**Source: Huawei Technologies Co., Ltd.**

**Title: IMS-based AR communication split rendering architecture and call flow**

**Agenda Item: 10.6**

**Document for: Discussion and Agreement**

1. Introduction

At the 3GPP-SA4#122, S4-230320 was agreed that adds split rendering function to the objective of IBACS.

In this contribution, we propose the signalling that is required to invoke split rendering in an AR call over IMS.

1. Architecture

The architecture for IMS-based AR communication split rendering is based on data channel, shown as below:



In this architecture:

1. The Split-Rendering Client (SRC) is responsible on behalf of the UE for negotiations with IMS to find the split-rendering configuration.
2. The Split-Rendering Function (SRF) is responsible on behalf of the IMS for negotiations with the UE to find the split-rendering configuration.

Note: SRF need to allocate ARMF media resource through DCSF/MMTel AS when receiving the split rendering request, to confirm whether there is enough media rendering resource.

The above entities use the following interfaces to interact with other entities:

1. SR-2 for AR AS and ARMF media delivery.
2. SR-4 for SRC and SRF through DCMF/MRF for negotiation on split: This interface is used for negotiation at the beginning of the media delivery session and/or during the media delivery session to update/change the split.
3. SR-6 for SRC to interact with the AR Application: This interface is used by the AR Application to request SRC to manage a split and to retrieve the status of the split management.
4. SR-7 for SRC to discover the client’s capabilities: The device capabilities are retrieved by SRC with this interface. The interface may provide static and dynamic capabilities, i.e. capabilities that do not change or may change during the media delivery session.
5. Procedures

When the UE has poor rendering capability which can’t satisfy the requirements of AR communication, the split rendering is involved between the UE and IMS.

TR 26.998 defines a use case UC#17 in clause A.2. That is, UE-A using a phone and UE-B wearing AR glass enter a communication, the UE-B shares a 3D model of house with the UE-A, UE-A can put some 3D objects into the house. The UE-A can only render the 3D objects due to its status, and the virtual 3D model of house needs to be rendered in the network.

The procedure for the split rendering is described in the following call flow:



The steps are as follows:

1. The UE-A initiates an AR communication session and establishes audio and video session connections with the UE-B. Then the bootstrap and application data channels are established for the UE-A and UE-B.

2. When the AR Application on UE-A discovers that the client’s media capabilities cannot meet the AR communication related media rendering requirements, the AR application decides to start split rendering call flow.

3. The AR application initiates the application data channels between the SRC and the SRF(DCMF), for the split rendering confirmation request and metadata transmission.

4-6. The AR application calculates which AR objects can be rendered by itself based on its status, and then decides some part of the AR objects to be rendered in the UE-A and the others to be rendered in the IMS network. The AR application sends a split rendering request to the SRC, the SRC sends a Split Rendering Confirmation Request to the SRF through the established application data channel, the request includes the information of the AR objects to be rendered in IMS network, the DCMF transfers the request to the AR AS.

7. The AR AS decides whether to provide AR media rendering function based on the request message received from the UE-A, the media rendering resource available on the ARMF and the split rendering provisioning status for the UE-A.

8. The AR AS sends a request to the DCSF to allocate media rendering resource on the ARMF for the AR objects that should be rendered in IMS network, the DCSF transfers the request to the MMTel AS.

9. The MMTel AS forwards the media resource allocation request to the ARMF, to reserve AR media rendering resource for the UE-A.

10. When the ARMF resource applied successfully, the MMTel AS return a successful response to the DCSF, the DCSF transfers the response to the AR AS.

11-12. The AR AS returns a successful Split Rendering Confirmation Response carrying the confirmation result to the DCMF. The SRF(DCMF) then transfers the response message to the UE-A through the application data channel.

13. The SRC acknowledges the AR Application that the split-rendering on IMS network is running

14-15. The MMTel AS then initiates a media re-negotiation procedure, to anchor the UE-A and UE-B’s audio/video connection to the ARMF for media rendering.

16. The AR application request the SRC to start AR media split rendering procedure based on the response received in step13.

18. The SRC retrieves metadata such as pose and user input from the Runtime.

19-20. The SRC sends metadata to the SRF through the dedicated application data channel(s), the metadata includes the information of the AR objects that should be rendered in the IMS network, then the DCMF transfer the metadata to the ARMF.

21. The ARMF renders the part of AR objects based on the metadata received.

22. (Optional) The SRC renders the part of AR objects that should be done in the UE-A according to the confirmation result in step12. This step is not needed if all the AR objects are rendered in the IMS network.

23. The SRC sends audio/video media stream including rendered AR objects to the ARMF, if all the AR objects are rendered in the IMS network, the UE-A should send original audio/video media stream to the ARMF.

24-25. The ARMF decodes the audio/video media stream received from the UE-A, and combines with the AR media rendered by the ARMF, then sends the combined audio/video media stream to the UE-B.

26. The ARMF sends the rendered audio/video overlay RTP media stream to the SRC when it needs to send video back to the UE-A through the video back channel.

27. The SRC composes and renders the frame, then transfers to the AR application for display.

1. Proposal

We propose to agree to include the proposed split rendering architecture and call flow into the IBACS PD.