3GPP TSG|WG-4 Meeting #127 S4-240289r03

Sophia-Antipolis, France, 29th January – 2nd February 2024

**Source: InterDigital Communications, Orange, B-COM, Nokia Corporation**

**Title: New SID on Spatial Computing in 5G Media Services**

**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: Study on Spatial Computing in 5G Media Services

Acronym: FS\_Spatial

Unique identifier:

{A number to be provided by MCC at the plenary}

Potential target Release: Rel-19

# 1 Impacts

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

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
| x | Study  |
|  | Normative – Stage 1 |
|  | Normative – Stage 2 |
|  | 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

{List here other Work Items which relate to the proposed one, such as a Work Item in an earlier Release if further enhancing the feature from the previous Release)}

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 880011 | FS\_5GSTAR | Initial study that contains relevant information and definitions for spatial computing. |
| 950015 | MeCAR | Defines AR anchoring capabilities. |
| 960044 | GA4RTAR | Generic architecture for real-time and AR/XR media communications that may be extended to support spatial computing. |
| 960046 | 5G\_RTP | RTP related functions may be handled as part of future extensions to the 5G\_RTP work.  |
| 960045 | SR\_MSE | Interactions between split rendering and spatial computing. |
| 960042 | IBACS | Defines split rendering call flows for AR.  |
|  |  |  |

# 3 Justification

The set of augmented reality (AR) functions which process sensor data to generate information about the 3D space surrounding the AR user are often collectively referred to as *spatial computing*. Spatial computing includes functions such as tracking (to estimate the movement of the AR device at a high frequency), relocalization (to estimate the pose of the AR device in an existing map), mapping (to reconstruct the 3D geometry of the surrounding space), and semantic perception (to segment the captured environment into objects and semantical concepts). The resulting output of spatial computing is a set of spatial mapping information that is organized in a data structure called the XR Spatial Description for storing and exchanging the information. Multiple devices can share their Spatial Descriptions with each other, and they can also make use of existing Spatial Descriptions stored in a network, so that not every device has to remap the environment from scratch.

The 3GPP SA1 TR 22.856 has defined several use cases which require the handling of XR Spatial Description. Spatial computing and spatial descriptions have also been briefly studied in 3GPP SA4 TR 26.998. The potential work identified by that study included specifying support for AR relevant functionalities such split-rendering or spatial computing on top of a 5G System based on a generic architecture for real-time media delivery. Some of these have been addressed in Rel-18 worked items. For example, SA4 has worked on defining a general architecture for real-time media communications and AR/XR experiences in TS 26.506 with a media service enabler for split rendering functions defined in TS 26.565.

The knowledge of the real world is essential for the localization of the AR device and for a seamless insertion of virtual content into the user’s real environment. The required knowledge about the real world can include (1) the location of trackables and anchors in order to localize the user and place virtual content(s) consistently at the same real location, and (2) the 3D representation of the surrounding environment (point cloud, mesh, semantics) in order to ensure proper interactions between virtual and real content (occlusion, physics).

While single-user AR applications can potentially perform AR tasks locally on the UE, multi-user AR applications, such as navigation, entertainment (e.g., geocaching), and field service applications, which allow multiple users to interact within the same physical space, critically rely on the network and often a cloud or edge server to support user interactions. Moreover, these networked AR applications need to perform the necessary AR tasks (e.g., pose estimation and synchronization to the same physical environment) at very low latency to obtain a consistent view of virtual objects.

While some anchoring capabilities have been defined in 3GPP SA4 TS 26.119 as supported in MPEG-I Scene description, the bigger issue of supporting the spatial computing functionality on top of the 5G architecture defined in TS 26.506 still needs to be addressed. Hence, an extension of this work is to study how this architecture can support core spatial computing functions and how to handle Spatial Descriptions. Spatial computing can leverage processing resources in a network function as well as the processing resources in the UE. As an example, the ETSI Industry Specification Group AR Framework (ISG ARF) has proposed an AR reference architecture that includes the concept of World Storage (with associated communication methods) that could be considered to be part of a network function for spatial description. The adaptation of processing operations for scene rendering 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. Furthermore, network resource could aid the localization process as well as persistently store location-specific digital contents that other users can discover.

# 4 Objective

The study has the following objectives:

1. Study relevant use cases from 3GPP SA1 TR 22.85 and SA4 TR 26.998 that require XR Spatial Description handling.
2. Collect and document the different formats for spatial descriptions as well as interoperability requirements for such descriptions.
3. Study architectural extensions and flows for supporting spatial computing based on the architecture defined in the TS 26.506.
4. Identify where spatial computing functions run and which media, sensor, and description formats are used for exchange between these elements of the described architecture.
5. Study and document procedures for the measurement and collection of relevant QoE metrics, taking into consideration the metrics defined in TR 26.812.
6. Study the cross-operation with split rendering.

# 5 Expected Output and Time scale

***{If this WID covers both stage 2 and stage 3, clearly indicate the different completion dates.}***

|  |
| --- |
| 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 |
| TR | 26.xxx | Spatial computing in 5G media services | SA#107 (11 - 14 March 2025, Korea) | SA#108 (10 - 13 June 2025, China) | {<FamilyName>, <GivenName>, <Company>, <email address>} |
|  |  |  |  |  |  |

{Note 1: Only TSs may contain normative provisions. Study Items shall create or impact only TRs.
"Internal TR" is intended for 3GPP internal use only whereas "External TR" may be transposed by OPs.}

{Note 2: The first listed Rapporteur is the specification primary Rapporteur. Secondary Rapporteur(s) are possible for particular aspect(s) of the TS/TR. In this case, their responsibility has to be provided as "Remarks".}

|  |
| --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
|  |  |  |  |

# 6 Work item Rapporteur(s)

{Mandatory: <FamilyName>, <GivenName>, <Company>, <email address>}

# 7 Work item leadership

SA4

# 8 Aspects that involve other WGs

SA2 may need to be involved for architectural aspects.

# 9 Supporting Individual Members

{At least 4 supporting Individual Members are needed. There is an expectation that these companies will provide resources to progress the work. Note that having 4 supporting companies is a necessary but not sufficient condition: the usual TSG approval process by consensus is needed for the WID approval}

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| --- |
| Supporting IM name |
| InterDigital Communications |
| Orange |
| B-COM |
| Nokia Corporation |
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