adopted for a broad range of tasks in multimedia analysis and processing, such as visual and acoustic classification, extraction of multimedia descriptors or image and video coding. The trained neural networks for these applications contain a large number of parameters (i.e., weights), resulting in a considerable size. Thus, transferring them to a number of clients using them in applications (e.g., mobile phones, smart cameras) requires compressed representation of neural networks. WG 11 issued the CfP on compressed representation of neural network. After a formal evaluation of submissions, the new project ISO/IEC 15938-17 compression of neural networks for multimedia content description and analysis was started.

ISO/IEC 23090-5 Video-based Point Cloud Compression (V-PCC) standard has been promoted to FDIS stage. V-PCC addresses lossless and lossy coding of 3D point clouds with associated attributes such as colour. By leveraging existing and video ecosystems in general (hardware acceleration, transmission services and infrastructure), and future video codecs as well, the V-PCC technology enables new applications. ISO/IEC 23090-9 Geometry-based Point Cloud Compression (G-PCC) standard has been promoted to DIS stage. G-PCC addresses lossless and lossy coding of time-varying 3D point clouds with associated attributes such as color and material properties.

ISO/IEC 23090-8 Network-Based Media Processing (NBMP) has been promoted to CD stage. The standard defines a standardized framework that allows content and service providers to describe, deploy, and control media processing for their content in the cloud. The framework includes an abstraction layer to be deployed on top of existing commercial cloud platforms and is designed to be able to be integrated with 5G core and edge computing. The implementation guidelines for some interesting use cases such as remote rendering of point cloud data and guided transcoding will be provided together with the specification.

ISO/IEC 23090-3 Versatile Video Coding (VVC) has been promoted to FDIS stage. VVC will be applicable to a very broad range of applications. It will provide a substantial improvement in coding efficiency relative to existing standards and will also provide additional functionalities. The focus during the development of the standard has primarily been on 10-bit 4:2:0 content, and 4:4:4 chroma format will also be supported. VVC is being developed in the Joint Video Experts Team (JVET), a group established jointly by WG11 (MPEG) and the Video Coding Experts Group (VCEG) of ITU-T Study Group 16.

WG 11 promoted the 2nd edition of the ISO/IEC 23090-2 Omnidirectional Media Format (OMAF) standard to Committee Draft (CD). This 2nd edition introduces new technologies including (i) support of improved overlay of graphics or textual data on top of video, (ii) efficient signaling of videos structured in multiple sub parts, (iii) enabling more than one viewpoint, and (iv) new profiles supporting dynamic bitstream generation according to the viewport. The encapsulation and signaling of new metadata storage in ISOBMFF are specified as a part of this specification in order to support these new features. Additionally, the streaming of omnidirectional media adopting, for example, dynamic adaptive streaming over HTTP (DASH, ISO/IEC 23009-1) and MPEG media transport (MMT, ISO/IEC 23008-1) is also specified as well as new media and presentation profiles. The 2nd edition of OMAF will reach its final milestone by the end of 2020.

ISO/IEC 23009-8 adds a mechanism to the Media Presentation Description (MPD) to refer to another document, called Session-based Description (SBD), which allows per-session information. The DASH client can use this information (i.e., variables and their values) provided in the SBD to derive the URLs for HTTP GET requests. This standard is expected to reach its final milestone in mid 2021.

WG 11 promoted ISO/IEC 23008-3:2019, Amendment 2 to Draft Amendment status. The Amendment incorporates improvements and corrections on the second edition of MPEG-H 3D Audio standard and introduces a new profile called Baseline profile. The 3D Audio Baseline profile is a subset of the existing Low Complexity profile and supports channel and object signals. It can be signaled in a backwards compatible fashion, enabling interoperability with devices implementing the 3D Audio Low Complexity profile.

The 3D Audio Baseline profile addresses industry demands and is tailored for broadcast, streaming, and high-quality immersive music delivery use cases. In addition to the advanced loudness and Dynamic Range Control (DRC) as well as interactivity and accessibility features supported in the 3D Audio standard, the Baseline profile enables the usage of up to 24 audio objects in Level 3 for high quality immersive music delivery.

Historically, in ISO/IEC 23009 (Dynamic Adaptive Streaming over HTTP; DASH), every client has used the same manifest as it best serves the scalability of the service. However, there have been increasing requests from the industry to enable customized manifests for more personalized services. WG 11 has studied a solution to this problem without sacrificing scalability, and it has reached the first milestone of its standardization.

The extensive usage of high-throughput deoxyribonucleic acid (DNA) sequencing technologies opens up new perspectives in the treatment of several diseases and enables “precision medicine”. As DNA sequencing technologies produce extremely large amounts of raw data, the ICT costs for the storage, transmission, and processing of DNA sequence data and related information, result to be very high due to the lack of universal standards preventing timely application of effective treatments. ISO/IEC 23092 MPEG-G standard jointly developed by WG11 and ISO Technical Committee for biotechnology standards (ISO TC 276/WG 5) is the first international standard to address and solve the problem of efficient and cost-effective handling of genomic data.

Artificial neural networks have been adopted for a broad range of tasks in multimedia analysis and processing, media coding, data analytics, translation and many other fields. Their recent success is based on the feasibility of processing much larger and complex neural networks (deep neural networks, DNNs) than in the past, and the availability of large-scale training data sets. As a consequence, trained neural networks contain a large number of parameters (weights), resulting in a quite large size (e.g., several hundred MBs). Many applications require the deployment of a particular trained network instance, potentially to a larger number of devices, which may have limitations in terms of processing power and memory (e.g., mobile devices or smart cameras). Any use case, devices could thus benefit from a standard for the compressed representation of

neural networks. WG11 started its standardization.

2.2 Accomplishments

The status of all standards published by SC 29, together with those under development, may be viewed in the SC 29 Standards Catalogue.

The accomplishments of SC 29 are reported below with respect to the two individual Working Groups, WG1 and WG11.

2.3 Resources

Each WG has sufficient participation of experts so that we proceed the works on JPEG, JPEG 2000, AIC, JPEG XR, JPEG XT, JPEG Systems, JPEG XS, JPEG XL, JPEG Pleno, MPEG-2, MPEG-4, MPEG-7, MPEG-21, MPEG-A to MPEG-E, MPEG-G, MPEG-H, MPEG-I, MPEG-M, MPEG-V, MPEG-U and MPEG-DASH projects in addition to other standards being investigated.

2.4 Competition and Cooperation (including consortia)

SC 29 maintains many liaisons with other organizations to meet the requirements and expectations of the standards users from the other communities. SC 29 has been continuing productive collaboration with ITU-T. The Joint Photographic Experts Group (JPEG) and the Joint Collaborative Team on Video Coding (JCT-VC) are the continued joint activities we share with ITU-T/SG 16. The Joint Video Experts~~loration~~ Team (JVET) is the latest joint activity with ITU-T to standardize Versatile Video Coding (VVC) to provide a significant improvement in compression performance over the existing HEVC standard. SC 29 works jointly with SC 24 in the Joint Ad hoc Group (JAhG) targeting Mixed and Augmented Reality Reference Model. SC 29/WG 11 has the joint activity on genomic information compression and storage with TC 276/WG 5 and WG 3.

While SC 29 and its WGs are open to welcome new members and willing to have opportunities to collaborate with new liaison partners, it is well recognized that this field of work requires rapid progress and has potential to bring about new competitors. SC 29 and its WGs should always communicate with the stakeholders in the industry and try to recruit appropriate members in order to keep its competitiveness.

In the area of video codec, other organizations, developed their own video codec. AOM (Alliance for Open Media) developed AV1 video codec and started to promote for video streaming services. AVS (Audio Video coding Standard Workgroup of China) and the IEEE group developed AVS3 video codec. Although some recent studies show that the coding efficiency of VVC (Versatile Video Coding) is higher than that other codec, SC29 will continue monitor the activities outside and will develop long term strategy.

3.0 Discussion of SC program of work

3.1 SC Opportunities and Strategies

SC 29 has delivered generations of significant media coding standards. The performances such as compression capability and the functionalities supporting media composition, transport and storage have been evolutionally enhanced. There are still evident needs for support of high quality, usability and advanced features. Further compression of media is expected to deliver media over the Internet and mobile channels. Ultra HD, 3D and 360-degree media should be supported. Regarding these requirements, the industry needs further efficiency and adaptability in compression, composition, description and control of digital media.

The recipients or consumers of digital media information are not necessary to be human but machines or systems in the era of Internet of Things. Thus, SC 29 has a lot of opportunities.

SC 29 continues to provide information on the progress of standardization work to the public through SC's and WGs' web sites as well as press releases, white papers or awareness events in order for attention to be paid to the area of the multimedia information technology.

SC 29 continues the practice of making their standards containing conformance testing bitstreams and reference software accessible as the freely available standards from ISO/IEC. SC 29 is pleased to hear the requirements from the industry, so that appropriate WG under SC 29 would study and work in case of observing good opportunities to deliver the standards that meet the requirements. The WGs may hold public seminars to introduce their activities and to align future standardization with users and industry needs.

3.2 SC and WG risks

- Scope and structure: Following an 18-month, thorough evaluation of its structure, SC 29 approved a reorganization of its working groups which will enable the committee to work with greater agility as it

develops the next generation of MPEG and JPEG standards. At the meeting in June that approved the reorganization, SC 29 members expressed strong support for the plan which organizes the work into 8 working groups. The new structure was effective on July 17, 2020. The revised scope of SC 29 has been approved by JTC 1 in its plenary meeting in November 2019. In this document, the activities are summarized as previous WG's activities, not as new structure.

- Risk related to patents: In order to meet the requirements of industry and to compete with other standards/specifications developing organizations, SC 29's standards should incorporate new technologies and ideas, which may be associated with patents. The number of such patents could be many corresponding to the advanced features of the standards. The proponents, other parties that have not participated in the development process or even someone else outside of the process, may own the patents. The owners may have their respective policies. Some policies may cause certain suspension of the standards development or dull deployment of the standards. SC 29 and WGs continue to encourage their members to submit patent declarations.

3.3 WG 1 Coding of digital representations of images

3.3.1 WG 1 accomplishments

WG 1 is progressing the development of the following standards.

- ISO/IEC 21794-2 Information technology — Plenoptic image coding system (JPEG Pleno) — Part 2: Light field coding
- ISO/IEC 21794-3 Information technology — Plenoptic image coding system (JPEG Pleno) — Part 3: Conformance testing
- ISO/IEC 21794-4 Information technology — Plenoptic image coding system (JPEG Pleno) — Part 4: Reference software
- ISO/IEC 10918-7 Information technology — Digital compression and coding of continuous-tone still images — Part 7: Reference software
- ISO/IEC 21122-1:2019/Amd 1 Information technology — JPEG XS low-latency lightweight image coding system — Part 1: Core coding system — Amendment 1: Extended capabilities for JPEG XS core coding system
- ISO/IEC 21122-2:2019/Amd 1 Information technology — JPEG XS low-latency lightweight image coding system — Part 2: Profiles and buffer models — Amendment 1: Profiles extensions
- ISO/IEC 19566-7 Information technologies — JPEG systems — Part 7: JPEG linked media format (JLINK)
- ISO/IEC 18181-3 Information technology — JPEG XL Image Coding System — Part 3: Conformance testing
- ISO/IEC 18181-4 Information technology — JPEG XL Image Coding System — Part 4: Reference software
- ISO/IEC 21794-2/Amd 1 Information technology — Plenoptic image coding system (JPEG Pleno) — Part 2: Light field coding — Amendment 1: Profiles and Levels for JPEG Pleno Light Field Coding System
- ISO/IEC 18181-2 Information technology — JPEG XL Image Coding System — Part 2: File format
- ISO/IEC 24800-2 Information technology — JPSearch — Part 2: Registration, identification and management of schema and ontology
- ISO/IEC 21794-1 Information technology — Plenoptic image coding system (JPEG Pleno) — Part 1: Framework
- ISO/IEC 21122-3:2019/Cor 1 Information technology — JPEG XS low-latency lightweight image coding system — Part 3: Transport and container formats — Technical Corrigendum 1
- ISO/IEC 21122-5 Information technology — JPEG XS low-latency lightweight image coding system — Part 5: Reference software
- ISO/IEC 19566-5:2019/Amd 1 Information technologies — JPEG systems — Part 5: JPEG universal metadata box format (JUMBF) — Amendment 1: Support for embedding mixed code streams
- ISO/IEC 19566-6:2019/Amd 1 Information technologies — JPEG systems — Part 6: JPEG 360 — Amendment 1: Addition of new JPEG 360 image types and accelerated ROI rendering

- ISO/IEC 18181-1 Information technology — JPEG XL Image Coding System — Part 1: Core coding system
- ISO/IEC 15444-4:2004/Amd 1 Information technology — JPEG 2000 image coding system: Conformance testing — Part 4: — Amendment 1: High-throughput JPEG 2000 conformance testing
- ISO/IEC 15444-5:2015/Amd 1 Information technology — JPEG 2000 image coding system: Reference software — Part 5: — Amendment 1: Additional reference software for HTJ2K
- ISO/IEC 15444-16 Information technology — JPEG 2000 image coding system — Part 16: Encapsulation of JPEG 2000 images into ISO/IEC 23008-12
- ISO/IEC 15444-17 Information technology — JPEG 2000 image coding system — Part 17: Extensions for coding of discontinuous media

3.3.2 WG 1 deliverables

Since October 2018, the following WG1 deliverables have been published.

- ISO/IEC 29199-2:2020 Information technology — JPEG XR image coding system — Part 2: Image coding specification
- ISO/IEC 29170-2:2015/Amd 1:2020 Information technology — Advanced image coding and evaluation — Part 2: Evaluation procedure for nearly lossless coding — Amendment 1: Evaluation procedure parameters for nearly lossless coding of high dynamic range media and image sequences
- ISO/IEC 21122-4:2020 Information technology — JPEG XS low-latency lightweight image coding system — Part 4: Conformance testing
- ISO/IEC 19566-4:2020 Information technologies — JPEG systems — Part 4: Privacy and security
- ISO/IEC 18477-1:2020 Information technology — Scalable compression and coding of continuous-tone still images — Part 1: Core coding system specification
- ISO/IEC 18477-8:2020 Information technology — Scalable compression and coding of continuous-tone still images — Part 8: Lossless and near-lossless coding
- ISO/IEC 15444-1:2019 Information technology — JPEG 2000 image coding system — Part 1: Core coding system
- ISO/IEC 15444-15:2019 Information technology — JPEG 2000 image coding system — Part 15: High-Throughput JPEG 2000
- ISO/IEC 10918-7:2019 Information technology — Digital compression and coding of continuous-tone still images — Part 7: Reference software

3.4 WG 11 Coding of Moving Pictures and Audio

3.4.1 WG 11 accomplishments

WG 11 is progressing the development of the following standards.

- ISO/IEC TR 23009-7 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 7: Delivery of CMAF contents with DASH
- ISO/IEC 23008-11:2015/Amd 1 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 11: MPEG media transport composition information — Amendment 1: Customization in composition information
- ISO/IEC 23090-7 Information technology — Coded representation of immersive media — Part 7: Immersive media metadata
- ISO/IEC 23090-10 Information technology — Coded representation of immersive media — Part 10: Carriage of Visual Volumetric Video-based Coding Data
- ISO/IEC 15938-16 Information technology — Multimedia content description interface — Part 16: Conformance and reference software for compact descriptors for video analysis
- ISO/IEC 23090-8/Amd 1 Information technology — Coded representation of immersive media — Part 8: Network based media processing — Amendment 1: NBMP function templates
- ISO/IEC 23090-12 Information technology — Coded representation of immersive media — Part 12:

Immersive Video

- ISO/IEC 23090-17 Information technology — Coded representation of immersive media — Part 17: Reference Software and Conformance for OMAF
- ISO/IEC 23008-7 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 7: MMT Conformance
- ISO/IEC 23001-10:2020/Amd 1 Information technology — MPEG systems technologies — Part 10: Carriage of timed metadata metrics of media in ISO base media file format — Amendment 1: Support for Content-Guided Transcoding and Spatial Relationship of Immersive Media
- ISO/IEC 23001-14:2019/Amd 1 Information technology — MPEG systems technologies — Part 14: Partial file format — Amendment 1: Support for HTTP entities, enhanced file type and byte-range priorities
- ISO/IEC 14496-15:2019/Amd 2 Information technology — Coding of audio-visual objects — Part 15: Carriage of network abstraction layer (NAL) unit structured video in the ISO base media file format — Amendment 2: Carriage of VVC in ISOBMFF
- ISO/IEC 23094-3 Iformation technology — General video coding — Part 3: Carriage of EVC
- ISO/IEC 23092-6 Information technology — Genomic information representation — Part 6: Coding of genomic annotations
- ISO/IEC 23090-18 Information technology — Coded representation of immersive media — Part 18: Carriage of Geometry-based Point Cloud Compression Data
- ISO/IEC 15938-17 Information technology — Multimedia content description interface — Part 17: Compression of neural networks for multimedia content description and analysis
- ISO/IEC 14496-16 Information technology — Coding of audio-visual objects — Part 16: Animation Framework eXtension (AFX)
- ISO/IEC 14496-27 Information technology — Coding of audio-visual objects — Part 27: 3D Graphics conformance
- ISO/IEC 23090-13 Information technology — Coded representation of immersive media — Part 13: Video Decoding Interface for Immersive Media
- ISO/IEC 23090-14 Information technology — Coded representation of immersive media — Part 14: Scene Description for MPEG Media
- ISO/IEC 23009-8 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 8: Session-based DASH operations
- ISO/IEC 23008-1 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 1: MPEG media transport (MMT)
- ISO/IEC 23008-4/Amd 2 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 4: MMT reference software — Amendment 2: Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 4: MMT reference and conformance software — Amendment 2: Support for MMTP extensions
- ISO/IEC TR 14496-24 Information technology — Coding of audio-visual objects — Part 24: Audio and systems interaction
- ISO/IEC 23094-1 Information technology — General video coding — Part 1: Essential video coding
- ISO/IEC 23094-2 Information technology – General video coding — Part 2: Low complexity enhancement video coding
- ISO/IEC 23092-1 Information technology — Genomic information representation — Part 1: Transport and storage of genomic information
- ISO/IEC 23092-2 Information technology — Genomic information representation — Part 2: Coding of genomic information
- ISO/IEC 23092-4 Information technology — Genomic information representation — Part 4: Reference software
- ISO/IEC 23092-5 Information technology — Genomic information representation — Part 5: Conformance

- ISO/IEC TR 23090-1 Information technology - Coded representation of immersive media — Part 1: Immersive media
- ISO/IEC 23090-2 Information technology — Coded representation of immersive media — Part 2: Omnidirectional media format
- ISO/IEC 23090-3 Information technology — Coded representation of immersive media — Part 3: Versatile video coding
- ISO/IEC 23090-5 Information technology — Coded representation of immersive media — Part 5: Visual Volumetric Video-based Coding (V3C) and Video-based Point Cloud Compression (V-PCC)
- ISO/IEC 23090-6 Information technology — Coded representation of immersive media — Part 6: Immersive media metrics
- ISO/IEC 23090-8 Information technology — Coded representation of immersive media — Part 8: Network based media processing
- ISO/IEC 23090-9 Information technology — MPEG-I (Coded Representation of Immersive Media) — Part 9: Geometry-based Point Cloud Compression
- ISO/IEC 23090-11 Information technology — Coded representation of immersive media — Part 11: Network-based media processing implementation guidelines
- ISO/IEC 23009-1:2019/Amd 1 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats — Amendment 1: CMAF support, events processing model and other extensions
- ISO/IEC 23009-2 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 2: Conformance and reference software
- ISO/IEC TR 23009-3 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 3: Implementation guidelines
- ISO/IEC 23008-1/Amd 1 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 1: MPEG media transport (MMT) — Amendment 1: Support of FCAST
- ISO/IEC 23008-2 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding
- ISO/IEC 23008-2/Amd 2 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding — Amendment 2: Shutter interval information SEI message
- ISO/IEC 23008-3:2019/Amd 2 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 3: 3D audio — Amendment 2: 3D Audio Baseline profile, Corrections and Improvements
- ISO/IEC 23008-10:2015/Amd 1 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 10: MPEG media transport forward error correction (FEC) codes — Amendment 1: Window-based FEC code
- ISO/IEC 23008-12:2017/Amd 2 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 12: Image File Format — Amendment 2: Support for predictive image coding, bursts, bracketing, and other improvements
- ISO/IEC TR 23008-13 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 13: MMT implementation guidance
- ISO/IEC 23005-1 Information technology — Media context and control — Part 1: Architecture
- ISO/IEC 23002-7 Information technology — MPEG video technologies — Part 7: Supplemental enhancement information messages for coded video bitstreams
- ISO/IEC 23000-19:2020/Amd 1 Information technology — Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media — Amendment 1: Additional CMAF HEVC media profiles
- ISO/IEC 23000-21:2019/Amd 1 Information technology — Multimedia application format (MPEG-A) — Part 21: Visual identity management application format — Amendment 1: Conformance and reference software

- ISO/IEC 23000-22:2019/Amd 1 Information technology — Multimedia application format (MPEG-A) — Part 22: Multi-image application format (MIAF) — Amendment 1: Reference software and conformance for multi image application format
- ISO/IEC 14496-10 Information technology — Coding of audio-visual objects — Part 10: Advanced video coding
- ISO/IEC 14496-12 Information technology — Coding of audio-visual objects — Part 12: ISO base media file format
- ISO/IEC 14496-12/DAmd 4 Information technology — Coding of audio-visual objects — Part 12: ISO base media file format — Amendment 4: Compact movie fragments
- ISO/IEC 14496-15:2019/Amd 1 Information technology — Coding of audio-visual objects — Part 15: Carriage of network abstraction layer (NAL) unit structured video in the ISO base media file format — Amendment 1: Improved support for tiling and layering
- ISO/IEC 14496-32 Information technology — Coding of audio-visual objects — Part 32: File format reference software and conformance
- ISO/IEC 13818-1:2019/Amd 2 Information technology — Generic coding of moving pictures and associated audio information — Part 1: Systems — Amendment 2: Carriage of VVC in MPEG-2 Systems
- ISO/IEC 13818-1:2019/Cor 1 Information technology — Generic coding of moving pictures and associated audio information — Part 1: Systems — Technical Corrigendum 1

3.4.2 WG 11 deliverables

Since October 2018, the following WG11 deliverables have been published.

- ISO/IEC 23093-1:2020 Information technology — Internet of media things — Part 1: Architecture
- ISO/IEC 23093-3:2019 Information technology — Internet of media things — Part 3: Media data formats and APIs
- ISO/IEC 23093-4:2020 Information technology — Internet of media things — Part 4: Reference software and conformance
- ISO/IEC 23092-2:2019 Information technology — Genomic information representation — Part 2: Coding of genomic information
- ISO/IEC 23092-3:2020 Information technology — Genomic information representation — Part 3: Metadata and application programming interfaces (APIs)
- ISO/IEC TR 23091-4:2020 Information technology — Coding-independent code points — Part 4: Usage of video signal type code points
- ISO/IEC 23009-1:2019 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats
- ISO/IEC 23009-5:2017/Amd 1:2020 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 5: Server and network assisted DASH (SAND) — Amendment 1: Improvements on SAND messages
- ISO/IEC 23008-4:2020 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 4: MMT reference software
- ISO/IEC 23008-6:2020 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 6: 3D audio reference software
- ISO/IEC 23008-8:2018/Amd 1:2019 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 8: Conformance specification for HEVC — Amendment 1: Conformance testing for HEVC screen content coding (SCC) extensions and non-intra high throughput profiles
- ISO/IEC 23008-12:2017/Cor 1:2020 Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 12: Image File Format — Technical Corrigendum 1
- ISO/IEC 23005-7:2019 Information technology — Media context and control — Part 7: Conformance

and reference software

- ISO/IEC 23003-3:2020 Information technology — MPEG audio technologies — Part 3: Unified speech and audio coding
- ISO/IEC 23003-4:2020 Information technology — MPEG audio technologies — Part 4: Dynamic range control
- ISO/IEC 23003-5:2020 Information technology — MPEG audio technologies — Part 5: Uncompressed audio in MPEG-4 file format
- ISO/IEC 23001-10:2020 Information technology — MPEG systems technologies — Part 10: Carriage of timed metadata metrics of media in ISO base media file format
- ISO/IEC 23001-15:2019 Information technology — MPEG systems technologies — Part 15: Carriage of web resources in ISOBMFF
- ISO/IEC 23000-19:2020 Information technology — Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media
- ISO/IEC 15938-6:2020 Information technology — Multimedia content description interface — Part 6: Reference software
- ISO/IEC 14496-3:2019 Information technology — Coding of audio-visual objects — Part 3: Audio
- ISO/IEC 14496-14:2020 Information technology — Coding of audio-visual objects — Part 14: MP4 file format
- ISO/IEC 14496-22:2019/Amd 1:2020 Information technology — Coding of audio-visual objects — Part 22: Open Font Format — Amendment 1: Color font technology and other updates
- ISO/IEC 13818-1:2019/Amd 1:2020 Information technology — Generic coding of moving pictures and associated audio information — Part 1: Systems — Amendment 1: Carriage of JPEG XS in MPEG-2 TS