**3GPP TSG SA WG 1 Meeting #104 S1-233zzz**

**Chicago, USA, 13 - 17 November 2023** *(revision of S1-23xxxx)*

**Source: Samsung, NTT DOCOMO, Huawei, Nokia, Nokia Shanghai Bell**

**pCR Title: 22.156 pCR Addition of Agreed Consolidated Requirements except for Digital Asset Management**

**Draft Spec: 3GPP TS 22.156 1.0.0**

**Agenda item: 7.3.2**

**Document for: Approval**

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*Abstract: Introduces new requirements to TS 22.156 as per agreements at SA1 103.*

**1. Introduction**

This pCR introduces the consolidated requirements agreed in SA1 103 to TR 22.856 to TS 22.156. As per agreement in SA1 103, alignment between TR 22.856 and TS 22.156 is no longer requred.

**2. Reason for Change**

This pCR introduces the consolidated requirements agreed in SA1 103 to TR 22.856 to TS 22.156. Some changes are needed to the text in TR 22.856 19.1.0 due to implementation errors after SA1 103. These corrections are made in a separate CR to TR 22.856 in S1-233zzz.

Summary of change:

add agreed CPRs from SA1 103:

- 1.6, 2.7, 2.8, 3.8, 4.5, 4.6

another pCR will add agreed CPRs from SA1 103 as well:

- 5.6, 5.7, 5.8

**SUGGESTION FOR HANDLING THIS pCR AT SA1 104:**

* **All *agreed* changes to 22.856 that affect CPRs will be captured in this pCR immediately, so that TS 22.156 can be sent for approval in a complete and correct state.**
* **All agreed changes to 22.156 that affect clauses captured in this pCR will be merged into this pCR to avoid any clashes, so that TS 22.156 can be sent for approval in a complete and correct state.**

Also, this handling should apply to S1-233zzz, including digital asset management pCRs.

**3. Conclusions**

None

**4. Proposal**

It is proposed to agree the following changes to 3GPP TS 22.156 1.0.0.

\* \* \* First Change \* \* \* \*
[adds 22.856 19.1.0, CPR.1.6]

### 5.2.1 Localized mobile metaverse service

#### 5.2.1.1 Description

Localized mobile metaverse services are immersive and integrated into a user's ordinary experiences. Such service experiences are location-related and can include presentation of AR, MR media.

Localized experiences are effectively present in the user's environment, so that the mobile metaverse media provided for a given mobile metaverse service is both appropriate to and integrated with both the physical world and with mobile metaverse media content displayed. Localized mobile metaverse services can be associated with specific places (3D locations in the physical world). The association between these places and service information is termed a spatial anchor.

Spatial anchors enable mobile metaverse services to be discovered and accessed, if the user is authorized. For example, the service information can convey the mobile metaverse server access information. When the user's application accesses the mobile metaverse service, the media associated with the service can be obtained by the user.



Figure 5.2.1.1-1: Services offering relevant information are anchored in space

Spatial anchors can associate diverse information with spatial location, beyond access control and access information of mobile metaverse services. Type of service information can also allow a user to discover appropriate spatial anchors, e.g. when the user seeks restaurants.

Spatial anchors can be defined by third parties, e.g. service providers, to offer relevant localized services, e.g. associated with specific items or features in their place of business. This information and its associated authorization information, determining who can discover the spatial anchor, can be managed - created, deleted and modified.

Users' localization is important in order to discover spatial anchors. The 5G system offers a spatial localization service to determine this information. Using sensor data related to the user's location, the 5G system can identify where the user is. This is possible by means of processing the sensor data as well as a spatial map. The result, precise user location and orientation in space, can be exposed to authorized third parties.

The spatial map is created using processed sensor data. The 5G system supports a spatial mapping service to customers that, for example, want to offer mobile metaverse services associated with spatial anchors on their premises. Creation of a spatial map for a location makes localization there possible, as well as assignment of spatial anchors in that location.

#### 5.2.1.2 Requirements

Subject to operator policy, the 5G system shall provide a means to define and expose to an authorized third party a spatial anchor, i.e. an association between a physical location (a point or volume in three dimensional space) and service information.

NOTE 1: Service information can include information to enable users to discover and access services, e.g. type of service, URLs, configuration data, the distance between the user and the spatial anchor, etc.

Subject to operator policy, the 5G system shall enable an authorized third party to request the information associated with a specific spatial anchor.

NOTE 2: How the service and location information is used by the third party to access a mobile metaverse server and the AR media itself is out of scope of this requirement.

Subject to operator policy, regulatory requirements and user consent, the 5G system shall provide a means for a UE to provide sensor data, (e.g. from UE sensors, cameras, etc.) to the network in order to derive localization information, e.g. to produce or modify a spatial map or discover or find spatial anchors. The 5G system shall enable an authorized third party to obtain all of the spatial anchors in a given three dimensional area.

NOTE 3: How an authorized third party identifies which three dimensional area to request spatial anchors in is not in scope of the 3GPP standard. Spatial localization and mapping information could be used to identify areas of interest.

Subject to operator policy and regulatory requirements, the 5G system shall support mechanisms to expose a spatial map or derived localization information to authorized third parties.

Subject to operator policy, regulatory requirements and user consent, the 5G System shall be able to process and expose information related to a UE's location and direction of orientation in space to authorized third parties.

NOTE: This requirement does not affect the ability of regulatory services, e.g., Lawful Interception service, to access required information without consent of the user.

\* \* \* Next Change \* \* \* \*
[adds 22.856 19.1.0, CPR.2.7 from 22.856 CR002r3,
and from 22.856 CR007r2]

### 5.2.2 Avatar-based real-time communication

#### 5.2.2.1 Description

A user can take part in mobile metaverse services that provide digital representations of several other users simultaneously, for example, to support a Conference using XR media. As these services are interactive and immersive, the 5G system provides a means so that the experience of each user of the same service is compatible and consistent. Users can participate together in this way, whether some of those in the Conference service are located in the same place: these users can experience remote users as AR or MR media. This media is conversational - meaning that all parties can participate, and real time - meaning that all users perceive each other's actions effectively simultaneously.

Avatars are employed in mobile metaverse services mainly to represent a user. To improve the user experience of this representation, the 5G system makes it possible to associate the user and the avatar representation and to expose this information to authorized third parties. This information could be valuable, as avatars can represent organizations, individual users, even groups of users.

The 5G system supports a means by which user's pose, gestures and expressions are captured as input for the conversational mobile metaverse service. Devices (e.g. UEs) can capture this information in a standardized form, which is used for the creation of an animated digital representation of the user (e.g. 3D avatar) that can be presented to other users. The system supports communication of this animated digital representation as "avatar media" as well as audio and other media as needed. The 5G system supports the creation of avatar media. Privacy and user consent is needed for sensor data used to capture a user's pose, gestures and (facial) expressions is sent from the UE to the network encoded as avatar media to be rendered.

The 5G system further supports predictive digital representation models in that it enables presentation of avatar media to users based upon timing and other information, so that information can be extrapolated or inferred even if it is not yet available from the network. Correction of these predictions is possible over time, as new information becomes available, e.g. from the real world. The 5G system can in this way enable the user experience of synchronized mobile metaverse services even where communication latencies (e.g. due to distance between users) do not permit this.

Capabilities of UEs differ. For example: some UEs can render avatar media, others video, others only text. To support interactive avatar communication, media transcoding can occur in the 5G network. Similarly, the display capabilities of UEs also differ. Avatar, video or text data can be transcoded as appropriate to be displayed to the user.

Capabilities of users also vary. To support accessibility for those with disability due to physical (e.g. impaired hearing, sight, etc.), environmental (e.g. in a noisy environment), conversational media can be transcoded. This is consistent with the objective for Total Conversation [5], clause 4.5. Avatar functionality provides new options, as media can be transcoded to and from an avatar call.

#### 5.2.2.2 Requirements

The 5G system shall support 5G CN to provide real-time feedback in support of conversational XR communication among multiple users simultaneously.

NOTE 1: The feedback can include information such as network condition, achieved QoS. Such information can be used by the IMS, for example, to trigger the codec negotiation.

Subject to user consent, the 5G system (including IMS) shall support multimedia conversational communications between two or more users including transfer of real time avatar media and audio media.

NOTE 2: Avatar media can be transmitted on both uplink and downlink.

NOTE 3: Confidentiality of the data used to produce the avatar (e.g. from the UE cameras, etc.) is assumed.

Subject to user consent, the 5G system (including IMS) shall support change of media types between video and avatar media for parties of a multimedia conversational communication.

The 5G system (including IMS) shall support transcoding between media such as text, video and avatar media in multimedia conversational communications.

NOTE 4: Text, video or other media could allow a party to control the appearance of its avatar, e.g. to express behaviour, movement, affect, emotions, etc.

NOTE 5: The transcoding of media enables avatar communication, e.g. in scenarios in which UE participating in an IMS call or other service does not support e.g. FACS, encoding avatar media, generating avatar media, etc.

Subject to operator policy, regulatory requirements and user consent, the 5G system (including IMS) shall support the capabilities of rendering the avatar based on the body movement information (e.g. body motion or facial expression) of a human user.

The 5G system (including IMS) shall support the encoding of sensor data capturing the facial expression and movement and gestures of a person, in a standard form.

NOTE 6: The actual transmission and rendering of facial expression and movement and gestures of a person within a multimedia conversational communication is subject to that person’s consent.

Subject to operator policy and regulatory requirements, the 5G system shall support mechanisms to uniquely identify an avatar, to associate the avatar with a subscriber and to expose this association to authorized third parties.

The 5G system (including IMS) shall support compensating for the end-to-end communication latency between the users and/or objects involved in a multimedia conversational communication prior/during rendering the digital representation (e.g. avatar) of the users and/or objects involved (e.g. by using a predictive digital representation model).

NOTE: As specified in clause 7.2.3, the subscriber that the avatar is associated with can temporarily authorize third parties to use the avatar.

\* \* \* Next Change \* \* \* \*
[adds 22.856 19.1.0, CPR.3.8]

### 5.1.1 Operational efficiency, exposure, and coordination

#### 5.1.1.1 Description

These capabilities whose service requirements are defined in clause 5.1.1.2 enable diverse mobile metaverse services.

One important class of services involves several users who take part in mobile metaverse services simultaneously, for example, to support a 'virtual sport event' where some of the environment or objects in the match are virtual, that is, they are produced by an application that provides the user with XR media. Users could be local (in the same location) or remote and have a service experience that is immersive and meets the expectations set by the interactive activity.

Another important class of services are those that require coordination of diverse service data flows of sensor data and media in order to satisfy the needs of a digital twin or situational awareness service.

The service requirements in this clause correspond to means by which the 5G system provides access to digital assets and communication services for mobile metaverse services so that

- the service experience of users of the same service are compatible and consistent;

- the service experience of a user involving media from different services is consistent, even when these services have different performance characteristics;

- the services can operate over a sufficient duration for devices with constrained energy storage;

- the services can communicate efficiently to a large number of authorized users;

- the communication performance for specific mobile metaverse services to specific users can be monitored and exposed to third parties.

#### 5.1.1.2 Requirements

Subject to operator policy, the 5G system shall support a mechanism that enables flexible adjustment of communication services based on e.g. the type of devices (e.g., wearables), or communication duration (e.g. more than one hour), such that the services can be operated with reduced energy utilization.

NOTE 1: Metaverse service experience over an extended period of time (e.g. 2h) requires significant power consumption by the UE. In some cases, a device with no external power supply cannot sustain downloading and rendering of media over a long interval, e.g. for the duration of an entire feature film or athletic event.

The 5G system shall provide a means to associate and coordinate data flows related to one or multiple UEs e.g. associated with the same object in digital twin applications provided by the mobile metaverse service.

Subject to operator policy, regulatory requirements and user consent, the 5G system (including IMS) shall be able to expose network performance information (e.g., observed or predicted bitrate, latency or packet loss) related to one or more users to an authorized third party metaverse application.

NOTE 2: The network performance information can be per UE and take into account all available access network types, i.e. 3GPP and non-3GPP.

Subject to operator policy, the 5G system (including IMS) shall support a mechanism, including enabling one or more authorized third party(ies) to coordinate multiple service data flows of a single mobile metaverse service delivered to/from one or more UE(s). Multiple UEs may be associated with one user/location or different users at different locations potentially using different access networks, i.e. 3GPP and non-3GPP.

NOTE 3: Coordination refers to the ability to provide an acceptable level of user experience for a given service, e.g. based on latency and synchronization constraints (due to multiple sources or long distance between UEs/users). This can be based on a quantitative bound.

NOTE 4: It is not assumed that it is always possible to coordinate and provide the same capabilities regardless of whether 3GPP or non-3GPP access is used.

The 5G system shall enable the coordination of diverse media, transmitted to a UE from one or more mobile metaverse services associated with a physical location, to be combined to form a localized service experience.

Subject to operator policy, the 5G system shall support exposure mechanisms enabling an authorized third party to determine one or more subscribers to whom mobile metaverse media can be distributed in a resource efficient manner.

Subject to operator policy and user consent, the 5G system shall support a means to provide resource efficient communication of third party mobile metaverse media to one or more subscribers.

The 5G system shall provide a mechanism to maintain consistent user experience, for a given UE, when XR media from different mobile metaverse services have different communication performance, e.g., resolution, latency or packet loss.

\* \* \* Next Change \* \* \* \*
[adds 22.856 19.1.0, CPR.4.5 and CPR.4.6]

*context shown to clarify the change*

# 7 Security, authorization and privacy

## 7.1 Description

Security and privacy requirements are important to consider in the context of the present document. Regulatory requirements and user consent are mentioned throughout, emphasizing the importance of data confidentiality. The requirements listed below identify specific capabilities needed for authorization to support functionality described in other clauses of the present document. These requirements supplement the general security requirements for the 5G system defined in [7].

This clause includes requirements that provide functionality to define and enforce authorization policies. These policies are articulated in the case of avatar-based real-time communication to provide users with the ability to define specific authorization rights to use avatars and multimedia communication services on behalf of a subscriber.

## 7.2 Requirements

### 7.2.1 General

Subject to operator policy, regulatory requirements and user consent, the 5G system shall be able to support mechanisms to expose to a trusted third party the result of the UE authenticating the user.

NOTE: How a UE authenticates the user's identity at the terminal equipment, e.g. using biometrics, is out of the scope of the present document.

### 7.2.2 Localized mobile metaverse service

Subject to operator policy, regulatory requirements and user consent, the 5G system shall support mechanisms to authorize Spatial Localization Service.

Subject to operator policy, the 5G system shall provide an authorized third party a means to define authorization to access spatial anchor information and to manage the spatial anchor(s), e.g. add, remove or modify spatial anchors.

### 7.2.3 Avatar-based real-time communication

Subject to operator policy, regulatory requirements and user consent and operator policy, the 5G system shall be able to authorize the avatar to be used in mobile metaverse services.

Subject to regulatory requirements, user consent and operator policy, the 5G system shall provide time-bound authorization for specified subscribers to use an avatar in mobile metaverse services.

Subject to operator policy, regulatory requirements and user consent, the 5G system shall be able to identify the subscriber who has the right to use an avatar in mobile metaverse services.

Subject to operator policy, regulatory requirements and user consent, the 5G system shall provide a means to temporarily authorize a third party to use a subscriber's digital representation and access specific multimedia communication services on behalf of the subscriber, including not by means of a UE, with restrictive conditions e.g., authorized list of parties.

### 7.2.4 Digital asset management

Subject to user consent, regulatory requirements and operator policy, the 5G system shall provide secure means to authorize the use of digital assets associated with a user (e.g. digital assets belonging to a third party customer).

The 5G system shall provide mechanisms to certify the authenticity of digital assets associated with a user.

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