**3GPP TSG-SA WG4 Meeting #130S4-242042**

**USA, Orlando, 18 – 22 November 2024**

**Source: Nokia**

**Title: Pseudo-CR on Seamless Adaptive Split Rendering**

**Spec: 3GPP TS 26.567 v0.3.0**

**Agenda item: 10.5**

**Document for: Agreement**

**1. Introduction**

In split rendering process for XR services, pose prediction is used to compensate for latency and reprojection techniques are used to correct pose prediction errors. However, certain objects (e.g., interactive, transparent) are difficult to apply prediction techniques on and reprojection is challenging, which can be further exacerbated in high latency conditions. Furthermore, users are more likely to notice these problems when the objects are placed near them.

***Observation 1:*** *Certain XR objects, e.g., interactive or transparent, can benefit from local rendering on the UE, especially when they are near the user’s viewpoint.*

*I*n TS 26.565, the adaptive split rendering procedures allows for rendering of specific objects locally (on the split rendering client) by sending a renderingSplit defined as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| renderingSplit | Object | 1..1 | An object identifying objects to be rendered and where they are to be rendered (SRS or SRC). The message shall be a dictionary object . with keys “SRS” and “SRC”, and values corresponding to a key shall be a list of named nodes from the scene description being rendered in the SR session. The keys shall indicate where the objects named in the corresponding value list are rendered. |

While this is an effective method to mitigate latency issues for interactive/transparent objects, the current mechanism requires signalling changes in the split of objects to be rendered by the SRS or SRC via the data channel with a corresponding ACK.

***Observation 2:*** *renderingSplit object defined in TS 26.565 can be used for adapting the split of rendering between the client and server to render nearby interactive/transparent objects on the UE, but require a REQ/ACK message exchange over the data channel which can take time.*

Efficient scenery object rendering may also include rendering certain spatial regions or objects with a higher level of detail, especially when they are closer to the user. Since, a UE may not have the capability to render 3D objects with high LOD, when such high-quality rendering is required, it has to be done on the server. While it is possible that all scenery rendering is done always by the remote server, the local rendering of these objects may be to limit the use of remote rendering based on service agreements.

***Observation 3:*** *objects in a scene that are typically rendered by the UE may need to be rendered by the server if a high-fidelity rendering is needed when they are closer to the user.*

**2. Solution: Seamless Adaptation of Rendering Split**

We propose that the current mechanism in TS 26.565 is adopted and extended in SR\_IMS to allow for a more seamless adaptation in the renderingSplit.

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Cardinality | Description |
| Id | string | 1..1 | A unique identifier of the message in the scope of the data channel session. |
| Type | string | 1..1 | urn:3gpp:split-rendering:v1:asrp:sr-split-seamless |
| Message | Object | 1..1 | Message content |
| Subtype | string | 1..1 | An identifier of the subtype of the message, it may be a request (REQ) for new split or acknowledgement (ACK), acceptance (OK) or rejection of a request (NOK). |
| renderingSplitId | string | 1..1 | An identifier of the rendering split unique within the scope of the SR session |
| renderingSplit | Object | 0..1 | An object identifying objects to be rendered and where they are to be rendered (SRS or SRC). The message shall be a dictionary object . with keys “SRS” and “SRC”, and values corresponding to a key shall be a list of named nodes from the scene description being rendered in the SR session. The keys shall indicate where the objects named in the corresponding value list are rendered. |
| seamlessSplit | object | 0..1 | An object that if present indicates a seamless adaptation of the rendering process when possible. |
| Radius | number | 1..1 | A distance in meters that defines a sphere centered at the UE, such that preferential rendering is used for objects that lie within this sphere. |
| Type | string | 1..1 | A string that indicates the type of preferential rendering to be used for the objects defined by the key ‘SRC’ in renderingSplit. The following values are supported:  “Local”: The objects are rendered at the UE when they are within the sphere define by R, and rendered by the server when they are outside of it.  “LOD”: The server renders the objects when they are within the radius R at a high fidelity. For example, 3D models with a higher Level-of-detail may be rendered. |

**3. Proposal**

We propose that the above message type is added to the TS 26.567 to enable seamless split rendering adaptation. A corresponding pCR is provided below.

\* \* \* First Change All New Text\* \* \* \*

Annex A (normative):

A.1 Supported Message Types

This clause defines the message types supported by this specification.

Editor’s Note: The clause may contain all message types for XR and other services. The suitable message types from TS 26.567 need to be referred or modified and imported to this spec as appropriate. If there is a need to further define profiles with support for specific messages as mandatory/optional is FFS.

A.1.X Adaptation Split

An SR-DCMTSI client that supports the adaptive split rendering shall support the split adaptation message as defined in table A.1.X-1 below based on the split adaptation message defined clause C.2.3.2 of TS 26.565,

**Table A.1.X-1 Message format for split adaptation messages**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Cardinality** | **Description** |
| id | string | 1..1 | A unique identifier of the message in the scope of the data channel session. |
| type | string | 1..1 | urn:3gpp:split-rendering:v1:asrp:sr-split |
| message | Object | 1..1 | Message content |
| subtype | string | 1..1 | An identifier of the subtype of the message, it may be a request (REQ) for new split or acknowledgement (ACK), acceptance (OK) or rejection of a request (NOK). |
| renderingSplitId | string | 1..1 | An identifier of the rendering split unique within the scope of the SR session |
| renderingSplit | Object | 0..1 | A object identifying objects to be rendered and where they are to be rendered (MF or UE). The message shall be a dictionary object . with keys “MF” and “UE”, and values corresponding to a key shall be a list of named nodes from the scene description being rendered in the SR session. The keys shall indicate where the objects named in the corresponding value list are rendered. |

A.1.Y Seamless Adaptive Split

An SR-DCMTSI client that supports the adaptive split rendering with seamless adaptation shall support the seamless adaptive split message format defined below.

**Table A.1.Y-1 Message format for seamless adaptive split messages**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Cardinality** | **Description** |
| Id | string | 1..1 | A unique identifier of the message in the scope of the data channel session. |
| type | string | 1..1 | urn:3gpp:split-rendering:v1:asrp:sr-split-seamless |
| message | Object | 1..1 | Message content |
| subtype | string | 1..1 | An identifier of the subtype of the message, it may be a request (REQ) for new split or acknowledgement (ACK), acceptance (OK) or rejection of a request (NOK). |
| renderingSplitId | string | 1..1 | An identifier of the rendering split unique within the scope of the SR session |
| renderingSplit | Object | 0..1 | An object identifying objects to be rendered and where they are to be rendered (MF or UE). The message shall be a dictionary object . with keys “MF” and “UE”, and values corresponding to a key shall be a list of named nodes from the scene description being rendered in the SR session. The key ‘UE is used for objects that are to be rendered by the UE and key ‘MF is used for objects that are to be rendered by the MF, when seamlessSplit conditions are not met. |
| seamlessSplit | object | 0..1 | An object that if present indicates a seamless adaptation of the rendering process when possible. |
| radius | number | 1..1 | A distance in meters that defines a sphere centered at the UE, such that preferential rendering is used for objects that lie within this sphere or intersect with it |
| type | string | 1..1 | A string that indicates the type of preferential rendering to be used for the objects defined by the key ‘UE’ in renderingSplit. The following values are supported:  “Local”: The objects are rendered at the UE when they are within the sphere define by R and rendered by the MF when they are outside of it.  “LOD”: The MF renders the objects when they are within the radius R at a high fidelity. For example, 3D models with a higher Level-of-detail may be rendered. |

Note: Whether an object falls within the distance specified in the parameter radius is implementation dependent based on how object borders are defined, for example, for physics. Care should be taken to prevent boundary conditions in which objects falling within the view frustum are rendered by both the MF and the SR-DCMTSI client or by neither the MF and nor the DC-MTSI. It is recommended that the collider associated with the mesh of an object, or a bounding volume or a bounding box associated with an object is used to determine whether an object is within the sphere defined by R or intersecting with it.

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