**3GPP TSG-SA WG1 Meeting #100 S1-223204**

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Title: New use case – Metaverse Multi Access Scenario

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*Abstract: This paper proposes a new use case to be captured in TR 22.856 v.0.2.0.*

---------- [All new Text] ----------

## 5.X Use case on Enabling Metaverse services to users via multiple access connections

### 5.X.1 Description

The metaverse enables immersive virtual media, 3D avatar and holographic communications for realizing use cases such as interactive gaming, virtualized shared workspaces, and immersive conference rooms for remote collaboration, etc. The goal is to create a virtual world we can work in, interact with, and even escape to. Many Metaverse use cases are applicable to indoor and/or localized areas such as home, offices, stadiums, shopping malls, movie theatres, theme parks, hospitals, universities, concert halls, etc. Even though metaverse services go beyond virtual reality media presenting virtual worlds that seem to be distant, the scenarios that this use case focusses on are tied to a single physical location which is mostly indoors and serving a localized area. Such physical locations often prefer non-3GPP (trusted, untrusted or wireline) access.

Some metaverse applications require more bandwidth and lower latencies which can be challenging to meet. Major improvements to satisfy these requirements of uninterrupted, lag-free, immersive metaverse experience using non-3GPP access have been made such as:

* incorporation of 1200 MHz of new spectrum in the 6 GHz band with Wi-Fi 6E enabling bigger channel sizes up to 160 MHz
* support up to 1024 QAM with Wi-Fi 6 and 6E and Wi-Fi 7 aiming to support up to 4096 QAM
* doubling maximum channel bandwidth available to each device to 320MHz in the 6GHz band with Wi-Fi 7
* incorporation of High Band Simultaneous (HBS) Multi-Link Operation (MLO) in 802.11be that aggregates two simultaneous 160 MHz channels (four streams) in 5 GHz and 6 GHz bands reducing latency to < 2msec

In case of converged or hybrid network architecture, a single mobile metaverse user can access metaverse applications via 5GS using both 3GPP and non-3GPP accesses simultaneously. Seamless access to metaverse services using different digital representations and exchange of related KPIs across accesses between the 5GS and metaverse application server would be critical from a user perspective.

### 5.X.2 Pre-conditions

Mark is enjoying a weekend at home where he has access to both residential broadband and cellular network from his service provider. Mark is using a pair of VR glasses to see a live concert and at the same time he is using tactile gloves for virtual painting using his residential broadband network. The two activities are running simultaneously on the same access network from the service provider.

### 5.X.3 Service Flows

1. Mark is simultaneously using VR glasses to see a live concert and tactile gloves for virtual painting via a 3rd party metaverse application service provider on his residential broadband access network (non-3GPP access).

2. Metaverse application server has a policy for the network to apply distinct QoS levels for the live concert and for virtual painting.

3. The non-3GPP access network now starts getting congested as Mark's children start streaming movies and Mark's wife is on the video call with her parents.

4. Now the service provider using non-3GPP access alone cannot provide the expected QoS level for Mark. The 5G system informs the Metaverse application about the access network(s) availability and KPI information e.g., latency, throughput, connection density for each of the available access network(s).

The metaverse application now begins using both 3GPP and non-3GPP access networks simultaneously for metaverse traffic meeting the required QoS requirements for Mark using existing traffic steering and splitting mechanisms.

5. Based on the KPI and network availability information shared by the network, the metaverse application server performs coordination for the metaverse traffic (between video flow and audio flow for the concert and the video flow and tactile flow for virtual painting) across the networks and shares the co-ordination information with the network for necessary policy modification.

### 5.X.4 Post-conditions

Mark can seamlessly access Metaverse applications via 5GS using both 3GPP and non-3GPP access networks.

### 5.X.5 Existing support

The 5G system supports n3GPP access and traffic steering already.

It is already possible to expose QoS monitoring information to third parties, when using 3GPP access.

### 5.X.6 Potential New Requirements

[P.R.-5.1.6-1] The 5G system shall expose access network(s) availability and their key performance indicators (KPIs), e.g., latency, throughput, connection density for communication on 3GPP and non-3GPP networks to third party Metaverse applications

[P.R.-5.1.6-2] Subject to operator policy, if metaverse application traffic traverses across different access networks, the 5G system shall be able to dynamically perform policy updates for a user to meet the desired QoS levels for the metaverse traffic across networks (two 3GPP networks, or 3GPP and non-3GPP networks).