



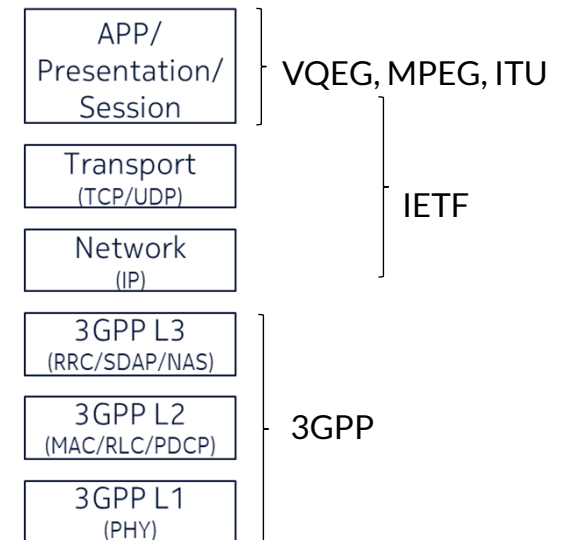
Current status of standardization & industry

5GKPI workshop at VQEG meeting in Klagenfurt, 1st July 2024

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Overview

- A probably to simplified and incomplete overview
- Application layer: VQEG, MPEG and ITU
- Transport and Network: IETF
- Lower layer: 3GPP



3rd Generation Partnership Project (3GPP)

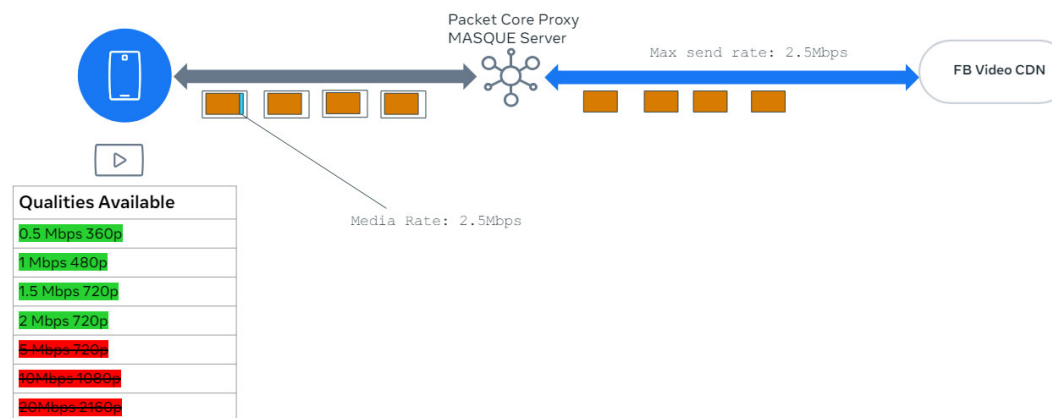
- The 3rd Generation Partnership Project (3GPP), created in December 1998, is a joint effort of seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC)
- Three Technical Specification Groups (TSG)
 - Radio Access Networks (RAN)
 - Services & Systems Aspects (SA)
 - Core Network & Terminals (CT)

3rd Generation Partnership Project (3GPP)

- Examples reference standards
 - 3GPP TS 22.261 (2021) version 16.14.0 Release 16), Service requirements for the 5G system
 - 3GPP TR 26.929 (2020) QoE parameters and metrics relevant to the Virtual Reality (VR) user experience.
 - 3GPP TR 26.909 version 17.0.0 Release 17 (2022) Study on improved streaming Quality of Experience (QoE) reporting in 3GPP services and networks.
 - 3GPP TS 23.502, 3GPP TS 38.321 clause 5.18.10, 6.1.3.20: Network exposure APIs and MAC CE up to R18 [5, 10]
- Examples of work items
 - 5G Real-time Transport Protocols (5G_RTP_Ph2) -> TR 26.822 “Real-Time XR Media Transport Protocol Enhancements”
 - 5G-Advanced codec support for messaging services (PROMISE)
- Examples of studies
 - Study on Enhancements for Immersive Real-time Communication for WebRTC (FS_eiRTCW)
 - Study on Beyond 2D Video (FS_Beyond2D)

Internet Engineering Task Force (IETF)

- IETF SCONEPRO: If the companion signaling protocol supports host-to-network metadata, individual packets within a flow can contain metadata describing their drop preference or their reliability [1][2]
 - [1] <https://datatracker.ietf.org/doc/draft-rwbr-scone-pro-flow-metadata/>
 - [2] <https://datatracker.ietf.org/doc/slides-119-scone-pro-proof-of-concept-trial/>



The Moving Picture Experts Group (MPEG)

- MPEG (mpeg.org) is a working group of authorities that was formed by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) to set standards for audio and video compression and transmission.
- MPEG-I: Coded Representation of Immersive Media
 - MPEG-I: Immersive Audio: 6 DOF Spatial Audio Renderer for AR/VR applications
 - MPEG-I: Versatile Video Coding (VVC): improve functionalities and compression efficiency for existing and emerging applications including XR and immersive video
 - MPEG-I: Point cloud compression (PCC) and 3D representations. MPEG defines two ways of compressing point clouds, either with a video-based method, V-PCC, or a geometry-based method, G-PCC.
 - MPEG-I: Scene description. API extensions 3D objects and modelling standardized in Khronos in order to support MPEG media, in particular immersive media

The Moving Picture Experts Group (MPEG)

- Augmented Reality Application Format (ARAF): ISO standard published by MPEG that can be used to formalize a full Mixed and Augmented Reality (MAR) experience.
- ISO/IEC JTC 1/SC 29/AG 5 – MPEG Visual Quality Assessment: advisory group devoted to support needs for quality assessment testing in close coordination with the relevant MPEG Working Groups, dealing with visual quality
- Per-picture quality metric reporting (SEI) using has been accepted into the VSEI (JVET-AG2032) TuC. Multiple options for both metric and reporting frequency is supported.

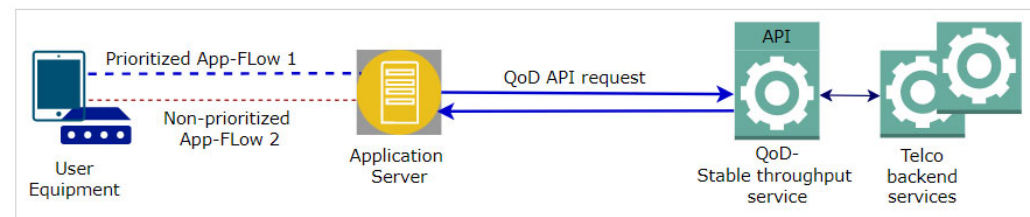
International Telecommunication Union (ITU)

- ITU-T Study Group 12: Performance, quality of service (QoS) and quality of experience (QoE) . It is organized in 3 working parties (WPs) and a series of questions addressing the field of QoE.
 - WP1 Testing methodology
 - Q7/Q10 Subjective test methods for VR/XR, crowdsourcing
 - WP2: QoE objective models
 - Q14 Audio/Video QoE modeling, streaming, cloud gaming, QoE vs user retention
 - Q17 testbed framework
 - Q19 No reference QoE models, collaboration with VQEG,
 - WP3 multimedia QoS and QoE , operational aspect , requirements for new services
 - Q13, QoE influencing factors, QoE requirements for 5G services

Video Quality Experts Group (VQEG)

- Embed metadata into the video steam [1], [2]
- A method to embed metadata into the video steam (T.35 can be embedded into SEI messages in the H-264 stream, and there are equivalent ways in H.26x and AV1).
 - The metadata includes coding parameter, and computed metrics of the coding quality (e.g. VMAF).
- [1] <https://docs.google.com/document/d/16ISQ4Mq4KzXVJffPNudvHl43IdXqVQMmBS7BNDFZndo/edit?usp=sharing>
- [2] https://docs.google.com/document/d/1zrUnttz4LxYbBcIsf8nYQ__13TVom6iH54ZPK6GaNws/edit?usp=sharing

CAMARA QoD API



- The Quality-On-Demand (QoD) API provides programmable interface for developers and other users (capabilities consumers) to request stable latency or throughput managed by Telco networks without the necessity to have an in-depth knowledge of the 4G/5G system or the overall complexity of the Telecom Systems. [1], [2]
- [1] <https://github.com/camaraproject/QualityOnDemand/tree/release-0.10.0>
- [2] <https://developer.orange.com/apis/camara-quality-on-demand/getting-started#summary-of-request-body-parameters>

IEEE HFVE_WG - Human Factors for Visual Experiences Working Group

- IEEE has a working group Standard focussing on human factors for AR/VR and Metaverse related applications. The IEEE Std 3333.1.3 (2022) standard, Deep Learning-Based Assessment of Visual Experience Based on Human Factors , focuses on identifying the factors that contribute to a user's perceptual experience including human, system, and context factors; specifically, the standard attempts to investigate how to estimate the mechanism of human visual perception. The human visual perception assessment is categorized into two subgroups: perceptual quality and virtual reality (VR) cybersickness. To measure the QoE, the standard uses two evaluation methods: Deep learning models considering human factors for various QoE assessments, and subjective test methodology with a content database. For the subjective test methodology, the standard developed an immersive VR content database for the evaluation of the cybersickness and sense of presence. The VR content database is freely available for download and uses in scientific research [2 IEEE 3333.1].
- In addition, another relevant IEEE working group , focussing onthe Metaverse AR/VR interoperability, IEEE 2048 VR/AR Working Group (VRARWG)

Summary

- A brief overview of standards and efforts for standardization for 5KPI has been presented
- It is most likely incomplete but may give some guidance
- Application layer: VQEG, MPEG and ITU
- Transport and Network: IETF
- Lower layer: 3GPP