**3GPP TSG SA WG4#133-e S4-251321**

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**Source: China Mobile Com. Corporation**

**Title: [FS\_Beyond2D] Gaps and Optimization Potential**

**Agenda item: 9.6**

**Document for: Agreement**

**1. Introduction**

This proposal provides a gap analysis and identifies potential optimizations for FS\_Beyond2D.

**2. Proposal**

It is proposed to agree the following changes to the 3GPP draft TR 26.956 V1.0.0

\* \* \* First Change \* \* \*

# 10 Gaps and Optimization Potential

## 10.1 Identified Gaps and Deficiencies with Video Capabilities

The Technical Report does not explicitly identify gaps or deficiencies with existing video capabilities in 3GPP standards needing immediate standardization. The focus of this study is primarily on evaluating existing and emerging Beyond 2D video representation formats where the principal findings are:

Dense Dynamic Point Clouds and Dynamic Meshes: A comprehensive evaluation has been performed revealing that:

- Dense dynamic point clouds and dynamic mesh are the dominant representation formats to produce and deliver camera captured volumetric video. Work on MPEG V-DMC for coding dynamic meshes was not finished at the closure date for the first version of the Technical Report and therefore the evaluation has been concentrated on dense dynamic point clouds with V-PCC as the codec.

- Dense dynamic point clouds with around 2 million points per frame encoded with MPEG V-PCC at 20 to 30 Mbit/s using the HEVC video codec provides a satisfying quality for the described scenario. See visual quality examples in clause 7.3.4.5 and videos in clause 9.X.4.1.5.2 subjective evaluation.

- Rendering of dense dynamic point clouds can produce holes and needs special care. The effect of very simple cube based rendering and simple splat blend-based rendering is investigated, where the latter mitigates the problem. Rendering is proprietary and allows manufacturers or vendors to differentiate. See impact of rendering in clause 4.3.3.3.

- Real time decoder implementation of the MPEG V-PCC profile “HEVC Main10 V-PCC Basic Rec0“ supporting up to 2-million-point points per frame on off the shelve consumer device has been proven [Vol-8].

- 3GPP provided a study on 6G use cases and services requirements in TR 22.870 [Vol-36]. Clause 9.12 of this report describes a use case on personalized interactive immersive guided tour, where assets represented as volumetric video are part of the scene.

- Identified gap: There is no support in 3GPP specifications for representation formats and codecs to support streaming of professionally produced volumetric video with single asset.

## 10.2 Potential Requirements for New Video Capabilities

From the collecting scenario, future 3GPP standards may need to consider the following new video capability requirements:

- **Extensions for Stereoscopic Video:** The collected scenario one indicates a need for enhanced support for stereoscopic video formats to enable more immersive Beyond 2D experiences. This aspect has been addressed in TS 26.265 [26265] and its potential next phase.- **Monitoring Market Adoption of New Beyond 2D Formats:** A comprehensive evaluation of emerging Beyond 2D formats, including point clouds, multi-view has been performed. The focus remains on continuous monitoring the market traction of these technologies, especially in content generation. Due to time constraints, Dynamic Mesh was not evaluated in this Technical Report and needs to be addressed in subsequent work. Immediate standardization is not required at this time and MPEG V-PCC and MPEG MIV remain candidate codecs for integration in 3GPP specifications in a future release. A potential future requirement for 3GPP is to define or support representations format(s) and codec(s) for streaming of produced volumetric video with single asset and for streaming of produced multiview plus depth video.

- **Gaussian Splatting:** 3DGS gets a lot of attention from academia and industry, but realistic use cases are not yet clear, the format is not yet stabilized and there is no codec from a recognized standards organization. Further study is needed and immediate standardization is not required.

- **AI-Generated Beyond 2D content:** The commercialization of AIGC has attracted attention from both academia and industry. This TR introduces AI-generated stereoscopic video, dynamic mesh and 4D content. However, further study is needed to improve quality and efficiency of AI generated content, as well as to develop the quality assessment methodologies.

## 10.3 Potential Network Optimizations

The network optimizations was not directly addressed in this study, potential needs can be inferred from the introduction of new video capabilities:

- **Transmission Efficiency:** More efficient transmission methods (e.g., protocols or distribution strategies) for these more complex video data.

- **Bandwidth Optimization and Network Capabilities:** Beyond 2D video technology involves processing, transmitting, and storing massive amounts of data over 3GPP networks, which presents significant challenges to both network bandwidth and user equipment (UE) computational capabilities. Therefore, exploring efficient network solutions and bandwidth optimization is critical to enabling real-time B2D video delivery across a wide range of viewing experiences without sacrificing the sense of immersion.

\* \* \* End of Changes \* \* \*