**3GPP TSG-SA WG4 Meeting #127S4-240442**

***Revison of S4-240227***

**Sophia-Antipolis, France, 29 January - 2 February 2024**

**Source: Nokia Corporation, Ericsson LM, Huawei Technologies Co., Ltd, InterDigital Inc., AT&T, Vodafone, ZTE, Samsung Electronics, CO., LTD**

**Title: WID on Split Rendering over IMS**

**Document for: Approval**

**Agenda Item: 6.2**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Split rendering over IMS

Acronym: SR\_IMS

Unique identifier: xxxxxx

Potential target Release: Rel-19

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes | x |  |  | x |  |
| No |  | x | x |  | x |
| Don't know |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
|  | Study  |
|  | Normative – Stage 1 |
|  | Normative – Stage 2 |
| x | Normative – Stage 3 |
|  | Normative – Other\* |

## 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| N/A |  |  |  |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 960046 | 5G\_RTP | RTP related functions will be handled as part of the 5G\_RTP work.  |
| 960042 | IBACS | Defines split rendering call flows for AR.  |
| 990025 | ISAR | Audio aspects from ISAR can be added to the output specification of this WID.  |
| 960045 | SR\_MSE | Split rendering functionalities from SR\_MSE  |
| 950015 | MeCAR | Functions and capabilities of AR devices  |

# 3 Justification

In Rel-18 SA4 will complete a work item on split rendering Media Service Enabler (SR\_MSE) that provides split rendering functionalities for UEs over the Generic RTC architecture in TS 26.506 using WebRTC for delivery of rendered media. Simultaneously, workflows for split rendering over the IMS for conversational AR were specified as part of the IBACS work item during Rel-18. However, the output specification for IBACS (TS 26.264) is for IMS-based AR Real-Time Communication, whereas the SR\_MSE is service agnostic. It is, therefore, appropriate to have a separate specification for split rendering over IMS. The same specification can also include remote rendering procedures, protocols for delivering rendered media ( AR,VR, including 360-degree video), which would be helpful for the implementation and deployment.

Split rendering can leverage rendering resources in a network function as well as the rendering resources in the UE to provide a seamless experience. Adjusting the split of the rendering operations based on changes in UE or network conditions may enable a consistent QoE for the end users as investigated in academia [1][2][3]. The adaptation of rendering operations based on UE capabilities is also considered in 3GPP studies into XR services, for example, TR 23.700-77 clause 5.8.1, TR 23.700-87 clause 6.9.3. Two popular remote rendering platforms, [Azure Remote Rendering](https://learn.microsoft.com/en-us/azure/remote-rendering/overview/about#hybrid-rendering) and [Nvidia CloudXR](https://docs.nvidia.com/cloudxr-sdk/unity_guide/index.html) can be configured for split rendering and adaptation of the split in rendering operations.

Finally, TS 23.501 introduces L4S support in 3GPP networks, and latency and bandwidth sensitive operations such as split rendering can benefit from network exposure and metrics that facilitate the application to react more efficiently to changes in network conditions.

[1] J. Dóka *et al*., "A Novel Split Rendering XR Framework with Occlusion Support," *2023 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)*, Sydney, Australia, 2023, pp. 772-774, doi: 10.1109/ISMAR-Adjunct60411.2023.00169.

[2]  Mohammadi, I.S., Ghanbari, M. & Hashemi, M.R. A hybrid graphics/video rate control method based on graphical assets for cloud gaming. J Real-Time Image Proc 19, 41–59 (2022). <https://doi.org/10.1007/s11554-021-01159-y>

[3] M. Xu *et al*., "A Full Dive Into Realizing the Edge-Enabled Metaverse: Visions, Enabling Technologies, and Challenges," in *IEEE Communications Surveys & Tutorials*, vol. 25, no. 1, pp. 656-700, First quarter 2023, doi: 10.1109/COMST.2022.3221119.

# 4 Objective

The Work has the following objectives:

1. Identify functional entities for IMS-based split rendering, and introduce a mapping of the IMS architecture (reuse of architectures in TS 26.264 or the IMS architecture used by TS 26.114) to the generic architecture for real-time communication (specified in TS 26.506).
2. Identify interfaces and define network APIs for delivering media from 3GPP and non-3GPP services for split rendering of XR services.
3. Define protocols, procedures, and codecs for delivery of split-rendered media and metadata for support of split rendered content including uplink (e.g., pose), and downlink (e.g., rendered pose) as part of a new specification. This includes defining advanced split rendering procedures beyond the ones defined for Rel-18.

Note1: For objectives 3, some of the work is done for AR services as part of Rel-18 WI IBACS, therefore, where possible, references to TS26.114, TS 26.264, TS 26.119, TS 26.522 and TS 26.565 will be added for metadata and codec capabilities. The procedures covered in TS 26.264 can be appropriately migrated to the new specification or referenced.

1. Define procedures for adaptation of split rendering between the split rendering client and split rendering server (e.g., depending on the type of device, battery level, content type, actions).
2. Identify and define network exposure functions (e.g., congestion exposure) and network estimation (e.g., through QoE metrics) to facilitate the split rendering process.

# 5 Expected Output and Time scale

|  |
| --- |
| New specifications {One line per specification. Create/delete lines as needed} |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| TS | 26.xxx | Split rendering over IMS | SA#106 (10 - 13 December 2024, Madrid) | SA#107 (11 - 14 March 2025, Korea) |  |
|  |  |  |  |  |  |

|  |
| --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| TS 26.264 | Move some of the split rendering related text to new specification with appropriate references. | SA#107 (11 - 14 March 2025, Korea) |  |

# 6 Work item Rapporteur(s)

*He, Shane, Nokia Corporation, shane.he@nokia.com*

# 7 Work item leadership

SA4

# 8 Aspects that involve other WGs

None

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Nokia Corporation |
| Ericsson  |
| Huawei  |
| InterDigital  |
| AT&T  |
| Vodafone  |
| ZTE  |
| Samsung Electronics, CO., LTD |