**3GPP TSG-WG SA2 Meeting #165 meetingS2-2410620**

**Hyderabad, IN, 14th Oct – 18th Oct, 2024 (Revision of S2-2410354)**

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| *CR-Form-v12.1* |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | Supporting Avatar Communication |
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| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NG\_RTC\_Ph2 |  | ***Date:*** | 2024-10-02 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Clause 8.8 in 3GPP TS 23.700-77 concludes KI#8 on "Support of IMS Avatar Communication". The corresponding normative work need to be implemented. |
|  |  |
| ***Summary of change:*** | 1. Enhance the IMS architecture and functionalities to support avatar communication2. Define the avatar communication call flows |
|  |  |
| ***Consequences if not approved:*** | No normative specification for conclusions of KI#8 |
|  |  |
| ***Clauses affected:*** | 3.1, 3.3, Annex XX (new Annex) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* \* First change \* \* \*

## 3.1 Definitions

Refer to TS 23.002 [1] for the definitions of some terms used in this document.

For the purposes of the present document the terms and definitions given in TR 21.905 [68] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [68].

For the purposes of the present document, the following terms and definitions given in TS 23.003 [24] apply:

**- Distinct Public Service Identity**

**- Public User Identity**

**- Wildcarded Public User Identity**

**- Wildcarded Service User Identity**

**Alias Public User Identities:** A set of Public User Identities that belong to the same alias group as specified in TS 29.228 [30].

**ALG:** Application Level Gateway (ALG) is an application specific functional entity that allows communication between disparate address realm or IP versions, e.g. an IPv6 node to communicate with an IPv4 node and vice versa, when certain applications carry network addresses in the payloads like SIP/SDP. NA(P)T-PT or NA(P)T is application unaware whereas ALGs are application specific translation entities that allow a host running an application to communicate transparently with another host running the same application but in a different IP version or IP address realm. See IETF RFC 2663 [34] for more details.

 For IMS, an IMS ALG provides the necessary application function for SIP/SDP protocols in order to communicate between different address realms or IP versions, e.g. IPv6 and IPv4 SIP applications.

**Application data channel:** A data channel within an IMS session used to transfer data of data channel applications between UEs or between the UE and the network.

**AR Application Server:** An application server used to control the service logic related to AR communication via IMS data channel.

**Avatar ID:** An identifier used to specify the avatar representation.

**Avatar media:** A media stream (e.g., video) that includes the animated avatar representation.

**Avatar metadata:** used for avatar animation, which may include the sensing data, e.g., action and facial expression.

**Avatar representation:** The 2D/3D representational content/model of an Avatar stored in a file, which can be accessed via an Avatar ID.

**Bootstrap data channel:** A data channel established within an IMS session between the UE and the network, to transfer a graphical user interface that can include a list of data channel applications.

**Business trunking:** as defined in TS 24.525 [81].

**Data channel application:** A HTML page including JavaScript(s) and optionally image(s) and style sheet(s). It is downloaded from the network to the UE through the bootstrap data channel.

**DC Application Server:** An application server that interacts with the DCSF and the DC media function for data channel traffic handling.

**Distinct Public User Identity:** used in relation to wildcarded Public User/Service Identities to denote an explicitly provisioned Public User/Service Identity. See more details in TS 23.003 [24].

**Entry point:** In the case that border control concepts are to be applied in an IM CN subsystem, then these are to be provided by capabilities within the IBCF, and the IBCF acts as an entry point for this network (instead of the I‑CSCF). In this case the IBCF and the I‑CSCF can be co-located as a single physical node. If border control concepts are not applied, then the I-CSCF is considered as an entry point of a network. If the P‑CSCF is in the home network, then the I‑CSCF is considered as an entry point for this document.

**Exit point:** If operator preference requires the application of border control concepts then these are to be provided by capabilities within the IBCF, and requests sent towards another network are routed via a local network exit point (IBCF), which will then forward the request to the other network (discovering the entry point if necessary).

**Geographical Identifier:** A Geographical Identifier identifies a geographical area within a country or territory. See more details in clause E.8.

**Geo-local service number:** A local service number that is used to access a service in the roamed network (a local service where the subscriber is located).

**Home local service number:** A local service number is used to access a service that is located in the home network of the user.

**HSS Group ID:** This refers to one or more SBI capable HSS instances managing a specific set of IMPIs/IMPUs.

**IMC:** IMS Credentials as defined in TR 21.905 [68].

**IMS application reference:** An IMS application reference is the means by which an IMS communication service identifies an IMS application.

**IMS application:** An IMS application is an application that uses an IMS communication service(s) in order to provide a specific service to the end-user. An IMS application utilises the IMS communication service(s) as they are specified without extending the definition of the IMS communication service(s).

**IMS communication service identifier:** An IMS communication service identifier uniquely identifies the IMS communication service associated with the particular IMS request.

**IMS communication service:** An IMS communication service is a type of communication defined by a service definition that specifies the rules and procedures and allowed medias for a specific type of communication and that utilises the IMS enablers.

**IMS enabler:** An IMS enabler is a set of IMS procedures that fulfils specific function. An IMS enabler may be used in conjunction with other IMS enablers in order to provide an IMS communication service.

**Instance identifier:** An identifier, that uniquely identifies a specific UE amongst all other UEs registered with the same Public User Identity.

**Inter-IMS Network to Network Interface:** The interface which is used to interconnect two IM CN subsystem networks. This interface is not constrained to a single protocol.

**IP Flow:** Unidirectional flow of IP packets with the following properties:

- same destination IP address and port number;

- same source IP address and port number;

- same transport protocol (port numbers are only applicable if used by the transport protocol).

**IP-Connectivity Access Network:** refers to the collection of network entities and interfaces that provides the underlying IP transport connectivity between the UE and the IMS entities. An example of an "IP-Connectivity Access Network" is GPRS.

**IP SM GW (IP short message gateway):** An IP SM GW is an AS providing the support of Short Message Service of the IMS domain. See more details in TS 23.204 [56].

**Local Service Number:** A local service number is a telephone number in non-international format. A local service number is used to access a service that may be located in the home network of the user (home local service number) or the roamed network of the user (geo-local service number).

**Media Flow:** One or more IP flows carrying a single media instance, e.g. an audio stream or a video stream. In the context of this specification the term Media Flow is used instead of IP Flow regardless of whether the actual IP packet corresponds to media plane information (e.g. audio RTP flow) or control signalling (e.g. RTCP or SIP Signalling).

**MPS:** Based on TS 22.153 [77]. Multimedia Priority Service allows authorized users to obtain and maintain radio and network resources with priority, also during national security or emergency situations when PLMN congestion may occur.

**MPS session:** A session (e.g. voice, video, data session) for which priority treatment is applied for allocating and maintaining radio and network resources.

**MPS-subscribed UE:** A UE having a USIM with MPS subscription.

NAT-PT/NAPT-PT: NAT-PT uses a pool of globally unique IPv4 addresses for assignment to IPv6 nodes on a dynamic basis as sessions are initiated across the IP version boundaries. NAT-PT binds addresses in IPv6 network with addresses in IPv4 network and vice versa to provide transparent routing between the two IP domains without requiring any changes to end points, like the UE. NAT-PT needs to track the sessions it supports and mandates that inbound and outbound data for a specific session traverse the same NAT-PT router.

 NAPT-PT provides additional translation of transport identifier (e.g. TCP and UDP port numbers, ICMP query identifiers). This allows the transport identifiers of a number of IPv6 hosts to be multiplexed into the transport identifiers of a single assigned IPv4 address. See IETF RFC 2766 [33] for more details.

**Network Address Translation (NA(P)T):** method by which IP addresses are mapped from one group to another, transparently to end users. Network Address Port Translation, or NA(P)T is a method by which many network addresses and their TCP/UDP (Transmission Control Protocol/User Datagram Protocol) ports are translated into a single network address and its TCP/UDP ports. See RFC 3022 [65] for further details.

**Outbound:** Managing Client Initiated Connections in the Session Initiation Protocol (Outbound) defines behaviours for User Agents, registrars and proxy servers that allow requests to be delivered on existing connections established by the User Agent. See RFC 5626 [48] for further details.

**Preferred Circuit Carrier Access:** An IMS service that allows a specific long distance circuit carrier to be selected for a long distance call.

**Preferred Circuit Carrier Selection:** An IMS service that allows the subscriber to select a long distance circuit carrier per call when dialling a call origination.

**Service User:** According to TS 22.153 [77].

**Stand-alone Non-Public Network:** A non-public network not relying on network functions provided by a PLMN.

**STUN:** Simple Traversal of UDP Through NAT (STUN), provides a toolkit of functions. These functions allow entities behind a NAT to learn the address bindings allocated by the NAT, to keep those bindings open, and communicate with other STUN-aware devices to validate connectivity. See RFC 5389 [47] for further details.

**STUN Keep-alive:** Is a usage of STUN, to keep NAT bindings open.

**STUN Relay:** Is a usage of STUN, that allows a client to request an address on the STUN server itself, so that the STUN server acts as a relay. See IETF RFC 5766 [46] for further details.

**Subscriber:** A Subscriber is an entity (comprising one or more users) that is engaged in a Subscription with a service provider. The subscriber is allowed to subscribe and unsubscribe services, to register a user or a list of user authorized to enjoy these services, and also to set the limits relative to the use that users make of these services.

**Transport address:** A unique identifier of transport-layer address, i.e. a combination of a network address, protocol identifier and port number. For example an IP address and a UDP port.

\* \* \* \* Second change \* \* \*

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [68] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [68].

5GS 5G System

API Application Program Interface

APN Access Point Name

AS Application Server

A2P Application to Person

BAR Base Avatar Repository

BCSM Basic Call State Model

BG Border Gateway

BGCF Breakout Gateway Control Function

BS Bearer Service

CAMEL Customised Application Mobile Enhanced Logic

CAP Camel Application Part

CDR Charging Data Record

CN Core Network

CS Circuit Switched

CSCF Call Session Control Function

CSE CAMEL Service Environment

DC Data Channel

DCAR Data Channel Application Repository

DCMTSI Data Channel Multimedia Telephony Service for IMS

DCSF Data Channel Signalling Function

DHCP Dynamic Host Configuration Protocol

DNN Data Network Name

DNS Domain Name System

ECN Explicit Congestion Notification

ENUM E.164 Number Mapping

GGSN Gateway GPRS Support Node

GLMS Group and List Management Server

GMLC Gateway Mobile Location Centre

GRUU Globally Routable User Agent URI

GUP Generic User Profile

HSS Home Subscriber Server

IBCF Interconnection Border Control Function

I‑CSCF Interrogating‑CSCF

IETF Internet Engineering Task Force

IM IP Multimedia

IMC IMS Credentials

IMS IP Multimedia Core Network Subsystem

IMS ALG IMS Application Level Gateway

IMSI International Mobile Subscriber Identifier

IN Intelligent Network

IP Internet Protocol

IPv4 Internet Protocol version 4

IPv6 Internet Protocol version 6

IP‑CAN IP-Connectivity Access Network

IP‑SM‑GW IP Short Message Gateway

ISDN Integrated Services Digital Network

ISIM IMS SIM

ISP Internet Service Provider

ISUP ISDN User Part

IWF Interworking Function

NP Number portability

MAP Mobile Application Part

MGCF Media Gateway Control Function

MGF Media Gateway Function

MRB Media Resource Broker

MRFC Multimedia Resource Function Controller

MRFP Multimedia Resource Function Processor

NAI Network Access Identifier

NAPT Network Address Port Translation

NAT Network Address Translation

NA(P)T-PT Network Address (Port-Multiplexing) Translation-Protocol Translation

II-NNI Inter-IMS Network to Network Interface

OSA Open Services Architecture

P2A Person to Application

P2P Person to Person

P‑CSCF Proxy‑CSCF

PCC Policy and Charging Control

PCEF Policy and Charging Enforcement Function

PCRF Policy and Charging Rules Function

PDN Packet Data Network

PDP Packet Data Protocol e.g. IP

P‑GRUU Public Globally Routable User Agent URI

PLMN Public Land Mobile Network

PSI Public Service Identity

PSTN Public Switched Telephone Network

QoS Quality of Service

RAB Radio Access Bearer

RFC Request for Comments

SCS Service Capability Server

S‑CSCF Serving‑CSCF

SDP Session Description Protocol

SGSN Serving GPRS Support Node

SLF Subscription Locator Function

SNPN Stand-alone Non-Public Network

SSF Service Switching Function

SS7 Signalling System 7

SIM Subscriber Identity Module

SIP Session Initiation Protocol

S‑GW Signalling Gateway

TAS Telephony Application Server

T‑GRUU Temporary Globally Routable User Agent URI

THIG Topology Hiding Inter-network Gateway

TrGW Transition Gateway

UE User Equipment

UMTS Universal Mobile Telecommunications System

URL Universal Resource Locator

USIM UMTS SIM

\* \* \* \* Third change \* \* \*

Annex XX (Normative):
Support Avatar Communication

# XX.1 General

This clause describes the enhancements to the IMS architecture for supporting avatar communication. The following two modes for avatar communication are supported:

- Network centric mode: When the UE detects that its capability can’t meet avatar communication requirement according to its status, the UE initiates capability negotiation of avatar media processing with the IMS network. The IMS network allocates avatar media resources and performs avatar animation/rendering functionalities based on the audio/video and/or metadata received from the UE, then IMS network sends the rendered Avatar media to the UE.

- UE centric mode: The UE downloads avatar representation from IMS network through application data channel and performs avatar animation/rendering functionalities based on the metadata generated locally or received from the peer UE.

One UE can set more than one avatar representation and choose one to use during the avatar communication. The avatar representation is stored in BAR and can be accessed by its avatar ID.

The avatar ID list which contains a list of avatar IDs is stored as the service data in HSS. The avatar ID list can be downloaded to its UE through the bootstrap data channel and is shared between different applications. Different applications may choose different avatar IDs in the avatar ID list, e.g., one application support only 2D avatar while the other supports 3D avatar. The avatar ID list may support classification of each avatar ID by defining several attributes for each avatar ID, for example category (e.g., 2D or 3D) and usage (e.g., business or entertainment). The application may get specific avatar ID(s) from the avatar ID list by the pre-defined attributes in the application.

Once an avatar representation is chosen by the UE in an avatar communication, the avatar ID is transmitted between UE and network or between UEs through application data channel.

NOTE 1: The avatar ID list downloading to its UE is optional, UE can subscribe avatar communication service in IMS network which use a default or pre-defined avatar ID.

# XX.2 Architecture

 

Figure xx.2-1: Architecture to support Avatar Communication

To support IMS avatar communication, the architecture is enhanced as follows:

Base Avatar Repository (BAR):

- The Base Avatar Repository is used to store and retrieve the avatar representations.

NOTE 2: The BAR can be co-located with DCAR or deployed standalone.

DC AS (XR):

- The DC AS is responsible for service control related to avatar communication, including avatar communication session media control and so on.

MF:

- Support media processing, e.g. ASR/TTS/SLR/SSL, under the service control of DC AS(XR).

- Support avatar animation and rendering, under the service control of DC AS(XR).

The following media interface are defined to support IMS Avatar Communication:

- DC6: Reference point of Avatar representation access between DC AS(XR) and BAR.

- DC7: Reference point of Avatar representation access between MF and BAR.

NOTE 4: How DC6 and DC7 reference points are secured and authenticated is to be determined by SA WG3.

Editor's note: Whether DC6 and DC7 reference points are in 3GPP R19 scope is FFS.

The following reference points are updated to support IMS Avatar Communication:

- N72: Reference point between the DCSF and HSS.

- N33: Reference point between the NEF and DC AS(XR).

- Nxx: Reference point between the IMS AS and NEF.

- DC2: Reference point between the IMS AS and MF.

# XX.3 Procedures

## XX.3.1 UE centric procedure

The UE centric mode includes two scenarios:

- Local UE centric: When the UE initiates an avatar communication with the peer UE, it downloads the avatar representation from BAR and performs avatar animation locally based on the metadata generated by itself and sends the animated avatar media to the peer UE.

- Peer UE centric: When the UE initiates an avatar communication with the peer UE, it sends the avatar ID to the peer UE. The peer UE downloads the avatar representation from BAR based on the received avatar ID and performs the avatar animation based on the received metadata.

### XX.3.1.1 Local UE centric procedure

 

**Figure XX.3.1.1-1: Procedures of Local UE centric IMS Avatar communication**

Figure XX.3.1.1-1 depicts a typical call flow procedure of local UE centric IMS Avatar communication. The main steps in the call flow are as follows:

1. IMS session and bootstrap data channel have been established. UE1 downloads its avatar ID list from DCSF through bootstrap data channel. Then UE1 chooses an avatar ID and runs the avatar communication application.

2. Application data channel(s) are established including a P2P ADC between UE1 and UE2 which is used for avatar metadata transmission, and a P2A ADC between UE1 and DC AS(XR) which is used for avatar representation transmission.

3. UE1 downloads Avatar representation from DC AS(XR) using avatar ID and UE1’s identity (e.g., IMSI or MSISDN) through the established application data channel.

4-5. The DC AS(XR) requests BAR to download Avatar representation using avatar ID and UE1’s identity, the BAR responses with avatar representation data.

6. The DC AS(XR) responses with the avatar representation data to MF, and then MF sends it back to UE1.

7. UE2 may send metadata (e.g., FOV data) to UE1 through the established application data channel.

8. UE1 may perform media transcoding such as ASR/TTS/SLR/SSL, and animates the avatar representation based on the transcoding result and the metadata which is generated locally and received from UE2.

9. UE1 transmits the animated avatar media over RTP to UE2.

### XX.3.1.2 Peer UE centric procedure

 

**Figure XX.3.1.2-1: Procedures of Peer UE centric IMS Avatar communication**

Figure XX.3.1.2-1 depicts a typical call flow procedure of peer UE centric IMS Avatar communication. The main steps in the call flow are as follows:

1. IMS session and bootstrap data channel have been established. UE1 downloads its avatar ID list from DCSF through bootstrap data channel. Then UE1 chooses an avatar ID and runs the avatar communication application.

2. Application data channel(s) are established including a P2P ADC between UE1 and UE2, and a P2A2P ADC between UE1/UE2 and DC AS(XR).

3. UE1 decides to request peer UE to perform avatar animation based on its status such as power, signal, computing power, internal storage, etc.

4. UE1 establishes a P2A2P ADC and performs avatar animation negotiation with the DC AS(XR) and UE2. The negotiation includes usage of the UE1’s avatar ID and the animation data types (e.g., text and/or facial expression) supported by UE1.

NOTE 5: The negotiation procedure needs to be further defined in SA4, and cooperation with SA4 is needed.

5. UE2 downloads avatar representation from DC AS(XR) using the avatar ID and UE identity received from UE1 through the established P2A2P application data channel.

6-7. The DC AS(XR) authorizes the request from UE2 and requests BAR to download avatar representation using UE1’s avatar ID and UE1’s identity, the BAR responses with UE1’s avatar representation data.

8. The DC AS(XR) responses with UE1’s avatar representation data to the MF, and the MF sends it back to UE2.

9. UE1 may send metadata (e.g., facial expression) to UE2 through the established application data channel or RTP channel between UE1 and UE2.

10. UE2 animates the UE1’s avatar representation based on the metadata received from UE1.

## XX.3.2 Network centric procedure

 

**Figure XX.3.2-1: Procedures of network centric IMS Avatar communication**

Figure XX.3.2-1 depicts a typical call flow procedure of network centric IMS avatar communication. The main steps in the call flow are as follows:

1. IMS session and bootstrap data channel have been established. UE1 downloads its avatar ID list from DCSF through bootstrap data channel. Then UE1 chooses an avatar ID and runs the avatar communication application.

2. Application data channel(s) are established including a P2P ADC between UE1 and UE2, and a P2A2P ADC between UE1/UE2 and DC AS.

3. UE1 decides to request network to perform avatar animation based on its status such as power, signal, computing power, internal storage, etc.

4. The avatar animation negotiation is finished between the DC AS(XR) and UE1 using the P2A2P ADC established in step 2.

NOTE 6: The avatar animation negotiation procedure and parameters need to be further defined in SA4, and cooperation with SA4 is needed.

5. The DC AS(XR) instructs the IMS AS through NEF to anchor UE1’s audio/video media and allocate avatar animation resource, by the Nnef\_ImsSessionManagement\_Update request. The request includes avatar ID, avatar type (i.e. 2D avatar or 3D avatar), animation method (e.g., audio, text or facial expression) and UE1’s audio/video media specification.

NOTE 7: DC AS(XR) will know the avatar related parameters included in the session management request based on the avatar animation negotiation result in step 4.

6. The IMS AS requests MF to allocate avatar animation media resource and audio/video media resources, by the Nmf\_MRM\_Update request. The request message includes UE1’s identity and the parameters carried in step 5.

7. The IMS AS sends the Nimsas\_ImsSessionManagement\_Update response to the DC AS(XR) through NEF.

8. The IMS AS finishes the media re-negotiation between UE1, UE2 and MF, which anchors UE1 and UE2’s audio/video to MF.

9. The MF downloads UE1’s avatar representation from BAR using the UE1’s avatar ID and UE identity.

10. The UE1 sends avatar metadata (such as facial expression) through the established P2A2P ADC, and/or audio/video stream over RTP, to the MF.

11. The UE2 may send avatar metadata (such as FOV data) through the established P2A2P ADC, to the MF.

12. MF may perform media transcoding such as ASR/TTS/SLR/SSL, and avatar animation based on the transcoding result and the avatar metadata received from application data channel. MF should support different media processing according the avatar type, e.g., animation with no rendering for 2D avatar, animation and rendering for 3D avatar.

13-14. MF sends the animated avatar media to UE2, and sends the animated avatar media to UE1 if required.

\* \* \* \* End of changes \* \* \* \*