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Universal Mobile Telecommunications System (UMTS);**

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5G;

IP Multimedia (IM) Subsystem Sh interface;

Signalling flows and message contents

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1 Scope

This 3GPP Technical Specification (TS) specifies:

1. The interactions between the HSS (Home Subscriber Server) and the SIP AS (Application Server) and between the HSS and the OSA SCS (Service Capability Server). This interface is referred to as the Sh reference point.
2. The interactions between the SIP AS and the SLF (Subscription Locator Function) and between the OSA SCS and the SLF. This interface is referred to as the Dh reference point.

The IP Multimedia (IM) Core Network Subsystem stage 2 is specified in 3GPP TS 23.228 [1] and the signalling flows for the IP multimedia call control based on SIP and SDP are specified in 3GPP TS 24.228 [2].

The IP Multimedia (IM) Session Handling with the IP Multimedia (IM) call model is specified in 3GPP TS 23.218 [4].

This document addresses the signalling flows and message contents for the protocol at the Sh and Dh interface.

This document also addresses how the functionality of Ph interface is accomplished.

The Presence Service Stage 2 description (architecture and functional solution) is specified in 3GPP TS 23.141 [18].

2 References

- [1] 3GPP TS 23.228: "IP Multimedia (IM) Subsystem – Stage 2".
- [2] 3GPP TS 24.228: "Signalling flows for the IP multimedia call control based on SIP and SDP (Release 5)".
- [3] 3GPP TS 23.002: "Network architecture".
- [4] 3GPP TS 23.218: "IP Multimedia (IM) Session Handling; IP Multimedia (IM) call model".
- [5] 3GPP TS 29.329: "Sh Interface based on Diameter – Protocol details".
- [6] 3GPP TS 29.228: "IP multimedia (IM) Subsystem Cx Interface; Signalling flows and Message Elements".
- [7] 3GPP TS 29.229: "Cx and Dx Interfaces based on the Diameter protocol ; Protocol details".
- [8] Void.
- [9] ITU-T recommendation Q.763: "Signalling System No. 7 - ISDN User Part formats and codes".
- [10] 3GPP TS 23.018: "Basic Call Handling; Technical realization".
- [11] 3GPP TS 23.003: "Numbering, Addressing and Identification".
- [12] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [13] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".
- [14] 3GPP TS 23.078: "Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 3 - Stage 2".
- [15] IETF RFC 2045: "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies".
- [16] IETF RFC 3261: "SIP: Session Initiation Protocol".
- [17] IETF RFC 3966: "The tel URI for Telephone Numbers".
- [18] 3GPP TS 23.141: "Presence Service; Architecture and Functional Description".
- [19] 3GPP TS 23.012: "Location Management Procedures".

- [20] ANSI X3.4: "Coded Character Set - 7-bit American Standard Code for Information Interchange"
- [21] Void
- [22] 3GPP TS 33.203: "Access Security for IP-based services".
- [23] IETF RFC 791: "Internet Protocol".
- [24] IETF RFC 4291: "IP Version 6 Addressing Architecture".
- [25] IETF RFC 4412: "Communications Resource Priority for the Session Initiation Protocol (SIP)".
- [26] 3GPP TS 29.272: "MME and SGSN Related Interfaces Based on Diameter Protocol".
- [27] 3GPP TS 23.008: "Organization of subscriber data".
- [28] 3GPP TS 29.212: "Policy and Charging Control (PCC); Reference points".
- [29] 3GPP TS 23.060: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description; Stage 2".
- [30] 3GPP TS 29.118: "SGs interface specification".
- [31] 3GPP TS 29.272: "Evolved Packet System; MME and SGSN Related Interfaces Based on Diameter Protocol".
- [32] 3GPP TS 23.237: "IP Multimedia Subsystem (IMS) Service Continuity; Stage 2".
- [33] 3GPP TS 23.292: "IP Multimedia Subsystem (IMS) centralized services; Stage 2".
- [34] 3GPP TS 29.273: "3GPP EPS AAA interfaces".
- [35] IETF RFC 4776: "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information".
- [36] IETF RFC 7683: "Diameter Overload Indication Conveyance".
- [37] ETSI ES 283 034: "e4 interface based on the DIAMETER protocol".
- [38] 3GPP TS 22.153: "Multimedia Priority Service".
- [39] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP" – stage 3.
- [40] 3GPP TS 29.364: "IP Multimedia Subsystem (IMS) Application Server (AS) service data description for AS interoperability".
- [41] IETF RFC 5952: "A Recommendation for IPv6 Address Text Representation".
- [42] IETF RFC 7944: "Diameter Routing Message Priority".
- [43] IETF RFC 8583: "Diameter Load Information Conveyance".
- [44] IETF RFC 6733: "Diameter Base Protocol".
- [45] 3GPP TS 24.323: "3GPP IP Multimedia Subsystem (IMS) service level tracing management object (MO)".
- [46] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".
- [47] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

IP Multimedia session: IP Multimedia session and IP Multimedia call are treated as equivalent in this specification.

Transparent data: Data that is understood syntactically but not semantically by the HSS. It is data that an AS may store in the HSS to support its service logic. One example is data that an AS stores in the HSS, using it as a repository.

Non-transparent data: Data that is understood both syntactically and semantically by the HSS.

AS (Application Server): a term used to denote either of a SIP Application Server or an OSA Service Capability Server.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AS	Application Server
C	Conditional
CSCF	Call Session Control Function
CSG	Closed Subscriber Group
DRMP	Diameter Routing Message Priority
DSCP	Differentiated Services Code Point
GIBA	GPRS-IMS-Bundled-Authentication
HSS	Home Subscriber Server
IE	Information Element
IP	Internet Protocol
IM	IP Multimedia
IMS	IP Multimedia Subsystem
M	Mandatory
O	Optional
SIP	Session Initiation Protocol
SLF	Subscription Locator Function
S-CSCF	Serving CSCF

4 Main Concept

This document presents the Sh interface related functional requirements of the communicating entities.

It gives a functional classification of the procedures and describes the procedures and message parameters.

Error handling flows, protocol version identification, etc. procedures are also included.

5 General Architecture

This clause further specifies the architectural assumptions associated with the Sh reference point, building on 3GPP TS 23.228 [1], 3GPP TS 23.218 [4] and also the Ph reference point building upon 3GPP TS 23.141 [18].

5.1 Functional requirements of network entities

5.1.1 Functional Requirements of the Application Server

The Application Server may communicate with the HSS over the Sh interface.

For functionality of the Application Server refer to 3GPP TS 23.002 [3], 3GPP TS 23.228 [1] and 3GPP TS 23.218 [4].

5.1.2 Functional requirements of HSS

The HSS may communicate with the Application Server over the Sh interface and with the Presence Network Agent over the Ph interface. The functionality of the Ph interface shall be the same as the functionality of the Sh interface.

For functionality of the HSS refer to 3GPP TS 23.002 [3], 3GPP TS 23.228 [1] and 3GPP TS 23.218 [4].

5.1.3 Functional Requirements of the Presence Network Agent

The Presence Network Agent may communicate with the HSS over the Ph interface. In this case, all references to an Application Server in this specification apply also to a Presence Network Agent.

5.2 Functional classification of Sh interface procedures

Operations on the Sh interface are classified in functional groups:

1. Data handling procedures
 - The download of data from the HSS to an AS.
 - The update of data in the HSS.
2. Subscription/notification procedures
 - An AS can subscribe to receive notifications from the HSS of changes in data.
 - The HSS can notify an AS of changes in data for which the AS previously had subscribed.

6 Procedure Descriptions

In the tables that describe the Information Elements transported by each command, each Information Element is marked as (M) Mandatory, (C) Conditional or (O) Optional.

- A mandatory Information Element (marked as (M) in the table) shall always be present in the command. If this Information Element is absent, an application error occurs at the receiver and an answer message shall be sent back to the originator of the request with the Result-Code set to DIAMETER_MISSING_AVP. This message shall also include a Failed-AVP AVP containing the missing Information Element i.e. the corresponding Diameter AVP defined by the AVP Code and the other fields set as expected for this Information Element.
- A conditional Information Element (marked as (C) in the table) shall be present in the command if certain conditions are fulfilled.
 - If the receiver detects that those conditions are fulfilled and the Information Element is absent, an application error occurs and an answer message shall be sent back to the originator of the request with the Result-Code set to DIAMETER_MISSING_AVP. This message shall also include a Failed-AVP AVP containing the missing Information Element i.e. the corresponding Diameter AVP defined by the AVP Code and the other fields set as expected for this Information Element.
 - If those conditions are not fulfilled, the Information Element shall be absent. If however this Information Element appears in the message, it shall not cause an application error and it may be ignored by the receiver if this is not explicitly defined as an error case. Otherwise, an application error occurs at the receiver and an answer message with the Result-Code set to DIAMETER_AVP_NOT_ALLOWED shall be sent back to the originator of the request. A Failed-AVP AVP containing a copy of the corresponding Diameter AVP shall be included in this message.
- An optional Information Element (marked as (O) in the table) may be present or absent in the command, at the discretion of the application at the sending entity. Absence or presence of this Information Element shall not cause an application error and may be ignored by the receiver.

When a procedure is required to determine the Public Identity used for an identity lookup in HSS and SLF, the HSS and SLF shall derive the Public Identity from the SIP URI or Tel URI contained in the Public-Identity AVP, if not already in canonical form as per 3GPP TS 23.003 [11], as described below:

- If the Public-Identity AVP contains a SIP URI, the HSS and SLF shall follow rules for conversion of SIP URI into canonical form as specified in IETF RFC 3261 [16] chapter 10.3.
- If the Public-Identity AVP contains a Tel URI in E.164 format, the HSS and SLF shall remove visual separators and remove all URI parameters.

When a command contains a ServiceData XML element with or without content (i.e. <ServiceData></ServiceData>), the Service Data element is defined as present in the clauses 6.1 to 6.4.

Unknown permanent failure error codes shall be treated in the same way as DIAMETER_UNABLE_TO_COMPLY. For unknown transient failure error codes the request may be repeated, or handled in the same way as DIAMETER_UNABLE_TO_COMPLY.

6.1 User data handling procedures

6.1.1 Data read (Sh-Pull)

This procedure is used between the AS and the HSS. The procedure is invoked by the AS and is used:

- To read transparent and/or non-transparent data for a specified user from the HSS.

This procedure is mapped to the commands User-Data-Request/Answer in the Diameter application specified in 3GPP TS 29.329 [5]. Tables 6.1.1.1 and 6.1.1.2 detail the involved information elements.

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Table 6.1.1.1: Sh-Pull

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Information element name	Mapping to Diameter AVP	Cat.	Description
User Identity (See 7.1)	User-Identity	M	IMS Public User Identity, Public Service Identity, MSISDN or External Identifier of the user for whom the data is required. See clause 7.1 for the content of this AVP.
Wildcarded PSI (See 7.1A)	Wildcarded-Public-Identity	O	If the request refers to a Wildcarded PSI, the AS may include the corresponding Wildcarded PSI in this information element. If this information element is present, it should be used by the HSS to identify the identity affected by the request. If that is the case, the terms User Identity or Public Service Identity in the detailed behaviour refer to the Wildcarded PSI. If this information element is present, Wildcarded Public User Identity shall not be present.
Wildcarded Public User Identity (See 7.1B)	Wildcarded-IMPU	O	If the request refers to a Wildcarded Public User Identity, the AS may include the corresponding Wildcarded Public User Identity in this information element. If this information element is present, it should be used by the HSS to identify the identity affected by the request. If that is the case, the terms User Identity or Public User Identity in the detailed behaviour refer to the Wildcarded Public User Identity. If this information element is present, Wildcarded PSI shall not be present.
Requested data (See 7.3)	Data-Reference	M	This information element indicates the reference to the requested information. The set of valid reference values are defined in 7.6.
Requested Identity set (See 7.11)	Identity-Set	O	If Data-Reference indicates that IMS Public Identities is the requested data set to be downloaded, this information element should be included and it indicates the information to be downloaded. See clause 7.6.2.
Requested domain (See 7.2)	Requested-Domain	C	This information element indicates the domain to which the operation is applicable. Check table 7.6.1 to see when it is applicable.
Requested nodes (See 7.2A)	Requested-Nodes	O	This information element indicates the Node Types to which the operation is applicable. Check table 7.6.1 to see when it is applicable.
Current Location (See 7.8)	Current-Location	C	This information element indicates whether an active location retrieval has to be initiated or not. It shall be present if Location Information is requested. If this information element takes the value InitiateActiveLocationRetrieval (1) the HSS shall indicate to the MSC/VLR and/or SGSN and/or MME the need to initiate an active location retrieval. Check table 7.6.1 to see when it is applicable.
Service Indication (See 7.4)	Service-Indication	C	IE that identifies, together with the User Identity included in the User-Identity AVP and Data-Reference, the set of service related transparent data that is being requested. Check table 7.6.1 to see when it is applicable.
Application Server Identity (See 7.9)	Origin-Host	M	IE that identifies the AS originator of the request and that is used to check the AS permission list.
Application Server Name (See 7.10)	Server-Name	C	IE that is used, together with the User Identity included in the User-Identity AVP and Data-Reference, as key to identify the filter criteria. Check table 7.6.1 to see when it is applicable.
DSAI Tag (See 7.14)	DSAI-Tag	C	IE that is used, together with the User Identity included in the User-Identity AVP and Data-Reference, as key to identify the instance of Dynamic Service Activation Info (DSAI) requested. Check table 7.6.1 to see when it is applicable.
Session Priority (see 7.15)	Session-Priority	O	This information element, if present, shall indicate the session's priority to the HSS.
Private Identity (see 7.6.19)	User-Name	C	Private Identity of the user for whom the data is required. Check table 7.6.1 to see when it is applicable.
Serving Node Indication (See 7.2B)	Serving-Node-Indication	O	This information element shall indicate that only the serving node address/identity associated to the location data is required. Check table 7.6.1 to see when it is applicable.