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* v6.1: M47709 (Geneva, CH) with updates from 3GPP, DVB, VRIF, ITU-R, VQEG, ITU-T, DASH-IF, Khronos, WebXR,
* v6.0: N18130 (Marrakech, MA) with updates from 3GPP, DASH-IF, SMPTE, CTA, ITU-R, VRIF, ITU-R, ETSI, SVA
* v5.1: M46076 (Marrakech, MA) with updates from 3GPP, VRIF, QoE (VQEG, ITU-T), DASH-IF, WebXR, CTA, SMPTE, ETSI, SVA.
* v5.0: N17930 (Macau, CN) with updates from 3GPP, VRIF, CTA, DASH-IF, Khronos, WebXR, SMPTE, ETSI, SVA.
* v4.1: M45001 (Macau, CN) with minor updates from VRIF, VQEG, Khronos, and WebXR.
* V4.0: N17751 (Ljubljana, SI) with updates from 3GPP, DVB, VRIF, QoE (QUALINET, VQEG, ITU-T), DASH-IF, Khronos, WebXR (former WebVR), and CTA.
* v3.1: M43754 (Ljubljana, SI) with minor updates and the proposal to update this document during the meeting.
* v3: N17676 (San Diego, CA, USA) with major updates here and there (3GPP, DVB, VRIF, QoE) incl. new sections for IETF, SMPTE, ETSI, and SVA
* v2.2: M42696 (San Diego, CA, USA) with minor updates and proposal to update during the meeting
* v2.1: M42187 (Gwangju, Korea) updates mainly on WebVR, 3GPP, and VRIF. Added new sections on DASH-IF and CTA.
* v2: N17136 (Macau, China) taking into account Liaison statements (ITU-T SG 12 to SC 29/WG 11 on QoE-VR, 3GPP TSG SA WG4 to SC 29/WG 11 on Virtual Reality progress in 3GPP SA4, VRIF to SC 29/WG 11 on VR Requirements for MPEG-I Phase 1b, ITU-R WP 6C to SC 29/WG 11 on Advanced Immersive Audio Visual (AIAV) Systems for Programme Production and Exchange for Broadcasting)
* v1.1: M41745 (Macau, China)
* v1: N17060 (Torino, Italy)

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1. **Introduction**

This document provides an overview of standards activities related to immersive media and we may take it into account when sending liaisons and information about MPEG-I.

This document is partially based on <http://bit.ly/mpegisdo> (May 22, 2018) and has been updated to reflect recent developments. Please note that the activities within ISO/IEC JTC 1/SC 29 are not included here.

1. **3GPP**

**Goal**: 3GPP SA WG4 Codec deals with the specifications for speech, audio, video, and multimedia codecs, in both circuit-switched and packet-switched environments. Other topics within the mandate of SA WG4 are: quality evaluation, end-to-end performance, and interoperability aspects with existing mobile and fixed networks (from codec point of view).

**Status**: active; we expect 3GPP to be a customer of MPEG-I standards.

October 2019:

* To be provided… by Thomas/Igor

July 2019:

* Two meetings were held between MPEG#126 and MPEG#127, namely SA4#103 and SA4#104;
  + The study item on FS\_XR5G progressed with full speed. The agreements are covered in two output documents:
    - The permanent document ([S4-190785](http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_104_Cork/Docs/S4-190785.zip)) adds information on technologies, use cases and a workshop summary (120 page document).
    - An updated version of the Technical Report as TR26.928v0.5.0 was issued in [S4-190786](http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_104_Cork/Docs/S4-190786.zip). The following is added:
  + The content of the new SID on "Draft New SID on Feasibility Study on VR Streaming Conformance and Guidelines (FS\_VRStream\_ConG)" [S4-190773](http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_104_Cork/Docs/S4-190773.zip) was agreed, but formally postponed. It addresses collection of guidelines and interop for the creation and distribution of VR content based on TS26.118.
  + The study on QoE metrics for VR Streaming was completed progressing. The completed TR26.929 was issued in [S4-190561](http://ftp.3gpp.org/tsg_sa/WG4_CODEC/TSGS4_103_Newport_Beach/Docs/S4-190561.zip). Based on the conclusions a WID was agreed in [S4-190539](http://ftp.3gpp.org/tsg_sa/WG4_CODEC/TSGS4_103_Newport_Beach/Docs/S4-190539.zip).
  + Rel-17 Work Item on EVS Codec Extension for Immersive Voice and Audio Services (IVAS\_Codec) as well as Rel-17 Work item on Support of Immersive Teleconferencing and Telepresence for Remote Terminals (ITT4RT) have been progressed by documenting the main issues in a permanent document.
  + The work on 5G Media Streaming Architecture is progressing: the stage-2 architecture in TS26.501 a stage-3 work item as approved was approved at the recent SA plenary.
  + Feasibility Study on Typical Traffic Characteristics (FS\_TyTraC) issued an updated TR26.925v0.4.0 ([S4-190808](http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_104_Cork/Docs/S4-190808.zip)) adding characteristics for Cloud Gaming and XR/AR/VR as well as updated on video codecs including VVC and EVC.

March 2019:

* One meeting was held between MPEG#125 and MPEG#126, namely SA4#102
* The study item on FS\_XR5G progressed with full speed. The agreements are covered in the following output documents:
  + The permanent document ([S4-190260](http://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_102_Bruges/Docs/S4-190260.zip)) adds significant information on technologies and use cases (80 page document).
  + The updated time plan was agreed in [S4-190227](http://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_102_Bruges/Docs/S4-190227.zip) adding three telcos for use case discussion.
  + An updated version of the Technical Report as TR26.928v0.3.0 was issued in [S4-190254](http://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_102_Bruges/Docs/S4-190254.zip) with small updates on delivery classification.
* SA4 has also further ongoing or emerging work related to Immersive Media representations. Worth highlighting are the following activities:
  + Rel-17 Work Item on EVS Codec Extension for Immersive Voice and Audio Services (IVAS\_Codec)
  + Rel-17 Work item on Support of Immersive Teleconferencing and Telepresence for Remote Terminals (ITT4RT)
* The next meeting will be SA4#103 in April 2019.
* 3GPP also provided updated information on a joint workshop of 3GPP, VRIF and AIS in April 2019 in Los Angeles. For details refer here: https://www.vr-if.org/events/3gpp-vrif-ais-workshop/

January 2019:

* Two meetings were held between MPEG#124 and MPEG#125, namely SA4#100 and SA4#101.
* The study item on FS\_XR5G was kicked off and progressed with full speed.
  + At SA4#100, the framework and working method was agreed. At SA4#101, contributions addressed relevant technologies (Point Cloud Compression, 3D formats) as well as use cases in the domain of AR and XR calls and meetings, 6DoF streaming as well as public safety. Updates to work in other SDOs were done.
  + Based on the work, the following new output documents were issued:
    - The updated time plan was agreed in [S4-181477](http://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_101_Busan/Docs/S4-181477.zip) with only minor changes. Completion by end of 2019.
    - An updated version of the Technical Report as TR26.928v0.2.0 was issued in [S4-181471](http://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_101_Busan/Docs/S4-181471.zip) with additional definitions and technologies.
    - The permanent document ([S4-181472](http://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_101_Busan/Docs/S4-181472.zip)) adds significant information on technologies and use cases.
* SA4 has also further ongoing or emerging work related to Immersive Media representations. Worth highlighting are the following activities:
  + Rel-17 Work Item on EVS Codec Extension for Immersive Voice and Audio Services (IVAS\_Codec)
  + Rel-17 Work item on Support of Immersive Teleconferencing and Telepresence for Remote Terminals (ITT4RT)
  + 3GPP SA4 sees potential applicability of its EVS codec for the Social VR component of MPEG-I. 3GPP SA4 also wants to highlight that the IVAS codec may also be of interest for the Social VR component of MPEG-I.
* The next meeting will be SA4#102 in end of January.
* 3GPP also provided updated information on a joint workshop of 3GPP, VRIF and AIS in April 2019 in Los Angeles. For details refer here: https://www.vr-if.org/events/3gpp-vrif-ais-workshop/

October 2018:

* No meeting was held in 3GPP SA4 in between MPEG#123 and MPEG#124
* However, 3GPP officially completed the work of VR for its first Release of 5G. A press release was issued that summarizes the status: [5G includes Virtual Reality from day 1](http://www.3gpp.org/news-events/3gpp-news/1981-vr_ws2)!
  + To facilitate that VR Adoption a set of VR Video and Audio operating points and their mapping to Dynamic and Adaptive HTTP Streaming (DASH) have now been specified in 3GPP specification [TS 26.118](https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3325).
  + In addition to TS 26.118, the audio work for VR is supported by:
    - 3GPP TS 26.259 Subjective test methodologies for the evaluation of immersive audio systems
    - 3GPP TR 26.818 Virtual Reality (VR) streaming audio; Characterization test results.
* 3GPP also announced a workshop
  + 3GPP and the VRIF, in cooperation with the Advanced Imaging Society (AIS), are announcing the second Workshop on VR Ecosystems & Standards, themed “Immersive Media meets 5G”. The workshop will take place on 15-16 April 2019 in a US West Coast location (exact place TBC), immediately after the NAB trade show and the 3GPP SA4#103 meeting.
  + The second edition will focus on next-generation immersive formats and services, including Virtual, Augmented & Mixed Reality, and it will investigate 5G business opportunities brought by immersive services – as well as their requirements. The workshop is integrated in the newly approved 3GPP Study item in Release 16, on Extended Reality over 5G (FS\_XR5G).
* The work on the Feasibility Study on Extended Reality over 5G will start in October 2018, addressing new VR experiences beyond TS26.118 enablers such Augmented Reality, six degrees of freedom and Mixed reality.

July 2018:

* VR Streaming: Technical work on TS 26.118 (Media Profiles for VR Streaming) was finalized. The latest version [TS26.118 1.1.0](http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_99/Docs/S4-180958.zip) is available. Some editing remains to be done in final telco.
  + The specification is expected to be approved in September
  + Operation points (elementary stream and rendering requirements) as well as Media Profiles (including file format and DASH constraints) for Video and Audio are defined
  + Video
    - Operation Points
      * Basic H.264/AVC: H.264/AVC HP@L5.1 with ERP (“legacy”)
      * Main H.265/HEVC: H.265/HEVC [MP10@L5.1](mailto:MP10@L5.1), ERP, RWP, stereoscopic; selects tools from OMAF
      * Flexible H.265/HEVC: H.265/HEVC [MP10@L5.1](mailto:MP10@L5.1), adds cubemap and HDR; up to 120 fps
    - Media Profiles
      * Basic Video: Based on Basic H.264/AVC OP, Single stream HEVC, no viewport optimization
      * Main Video: Based on Main H.265/HEVC OP, sample entry hvc1, single or multiple independent Adaptation Sets offered, Single Representation streaming
      * Advanced Video: Based on Flexible H.265/HEVC OP, sample entry hvc1/hvc1, single or multiple dependent Adaptation Sets offered, Single and multiple Representation streaming, permits tiling, etc.
      * All profiles can be offered as a subset of OMAF Video Profiles.
  + Audio
    - Tested 4 candidates; results documented in [Technical Report](http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_99/Docs/S4-181000.zip)
    - Agreed to specify MPEG-H Audio with OMAF compatibility
    - For the other proposals, it is expected that more evaluation will be done in the Rel-16 time frame.
  + Metadata: supporting the rendering of 360 experiences on 2D screens, including the aspects of rendering without pose information.
  + On system level, integration of PSS and MBMS services done. This means that broadcast VR is possible.
* Work ongoing on speech-centric coding that includes immersive aspects
* Agreement to have new Study Item about [XR in 5G](http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_99/Docs/S4-180973.zip). Not moving to Normative Spec straight-away, but first look at use cases. Longer timeframe. Considered very important to 5G, runs for 1.5 years until Dec ’19
* The work on e-FLUS (Extended Framework on Live Uplink Streaming) was further progressed, including the discussion on conversational VR services

1. **DVB**

**Goal**: The overall goal for DVB’s commercial module on virtual reality (CM-VR) is at delivering commercial requirements to be passed to the relevant DVB technical module (TM) groups in order to work on developing technical specifications targeting the delivery of VR contents over DVB networks, as mandated per the DVB CM.

**Status**: paused.

October 2019: status unchanged.

July 2019: status unchanged.

March 2019: in July 2018 DVB paused this activity and it hasn’t resumed yet. However, 3GPP has a study mission on formats beyond UHD-1 phase 2 that also includes VR.

January 2019: No further updates since October 2018. As mentioned in July 2018, it is paused and probably reconsidered in February 2019.

October 2018: No further updates since July 2018.

July 2018: Considering the current level of support for the CM-VR (Virtual Reality) group, the SB decided to pause the work on VR for six months and reconsider the topic at SB91 in February 2019.

April 2018 (and earlier): Following the conclusions of the DVB Virtual Reality Study mission (summary can be found [here](https://www.dvb.org/resources/public/whitepapers/dvb_vr_study_mission_report_summary.pdf)), the DVB VR activity is promoted from a commercial module (CM) study mission on VR (CM-VR-SMG) to a CM-VR official group as approved by the DVB CM on June 28th, 2017. The overall goal for the CM-VR is at delivering commercial requirements to be passed to the relevant DVB technical module (TM) groups in order to work on developing technical specifications targeting the delivery of VR contents over DVB networks, as mandated per the DVB CM.

A report on DVB and VR is available here: <https://www.itu.int/en/ITU-T/studygroups/2017-2020/16/Documents/ws/201701ILE/S2P3-2017-01-19-EBU-VR_David_Wood.pdf> including some conclusions, commercial success factors, technical aspects (i.e., frame rates, bit rates, FoV, resolution, geometrical congruency, degree of audio/visual immersion, head tracking latency) at the end. Additionally, points out AR at the very end.

Presentation at 3GPP/VRIF workshop is available here <http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/Joint%203GPP%20SA4%20-%20VRIF%20Workshop%20on%20VR/Docs/VRSTD-06%20DVB%20CM-VR%20Ludovic%20Noblet.zip>.

A questionnaire has been launched on Feb 26th, 2018 with the focus on VR/360/3DOF contents with the goal at

– Ensuring there is a commercial demand

– Focusing on use cases, prioritizing them depending on expressed interest – In order to define relevant commercial requirements (June 2018)

Structure: plans, use cases at service, features and delivery levels

So far, 7 answers have been received and processed

– 2 technology providers, 1 broadcaster, 1 broadcaster network operator, 1 professional equipment manufacturer, 2 consumer electronics manufacturers

– Answers from more broadcasters are expected in the future

1. **VRIF**

**Goal**: The principal purpose of the VR Industry Forum (VRIF) shall be: To further the widespread availability of high-quality audiovisual VR experiences, for the benefit of consumers. The VRIF is not a standards development organization, but will rely on, and liaise with, standards development organizations for the development of standards in support of VR services and devices.

The guidelines provided by VRIF cover all aspects of the distribution ecosystems, including compression, storage and delivery, in order to ensure high quality, comfortable consumer VR experiences. These guidelines are aimed at addressing best practices for VR content production and distribution as well as advocating interoperability and deployment guidelines based on common technical standards for VR content distribution, including promoting the use of common profiles across the industry.

**Status**: active; VRIF is clearly seen as a customer of MPEG, expecting specifications and profiles of immersive media standards (e.g., OMAF, V-PCC).

October 2019: VRIF Guidelines 2.0 released (see below); VRIF is currently developing the requirements for its next Guidelines release, planned to be available in the first quarter of 2020. See also recent VRIF publication in SMPTE Motion Imaging Journal ([LINK](https://www.vr-if.org/vrifs-view-on-state-of-the-immersive-media-industry/)).

July 2019: VRIF Guidelines 2.0 available [here](https://www.vr-if.org/wp-content/uploads/VRIF_Guidelines2.0.pdf). This version of the VR Industry Forum (VRIF) Guidelines builds upon version 1.1, adding recommendations on:

* Producing and distributing Live VR services
* The use of text and fonts in VR experiences
* Watermarking of 2D framed content in Theatrical VR
* The use of HDR in VR content presentation – what works and what does not
* A new media profile with a high-quality field-of-view

March 2019: VRIF still focuses on adding live services to its Guidelines. Seeking to release new version of Guidelines by NAB; the draft version is still in public comment phase.

January 2019: the draft VR distribution guidelines 2.0 for community review is available [here](https://www.vr-if.org/wp-content/uploads/vrif2018.110.04-Guidelines-2.0-for-Community-Review-1.pdf) (feedback requested until March 1, 2019; Feedback can be provided through the VRIF Guidelines Comment Submission Form linked from: <https://www.vr-if.org/guidelines/>)

October 2018: VRIF members exhibited at IBC2018 (see [vr-if.org)](https://www.vr-if.org/news/vr-industry-forum-reveals-the-future-of-cinematic-virtual-reality-at-ibc2018/). Release 2 still planned for early 2019. Guidelines for use of text and fonts moving ahead well; will likely explicitly address subtitles too.

* Upcoming versions
  + Live VR 360 Services
  + Use of HDR in VR
  + Text and fonts, including subtitles
  + Security: watermarking in VR content
* Adding Presentation APIs to Guidelines likely only beyond 2.0
* Testing and Interop: slowly moving ahead

July 2018: V1.1 of their guidelines have been released on May 11 with minor corrections and additional clarifications.

April 2018 (and earlier): The **VR Industry Forum** has been established with the aim *"to further the widespread availability of high quality audiovisual VR experiences, for the benefit of consumers"* comprising working groups related to Requirements, Guidelines, Communications, and Liaison. The current focus is on enabling a high-quality, interoperable experience for services that distribute content represented as audio and video (it doesn’t necessarily have to be captured by cameras and microphones). VRIF and MPEG have a formal liaison relationship that allows the exchange of documents.

There are some similarities to DASH-IF, but VRIF does not have a predetermined focus on a particular technology like DASH-IF has for DASH. Moreover, VRIF does not wish to write specifications – it will define Profiles at most.

VRIF published guidelines at CES 2018, and these are available here <http://www.vr-if.org/guidelines/>: The initial release of the VRIF Guidelines focuses on the delivery ecosystem of 360° video with three degrees of freedom (3DOF) and incorporates:

* Documentation of cross-industry interoperability points, based on ISO MPEG’s Omnidirectional Media Format (OMAF)
* Best industry practices for production of VR360 content, with an emphasis on human factors such as motion sickness
* Security considerations for VR360 streaming, focusing on content protection but also looking at user privacy.

The liaison statement received at the 120th MPEG meeting comprises a set of use cases (live VR services specifically targeting sports, interactive VR services) and provides requirements for MPEG-I phase 1b.

Topics to be addressed in 2018 by VRIF include live virtual reality services and support for high dynamic range (HDR).

1. **ITU-R WP 6C**

**Goal**: WP 6C studies and develops issues associated with what is termed the "presentation layer" for radio and television broadcasting. This includes signal formats for the making and exchange of television and radio programmes, and also ways to evaluate picture and sound quality that are a critical element in the choice of the parameters for the "presentation layer" end-to-end.

**Status**: active; we expect 3GPP to be a customer of MPEG-I standards.

October 2019: no updates can be found on the web site – check during meeting, if possible!

July 2019: meeting mentioned below is only after MPEG#127. We may expect updates after MPEG#127.

March 2019: ITU-R meeting at the same week as MPEG; no update was available at this meeting, but an update *is* expected in July.

January 2019: ITU-R Working Party 6C (WP 6C) studies on Advanced Immersive Audio-Visual (AIAV) systems for programme production and exchange in broadcasting.  
AIAV systems will provide viewers with immersive experiences with an unprecedented degree of presence by enabling a wide field of view of their desired direction. In order to produce high-quality comfortable images, AIAV systems require video system parameters that go beyond the levels of UHDTV as well as additional system parameters to support omnidirectional image representation.

At its October 2018 meeting, WP 6C produced a draft new Recommendation on video parameter values for AIAV systems. These include parameter values such as image pixel count of 30K × 15K for a 360° image with equirectangular projection mapping methods, as well as other relevant parameters for production and exchange of AIAV content.

1. **ITU-T SG16**

To be added

1. **QoE: QUALINET, VQEG, ITU-T**

**Goal**: ***QUALINET*** is a (European) network on quality of experience in multimedia systems and services. Its main objective is to develop and to promote methodologies to subjectively and objectively measure the impact in terms of quality of future multimedia products and services. The general motivation of ***VQEG*** is to advance the field of video quality assessment by investigating new and advanced subjective and objective methods for assessing quality. ***ITU-T Study Group 12*** is the expert group responsible for the development of international standards (ITU-T Recommendations) on performance, quality of service (QoS) and quality of experience (QoE). SG12’s standardization work targets operational aspects of performance, QoS and QoE; the end-to-end quality aspects of interoperability; and the development of both subjective and objective quality-assessment methodologies for multimedia services.

**Status**: active; seen as both provider and customer of immersive media standards, specifically wrt quality assessments and metrics.

October 2019:

* QUALINET: work on white paper on definitions of immersive media experience is ongoing; an update may be expected for the January 2020 meeting
* VQEG: the VQEG Immersive Media Group is working on a “Test Plan for Quality Assessment of 360-degree Video”
* ITU-T: status see here [Q10/12](https://www.itu.int/itu-t/workprog/wp_search.aspx?Q=10/12) and [Q13/12](https://www.itu.int/itu-t/workprog/wp_search.aspx?Q=13/12)

July 2019:

* QUALINET: general assembly was held in June’19 (co-located with QoMEX’19) were task force on Immersive Media Experience (IMEx) was renewed with the goal to produce a white paper on definitions of Immersive Media Experience (IMEx) to be published early 2020.
* VQEG: identified uses cases: <https://docs.google.com/spreadsheets/d/1FgnRXjiU4td_KwkeKwGvy652nCDBvrAvkSug6HZivZ4/edit#gid=0>; working on a joint test plan for Subjective Quality Assessment of 360-degree video; short sequences: Length of sequences, ACR vs DCR, Influence of HW, typical artifact (coding, projections, stitching, etc.); long sequences: immersiveness, presence, simulator sickness, etc.
* ITU-T: Q10/12: P.QXM, "QoE assessment of eXtended Reality (XR) meetings“; Q13/12: Three main standards in preparation 🡪 collaboration with VQEG on two of these; G.QoE-VR, "Overview of Quality of Experience (QoE) in Virtual Reality Services" (Q13/12); P.360-VR, "Subjective test methodologies for 360 degree video on HMD" (Q13/12); G.QoE-AR, "QoE factors of Augmented Reality (AR)" (Q13/12) => see also liaison statements from ITU-T submitted to this meeting (m48128, m48129)

March 2019:

* QUALINET: no further updates
* VQEG: Minutes of the VQEG-IMG group are [here](https://drive.google.com/file/d/1zFy4cqESpAh7ygNLWVHHBxsN3AHZvQax/view). It documents (provides further links) to test plans for quality assessment of short and long sequences.
* ITU-T (Q13/12): G.QoE-AR (QoE factors of Augmented Reality (AR)), G.QoE-VR (QoE for VR services) and P.360-VR (ex G.VR-360) (Subjective test methodologies for 360 degree video on HMD) are relevant for MPEG-I. We sent a liaison asking for status update.

January 2019:

* QUALINET: no further updates
* VQEG: See [here](https://www.its.bldrdoc.gov/vqeg/projects/immersive-media-group.aspx) for details which provides a link to a shared document providing details for a collaboration between VQEG-IMG and ITU Q13/12
* ITU-T: see above + G.QoE-VR, targeted to be finished by end of 2018 (if not possible, to mid 2019) and P.360-VR, targeted for (end of?) 2019 (according to [this document](https://docs.google.com/document/d/1sJnb2ty1diOflXZgDSE-et9flSkctoTinNlJM9ZLuKQ/edit))

October 2018:

* QUALINET: no further updates
* VQEG: IMG meets on a regular basis; additionally, VQEG Tools and Subjective Labs Setup can be found [here](https://vqeg.github.io/software-tools/)
* ITU-T: no further updates

July 2018:

* QUALINET had their annual meeting co-located with QoMEX and renewed immersive media related task forces, specifically one on “Joint Qualinet and VQEG team on Immersive Media (JQVIM)” and one on “Immersive Media Experiences (IMEx)”. Details can be found at <http://www.qualinet.eu/>.
* VQEG runs the Immersive Media Group (IMG) and details can be found here <https://www.its.bldrdoc.gov/vqeg/projects/immersive-media-group.aspx>.
* **ITU-T** SG12 Q13/12 currently lists the following work items related to immersive media: G.QoE-5G (QoE factors for new services in 5G networks), [G.QoE-AR](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14679) (QoE factors of Augmented Reality (AR)), [G.QoE-VR](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14045) (QoE for VR services), and [P.360-VR (ex G.VR-360)](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14417) (Subjective test methodologies for 360 degree video on HMD). Further details available here https://www.itu.int/itu-t/workprog/wp\_search.aspx?Q=13/12.

April 2018 (and earlier): Regarding **Quality of Experience (QoE)** it is worth to mention QUALINET (<http://www.qualinet.eu/)> and VQEG (<https://www.its.bldrdoc.gov/vqeg/)> who created a Joint Qualinet-VQEG team on Immersive Media (JQVIM) with the following mandates:

* Start collecting/producing immersive media content and dataset, document tools used for that purpose (possibly contribute to VRIF, MPEG, etc. activities)
* Start collecting papers providing initial ideas/proposals/limitations towards a methodology for QoE assessment of immersive media applications
* Take https://multimediacommunication.blogspot.co.at/2017/04/vr360-streaming-standardization-related.html as a basis for standards survey

How to join

* E-mail reflector: [jqvim.qualinet@listes.epfl.ch](mailto:jqvim.qualinet@listes.epfl.ch)
* In order to subscribe in mailing list, you simply have to send an (empty) email to [jqvim.qualinet-subscribe@listes.epfl.ch](mailto:jqvim.qualinet-subscribe@listes.epfl.ch) and follow the steps of the e-mail being received.
* The instructions can also be found <http://listes.epfl.ch/doc.cgi?liste=jqvim.qualinet>

Website/Wiki: <https://www3.informatik.uni-wuerzburg.de/qoewiki/qualinet:imex:jqvim>

Finally, the **ITU-T** SG12 Q13/12 shared baseline text of work item G.QoE-VR and the baseline proposal for work item G.360-VR through a liaison which can be found under M42517 (MPEG122, San Diego).

ITU-R WP 6C describes with a working draft a prototype head mounted display with a spatial resolution of 8K × 4K and a 360° image with a spatial resolution of 30K × 15K. Additionally, they have started working on parameter values for Advanced Immersive Audio Visual (AIAV) systems such as picture resolution, projection mapping methods, and other identified gaps in the linear 360° AIAV programme and production path.

1. **DASH-IF**

**Goal**: The DASH-IF decided to take the raw DASH standard, marry it with a codec, apply tight profiles and other restrictions, and create a baseline recommendation that everyone could use to build interoperable products and services without painful integration. Interoperability is the key to adoption because if a format “works everywhere” then its growth will accelerate. Furthermore, DASH-IF provides conformance software, a set of test vectors, and an open source reference client implementation.

**Status**: active; currently DASH-IF does have anything specific related to immersive media.

October 2019: status with respect to immersive media unchanged, see below.

July 2019: DASH-IF IOP documents for community review feat. low latency and live media ingest; overview can be found [here](https://multimediacommunication.blogspot.com/2019/07/dash-if-interoperability-documents-for.html).

March 2019: The work on low latency live has further progressed, waiting for final MPEG decisions during MPEG#126. DASH-IF will meet in May 2019.

January 2019: The work on low latency live has further progressed, completion target is slightly shifted to February 2019 for community review and July 2019 for publication.

October 2018: The work on low latency live has progressed, completion target is January 2019 for community review and July 2019 for publication.

July 2018: DASH-IF is working on low latency DASH, which might be relevant for live VR services, and may include synchronization aspects for a regular broadcast with a DASH-based (VR) distribution.

April 2018 (and earlier): There has been a presentation at 3GPP/VRIF workshop which is available here <http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/Joint%203GPP%20SA4%20-%20VRIF%20Workshop%20on%20VR/Docs/VRSTD-07%20DASH-IF%20Thomas%20Stockhammer.zip>.

1. **Khronos**

**Goal**: The Khronos Group is a member-driven consortium developing royalty-free open standards and vibrant ecosystems, to harness silicon acceleration for demanding graphics rendering and computationally intensive applications such as 3D graphics, Virtual and Augmented Reality, Parallel Computing, Neural Networks, and Vision Processing. OpenXR is an API (Application Programming Interface) for XR applications. XR refers to a continuum of real-and-virtual combined environments generated by computers through human-machine interaction and is inclusive of the technologies associated with virtual reality (VR), augmented reality (AR) and mixed reality (MR). OpenXR is the interface between an application and an in-process or out-of-process "XR runtime system", or just "runtime" hereafter. The runtime may handle such functionality as frame composition, peripheral management, and raw tracking information.

**Status**: active.

October 2019:

* OpenXR 1.0 is Here! The OpenXR 1.0 specification was released on July 29th 2019, <https://www.khronos.org/openxr/>

July 2019:

* [Presentation covering OpenXR and glTF from the Open AR Cloud Symposium](https://www.khronos.org/developers/library/2019-open-ar-cloud)

March 2019: The OpenXR 0.90 provisional specification was released on March 18th 2019, see <https://www.khronos.org/openxr> for details. Specifically:

* [The OpenXR Specification [PROVISIONAL RELEASE]](https://www.khronos.org/registry/OpenXR/specs/0.90/html/xrspec.html)
* [Launch Slides](https://www.khronos.org/assets/uploads/apis/OpenXR-Update-GDC_v20190316c_Mar19.pdf)
* … and much more

January 2019: No major updates on the web site.

October 2018: OpenXR – First Public Demonstrations at SIGGRAPH 2018 with details [here](https://www.khronos.org/blog/openxr-first-public-demonstration-at-siggraph-2018). Details on the status are provided here:

* <https://www.khronos.org/blog/openxr-first-public-demonstration-at-siggraph-2018>.
* https://www.khronos.org/events/2018-siggraph

July 2018: No major updates, but for some new blog posts please see here <https://www.khronos.org/news/tags/tag/OpenXR> for details.

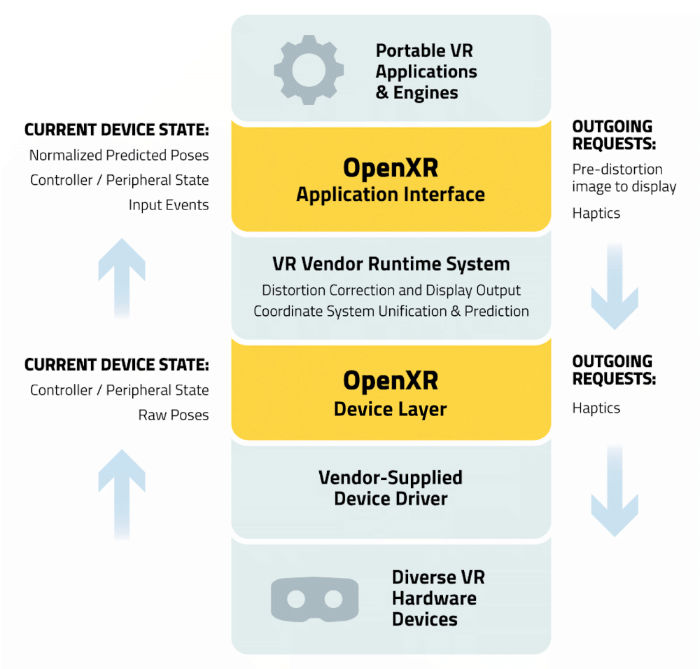
April 2018 (and earlier): There has been a presentation at 3GPP/VRIF workshop accessible here <http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/Joint%203GPP%20SA4%20-%20VRIF%20Workshop%20on%20VR/Docs/VRSTD-02%20Kronos%20OpenXR%202017%20Paul%20Pedriana.zip> but it mainly describes what is shown below.

An overview of OpenXR (March’18) can be found here:

<https://www.khronos.org/assets/uploads/developers/library/2018-gdc-webgl-and-gltf/OpenXR-GDC_Mar18.pdf>

The **Khronos group** announced a VR standards initiative which resulted into OpenXR (Cross-Platform, Portable, Virtual Reality) defining an APIs for VR and AR applications. Further information is available here: <https://www.khronos.org/openxr>. OpenXR defines two levels of API interfaces that a VR platform’s runtime can use to access the OpenXR ecosystem:

* Apps and engines use standardized interfaces to interrogate and drive devices. Devices can self-integrate to a standardized driver interface.
* Standardized hardware/software interfaces reduce fragmentation while leaving implementation details open to encourage industry innovation.



**Figure 1. OpenXR Architecture Design Goals (source:** [**https://www.khronos.org/openxr)**](https://www.khronos.org/openxr))**.**

OpenXR related news (see <https://www.khronos.org/news/tags/tag/OpenXR> for details):

* [Khronos Group welcomes Dell as newest Contributor Member](https://www.dell.com/)
* [Khronos at VRDC Fall 2017 for OpenXR Panel](https://www.khronos.org/blog/khronos-at-vrdc-fall-2017-for-openxr-panel)
* [Khronos Brings ReVive Developer Into OpenXR Working Group](http://www.tomshardware.com/news/revive-developer-openxr-working-group,35386.html)
* [Learn about four myths blocking needed VR standards](https://venturebeat.com/2017/08/25/4-myths-getting-in-the-way-of-necessary-vr-standardization/)

The last one is interesting as it discusses four myths:

* Myth 1: It’s too early for standards
* Myth 2: Standards stifle innovation
* Myth 3: Consumers won’t be impacted
* Myth 4: There are too many cooks developing standards

1. **WebXR**

**Goal**: The Immersive Web Working Group will develop standardized APIs to provide access to input and output capabilities commonly associated with XR hardware such as Google’s Daydream, the Oculus Rift, the Samsung GearVR, the HTC Vive, and Windows Mixed Reality headsets and sensors as well as mobile handheld devices and standalone headsets such as the Oculus Go. The WG will develop APIs to enable the creation of XR web experiences that are embeddable in the Web of today, enabling progressive enhancement of existing sites.

The **scope** of the Immersive Web Working Group charter is to define APIs which: Detect available XR devices and sensors; Query XR devices for device-specific capabilities; Receive updated information about the device's position and orientation over time; Receive updated information about the device's environment; Present imagery to the device at the device's native frame rate, using the device’s position and orientation over time to provide an immersive experience; Provide information about XR-specific input, including tracked controller state and hand gesture; For augmenting reality on devices which support AR, enable XR sessions that provide real-world display, and provide the ability to hit-test surfaces in the real world. **Out of scope**: Defining browser user experience inside virtual or augmented reality, aside from navigating between XR sites; Defining mechanisms for global-scale AR browsing.

**Status**: active.

October 2019: The latest version of “WebXR Device API, Editor’s Draft, 25 September 2019” is available here <https://immersive-web.github.io/webxr/> (note: no longer marked as unstable API).

July 2019: The latest version of “WebXR Device API, Editor’s Draft, 2 July 2019” is available here <https://immersive-web.github.io/webxr/> (still marked as unstable API) + link to [WebXR Device API Explained](https://github.com/immersive-web/webxr/blob/master/explainer.md).

March 2019: The latest version of “WebXR Device API, Editor’s Draft, 15 March 2019” is available here <https://immersive-web.github.io/webxr/> + link to [WebXR Device API Explained](https://github.com/immersive-web/webxr/blob/master/explainer.md).

January 2019: The latest “WebXR Device API, Editor’s Draft, 10 January 2019” is available here <https://immersive-web.github.io/webxr/> and provides an interface to VR/AR hardware. It is marked as “UNSTABLE API”. It also provides a link to [WebXR Device API Explained](https://github.com/immersive-web/webxr/blob/master/explainer.md).

October 2018: The latest “WebXR Device API, Editor’s Draft, 20 August 2018” is available here <https://immersive-web.github.io/webxr/spec/latest/> and provides an interface to VR/AR hardware. It is marked as “UNSTABLE API”.

July 2018: The latest “WebXR Device API, Editor’s Draft, 6 July 2018” is available here <https://immersive-web.github.io/webxr/spec/latest/> and provides an interface to VR/AR hardware. It is marked as “UNSTABLE API”.

April 2018 (and earlier): In this context, the **WebVR** already defines an API which provides support for accessing virtual reality devices, including sensors and head-mounted displays on the web. Link: <https://webvr.info/> which includes a link to “WebVR, Editor’s Draft, 12 December 2017”: <https://immersive-web.github.io/webvr/spec/1.1/>. Important note: “**Development of the WebVR API has halted in favor of being replaced the [WebXR Device API](https://immersive-web.github.io/webxr/). Several browsers will continue to support this version of the API in the meantime.”**

The WebXR Device API Specification (https://immersive-web.github.io/webxr/) provides interfaces to VR and AR hardware to allow developers to build compelling, comfortable VR/AR experiences on the web. It is intended to completely replace the legacy [WebVR specification](https://immersive-web.github.io/webvr/spec/1.1/) when finalized. In the meantime, multiple browsers will continue to expose the older API. The latest “WebXR Device API, Editor’s Draft, 6 July 2018” is available here <https://immersive-web.github.io/webxr/spec/latest/> and provides an interface to VR/AR hardware. It is marked as “UNSTABLE API”.

Additionally, there has been a presentation at 3GPP/VRIF workshop which is accessible here <http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/Joint%203GPP%20SA4%20-%20VRIF%20Workshop%20on%20VR/Docs/VRSTD-03%20W3C%20Wendy%20Seltzer.zip> but only provides a rough overview about W3C and W3C Immersive Web: Virtual and Augmented Reality (<https://www.w3.org/community/webvr/>).

1. **IDEA**

**Goal**: Working toward a common goal to develop a family of royalty-free technical specifications that define interoperable interfaces and exchange formats to support the end-to-end conveyance of immersive volumetric and/or light field media. Our purpose is to gather marketplace and technical requirements to define and support the immersive media specifications, to facilitate interoperability testing and demonstration of immersive technologies in order to gain feedback for the immersive media specifications and support from stakeholders.

**Status**: started.

October 2019: The Immersive Media Technologies Format (ITMF) is a suite of royalty-free specifications that establishes a baseline for an interchange of immersive media. The format is initially intended to be used for interchange amongst industry-standard digital content creation (DCC) tools, i.e. for the packaging and creation of 3D synthetic, computer generated, and natural media, including audio and visual media. As a baseline format primarily for use with DCC tools, assets described by ITMF are agnostic to the specific type of device on which they may be presented. Visual media, for example, will be display-agnostic, so that a subsequent rendering step in a (media and application aware) distribution system can reformat the visual media to match the capabilities of the client display. The initial version of the ITMF suite may therefore be described as a mezzanine or master format in parlance used by content creators and distributors. Future versions will describe the specifics for ITMF distribution and other applications.

The ITMF suite currently includes three documents: *Scene Graph Specification*, *Container Specification* and *Data Encoding Specification*. These are available at no charge, and may be downloaded [here](http://immersivealliance.org/download/download-itmf-scene-graph-specification-0-9/). The current version is ver 0.9, which is a draft for public comment. Please send your questions or comments to Comments@ImmersiveAlliance.org.

July 2019:

* Started in April 2019 (<http://immersivealliance.org/>), currently an overview/introduction presentation is available [here](http://box660.temp.domains/~ocaallia/immersivealliance/wp-content/uploads/2019/02/IDEA-NAB-Launch-Deck-small.pdf).

1. **CTA**

**Goal**: The Consumer Technology Association (CTA)™ AR/VR Working Group supports the growth of companies developing technologies and services for the augmented, mixed and virtual reality segment of the technology industry. Key Initiatives: Educate consumers about the benefits of augmented, mixed and virtual reality technologies; Promote augmented, mixed and virtual reality technologies to support the advancement of the industry; Conduct market research focused on augmented and virtual reality technologies; Support standards initiatives to create industry best practices.

**Status**: active.

October 2019: CTA Technology & Standards Forum has been on Sep 23-27, 2019 with a session on CTA AR/VR Membership Working Group Meeting (Invited Guests Only). Further input from CTA experts is needed.

July 2019:

* CTA created the AR/VR Standards Committee in August 2018. This Committee will develop standards, recommended practices, and technical reports related to augmented reality, virtual reality and related technologies. Current Focus includes: WG 1 Definitions/ Categorization ANSI/CTA-2085, Definitions and Characteristics for VR Video and VR Images (nearing completion) ANSI/CTS-2086, Categorization of Augmented and Virtual Reality Consumer Experiences; WG 2 Accessories ANSI/CTA-2087, Recommendations and Best Practices for Connection and Use of Accessories for Augmented and Virtual Reality Technologies (nearing completion). Undergoing brainstorming on future work projects and specifically considering projects addressing AR applications.

March 2019:

* The 2019 Spring CTA Technology & Standards Forum on April 12th will be held in in San Francisco, Industry experts will gather to discuss artificial intelligence, health fitness and wellness technology, security, privacy, robotics, audio, video and more. Additional information on the Forum is available [here](http://www.cvent.com/events/technology-standards-forum/event-summary-dc1fa76e96ed44cea3e5694371d7e824.aspx).
* During the CTA Technology & Standards Spring Forum, there will be an open discussion on the topic of gesture control in consumer technology. Once limited to gaming applications, gesture control is now being used in many areas, including robotics, vehicles, AR/VR and retail.
* R12 WG 1 Definitions/Categorization: The WG has continued to meet regularly to advance its work. In recent meetings the WG has agreed to definitions for pre-rendered content and real-time rendered content.
* R12 WG2 Accessories:  The WG has continued to meet regularly to progress work focused on the identification and organization of terms in the document.

January 2019: The web site of the AR/VR Working Group is [here](https://www.cta.tech/Membership/Member-Groups/AR-VR-Working-Group.aspx) including two research reports: (1) Consumer Sentiments: Virtual Reality In-Store Demonstration: VR Headset and Content, (2) Augmented Reality and Virtual Reality: Consumer Sentiments. Please note that the AR/VR Working Group is focusing on commercial aspects while R12, Augmented Reality/Virtual Reality Committee is focusing on technical aspects and continuing to work on the following two documents: (1) ANSI/CTA-2085 (Definitions and Characteristics for VR Video and VR Images) and (2) ANSI/CTA-2087 (Recommendations and Best Practices for Connection and Use of Accessories for Augmented and Virtual Reality Technologies).

October 2018: During August, some restructuring took place with regards to AR/VR standards activities within CTA. In summary, CTA created a new committee which is called R12 (AR/VR Committee) to undertake on developing standards, recommended practices, and technical reports related to AR, VR, and related technologies. Until creation of R12, AR/VR activities were done at WG level (R6 WG24), so there is some kind of elevation of AR/VR activities to Committee level.

For further details on R12 and its two working groups, you can refer to the following link: <https://standards.cta.tech/kwspub/current_projects/>

July 2018: CTA recently published CTA-2069 (<https://www.cta.tech/News/Press-Releases/2018/July/CTA-Announces-First-Augmented-and-Virtual-Reality.aspx>), Definitions and Characteristics of Augmented and Virtual Reality Technologies, which introduces various terms defining emerging consumer technologies such as AR, mixed reality, outside-in-tracking, VR video and VR images, room-scale VR and X reality (XR).

April 2018 (and earlier): There has been a presentation at 3GPP/VRIF workshop which is available here <http://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/Joint%203GPP%20SA4%20-%20VRIF%20Workshop%20on%20VR/Docs/VRSTD-08%20CTA%20Kerri%20Haresign.zip>. The last slide mentions the creation of a first standards WG on AR/VR technology in May 2016. Web site is available here <https://www.cta.tech/Membership/Member-Groups/AR-VR-Working-Group.aspx> which provides:

* [**Virtual Reality - Reality Check: Consumer Experience and Expectations**](https://www.cta.tech/Research-Standards/Reports-Studies/Studies/2017/Virtual-Reality-Reality-Check-Consumer-experien.aspx)  
  This study explores U.S. consumers’ experiences with virtual reality to get an in-depth understanding of what content consumers are exposed to and their content preferences.
* [**Consumer Sentiments: Virtual Reality In-Store Demonstrations: VR Headset and Content**](https://www.cta.tech/Research-Standards/Reports-Studies/Studies/2016/Consumer-Sentiments-Virtual-Reality-In-Store-Demo.aspx)  
  This study will aide as a guide for industry on content development and distribution strategies for video content and the future of VR products.
* [**Augmented Reality and Virtual Reality: Consumer Sentiments**](https://www.cta.tech/Research-Standards/Reports-Studies/Studies/2016/Augmented-Reality-and-Virtual-Reality-Consumer-Se.aspx)  
  Augmented Reality (AR) and Virtual Reality (VR): Consumer Sentiments report identifies consumer awareness and perceptions of AR and VR technologies and its various use cases.

1. **IETF/IRTF**

**Goal**: -

**Status**: not active.

October 2019: status unchanged.

July 2019: status unchanged.

March 2019: status unchanged.

January 2019: no updates available.

October 2018: no updates available.

July 2018: no updates available.

April 2018 (and earlier): We found little activity related to immersive media within IETF/IRTF except <https://tools.ietf.org/html/draft-han-iccrg-arvr-transport-problem-01> which expired in September 2017.

1. **SMPTE**

**Goal**: The project scope is to study the current VR and AR ecosystem for production and post production workflows and create a report documenting the current ecosystem, relevant existing standards and recommendations of new standards, recommended practices or engineering guidelines.

**Status**: active.

October 2019: the latest report from June is available [here](https://www.smpte.org/sites/default/files/Final%20Outcome%20Report-Tokyo-Jun2019_0.pdf), which includes a section about Study Group on Virtual Reality / Augmented Reality with the status: This SG will be closed down as contributions for its report have not been forthcoming.

July 2019: Latest report is from March and available [here](https://www.smpte.org/sites/default/files/Final%20Outcome%20Report-WhitePlains-Mar%202019.pdf), which basically provides a link to [here](https://kws.smpte.org/higherlogic/ws/public/projects/499/details).

* The project scope is to study the current VR and AR ecosystem for production and post production workflows and create a report documenting the current ecosystem, relevant existing standards and recommendations of new standards, recommended practices or engineering guidelines.
* Status: The SG plans to draft a short report based upon a list of industry assumptions and a few key points. Future updates will be posted [here](https://www.smpte.org/outcome-report).

March 2019: next quarterly report is due in April.

January 2019: The [quarterly report](https://www.smpte.org/standards/outcomereports)s [here](https://www.smpte.org/sites/default/files/Final%20Outcome%20Report%20-%20SEPT%20Geneva.pdf) and [here](https://www.smpte.org/sites/default/files/Outcome%20Report-SanFrancisco-Dec2018.pdf) mention "Study Group on Virtual Reality / Augmented Reality" which includes a link to [this website](https://kws.smpte.org/higherlogic/ws/public/projects/499/details) but then no further details are provided.

October 2018: no updates available.

July 2018: no updates are available.

April 2018 (and earlier): [SMPTE VR/AR Study Group](https://kws.smpte.org/higherlogic/ws/public/projects/499/details) has been created Feb 28, 2018 to study the current and projected needs for standardized approaches to capture and post produce images and sound to create a distribution master for Virtual Reality (VR) and Augmented Reality (AR) distribution and display systems. The goal is to study where possible standardization could be applied and to make recommendations which are to be all included into an Engineering Report to be published.

Project Overview

* Problem to be solved: There are many different capture methods, file formats, display systems and post production methods for VR and AR content. The problem for the group to solve is to identify if there is a need to standardize any of these methods so that easier interchange can be more easily accomplished. Once this study of the ecosystem is completed then the project will consolidate the findings and any recommendations into an Engineering Report.
* Project scope: Study the current VR and AR ecosystem for production and post production workflows and create a report documenting the current ecosystem, relevant existing standards and recommendations of new standards, recommended practices or engineering guidelines.
* Specific tasks: Explore the current VR and AR ecosystems and document that for the report. Investigate the needs in the industry for standardization of aspects of the production, processing and post production to create a VR/AR distribution master. Investigate if there are existing standards for production, post production of VR/AR content and document them for the report. Do the gap analysis between existing and required standardization for the production and post production of VR/AR content. Make recommendations for future standards and work required for the production and post production of VR/AR content to create a distribution master.

Additionally, we found this section meeting which also provides some links to the presentations: <https://www.smpte.org/sections/united-kingdom/events/virtual-reality-%E2%80%93-next-big-thing>

1. **ETSI**

**Goal**: ETSI is working to define a framework for the interoperability of Augmented Reality (AR) applications and services. The AR framework will define an overall high-level architecture, identify key components and interfaces.

**Status**: active.

October 2019: the web site listed below provides a link to [here](https://www.etsi.org/committee/1420-arf) (Industry Specification Group (ISG) Augmented Reality Framework (ARF)) which lists two publications:

* ETSI GR ARF 001 V1.1.1 (2019-04): Augmented Reality Framework (ARF); AR standards landscape
* ETSI GR ARF 002 V1.1.1 (2019-07): Augmented Reality Framework (ARF) Industrial use cases for AR applications and services

July 2019: status unchanged

March 2019:

* Web site of ETSI ISG ARF: <https://www.etsi.org/technologies/augmented-reality>
* Workshop: <http://thearea.org/ar-news/25th-january-2019-etsi-workshop-london-augmented-reality-framework/> but no report available at this time.

January 2019:

* ETSI ISG ARF is organising an open, half-day workshop in London on 25th January 2019.
* **Scope:** This Workshop will present the objective and workplan of the recently launched Industry Specification Group ARF on Augmented Reality and the results of the first survey on industrial use cases conducted by the group. It will aim to raise awareness of the new ISG, collect interoperability requirements from the industry and stimulate discussions during the presentation of the first draft of the interoperability framework the group is developing.

October 2018: no updates available.

July 2018: no updates available.

April 2018 (and earlier): ETSI launched new group on augmented reality (<http://www.etsi.org/index.php/news-events/news/1244-2017-12-news-etsi-launches-new-group-on-augmented-reality>), specifically a Augmented Reality Framework Industry Specification Group (ARF ISG) which can be found here <http://www.etsi.org/technologies-clusters/technologies/augmented-reality>. “In this initial phase of work the ARF ISG is interested in hearing from the industry about AR industrial use cases, obstacles encountered when deploying (pilot) AR services and requirements for interoperability.”

1. **SVA**

**Goal**: The Streaming Video Alliance VR/360-Degree Video Study Group has the following objectives. First, to understand the VR market and how it is impacting traditional video experiences. Second, to capture the state of VR technologies, the players, and use-cases. And, third, to catalog existing standards efforts.

**Status**: unknown.

October 2019: status unchanged; no activities on Immersive Media it seems

July 2019: status unchanged.

March 2019: no further updates

January 2019: The State of VR/360-Degree Video is provided [here](https://www.streamingvideoalliance.org/portfolio-archive/the-state-of-vr-360-degree-video/) which provides a link to a document about further information.

October 2018: published a white paper here: https://www.streamingvideoalliance.org/2018/09/15/streaming-video-alliance-publishes-new-documents-on-advertisement-delivery-across-ott-and-current-state-of-360-degree-video-and-best-practices/.

July 2018: no updates available. A report to be published in May 2018 – as mentioned below – is not yet available.

April 2018 (and earlier): The Streaming Video Alliance (SVA) formed a Study Group on Virtual Reality/360 Degree Video late in 2016 (<https://www.streamingvideoalliance.org/technical-work/working-groups/virtual-reality360-degree-video/>). Their current work is to document the relevant technologies and experiences in the 360-degree video market, and it is expected that their report will be published in May 2018. In addition, the SVA is looking to organize its second Proof of Concept for later in 2018. In addition to evaluating CDN performance for traditional video services, SVA are looking to include VR360 content in order to understand latency factors and CDN impacts on 360-degree delivery.

1. **IEEE P2048**

**Goal**: unclear, see here <https://digitalreality.ieee.org/standards>

**Status**: unknown.

October 2019: status unchanged.

July 2019: status unchanged.

March 2019: no further updates.

January 2019: no further updates other than it is still marked as “active project”.

October 2018: no updates available, although they have a next meeting set to 2018.10.19.

July 2018: no updates available.

April 2018 (and earlier): The IEEE has created a **Virtual Reality and Augmented Reality Working Group (VRAR)** under P2048 which now lists 12 parts. An overview is available here <http://theinstitute.ieee.org/resources/standards/nine-ieee-virtual-and-augmented-reality-standards-projects-in-the-works> (Aug 3, 2017).

No further news on the web site of IEEE P2048 but there has been a meeting during CES’18. The agenda included reports from ad-hoc groups as well as “collaboration” with IEEE P1589 (is related to AR) and W3C. Perhaps it is time to inform them about what we are doing.

The following table provides a short description and possible relationship with MPEG activities:

|  |  |  |
| --- | --- | --- |
| **parts** | **Short description** | **Possible relationship with MPEG activities** |
| **P2048.1 Device Taxonomy and Definitions** | This standard specifies the taxonomy and definitions for Virtual Reality (VR) and Augmented Reality (AR) devices. | MPEG-I as a whole, specifically Part 1 |
| **P2048.2 Immersive Video Taxonomy and Quality Metrics (P)** | This standard specifies the taxonomy and quality metrics for immersive video including several aspects: 360 degrees or 180 degrees, stereoscopic or not, view point movable or not, focus adjustable or not, etc. | MPEG-I as a whole, specifically Part 1 and also related to the recently established AhG on Immersive Media Quality Evaluation |
| **P2048.3 Immersive Video File and Stream Formats** | This standard specifies the formats of immersive video files and streams, and the functions and interactions enabled by the formats.  This project is needed to define the immersive video file and stream formats that support all the variants and facilitate the development of cross- platform content and services. This standard identifies existing applicable video coding standards, and defines the integration of these standards into immersive video. | MPEG-I Part 2 (OMAF) and Part 3 (Immersive Video Coding) |
| **P2048.4 Person Identity** | The standard specifies the requirements and methods for verifying a person's identity in virtual reality.  The standard would allow a virtual reality user to; identify themselves to a site or service through a number of identity authorities; authenticate singular pieces of information without needing to trust the site with additional information; present themselves with specific visual assets; while having the visualization of their appearance certified. | It seems MPEG-I is not concerned about this aspect but perhaps MPEG-V or even MPEG-7/21 are having tools to address this aspect or parts thereof. |
| **P2048.5 Environment Safety** | This standard specifies recommendations for workstation and content consumption environment for Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR) and all related devices where a digital overlay might interact with the physical world, potentially impacting users' perception. This standard focuses on setting quality assurance and testing standards for qualifying products in said environments, achieving satisfactory safety levels for creation and consumption environment for all or majority of related products available for consumer and commercial purposes. | Probably no relationship with any MPEG activity in this area. |
| **P2048.6 Immersive User Interface** | This standard specifies the requirements and methods for enabling the immersive user interface in Virtual Reality (VR) applications, and the functions and interactions provided by the immersive user interface.  This project is needed to unite these efforts and specify the baselines of immersive user interfaces in order to help facilitate the development of cross-platform content and services, and promote a healthy growth of the VR industry. | It seems MPEG-I is not concerned about this aspect but perhaps MPEG-V or even MPEG-U are having tools to address this aspect or parts thereof. |
| **P2048.7 Map for Virtual Objects in the Real World** | This standard specifies the requirements, systems, methods, testing and verification for Augmented Reality (AR) and Mixed Reality (MR) applications to create and use a map for virtual objects in the real world. | It seems MPEG-I is not concerned about this aspect but the scope of MPEG-V certainly addresses this aspect or parts thereof. Additionally, MPEG-A ARAF might be interesting here. |
| **P2048.8 Interoperability between Virtual Objects and the Real World** | This standard specifies the requirements, systems, methods, testing and verification for the interoperability between virtual objects and the real world in Augmented Reality (AR) and Mixed Reality (MR) applications. | It seems MPEG-I is not concerned about this aspect but the scope of MPEG-V certainly addresses this aspect or parts thereof. Additionally, MPEG-A ARAF might be interesting here. |
| **P2048.9 Immersive Audio Taxonomy and Quality Metrics** | This standard specifies the taxonomy and quality metrics for immersive audio. | MPEG-I as a whole, specifically Part 1 and also related to the recently established AhG on Immersive Media Quality Evaluation |
| **P2048.10 Immersive Audio File and Stream Formats** | This standard specifies the formats of immersive audio files and streams, and the functions and interactions enabled by the formats. | MPEG-I Part 2 (OMAF) and Part 4 (Immersive Audio Coding) |
| **P2048.11 In-Vehicle Augmented Reality** | This standard defines an overarching framework for Augmented Reality (AR)  systems that assist drivers and/or passengers in vehicles. | MPEG-A ARAF might be interesting here. |
| **P2048.12 Content Ratings and Descriptors** | This standard defines the content ratings and descriptors for Virtual Reality (VR),  Augmented Reality (AR) and Mixed Reality (MR). | MPEG-7 and MPEG-21 (parts thereof). |

**References**

1. Christian Timmerer, [Immersive Media Delivery: Overview of Ongoing Standardization Activities](http://www-itec.uni-klu.ac.at/bib/files/08258607.pdf), *In IEEE Communications Standards Magazine*, IEEE Communications Society, vol. 1, no. 4, N.N., pp. 71-74, 2017. [[bib]](http://www-itec.uni-klu.ac.at/bib/index.php?key=Timmerer2017i&bib=itec.bib) [[doi]](http://dx.doi.org/10.1109/MCOMSTD.2017.1700038) [[pdf]](http://www-itec.uni-klu.ac.at/bib/files/08258607.pdf)