**Agenda item:** 9.5

**Source:** Qualcomm Incorporated

**Title:** [MeCAR] Device Architecture for External Display Glass for AR (EDGAR) device

**Document for** Discussion andAgreement

# Summary

According to the approved work item description, the MeCAR work item provides the following objectives.:

* Define at least one AR device category that addresses the constraints of an EDGAR-type AR glass
  + Note: Additional device categories may be defined, but with lower priority.
* For each AR device category
  + Define a reference terminal architecture regarding media capability aspects for this AR device category
  + Define media types and formats produced and consumed by the AR device, including basic scene descriptions, audio, graphics and video as well as sensor information and metadata about user and environment.
  + Define the integration of the relevant existing 3GPP codecs into the reference terminal architecture
  + Define decoding capabilities, including support for multiple parallel decoders
  + Define encoding capabilities
  + Define security aspects related to the media capabilities
  + Define the required, recommended and optional media capabilities for this AR device category
* Integrate IVAS into suitable AR device categories, once IVAS is available
* Define capability exchange mechanisms based on complexity of AR media and capability of device to support EAS KPIs for provisioning of edge/cloud resources
  + Note: Identify a suitable existing capability framework, or if it does not exist, we need to work with the broader industry (e.g., IETF, KHRONOS, W3C, etc.) to get this done.
* Identify which QoE metrics from VR QoE metrics can be reused or enhanced for AR media (e.g., resolution per eye, Field of view (FOV), round-trip interaction delay, etc.) and define relevant KPIs that are dedicated to AR/MR
* Specify additional relevant KPIs and simple QoE Metrics for AR media
* Specify encapsulations into RTP, ISOBMFF and CMAF
* Specify the relevant codec-level parameters for session setup and negotiation of the media delivery and provide instantiations for SDP and DASH MPD
* Enable AR media in 5G Media Streaming by defining suitable 5GMS profiles based on AR media capabilities
* Define typical traffic characteristics for AR media

This document provides updates on naming convention and proposed updates to the device architecture.

# Naming

Looking at existing AR Glasses, based on the study in TR26.998, but primarily also based on communication with Qualcomm product teams on existing and emerging devices, an AR Glass for AR experience does integrate quite some complex functionalities, many of those relate to capabilities. Below is a picture that provides an overview of an AR glass.



Hinge

SoC Media

Connectivity

Eye Tracking + Camera/Sensor Aggregator

The term EDGAR was coined in TR26.998 under the assumption to not differentiate different capabilities. The Edge-dependency was considered relevant. However, while the name is good, the term is misleading.

We propose to change the abbreviation to:

* External Display Glass for AR (EDGAR)

And call the first profile of such device: EDGAR-1. EDGAR-1 has a specific video codec(s), audio codec(s) and scene rendering capabilities and any device conforming to EDGAR-1 shall satisfy those requirements.

# Architecture

The permanent document in S4-220501 documents

* in clause 2.2 a general architecture
* in clause 2.3 an EDGAR architecture
* in clause 2.4 an architecture with focus on Media access functions.

While the figure 2.3 is interesting for a network architecture, we strongly believe that the figure 2.2 and 2.4 should serve as the starting point with some updates.

A first and important aspect from figure 2.4 is, that the interface/API between the renderer and the runtime needs no definition. Based on this, figure 2.2 can be simplified in order to address XR related functions in one block. Figure below shows the basic setup.

In the downlink, the basic functions are as follows:

* XR Rendering and Runtime is provided a presentation data format based on a scene description that established raw data format swap chains, i.e. media pipelines. The XR Rendering and runtime converts the media information to output on eye buffers, speakers and other actuators. The data has an associated spatial information and the XR Rendering and runtime uses the information for latest pose reprojection and rendering. The content and data is handled by the presentation description.
* The Media access functions accesses and decodes the information to provide raw data to the media pipelines.



In the uplink, the basic functions are as follows:

* The XR Runtime captures information, does potentially some pre-processing and provide media data to the access functions
* The Media access functions accesses and decodes the information to provide raw data to the media pipelines.

The capability discovery function provides the AR/MR Application the functionalities supported by XR rendering and Runtime, the media pipelines an d the Media Access Function

The key for an XR device are now the definition of functionalities of the red and yellow box, whereby

* The red box is more defined as a functional reference without specific internal details, i.e. requirements on the APIs and the rendering functionalities
* The yellow box is defined in details wrt to codecs, and so on.

In a refinement of the above architecture, architecture from 2.4 may be used



Note 1: Any of downlink and/or uplink media pipelines may include an optional decryption/encryption. In the figure, this option is only shown for both downlink and uplink video.

# Proposal

It is proposed to take into account the information in clause 2 and 3 and document in the PD for MeCAR and define the following steps toward completion of the work:

1. Use the above figures as the general EDGAR architecture in PD.
2. Focus on defining the EDGAR-1 profile, i.e. the first profile for an MeCAR EDGAR
3. After completion of 2, work on the network architecture, discuss what is needed to network signaling as well as the AR/MR App interface. Discuss the need for the capability discovery, if any and/or identifying EDGAR-1 profile.
4. Update the above figures according to the output of 3 for EDGAR-1 device.