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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
IP Multimedia Subsystem (IMS) Sh interface;
Signalling flows and message contents
(3GPP TS 29.328 version 5.14.0 Release 5)**



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1 Scope

This 3GPP Technical Specification (TS) specifies 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.

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 interface.

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".
- [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] IETF RFC 3588 "Diameter Base Protocol"
- [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 2806: "URLs for Telephone Calls"
- [18] 3GPP TS 23.012: "Location Management Procedures"
- [19] ANSI X3.4: "Coded Character Set - 7-bit American Standard Code for Information Interchange"

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
CSCF	Call Session Control Function
C	Conditional
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
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] and 3GPP TS 23.218 [4].

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.

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

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.

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 IMS Subscription 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.

Table 6.1.1.1: Sh-Pull

Information element name	Mapping to Diameter AVP	Cat.	Description
User Identity (See 7.1)	User-Identity	M	IMS Public User Identity or MSISDN of the user for whom the data is required. See section 7.1 for the content of this AVP.
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 domain (See 7.2)	Requested-Domain	C	This information element indicates the domains 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 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 Public 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	Server-Name	C	IE that is used, together with the IMS Public 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.

Table 6.1.1.2: Sh-Pull Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.5)	Result-Code / Experimental-Result	M	Result of the request. Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Sh errors. This is a grouped AVP which contains the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.
Data (See 7.6)	User-Data	O	Requested data. This element shall be present if the requested data exists in the HSS and the AS has permissions to read it.

6.1.1.1 Detailed behaviour

The conditions for the inclusion of Requested-Domain as an additional key to the requested data are described in table 7.6.1. If repository data is requested, Service-Indication shall be present in the request. If initial filter criteria are requested, the Server-Name AVP shall contain the SIP URL of the AS that initiates the request; requests for initial filter criteria are limited to those initial filter criteria which are relevant to the requesting AS.

Upon reception of the Sh-Pull request, the HSS shall, in the following order:

1. Check that the AS sending the request (identified by the Origin-Host AVP) has Sh-Pull permission in the AS Permissions List (See 6.2). If not, Experimental-Result-Code shall be set to DIAMETER_ERROR_OPERATION_NOT_ALLOWED in the Sh-Pull Response.
2. Check that the User Identity exists in HSS. If not, Experimental-Result-Code shall be set to DIAMETER_ERROR_USER_UNKNOWN in the Sh-Pull Response.
3. Check that the requested data is allowed to be read by the AS.
 - If the data referenced in the request is not allowed to be read, Experimental-Result Code shall be set to DIAMETER_ERROR_USER_DATA_CANNOT_BE_READ in the Sh-Pull Response.
4. Check whether or not the data that is requested to be downloaded by the AS is currently being updated by another entity. If there is an update of the data in progress, the HSS shall delay the Sh-Pull-Resp message until the update has been completed.

If there is an error in any of the above steps then the HSS shall stop processing and shall return the error code specified in the respective step (see 3GPP TS 29.329 [5] and 3GPP TS 29.229 [7] for an explanation of the error codes). Otherwise, the requested operation shall take place and the HSS shall return the Result-Code AVP set to DIAMETER_SUCCESS. Result-Code DIAMETER_SUCCESS is used also if the requested data does not exist in the HSS.

6.1.2 Data Update (Sh-Update)

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

- To allow the AS to update the transparent (repository) data stored at the HSS for each IMS Public User Identity.

This procedure is mapped to the commands Profile-Update-Request/Answer in the Diameter application specified in 3GPP TS 29.329 [5]. Tables 6.1.2.1 and 6.1.2.2 detail the involved information elements.

Table 6.1.2.1: Sh-Update

Information element name	Mapping to Diameter AVP	Cat.	Description
User Identity (See 7.1)	User-Identity	M	IMS Public User Identity for which data is updated. See section 7.1 for the content of this AVP.
Requested data (See 7.3)	Data-Reference	M	This information element includes the reference to the data on which updates are required (possible values of the Data Reference are defined in Table 7.6.1)
Data (See 7.6)	User-Data	M	Updated data.
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.

Table 6.1.2.2: Sh-Update Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.5)	Result-Code / Experimental-Result	M	Result of the update of data in the HSS. Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Sh errors. This is a grouped AVP which contains the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.

6.1.2.1 Detailed behaviour

Within the Sh-Update Request, the keys to determine the updated data are part of the information element Data (See 7.6). When data in the repository is updated (i.e. added, modified or removed) Service-Indication and Sequence-Number are also sent as part of the information element Data.

Newly added transparent data shall be associated with a Sequence Number of 0 in the Sh-Update Request. Sequence Number value 0 is reserved exclusively for indication of newly added transparent data.

Modified and removed transparent data shall be associated within the Sh-Update Request with a Sequence Number of $n+1$ where n is the original Sequence Number associated with the transparent data before modification or removal. If n equals 65535, then the next modification or deletion of that transparent data shall be associated with a Sequence Number of 1.

Upon reception of the Sh-Update request, the HSS shall, in the following order:

1. Check that the AS sending the request (identified by the Origin-Host AVP) has Sh-Update permission in the AS Permissions List (See 6.2). If the AS does not have Sh-Update permission, Experimental-Result-Code shall be set to `DIAMETER_ERROR_OPERATION_NOT_ALLOWED` in the Sh-Update Response.
2. Check that the IMS Public User Identity for which data is asked to be updated exists in the HSS. If not, Experimental-Result-Code shall be set to `DIAMETER_ERROR_USER_UNKNOWN` in the Sh-Update Response.
3. Check that the user data that is requested to be updated by the AS, is allowed to be updated. If the data is not allowed to be updated, Experimental-Result Code shall be set to `DIAMETER_ERROR_USER_DATA_CANNOT_BE_MODIFIED` in the Sh-Update Response.
4. Check whether or not the data that is requested to be updated by the AS, as identified by the Service-Indication, is currently being updated by another entity. If there is an update of the data in progress, Experimental-Result Code shall be set to `DIAMETER_PRIOR_UPDATE_IN_PROGRESS` in the Sh-Update Response.
5. Check whether or not there is any repository data stored at the HSS already for the specified Service-Indication and the associated IMS Public User Identity.
 - If repository data identified by the Service-Indication is stored at the HSS for the specified IMS Public User Identity, check the following premises:
 1. `Sequence_Number_in_Sh_Update` is not equal to 0
 2. $(\text{Sequence_Number_in_Sh_Update} - 1)$ is equal to $(\text{Sequence_Number_In_HSS} \bmod 65535)$
 - If either of the above premises is false then Experimental-Result-Code shall be set to `DIAMETER_ERROR_TRANSPARENT_DATA_OUT_OF_SYNC` in the Sh-Update Response.
 - If both of the above premises are true, then check whether or not Service Data is received within the Sh-Update Req.
 - If Service Data is included in the Sh-Update Req, check whether or not the size of the data is greater than that which the HSS is prepared to accept.
 - If there is more data than the HSS is prepared to accept then Experimental-Result-Code shall be set to `DIAMETER_ERROR_TOO_MUCH_DATA` and the new data shall be discarded.
 - If the HSS is prepared to accept the data, then the repository data stored at the HSS shall be updated with the repository data sent in the Sh-Update Req and the Sequence Number associated with that repository data shall be updated with that sent in the Sh-Update Req. This triggers the sending of Sh-Notif messages to any other ASs that are subscribed to Notifications for updates to the service data for that IMS Public User Identity (see 6.1.4).
 - If Service Data is not received, the data stored in the repository at the HSS shall be removed, and as a consequence the Service Indication and the Sequence Number associated with the removed data shall also be removed. This triggers the sending of Sh-Notif messages to any other ASs that are subscribed to Notifications for updates to the service data for that IMS Public User Identity (see 6.1.4). After sending Sh-Notif messages, the subscriptions to Notifications for the removed Repository Data shall be deleted.

- If repository data identified by the Service-Indication is not stored for the IMS Public User Identity i.e. the Sh-Update Req intends to create a new repository data, check whether or not the Sequence Number in the Sh-Update Req is 0.
 - If the sequence number is not set to 0, Experimental-Result Code shall be set to `DIAMETER_ERROR_TRANSPARENT_DATA_OUT_OF_SYNC`
 - If the sequence number is set to 0 check whether Service Data is included within the Sh-Update Req.
 - If Service Data is not included in the Sh-Update Req, then Experimental-Result-Code shall be set to `DIAMETER_ERROR_OPERATION_NOT_ALLOWED` and the operation shall be ignored by the HSS.
 - If Service Data is included in the Sh-Update Req, check whether or not the size of the data is greater than that which the HSS is prepared to accept. If there is more data than the HSS is prepared to accept then Experimental-Result-Code shall be set to `DIAMETER_ERROR_TOO_MUCH_DATA` and the new data shall be discarded.
 - If the HSS is prepared to accept the data included in the Sh-Update Req, then the data shall be stored in within the data repository in the HSS.

If there is an error in any of the above steps then the HSS shall stop processing and shall return the error code specified in the respective step (see 3GPP TS 29.329 [5] and 3GPP TS 29.229 [7] for an explanation of the error codes). Otherwise, the requested operation shall take place and the HSS shall return the Result-Code AVP set to `DIAMETER_SUCCESS`.

NOTE: When an AS receives `DIAMETER_ERROR_TRANSPARENT_DATA_OUT_OF_SYNC` the AS may attempt to resolve the inconsistency between the version of the repository data that it holds and that stored at the HSS. It may execute a Sh-Pull to retrieve the current version of the data from the HSS or it may wait to receive a subsequent Sh-Notif message from the HSS for the affected repository data.

6.1.3 Subscription to notifications (Sh-Subs-Notif)

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

- To subscribe to Notifications for when particular transparent and/or non-transparent data for a specified IMS Public User Identity is updated, from the HSS.

This procedure is mapped to the commands `Subscribe-Notifications-Request/Answer` in the Diameter application specified in 3GPP TS 29.329 [5]. Tables 6.1.3.1 and 6.1.3.2 detail the information elements involved.

Table 6.1.3.1: Sh-Subs-Notif

Information element name	Mapping to Diameter AVP	Cat.	Description
User Identity (See 7.1)	User-Identity	M	IMS public identity for which notifications of data changes are requested. See section 7.1 for the content of this AVP.
Requested data (See 7.3)	Data-Reference	M	This information element includes the reference to the data on which notifications of change are required (valid reference values are defined in 7.6).
Subscription request type (See 7.7)	Subs-Req-Type	M	This information element indicates the action requested on subscription to notifications.
Service Indication (See 7.4)	Service-Indication	C	IE that identifies, together with the IMS Public User Identity and Data-Reference, the set of service related transparent data for which notifications of changes are requested. This element shall be present when the Data-Reference value is RepositoryData (0).
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	Server-Name	C	IE that is used, together with the IMS Public User Identity and Data-Reference, as key to identify the filter criteria. This element shall be present when the Data-Reference value is InitialFilterCriteria (13).

Table 6.1.3.2: Sh-Subs-Notif Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Data request result (See 7.5)	Result-Code / Experimental-Result	M	Result of the request. Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Sh errors. This is a grouped AVP which contains the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.

6.1.3.1 Detailed behaviour

The HSS shall take note of the subscription request on the data identified by IMS Public User Identity and Data-Reference. If notifications on changes of repository data are requested, Service-Indication shall be present in the request. If notifications on changes of filter criteria are requested, the Server-Name AVP shall be used as key to the filter criteria. The Server-Name AVP shall contain the SIP URL of the AS sending the request.

Upon reception of the Sh-Subs-Notif request, the HSS shall, in the following order (if there is an error in any of the following steps the HSS shall stop processing and return the corresponding error code, see 3GPP TS 29.329 [5] and 3GPP TS 29.229 [7]):

1. Check that the IMS Public User Identity for which notifications are asked exists in HSS. If not, Experimental-Result Code shall be set to DIAMETER_ERROR_USER_UNKNOWN in the Sh-Subs-Notif Response.
2. Check that the AS sending the request (identified by the Origin-Host AVP) has Sh-Subs-Notif permission in the AS Permissions List (See 6.2). If the AS does not have Sh-Subs-Notif permission, Experimental-Result Code shall be set to DIAMETER_ERROR_OPERATION_NOT_ALLOWED in the Sh-Subs-Notif Response.

3. Check that Notifications are allowed for the requested data (see table 7.6). If the Notifications of changes in the data referenced in the request are not allowed, Experimental-Result Code shall be set to DIAMETER_ERROR_USER_DATA_CANNOT_BE_NOTIFIED in the Sh-Subs-Notif Response.
4. Associate the Application Server Identity with the list of entities that need to be notified when the data identified by Data-Reference is modified and set the Result-Code to DIAMETER_SUCCESS in the Sh-Subs-Notify response.

6.1.4 Notifications (Sh-Notif)

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

- To inform the AS of changes in transparent and/or non-transparent data to which the AS has previously subscribed to receive Notifications for, using Sh-Subs-Notif (see 6.1.3).

This procedure is mapped to the commands Push-Notification-Request/Answer in the Diameter application specified in 3GPP TS 29.329 [5]. Tables 6.1.4.1 and 6.1.4.2 detail the involved information elements.

Table 6.1.4.1: Sh-Notif

Information element name	Mapping to Diameter AVP	Cat.	Description
User Identity (See 7.1)	User-Identity	M	IMS Public User Identity for which data has changed. See section 7.1 for the content of this AVP.
Data (See 7.6)	User-Data	M	Changed data.

Table 6.1.4.2: Sh-Notif Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Data request result (See 7.5)	Result-Code / Experimental-Result	M	Result of the request. Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Sh errors. This is a grouped AVP which contains the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.

6.1.4.1 Detailed behaviour

The keys to the updated data are part of the information element User-Data (See Annex C). When data repository is updated Service-Indication is also part of the information element User-Data.

Removal of the subscribed data is indicated with the content of User-Data AVP. The content shall be compliant with the XML-schema defined in Annex D. Removed repository data shall be indicated with RepositoryData element that does not contain ServiceData element. Removed S-CSCF name shall be indicated with empty SCSCFName element. If all iFCs for the user that are relevant for the AS have been removed it shall be indicated with empty IFCs element.

6.2 AS permissions list

The HSS shall maintain a list of AS permissions (the "AS Permissions List"). AS permissions are identified by AS identity and Data Reference (See Table 7.6.1). The possible permissions are Sh-Pull, Sh-Update, Sh-Subs-Notif or any combination of these permissions. The permissions apply to all users served by the HSS, they are not user specific. When an AS requests Sh-Pull, Sh-Update or Sh-Subs-Notif the HSS shall check permissions and return an error result if the AS does not have the required permission.

7 Information element contents

7.1 User Identity

This information element contains a user identity according to the conditions described in table 7.1.1.

Table 7.1.1: User Identity content

Information element name	Mapping to Diameter AVP	Cat.	Description
IMS Public User Identity (See 7.1.1)	Public-Identity	C	IMS Public User Identity for which data is required. If the MSISDN is not included in the User-Identity AVP, the Public-Identity AVP shall be included in Sh messages only for allowed Data References as described in Table 7.6.1.
MSISDN (See 7.1.2)	MSISDN	C	MSISDN for which data is required. If the Public-Identity AVP is not included in the User-Identity AVP, the MSISDN AVP shall be included in the Sh-Pull message only for allowed Data References as described in Table 7.6.1.

7.1.1 IMS Public User Identity

This information element contains an IMS Public User Identity (either SIP-URI or TEL-URL).

7.1.2 MSISDN

This information element contains a Basic MSISDN (see 3GPP TS 23.012 [18]).

7.2 Requested Domain

This information element details the access domains for which certain data (e.g. user state, location information) are requested. See 3GPP TS 29.329 [5] for the list of possible values.

7.3 Requested Data

- Reference to the data that an AS is requesting from the HSS.
- Reference to the data which, an AS wants to be notified of, when changed.
- Reference to data for which subscription to notification of change is rejected.

See chapter 7.6.

7.4 Service Indication

Identifier of one set of service related transparent data, which is stored in an HSS in an operator network per Public Identity. The HSS shall allocate memory space for a data repository to store transparent data per IMS Public User Identity or Public Service Identity and value of Service Indication.

7.5 Result

This information element contains the result code of the operation. See 3GPP TS 29.329 [5] for the list of possible values.

7.6 Data

This information element contains an XML document conformant to the XML schema defined in Annex D.

Annex C specifies the UML logical model of the data downloaded via the Sh interface.

Table 7.6.1 defines the data reference values and tags, access key and recommended access rights for the the operation(s) on data accessible via the Sh interface, i.e. the listed operation(s) in the Operations column are the only ones allowed to be used with this Data Ref value. It is a matter of operator policy to further restrict the access rights defined in table 7.6.1.

Table 7.6.1: Data accessible via Sh interface

Data Ref.	XML tag	Defined in	Access key	Operations
0	RepositoryData	7.6.1	IMS Public User Identity + Data-Reference + Service-Indication	Sh-Pull, Sh-Update, Sh-Subs-Notif
10	IMSPublicIdentity	7.6.2	IMS Public User Identity or MSISDN + Data-Reference	Sh-Pull
11	IMSUserState	7.6.3	IMS Public User Identity + Data-Reference	Sh-Pull, Sh-Subs-Notif
12	S-CSCFName	7.6.4		Sh-Pull, Sh-Subs-Notif
13	InitialFilterCriteria	7.6.5	IMS Public User Identity + Data-Reference + Server-Name	Sh-Pull, Sh-Subs-Notif
14	LocationInformation	7.6.6	MSISDN + Data-Reference+ Requested-Domain	Sh-Pull
15	UserState	7.6.7		
16	Charging information	7.6.8	IMS Public User Identity or MSISDN + Data-Reference	Sh-Pull
17	MSISDN	7.6.9		Sh-Pull

7.6.1 Repository Data

This information element contains transparent data. A data repository may be shared by more than one AS implementing the same service.

7.6.2 IMSPublicIdentity

This information element contains an IMS public identity that would be either:

- associated with the Private Identity of the subscriber for whom the IMS Public Identity is included in the request or
- associated with the MSISDN present in the request.

Multiple instances of this information element may be included in the message.

7.6.3 IMS User State

This information element contains the IMS User State of the public identifier referenced. Its possible values are:

- REGISTERED,
- NOT_REGISTERED,
- AUTHENTICATION_PENDING,
- REGISTERED_UNREG_SERVICES.

7.6.4 S-CSCF Name

This information element contains the name of the S-CSCF where a multimedia public identity is registered.

7.6.5 Initial Filter Criteria

This information element contains the triggering information for a service.

For a more detailed description, refer to 3GPP TS 23.218 [4] and 3GPP TS 29.228 [6].

7.6.6 Location Information

This information element contains the location of the served subscriber in the MSC/VLR if the requested domain is CS, or the location of the served subscriber in the SGSN if the requested domain is PS. If the HSS has to communicate with the MSC/VLR and/or SGSN to retrieve location information, it shall make use of the service MAP-PROVIDE-SUBSCRIBER-INFO.

For both Location Information for CS and Location Information for GPRS, the considerations described in 3GPP TS 23.078 [14] apply.

7.6.6.1 Location information for CS

This information element consists of the following subordinate information elements:

- Location number: defined in ITU-T Recommendation Q.763 [9]. Considerations described in 3GPP TS 23.018 apply [10].
- Service area ID: defined in 3GPP TS 23.003 [11].
- Global Cell ID: defined in 3GPP TS 23.003 [11].
- Location area ID: defined in 3GPP TS 23.003 [11].
- Geographical Information: defined in 3GPP TS 23.032 [12]. Considerations described in 3GPP TS 23.018 [10] and 3GPP TS 29.002 [13] apply.
- Geodetic Information: defined in ITU-T Recommendation Q.763 [9]. Considerations described in 3GPP TS 23.018 [10] and 3GPP TS 29.002 [13] apply.
- VLR Number: defined in 3GPP TS 23.003 [11].
- MSC Number: defined in 3GPP TS 23.003 [11].
- Age of location information: defined in 3GPP TS 23.018 [10].
- Current Location Retrieved: shall be present when location information was obtained after a successful paging procedure for Active Location Retrieval.

7.6.6.2 Location information for GPRS

This information element consists of the following subordinate information elements:

- Service area ID: defined in 3GPP TS 23.003 [11].
- Global Cell ID: defined in 3GPP TS 23.003 [11].
- Location area ID: defined in 3GPP TS 23.003 [11].
- Geographical Information: defined in 3GPP TS 23.032 [12]. Considerations described in 3GPP TS 23.018 [10] and 3GPP TS 29.002 [13] apply.
- Geodetic Information: defined in ITU-T Recommendation Q.763 [9]. Considerations described in 3GPP TS 23.018 [10] and 3GPP TS 29.002 [13] apply.

- SGSN Number: defined in 3GPP TS 23.003 [11].
- Routing Area ID: defined in 3GPP TS 23.003 [11].
- Current Location Retrieved: shall be present when location information was obtained after a successful paging procedure for Active Location Retrieval.

7.6.7 User state

This information element indicates the state of the user in the domain indicated by the Requested-Domain (see 7.2), with the values specified in 3GPP TS 23.078 [14] for Subscriber State and PS Domain Subscriber State. The HSS shall make use of the operation MAP-PROVIDE-SUBSCRIBER-INFO towards the MSC/VLR and/or the SGSN to obtain this information.

7.6.8 Charging information

This information element contains the addresses of the charging functions (primary event charging function name, secondary event charging function name, primary charging collection function name, secondary charging collection function name). When a clash occurs between the charging function address(es) received over the ISC interface and those received over the Sh interface, the address(es) received over the ISC interface should take precedence.

NOTE: The use of the Sh interface to retrieve charging function addresses is not intended as a general-purpose alternative to receiving charging function addresses from the ISC interfaces. Rather, it is meant to address a special case where the AS needs to interact with the charging system before initiating a request to a user when the AS has not received the third party REGISTER for that user.

7.6.9 MSISDN

This information element contains an MSISDN that is associated with the User Identity (Public Identity or MSISDN) present in the request. All valid instances of this information element shall be included in the message.

7.7 Subscription request type

This information element indicates the action requested for subscription to notifications. See 3GPP TS 29.329 [5] for the list of valid values.

7.8 Current Location

This information element indicates whether an active location retrieval has to be initiated or not when an AS requested location information. See 3GPP TS 29.329 [5] for the list of possible values.

7.9 Application Server Identity

This information element contains the identity of the Application Server. It is used for the AS permission check (see 6.2).

7.10 Application Server Name

This information element indicates application server's SIP URI. See 3GPP TS 29.229 [7] for the detailed definition of the AVP.

8 Protocol version identification

See 3GPP TS 29.329 [5].

9 Operational Aspects

See 3GPP TS 29.329 [5].

Annex A (normative): Mapping of Sh operations and terminology to Diameter

A.1 Introduction

This appendix gives mappings from Sh to Diameter protocol elements. Diameter protocol elements are defined in 3GPP TS 29.329 [5].

A.2 Sh message to Diameter command mapping

The following table defines the mapping between stage 2 operations and Diameter commands:

Table A.2.1: Sh message to Diameter command mapping

Sh message	Source	Destination	Command-Name	Abbreviation
Sh-Pull	AS	HSS	User-Data-Request	UDR
Sh-Pull Resp	HSS	AS	User-Data-Answer	UDA
Sh-Update	AS	HSS	Profile-Update-Request	PUR
Sh-Update Resp	HSS	AS	Profile-Update-Answer	PUA
Sh-Subs-Notif	AS	HSS	Subscribe-Notifications-Request	SNR
Sh-Subs-Notif Resp	HSS	AS	Subscribe-Notifications-Answer	SNA
Sh-Notif	HSS	AS	Push-Notification-Request	PNR
Sh-Notif Resp	AS	HSS	Push-Notification-Answer	PNA

A.3 Void

Annex B (informative): Message flow

B.1 Message flows

The following message flows give examples regarding which Diameter messages shall be sent in scenarios described in 3GPP TS 23.218 [4].

B.1.1 Data Update, Registration, Notification Subscription.

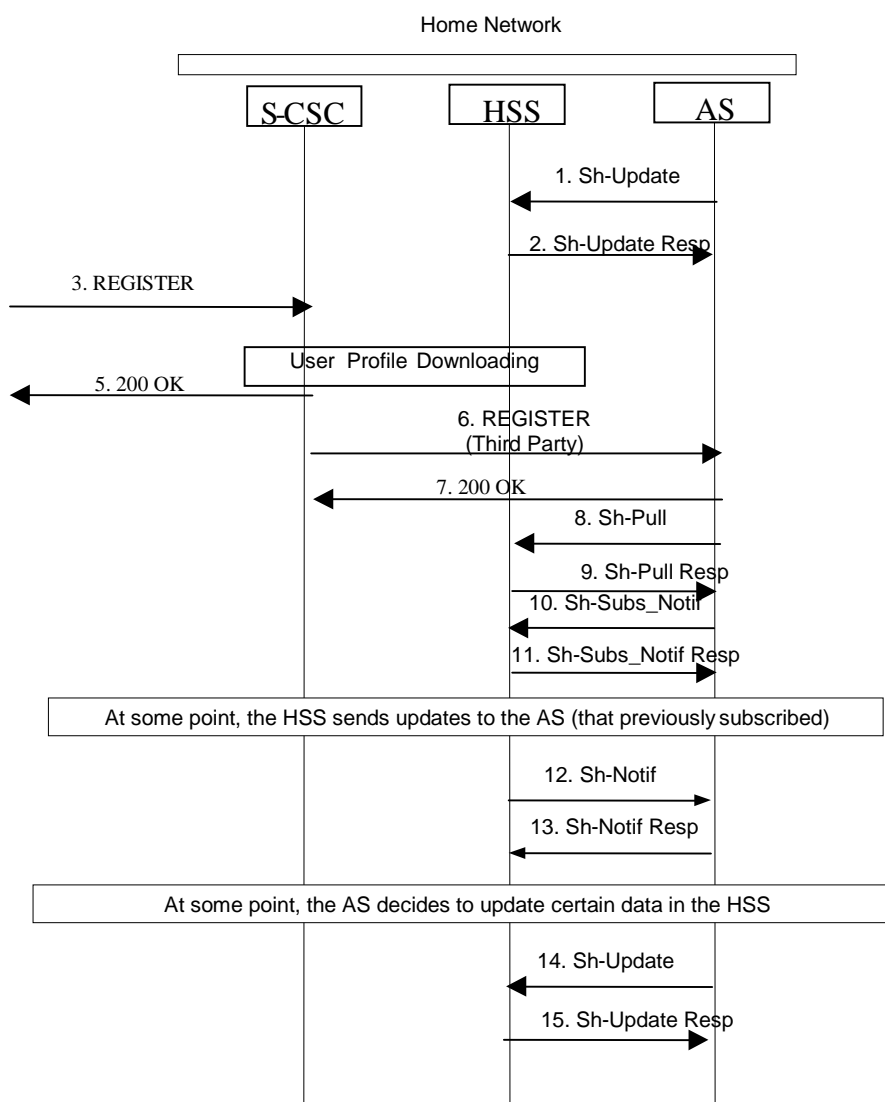


Figure B.1.1: Data Update, Registration, Notification Subscription

1. A user subscribes to a new service. The operator provisions the service in an AS. The AS stores some service data for a user in the HSS, Sh-Update (user identity, updated data) e.g. repository data.
2. HSS confirms the data is updated
3. Some time later, user registers with the network
4. S-CSCF downloads the data from the HSS (during the procedure S-CSCF Registration Notification on Cx interface). Filter criteria specify that the AS wants to be notified that the end user is registered.

5. 200 OK
6. S-CSCF sends third party registration message to the application server to notify that user is registered.
7. 200 OK
8. The AS downloads data needed for providing service from HSS, by means of Sh-Pull (user identity, requested data, and service information).
9. HSS sends data to AS
10. The AS subscribes to notifications from the HSS of changes in data, by means of Sh-Subs-Notif (user identity, requested data, and/or service information).
11. The HSS confirms the subscription request.
12. At some moment, user data is updated in the HSS. As the AS subscribed to notifications (step 10), the HSS sends to the AS the requested updates, by means of Sh-Notif (user identity, updated data).
13. The AS acknowledges the notification.
14. At some moment, the AS decides to update user"s service data e.g. repository data in the HSS, by means of Cx-Update (user identity, updated data).
15. The HSS confirms the service data is updated.

Annex C (informative): UML model of the data downloaded over Sh i/f

The purpose of this UML model is to define in an abstract level the structure of the data downloaded over the Sh interface and describe the purpose of the different information classes included in it.

C.1 General description

The following picture gives an outline of the UML model of the user profile, which is exchanged between the HSS and an AS:

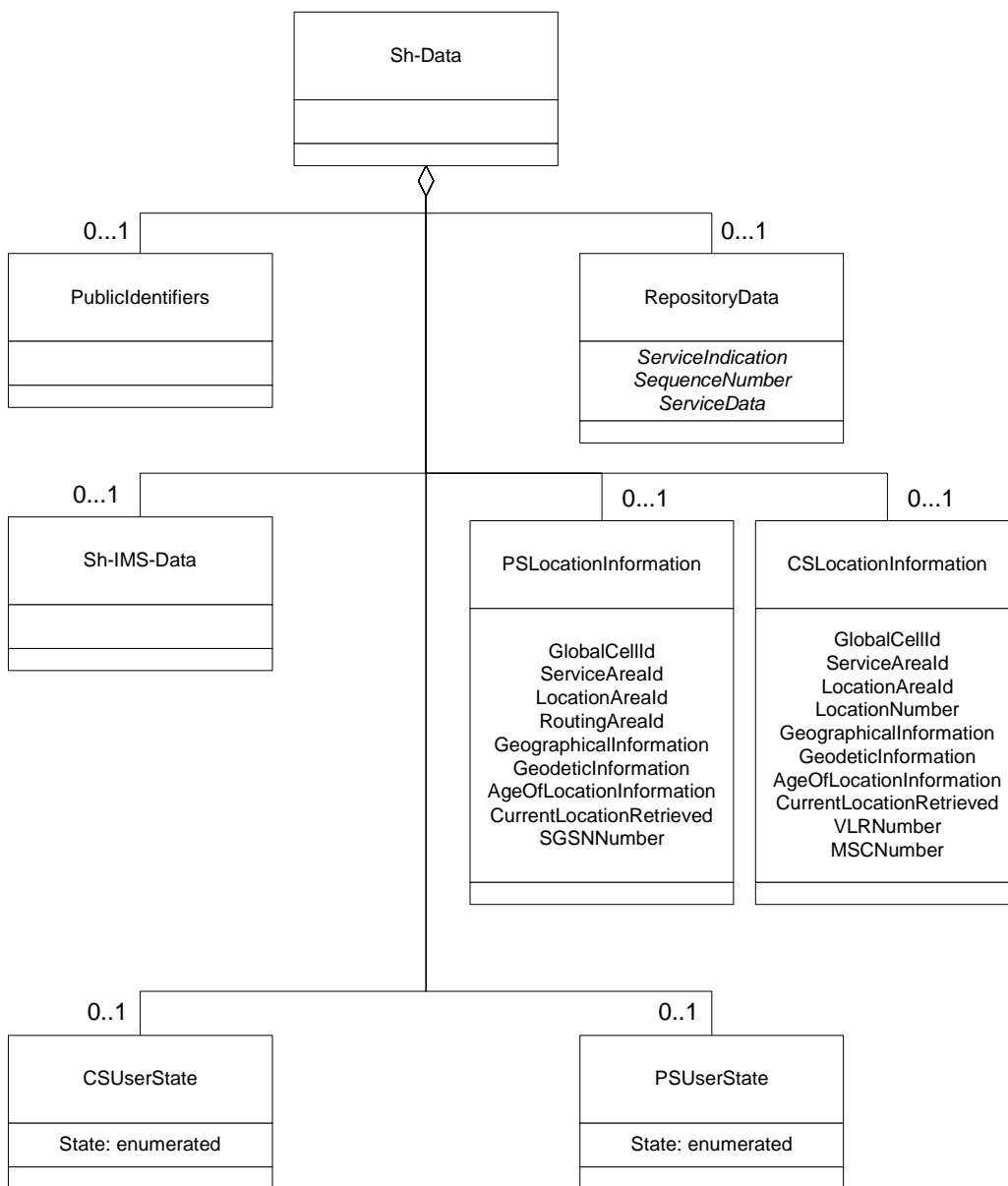


Figure C.1.1: Sh-Data

Each instance of the Sh-Data class contains 0 or 1 instance of the class PublicIdentifiers, 0 or 1 instance of the class Repository, 0 or 1 instance of the class Sh-IMS-Data, 0 or 1 instance of the class CSUserState, 0 or 1 instance of the class PSUserState and/or 0 or 1 instance of the class CSLocationInformation or 0 or 1 instance of the class PSLocationInformation.

Class RepositoryData contains repository data (transparent data) for a given service. It has attributes ServiceIndication, SequenceNumber and ServiceData.

Class CSUserState contains the state of a user in the CS domain. Its only attribute, State, is an enumeration whose possible values are defined in chapter 7.6.7.

Class PSUserState contains the state of a user in the PS domain. Its only attribute, State, is an enumeration whose possible values are defined in chapter 7.6.7.

NOTE: the fact that attribute State is an enumeration is a difference from what can be carried in the MAP protocol.

Class CSLocationInformation has the attributes Location Number, Service Area ID, GlobalCellId, LocationAreaId, GeographicalInformation, GeodeticInformation, VLR Number, MSC Number, AgeOfLocationInformation and CurrentLocationRetrieved. They are defined in 7.6.

Class PSLocationInformation has the attributes ServiceAreaId, GlobalCellId, LocationAreaID, RoutingAreaID, GeographicalInformation, GeodeticInformation, SGSN Number, AgeOfLocationInformation and CurrentLocationRetrieved. They are defined in 7.6.

C.2 PublicIdentifiers

The following picture details the UML model of the class PublicIdentifiers:

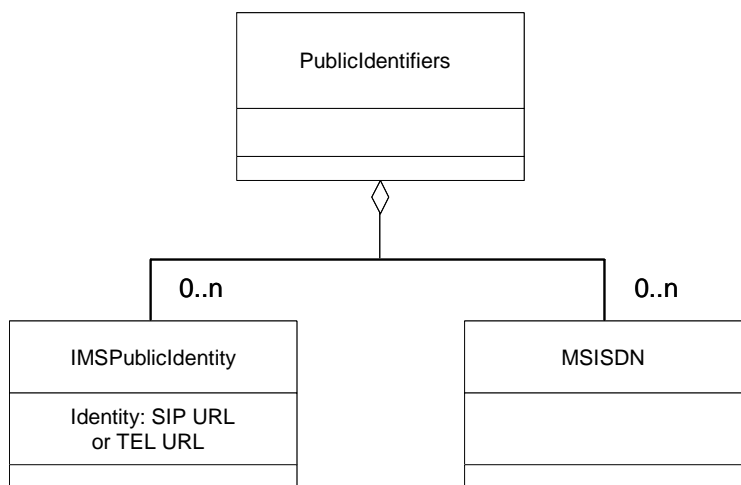


Figure C.2.1: The UML model of the class PublicIdentifiers

Class PublicIdentifiers contains 0 to n user public identities which may be either of class IMSPublicIdentity or of class MSISDN. The identifiers are of format SIP URL, TEL URL or MSISDN.

C.3 Sh-IMS-Data

The following picture details the UML model of the class Sh-IMS-Data.

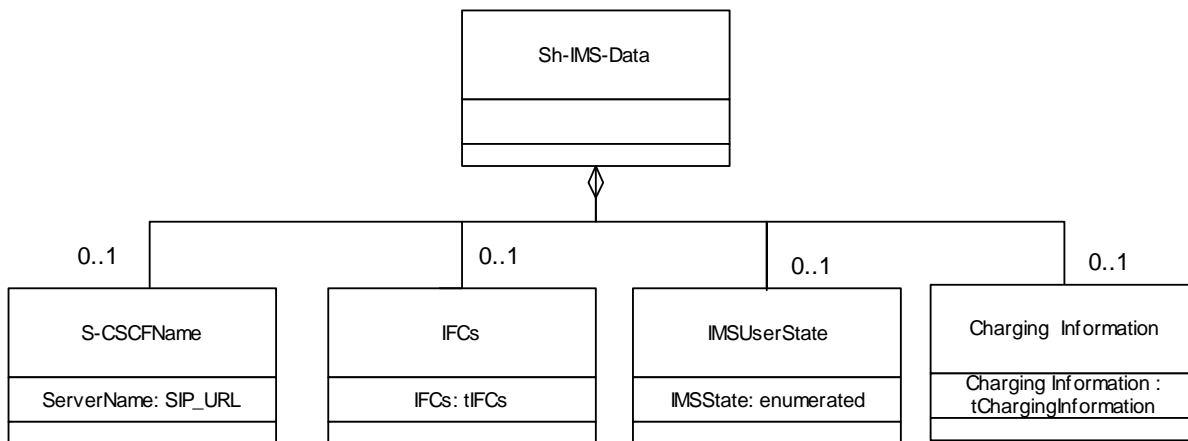


Figure C.3.1: Sh-IMS-Data

Each instance of the class Sh-IMS-Data contains 0 or 1 instance of the class S-CSCFName, 0 to n instances of the class InitialFilterCriteria, 0 or 1 instance of the class IMSUserState, and/or 0 or 1 instance of the class ChargingInformation.

Class S-CSCFName contains the SIP URL of the S-CSCF where the multimedia public identity that the AS included in the request is registered.

Class IFCs contains 0 to n instances of the initial filter criteria of the multimedia public identity that the AS included in the request. The initial filter criteria is defined in 3GPP TS 29.228 [6].

Class IMSUserState contains the registration state of the identity given by the attribute of class Sh-IMS-Data. See chapter 7.6 for possible values.

Class Charging Information contains the online and offline charging function addresses. See chapter 7.6 for possible values.

Annex D (normative): XML schema for the Sh interface user profile

The file ShDataType.xsd, attached to this specification, contains the XML schema for the Sh interface user profile. Such XML schema details all the data types on which XML documents containing Sh profile information shall be based. The XML schema file is intended to be used by an XML parser.

Tables D.1 and D.2 describe the data types and the dependencies among them that configure the XML schema.

Table D.1: XML schema for Sh interface: simple data types

Data type	Tag	Base type	Comments
tPriority	Priority	integer	>= 0
tProfilePartIndicator	ProfilePartIndicator	enumerated	Possible values: 0 (REGISTERED) 1 (UNREGISTERED)
tGroupID	Group	integer	>= 0
tDefaultHandling	DefaultHandling	enumerated	Possible values: 0 (SESSION_CONTINUED) 1 (SESSION_TERMINATED)
tDirectionOfRequest	SessionCase	enumerated	Possible values: 0 (ORIGINATING_SESSION) 1 TERMINATING_SESSION 2 (TERMINATING_UNREGISTERED)
tIMSUserState	IMSUserState	Enumerated	Possible values: 0 (NOT_REGISTERED) 1 (REGISTERED) 2 (REGISTERED_UNREG_SERVICES) 3 (AUTHENTICATION_PENDING)
tCSUserState	CSUserState	Enumerated	Possible values (as defined in 3GPP TS 23.078 [14]): 0 (CAMELBusy) 1 (NetworkDeterminedNotReachable) 2 (AssumedIdle) 3 (NotProvidedfromVLR)
tPSUserState	PSUserState	Enumerated	Possible values (as defined in 3GPP TS 23.078 [14]): 0 (Detached) 1 (AttachedNotReachableForPaging) 2 (AttachedReachableForPaging) 3 (ConnectedNotReachableForPaging) 4 (ConnectedReachableForPaging) 5 (NotProvidedFromSGSN) 6 (NetworkDeterminedNotReachable)
tLocationNumber	LocationNumber	string	Syntax described in ITU-T Q.763 [9] (Base64 encoded according to RFC 2045 [15]). Length >=4 and <=16 (multiples of 4).
tCellGlobalId	CellGlobalId	string	Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]). Length = 12.
tServiceAreaId	ServiceAreaId	string	Syntax described in 3GPP TS 29.002 [13]

			(Base64 encoded according to RFC 2045 [15]). Length = 12.
tLocationAreald	LocationAreald	string	Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]). Length = 8.
tRoutingAreald	RoutingAreald	string	Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]). Length = 8.
tGeographicalInformation	GeographicalInformation	string	Syntax described in 3GPP TS 29.002 (base 64 encoded according to RFC 2045). Length = 12.
tGeodeticInformation	GeodeticInformation	string	Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]). Length = 16.
tAgeOfLocationInformation	AgeOfLocationInformation	integer	>=0, <=32767
tAddressString	AddressString	string	Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]). Length >= 4 and <=28 (multiples of 4).
tMSISDN	MSISDN	string	Number structure described in 3GPP TS 23.003 [11]. ASCII encoded according to ANSI X3.4 [19].
tSIP_URL	PublicIdentity	anyURI	Syntax described in RFC 3261 [16]
tTEL_URL	PublicIdentity	anyURI	Syntax described in RFC 2806 [17]
tDiameterURI	DiameterURI	string	Syntax of a Diameter URI as described in IETF RFC 3588 [8]
tIMSPublicIdentity	IMSPublicIdentity	(union)	Union of tSIP_URL and tTEL_URL
tServiceInfo	ServiceInfo	string	
tString	RequestURI, Method, Header, Content, Line	string	
tBool	ConditionTypeCNF, ConditionNegated	boolean	Possible values: 0 (false) 1 (true)
tSequenceNumber	SequenceNumber	integer	>=0, <=65535

Table D.2: XML schema for Sh interface: complex data types

Data type	Tag	Compound of		
		Tag	Type	Cardinality
tSh-Data	Sh-Data	PublicIdentifiers	tPublicIdentity	0 to 1
		RepositoryData	tTransparentData	0 to 1
		Sh-IMS-Data	tShIMSData	0 to 1
		CSLocationInformation	tCSLocationInformation	0 to 1
		PSLocationInformation	tPSLocationInformation	0 to 1
		CSUserState	tCSUserState	0 to 1
		PSUserState	tPSUserState	0 to 1
tTransparentData	RepositoryData	ServiceIndication	string	1
		SequenceNumber	tSequenceNumber	1
		ServiceData	tServiceData	0 to 1
tServiceData	any	any	any	1
tIFCs	IFCs	InitialFilterCriteria	tInitialFilterCriteria	0 to n
tShIMSData	Sh-IMS-Data	SCSCFName	tSIP_URL	0 to 1
		IFCs	tIFCs	0 to 1
		IMSUserState	tIMSUserState	0 to 1
		ChargingInformation	tChargingInformation	0 to 1
tCSLocationInformation	CSLocationInformation	LocationNumber	tLocationNumber	0 to 1
		CellGlobalId	tCellGlobalId	0 to 1
		ServiceAreaId	tServiceAreaId	0 to 1
		LocationAreaId	tLocationAreaId	0 to 1
		GeographicalInformation	tGeographicalInformation	0 to 1
		GeodeticInformation	tGeodeticInformation	0 to 1
		VLRNumber	tISDNAddress	0 to 1
		MSCNumber	tISDNAddress	0 to 1
		CurrentLocationRetrieved	tBool	0 to 1
		AgeOfLocationInformation	tAgeOfLocationInformation	0 to 1
tPSLocationInformation	PSLocationInformation	CellGlobalId	tCellGlobalId	0 to 1
		ServiceAreaId	tServiceAreaId	0 to 1
		LocationAreaId	tLocationAreaId	0 to 1
		RoutingAreaId	tRoutingAreaId	0 to 1
		GeographicalInformation	tGeographicalInformation	0 to 1
		GeodeticInformation	tGeodeticInformation	0 to 1

		SGSNNumber	tISDNAddress	0 to 1	
		CurrentLocationRetrieved	tBool	0 to 1	
		AgeOfLocationInformation	tAgeOfLocationInformation	0 to 1	
tPublicIdentity	PublicIdentifiers	IMSPublicIdentity	tIMSPublicIdentity	0 to n	
		MSISDN	tMSISDN	0 to n	
tInitialFilterCriteria	InitialFilterCriteria	Priority	tPriority	1	
		TriggerPoint	tTrigger	0 to 1	
		ApplicationServer	tApplicationServer	1	
		ProfilePartIndicator	tProfilePartIndicator	0 to 1	
tTrigger	TriggerPoint	ConditionTypeCNF	tBool	1	
		SPT	tSePoTri	1 to n	
tSePoTri	SPT	ConditionNegated	tBool	0 to 1	
		Group	tGroupID	1 to n	
		Choice of	RequestURI	tString	1
			Method	tString	1
			SIPHeader	tHeader	1
			SessionCase	tDirectionOfRequest	1
			SessionDescription	tSessionDescription	1
tHeader	SIPHeader	Header	tString	1	
		Content	tString	0 to 1	
tSessionDescription	SessionDescription	Line	tString	1	
		Content	tString	0 to 1	
tApplicationServer	ApplicationServer	ServerName	tSIP_URL	1	
		DefaultHandling	tDefaultHandling	0 to 1	
		ServiceInfo	tServiceInfo	0 to 1	
tChargingInformation	ChargingInformation	PrimaryEventChargingFunctionName	tDiameterURI	0 to 1	
		SecondaryEventChargingFunctionName	tDiameterURI	0 to 1	
		PrimaryChargingCollectionFunctionName	tDiameterURI	0 to 1	
		SecondaryChargingCollectionFunctionName	tDiameterURI	0 to 1	

NOTE: 'n' shall be interpreted as non-bounded.

Annex E (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
Jun 2002	CN#16	NP-020277			Version 2.0.0 approved at CN#16	2.0.0	5.0.0
Sep 2002	CN#17	NP-020450	1	1	The Correction of Section 7 Numbering and internal referencing	5.0.0	5.1.0
Sep 2002	CN#17	NP-020450	2	1	Correction of handling of subscriptions to notifications	5.0.0	5.1.0
Sep 2002	CN#17	NP-020450	3	1	Definition of User Location for Sh interface	5.0.0	5.1.0
Sep 2002	CN#17	NP-020450	4	1	Definition of User State for Sh interface	5.0.0	5.1.0
Sep 2002	CN#17	NP-020450	5		Missing references to XML schema for Sh interface	5.0.0	5.1.0
Sep 2002	CN#17	NP-020450	6		Extensibility of XML schema for Sh interface	5.0.0	5.1.0
Dec 2002	CN#18	NP-020592	007	-	Removal of upper bounds in Sh i/f user profile and correction of mistake in XML schema documentation	5.1.0	5.2.0
Dec 2002	CN#18	NP-020593	008	1	Clarification on update of repository data	5.1.0	5.2.0
Dec 2002	CN#18	NP-020593	009	1	Removing the DDF dependencies from Sh interface	5.1.0	5.2.0
Dec 2002	CN#18	NP-020592	013	2	Error handling in HSS when being updated with too much data	5.1.0	5.2.0
Dec 2002	CN#18	NP-020591	014	-	Correction of the SPI	5.1.0	5.2.0
Jan 2003					Restoration of Annex E	5.2.0	5.2.1
Mar 2003	CN#19	NP-030102	012	3	Initial Filter Criteria	5.2.0	5.3.0
Mar 2003	CN#19	NP-030102	015	-	Deletion of Annex E	5.2.0	5.3.0
Mar 2003	CN#19	NP-030102	016	2	Update after Diameter has become RFC	5.2.0	5.3.0
Mar 2003	CN#19	NP-030102	017	1	Correction to application server identity	5.2.0	5.3.0
Mar 2003	CN#19	NP-030102	018	2	Clarification on Sh interface for charging purposes	5.2.0	5.3.0
Mar 2003	CN#19	NP-030101	019	2	Change of SPI to SPT	5.2.0	5.3.0
Apr 2003					ShDataType.xsd - file attached	5.3.0	5.3.1
Apr 2003					Updated ShDataType.xsd - file attached	5.3.1	5.3.2
Jun 2003	CN#20	NP-030216	022	1	Co-ordination of Update of Repository Data	5.3.2	5.4.0
Jun 2003	CN#20	NP-030216	023	1	Enhanced description of Sh-Pull Request and Response	5.3.2	5.4.0
Jun 2003	CN#20	NP-030216	024	2	Enhanced description of Sh-Notif and Sh-Notif-Subs Request and Response	5.3.2	5.4.0
Jun 2003	CN#20	NP-030216	025	2	A range of editorial changes and corrections and additions of references	5.3.2	5.4.0
Jun 2003	CN#20	NP-030216	027	-	Discrepancy between XML schema of Cx and Sh interface	5.3.2	5.4.0
Jun 2003	CN#20	NP-030216	029	-	Correction to the use of User-Identity	5.3.2	5.4.0
Jun 2003	CN#20	NP-030216	030	-	Clarification on the handling of the "Charging Information" via the Sh interface	5.3.2	5.4.0
Sep 2003	CN#21	NP-030384	032	2	Correction of message flow	5.4.0	5.5.0
Sep 2003	CN#21	NP-030384	033	2	Correction of Sh data definition in Annex C and D	5.4.0	5.5.0
Sep 2003	CN#21	NP-030384	035	2	Mistakes in the XML schema	5.4.0	5.5.0
Dec 2003	CN#22	NP-030501	038	-	XML Schema Correction	5.5.0	5.6.0
Dec 2003	CN#22	NP-030501	041	-	The extensibility of the XML schema	5.5.0	5.6.0
Dec 2003	CN#22	NP-030518	042	-	Clarification of inclusion of elements in Charging Information	5.5.0	5.6.0
Dec 2003	CN#22				Reference [8] updated	5.5.0	5.6.0
Mar 2004	CN#23	NP-040135	044	3	Clarification of which Public Identities are downloaded	5.6.0	5.7.0
Dec 2004	CN#26	NP-040578	109	2	Handling of Information Element marked as (M), (C) or (O)	5.7.0	5.8.0
Dec 2004	CN#26	NP-040578	110	-	Access Key for Charging Information	5.7.0	5.8.0
Mar 2005	CN#27	NP-050031	098	3	Sh-Update needs to include Data-Reference to be future proof	5.8.0	5.9.0
Mar 2005	CN#27	NP-050031	112	-	Align UML Model and the XML schema for Public Identity	5.8.0	5.9.0
Mar 2005	CN#27	NP-050031	115	1	Conditional Service indication in Sh-Subs-Notif	5.8.0	5.9.0
Mar 2005	CN#27	NP-050031	117	-	Sh Diameter AVP Mapping Correction	5.8.0	5.9.0
Mar 2005	CN#27	NP-050031	120	2	Clarification of Sh Access Keys	5.8.0	5.9.0
Jun 2005	CT#28	CP-050216	126	-	Sh user-data correction	5.9.0	5.10.0
Jun 2005	CT#28	CP-050216	131	1	Removal of the word "user" where it is misleading	5.9.0	5.10.0
Jun 2005	CT#28	CP-050216	138	-	XML correction for iFC	5.9.0	5.10.0
Jun 2005	CT#28	CP-050216	140	-	Behavior of HSS when it accepts Sh-Subs-Notif message	5.9.0	5.10.0
Sep 2005	CT#29	CP-050283	145	-	Correction to Sh-IMS-Data for Initial Filter Criteria	5.10.0	5.11.0
Sep 2005	CT#29	CP-050283	151	1	ISDN-address correction	5.10.0	5.11.0
Sep 2005	CT#29	CP-050282	159	-	Charging-Information correction	5.10.0	5.11.0
Dec 2005	CT#30	CP-050604	143	4	XML syntax correction	5.11.0	5.12.0
Dec 2005	CT#30	CP-050605	166	-	PSUserState correction	5.11.0	5.12.0
Mar 2006	CT#31	CP-060065	0170	2	Handling of unknown errors	5.12.0	5.13.0
Sep 2006	CT#33	CP-060399	0202	2	Correction of the relationship between Repository Data and Public Identities	5.13.0	5.14.0

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