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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 7.9.0 Release 7)**

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# Foreword

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# Contents

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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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] 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 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"

# 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 |
| 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 section 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.

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.

**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, Public Service Identity, or MSISDN of the user for whom the data is required.<br>See section 7.1 for the content of this AVP. |
| Wildcarded PSI (See 7.1A) | Wildcarded-PSI | O | If the request refers to a Wildcarded PSI, the AS may include the corresponding Wildcarded PSI in this information element.<br><br>If this 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. |
| 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.<br><br>When this information element takes the value IMPLICIT_IDENTITIES, the HSS shall provide all non-barred IMS Public Identities that belong to the same implicit registration set as the IMS Public Identity included in the message in the User-Identity AVP. The MSISDN user identity is not applicable for this value. If the User Identity is a Public Service Identity, the HSS shall return only the User Identity in the request.<br><br>When this information element takes the value ALIAS_IDENTITIES, the HSS shall provide all non-barred IMS Public User Identities that are in the same alias group as the IMS Public User Identity included in the message in the User-Identity AVP (see 3GPP TS 23.228 [1] for the definition of Alias Public User Identities). The MSISDN user identity is not applicable for this value. If the User Identity is a Public Service Identity, the HSS shall return only the User Identity in the request.<br><br>When this information element takes the value REGISTERED_IDENTITIES, the HSS shall provide all non-barred IMS Public Identities whose state is registered, belonging to all Private Identities that the IMS Public Identity or MSISDN in the User-Identity AVP is associated with. If the User Identity is a Public Service Identity, the HSS shall return no identities in the response.<br><br>When this information element takes the value ALL_IDENTITIES, the HSS shall provide all non-barred IMS Public Identities, belonging to all Private Identities that the User Identity is associated with.<br><br>If Data-Reference indicates that IMS Public Identities is the requested data set to be downloaded and this information element is not included, the HSS shall download the set of IMS Public Identities that would be downloaded if the value of this information element had been ALL_IDENTITIES. |
| 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.<br>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.<br>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.<br>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.<br>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.<br><br>Result-Code AVP shall be used for errors defined in the Diameter Base Protocol.<br><br>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. |
| Wildcarded PSI (See 7.1A) | Wildcarded-PSI | O | If the request refers to a specific PSI matching a Wildcarded PSI and the Wildcarded PSI AVP was not included in the request and is not included in the User-Data AVP, the HSS may include the corresponding Wildcarded PSI in this information element. This information may be used by the AS to identify the affected Wildcarded PSI. |
| Data (See 7.6) | User-Data | C | 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. If DSAI information is requested, the DSAI-Tag AVP shall be present.

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

1. In the AS permission list (see section 6.2) check that the requested user data is allowed to be read (Sh-Pull) by this AS by checking the combination of the identity of the AS sending the request (identified by the Origin-Host AVP) and the supplied Data-Reference.

   If one or more Data References in the request are not allowed to be read, Experimental-Result shall be set to DIAMETER_ERROR_USER_DATA_CANNOT_BE_READ in the Sh-Pull Response.

2. Check that the User Identity for whom data is asked exists in HSS. If not, Experimental-Result shall be set to DIAMETER_ERROR_USER_UNKNOWN in the Sh-Pull Response.

3. If the User Identity does not apply to the Data-Reference indicated in the request according to Table 7.6.1, Experimental-Result shall be set to DIAMETER_ERROR_OPERATION_NOT_ALLOWED in the Sh-Pull Response.

3a. If Data-Reference is AliasesRepositoryData (20), check that the User Identity contains an IMS Public User Identity (any IMS Public User Identity in the group may be used as a key for the repository data of the group). If not, Experimental-Result shall be set to DIAMETER_ERROR_OPERATION_NOT_ALLOWED 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 may delay the Sh-Pull-Resp message until the update has been completed. The HSS shall ensure that the data returned is not corrupted by this conflict. If HSS is not able to delay the Sh-Pull-Resp message e.g. due to timeout the Experimental-Result-Code shall be set to DIAMETER_USER_DATA_NOT_AVAILABLE.

5. The HSS shall include the data pertinent to the requested Data Reference in the User-Data AVP and if the HSS supports the Notif-Eff feature, the HSS shall include the data pertinent to all the requested Data References in the User-Data AVP. Combining Data Reference RepositoryData (0) and AliasesRepositoryData (20) in the same request is not supported and the HSS shall set the Result-Code to DIAMETER_UNABLE_TO_COMPLY in this case, otherwise the HSS shall set the Result-Code to DIAMETER_SUCCESS. This includes cases where the data is not available to the HSS.

   If both the AS and the HSS have determined via mutual feature evaluation to not support the Notif-Eff feature and in the case that requested data is not available to the HSS, the HSS shall not include the User-Data AVP in the Sh-Pull Response. If both the AS and the HSS support the Notif-Eff feature and none of the requested data is available to the HSS, the HSS shall not include the User-Data AVP in the Sh-Pull Response.

   If both the AS and the HSS support the Notif-Eff feature and some of the requested data is not available to the HSS, it shall be indicated as follows. Empty repository data shall be indicated with the RepositoryData or AliasesRepositoryData element that contains a Service Indication and a Sequence Number but does not contain a ServiceData element. Empty Public Identifiers shall be indicated with an empty PublicIdentifiers element. Empty location information shall be indicated by an empty CSLocationInformation and/or an empty PSLocationInformation element. Empty elements of Sh IMS Data shall be indicated as follows. An empty S-CSCF name shall be indicated with empty SCSCFName element. If all iFCs for the user that are relevant for the AS are empty it shall be indicated with empty IFCs element.

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).

If the HSS cannot fulfil the received request for reasons not stated in the above steps, e.g. due to a database error or empty mandatory data elements, it shall stop processing the request and set Result-Code to DIAMETER_UNABLE_TO_COMPLY.

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 i.e. when the HSS is indicating valid empty data elements.

### 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 or Public Service Identity (for Public Service Identities matching a Wildcarded PSI, the transparent data shall be stored per Wildcarded PSI, and not for each specific Public Service Identity matching that Wildcarded PSI).
- To allow the AS to update the PSI Activation State of a distinct Public Service Identity in the HSS.
- To allow the AS to update the Dynamic Service Activation Info stored at the HSS.

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 or Public Service Identity for which data is updated.<br>See section 7.1 for the content of this AVP. |
| Wildcarded PSI (See 7.1A) | Wildcarded-PSI | O | If the request refers to a Wildcarded PSI, the AS may include the corresponding Wildcarded PSI in this information element.<br><br>If this 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. |
| 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.<br><br>Result-Code AVP shall be used for errors defined in the Diameter Base Protocol.<br><br>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. |
| Wildcarded PSI (See 7.X) | Wildcarded-PSI | O | If the request refers to a specific PSI matching a Wildcarded PSI and the Wildcarded-PSI AVP was not included in the request, the HSS may include the corresponding Wildcarded PSI in this information element. This information may be used by the AS to identify the affected Wildcarded PSI. |

### 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. In the AS permission list (see section 6.2) check that the data that is requested to be updated (Sh-Update) by this AS, is allowed to be updated by checking the combination of the identity of the AS sending the request (identified by the Origin-Host AVP) and the supplied Data-Reference.

   - If the data is not allowed to be updated, Experimental-Result shall be set to DIAMETER_ERROR_USER_DATA_CANNOT_BE_MODIFIED in the Sh-Update Response.

2. Check that the IMS Public User Identity or Public Service Identity in the request exists in the HSS. If not, Experimental-Result shall be set to DIAMETER_ERROR_USER_UNKNOWN in the Sh-Update Response.

3. If the User Identity does not apply to the Data-Reference indicated in the request according to Table 7.6.1, Experimental-Result shall be set to DIAMETER_ERROR_OPERATION_NOT_ALLOWED in the Sh-Update Response.

4. If Data-Reference is PSIActivation (18), then the HSS shall check that the User Identity contains a distinct Public Service Identity. If it does, then the HSS shall update the corresponding PSI Activation State and return the Result-Code AVP set to DIAMETER_SUCCESS. If it does not, then the Experimental-Result shall be set to DIAMETER_ERROR_OPERATION_NOT_ALLOWED in the Sh-Update Response.

   The change of a Public Service Identity from ACTIVE to INACTIVE shall trigger the network initiated deregistration of the Public Service Identity in the HSS.

4a. If Data-Reference is DSAI (19), check whether or not, for the Public Identity, there is an instance of DSAI matching the DSAI-Tag contained in the Sh-Update command. If so, then the HSS shall update the DSAI value and return the Result-Code AVP set to DIAMETER_SUCCESS. If not, Experimental-Result shall be set to DIAMETER_ERROR_DSAI_NOT_AVAILABLE.

   The changes of DSAI value shall trigger the procedures described in section 7.14 in order to determine which initial filter criteria should be masked or unmasked. If these procedures change the set of unmasked initial filter criteria, the HSS should behave as if the initial filter criteria had been administratively changed, which implies e.g. sending Sh-Notif or Cx-Update_Subscr_Data messages (see 3GPP TS 29.228 [6]).

5. 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 shall be set to DIAMETER_PRIOR_UPDATE_IN_PROGRESS in the Sh-Update Response.

6. 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 (or group if Data-Reference is AliasesRepositoryData) or Public Service Identity.

   - If repository data identified by the Service-Indication is stored at the HSS for the specified IMS Public User Identity, IMS Public User Identity group or Public Service Identity, check the following premises:

     1. Sequence_Number_in_Sh_Update is not equal to 0

     2. (Sequence_Number_in_Sh_Update - 1) is equal to (Sequence_Number_In_HSS modulo 65535)

     - If either of the above premises is false then Experimental-Result- 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 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 or Public Service 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 with that Service Indication and Sequence Number to be deleted but with an absent Service Data element, to any other ASs that are subscribed to Notifications for updates to the service data for that IMS Public User Identity or Public Service 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, IMS Public User Identity group or Public Service 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 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 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 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 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).

If the HSS cannot fulfil the received request for reasons not stated in the above steps, e.g. due to database error, it shall stop processing the request and set Result-Code to DIAMETER_UNABLE_TO_COMPLY.

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 inconsitency 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 or Public Service Identity is updated, from the HSS.

- Optionally to request the user data from the HSS in the same operation.

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 User Identity or Public Service Identity for which notifications of data changes are requested. See section 7.1 for the content of this AVP. |
| Wildcarded PSI (See 7.1A) | Wildcarded-PSI | O | If the request refers to a Wildcarded PSI, the AS may include the corresponding Wildcarded PSI in this information element.<br><br>If this 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. |
| 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. |
| Send Data Indication (See 7.13) | Send-Data-Indication | O | This information element requests that the data is sent in the response. |
| Service Indication (See 7.4) | Service-Indication | C | IE that identifies, together with the User Identity and Data-Reference, the set of service related transparent data for which notifications of changes are requested.<br>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 and Data-Reference, as key to identify the filter criteria.<br>Check table 7.6.1 to see when it is applicable. |
| Expiry Time (See 7.12) | Expiry-Time | O | Gives the absolute time requested at which the subscription expires. |
| Dynamic Service Activation Information Tag (see 7.14) | DSAI-Tag | C | IE that identifies, together with the User Identity and Data-Reference, the instance of Dynamic Service Activation Info (DSAI) requested.<br>Check table 7.6.1 to see when it is applicable. |
| Requested Identity set (See 7.11) | Identity-Set | C | Check table 7.6.1 to see when it is applicable. |

**Table 6.1.3.2: Sh-Subs-Notif Resp**

| Information element name | Mapping to Diameter AVP | Cat. | Description |
|---|---|---|---|
| Expiry Time (See 7.12) | Expiry-Time | O | Acknowledges the absolute time at which the subscription expires. |
| Data (See 7.6) | User-Data | O | Current values of the data for which notifications have been requested.<br><br>It should be present if the Send-Data-Indication AVP is set to value USER_DATA_REQUESTED. |
| Wildcarded PSI (See 7.1A) | Wildcarded-PSI | O | If the request refers to a specific PSI matching a Wildcarded PSI and the Wildcarded PSI AVP was not included in the request and is not included in the User-Data AVP, the HSS may include the corresponding Wildcarded PSI in this information element. This information may be used by the AS to identify the affected Wildcarded PSI. |
| Result (See 7.5) | Result-Code / Experimental-Result | M | Result of the request.<br><br>Result-Code AVP shall be used for errors defined in the Diameter Base Protocol.<br><br>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 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. If the request contains a specific Public Service Identity matching a Wildcarded PSI, the HSS shall interpret that the subscription refers to the information associated to the Wildcarded PSI. The Server-Name AVP shall contain the SIP URL of the AS sending the request. If notifications on changes of DSAI are requested, the DSAI-Tag AVP shall be used as key of the DSAI whose changes are to be monitored.

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. In the AS permission list (see section 6.2) the HSS shall check that the AS is allowed to subscribe to notifications (Sh-Subs-Notif) for the requested data by checking the combination of the identity of the AS sending the request (identified by the Origin-Host AVP) and the supplied Data-Reference.

   - If this AS does not have Sh-Subs-Notif permission for the data referenced, Experimental-Result shall be set to DIAMETER_ERROR_USER_DATA_CANNOT_BE_NOTIFIED in the Sh-Subs-Notif Response.

2. Check that the IMS Public User Identity or Public Service Identity in the request exists in HSS. If not, Experimental-Result shall be set to DIAMETER_ERROR_USER_UNKNOWN in the Sh-Subs-Notif Response.

3. If the User Identity does not apply to the Data-Reference indicated in the request according to Table 7.6.1, Experimental-Result shall be set to DIAMETER_ERROR_OPERATION_NOT_ALLOWED in the Sh-Subs-Notif Response.

3a. If Data-Reference is DSAI (19), check whether or not, for the Public Identity, there is an instance of DSAI matching the DSAI-Tag contained in the Sh-Subs-Notif command. If not, Experimental-Result shall be set to DIAMETER_ERROR_DSAI_NOT_AVAILABLE.

4. If the Sh-Subs-Notif Request contains an Expiry Time, the HSS should also include in the Sh-Subs-Notif Response an Expiry Time IE with the absolute time at which the subscription expires in the case of a successful subscription. This time may be earlier than the requested expiry time. If the HSS includes this IE, then no notification shall be sent to the AS after the expiration time. If the HSS receives a Sh-Subs-Notif Request without the Expiry Time IE, the HSS should treat it as a request for an unlimited subscription.

If the HSS does not include this IE in the response, that indicates an unlimited subscription.

If a subsequent request is received by the HSS where the Expiry Time IE is present but different from what the HSS has previously stored, the HSS should replace the stored expiration time with what was received in the request.

5. If Data-Reference is RepositoryData(0) or AliasesRepositoryData(20) and the transparent data associated with the Service Indication does not exist in the HSS, then Experimental-Result shall be set to DIAMETER_ERROR_SUBS_DATA_ABSENT.

6. If the Subscription request type information element indicates that this is a request to subscribe, the HSS shall associate the Application Server Identity with the list of entities that need to be notified when the data identified by the request is modified and set the Result-Code to DIAMETER_SUCCESS in the Sh-Subs-Notify response. If the Subscription request type information element indicates that this is a request to unsubscribe, the HSS shall remove the association of the Application Server Identity with the same list. In this last case, the Result-Code shall be set to DIAMETER_SUCCESS if the operation is successful or if the Application Server Identity was not present in the list.

7. If the HSS and AS supports the Notif-Eff feature and if multiple Data-Reference AVPs occur in the Sh-Subs-Notif Request, each Data-Reference shall be treated as a request to establish a separate notification request. When mulitiple notification requests are requested, and all of them succeed, the HSS shall set the Result-Code to DIAMETER_SUCCESS in the Sh-Subs-Notify response.

8. If the HSS and AS supports the Notif-Eff feature and if multiple Service-Indication AVPs occur in the Sh-Subs-Notif Request, each Service-Indication shall be treated as a request to establish a separate notification request for change of Transparent data. When mulitiple notification requests are requested, and all of them are successful, the HSS shall return the Result-Code set to DIAMETER_SUCCESS in the Sh-Subs-Notify response.

9. If the Send Data Indication is present in the request and the HSS supports the return of the User-Data in this request, 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 may delay the response until the update has been completed. The HSS shall ensure that the data returned is not corrupted by this conflict.

10. If the Send Data Indication is present in the request, the HSS should include the data pertinent to the requested Data Reference in the User-Data AVP and if the HSS supports the Notif-Eff feature, the HSS should include the data pertinent to all the requested Data References in the User-Data AVP. Combining Data Reference RepositoryData (0) and AliasesRepositoryData (20) in the same request is not supported and the HSS shall set the Result-Code to DIAMETER_UNABLE_TO_COMPLY in this case, otherwise the HSS shall set the Result-Code to DIAMETER_SUCCESS. This includes cases where the data is not available to the HSS and an empty tag is included as follows. Empty elements of Sh IMS Data shall be indicated as follows. An empty S-CSCF name shall be indicated with empty SCSCFName element. If all iFCs for the user that are relevant for the AS are empty it shall be indicated with empty IFCs element. Similarly for PSI activation information.

If the HSS cannot fulfil the received request for reasons not stated in the above steps, e.g. due to database error, it shall stop processing the request and set Result-Code to DIAMETER_UNABLE_TO_COMPLY.

### 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 or Public Service Identity for which data has changed.<br>If the request refers to a Wildcarded PSI, the HSS may include any PSI matching the corresponding Wildcarded PSI in this information element. The AS shall find the corresponding Wildcarded PSI with this information.<br>See section 7.1 for the content of this AVP. |
| Wildcarded PSI (See 7.1A) | Wildcarded-PSI | O | If the request refers to a Wildcarded PSI, the HSS shall include the corresponding Wildcarded PSI in this information element.<br><br>If this element is present, it shall be used by the AS instead of the User Identity to identify the identity affected by the request. |
| 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 |
|---|---|---|---|
| Result (See 7.5) | Result-Code / Experimental-Result | M | Result of the request.<br><br>Result-Code AVP shall be used for errors defined in the Diameter Base Protocol.<br><br>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 AVP. When data repository is updated Service-Indication and Sequence Number shall also be part of the information element User-Data.

Since authentication pending is a transient state of normally very short duration, notification of an IMS user's state change, to and from the authentication pending state shall not be sent to Application Servers, when the previous state before authentication pending and next state after authentication pending are the same. If the states are different before the authentication pending state is entered and after the authentication pending state is left then notification is sent to the AS of this new state.

If the HSS and AS supports the Notif-Eff feature and if multiple subscriptions to notifications are associated with a Public User Identity, the HSS may combine the notifications for multiple Data References and Service Indications into a single notification message.

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 or AliasesRepositoryData 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.

Table 6.1.4.1 details the valid result codes that the AS can return in the response.

**Table 6.1.4.1.1: Sh-Notif response valid result codes**

| Result-Code AVP value | Condition |
|---|---|
| DIAMETER_SUCCESS | The request succeeded. |
| DIAMETER_ERROR_USER_DATA_NOT_RECOGNIZED | The request failed. The AS informs the HSS that the received user information contained information, which |

| | |
|---|---|
| | was not recognized or supported by the AS. |
| DIAMETER_ERROR_USER_UNKNOWN | The request failed because the Public Identity is not found in the AS. |
| DIAMETER_ERROR_TOO_MUCH_DATA | The request failed. The AS informs the HSS that it tried to push too much data into the AS. |
| DIAMETER_ERROR_NO_SUBSCRIPTION_TO_DATA | The request failed. The AS informs the HSS that the notification refers to information to which the AS is not subscribed. |
| DIAMETER_UNABLE_TO_COMPLY | The request failed. |

## 6.2 AS permissions list

In table 7.6.1, the contents of the Data-AVP are described. Some of the individual elements carried within Data-AVP may be requested by the AS from the HSS using the Sh-Pull command (see section 6.1.1) or may be updated at the HSS by the AS using the Sh-Update command (see section 6.1.2). The AS may also request that the HSS notifies the AS of changes to specific elements within the Data-AVP using the Sh-Subs-Notif command (see section 6.1.3). The HSS will only allow these operations to take place if the element of the Data-AVP is permitted to be included in the specific command requested by the AS, as indicated in table 7.6.1.

To manage whether an AS may request each element of Data-AVP with a specific command, the HSS shall maintain a list of AS permissions (the "AS Permissions List"). AS permissions are identified by AS identity and Data Reference with the possible permissions associated with each Data Reference being Sh-Pull, Sh-Update, Sh-Subs-Notif or any combination of these permissions (see table 7.6.1 for details of which permissions are allowed for each Data Reference). 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.

## 6.3 Void

## 6.4 Void

## 6.5 User identity to HSS resolution

The User identity to HSS resolution mechanism enables the AS to find the address of the HSS that holds the subscriber data for a given IMS Public User Identity or Public Service Identity when multiple and separately addressable HSSs have been deployed by the network operator. The resolution mechanism is not required in networks that utilise a single HSS or when an AS is configured to use pre-defined HSS.

The resolution mechanism described in 3GPP TS 23.228 [8] is based on the Subscription Locator Function (SLF). The AS accesses the subscription locator via the Dh interface. The Dh interface is always used in conjunction with the Sh interface. The Dh interface is based on Diameter. Its functionality is implemented by means of the routing mechanism provided by an enhanced Diameter redirect agent, which is able to extract the IMS Public User Identity or Public Service Identity from the received requests.

To get the HSS address the AS sends to the SLF the Sh requests aimed for the HSS. On receipt of the HSS address from the SLF, the AS shall send the Sh requests to the HSS. The AS may store the HSS address and use it in further requests associated to the same IMS Public User Identity or Public Service Identity.

In networks where the use of the user identity to HSS resolution mechanism is required and the AS is not configured to use predefined HSS, each AS shall be configured with the address/name of the SLF implementing this resolution mechanism.

# 7 Information element contents

## 7.1 User Identity

This information element contains an IMS Public User Identity, Public Service Identity or MSISDN 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 / Public Service Identity (See 7.1.1) | Public-Identity | C | IMS Public User Identity or Public Service 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 / Public Service Identity

This information element contains an IMS Public User Identity / Public Service Identity (either SIP URI or tel URI). See 3GPP 23.003 [11].

### 7.1.2 MSISDN

This information element contains a Basic MSISDN (see 3GPP TS 23.012 [19]).

## 7.1A Wildcarded PSI

This information element contains a Wildcarded PSI that is hosted by an application server. For definition of a Wildcarded PSI, see 3GPP TS 23.003 [11].

## 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 section 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 to implement a data repository to store transparent data per IMS Public User Identity or Public Service Identity and value of Service Indication with a Sequence Number for verification. For

Public Service Identities matching a Wildcarded Public Service Identity, the repository data shall be stored per Wildcarded Public Service Identity and not for each specific Public Service Identity.

## 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 AS permissions (as described in section 6.2) 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 AS permission 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 or Public Service Identity + Data-Reference + Service-Indication | Sh-Pull, Sh-Update, Sh-Subs-Notif (Note 1) |
| 10 | IMSPublicIdentity | 7.6.2 | IMS Public User Identity or Public Service Identity or MSISDN + Data-Reference + Identity-Set (all values other than ALIAS_IDENTITIES) | Sh-Pull, Sh-Subs-Notif |
| 10 | IMSPublicIdentity | 7.6.2 | IMS Public User Identity + Data-Reference + Identity-Set (with value ALIAS_IDENTITIES) | Sh-Pull, Sh-Subs-Notif |
| 11 | IMSUserState | 7.6.3 | IMS Public User Identity + Data-Reference | Sh-Pull, Sh-Subs-Notif |
| 12 | S-CSCFName | 7.6.4 | IMS Public User Identity or Public Service Identity + Data-Reference | Sh-Pull, Sh-Subs-Notif (Note 1) |
| 13 | InitialFilterCriteria | 7.6.5 | IMS Public User Identity or Public Service Identity + Data-Reference + Server-Name | Sh-Pull, Sh-Subs-Notif (Note 1) |
| 14 | LocationInformation | 7.6.6 | MSISDN + Data-Reference+ Requested-Domain + CurrentLocation | Sh-Pull |
| 15 | UserState | 7.6.7 | MSISDN + Data-Reference+ Requested-Domain | |
| 16 | Charging information | 7.6.8 | IMS Public User Identity or Public Service Identity or MSISDN + Data-Reference | Sh-Pull, Sh-Subs-Notif |
| 17 | MSISDN | 7.6.9 | IMS Public User Identity or MSISDN + Data-Reference | Sh-Pull |
| 18 | PSIActivation | 7.6.10 | Specific Public Service Identity matching a Wildcarded Public Service Identity or Wildcarded Public Service Identity + Data-Reference | Sh-Pull, Sh-Subs-Notif (Note 1) |
| 18 | PSIActivation | 7.6.10 | Distinct Public Service Identity + Data-Reference | Sh-Pull, Sh-Update, Sh-Subs-Notif |
| 19 | DSAI | 7.6.11 | Public User Identity or Public Service Identity + Data-Reference + DSAI-Tag + Server-Name | Sh-Pull, Sh-Update, Sh-Subs-Notif (Note 1) |
| 20 | AliasesRepositoryData | 7.6.12 | IMS Public User Identity + Data-Reference + Service-Indication | Sh-Pull, Sh-Update, Sh-Subs-Notif |
| Note 1: If an AS subscribes to a Specific PSI matching a Wildcarded PSI, the notification shall be sent as if the subscription was made to the corresponding Wildcarded PSI. | | | | |

## 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 User Identity or a Public Service Identity. If a wildcarded PSI that is stored in the HSS matches the Public Service Identity received, the HSS shall return the wildcarded PSI in addition to the Public Service Identity that was received in the request.

An IMS Public Identity would be either:

- associated with the same Private User Identity or Private Service Identity as the User Identity 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.

If the IMS Public User Identity is shared between multiple Private User Identities, HSS shall indicate the most registered state of the shared IMS Public User Identity to an AS. The most registered state of a shared IMS Public User Identity is defined as follows:

- If the shared IMS Public User Identity is registered with any of the Private User Identities, the most registered state of the shared IMS Public User Identity is REGISTERED.
- If the shared IMS Public User Identity is not currently registered with any of the Private User Identities, but it is in state REGISTERED_UNREG_SERVICES, then the most registered state of the shared IMS Public User Identity is REGISTERED_UNREG_SERVICES.
- If the shared IMS Public User Identity is not currently registered with any of the Private User Identities, and it is not in state REGISTERED_UNREG_SERVICES, but it is in the process of being authenticated with any of the Private User Identities, then the most registered state of the shared IMS Public User Identity is AUTHENTICATION_PENDING.
- If the shared IMS Public User Identity is not currently registered with any of the Private User Identities, and it is not in state REGISTERED_UNREG_SERVICES, and it is not in the process of being authenticated with any of the Private User Identities, then the most registered state of the shared IMS Public User Identity is NOT_REGISTERED.

### 7.6.4 S-CSCF Name

This information element contains the name of the S-CSCF assigned to the IMS Subscription.

### 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 Identity 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 Online Charging Function (PrimaryEventChargingFunctionName), secondary Online Charging Function (SecondaryEventChargingFunctionName), primary Charging Data Function (PrimaryChargingCollectionFunctionName), and secondary Charging Data Function (SecondaryChargingCollectionFunctionName). 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 a Basic MSISDN (see 3GPP TS 23.012 [19]) that is associated with the User Identity present in the request. All valid instances of this information element shall be included in the message.

### 7.6.10 PSIActivation

This information element contains the activation state of the Public Service Identity present in the request. Its possible values are:

- ACTIVE,
- INACTIVE.

### 7.6.11 DSAI

When a service is provisioned but not active, an Application Server is typically involved through the ISC interface in sessions where the Application Server is not supposed to perform any task but to proxy incoming transactions.

In order to avoid this disoptimization, a mechanism is provided for the Application Server to signal the HSS that a set of initial filter criteria should be 'masked' for a specific Public User Identity or Public Service Identity. This is, from the Application Server"s perspective, just an indication, and an Application Server must be prepared to be involved in sessions even if the trigger that caused its involvement has been masked by that Application Server.

This information element contains the activation state of a Service (identified by its DSAI-tag, see section 7.14, for a specific user identified by a Public User Identity or of a Service identified by its PSI). Its possible values are:

- ACTIVE,
- INACTIVE.

In the HSS the DSAI can also be associated to a wildcarded PSI. In that case, there is a set of identities matching a specific wildcarded PSI and all the identities in the set share the same DSAIs. Any change in these DSAIs masked from a single identity of the set will apply to all the identities associated to that wildcarded PSI.

Each DSAI is implicitly bound to a list of (at least one) initial filter criteria. The binding is not exclusive, i.e. one instance of initial filter criteria may be bound to zero or more DSAIs, however all the iFCs bound to a given DSAI should trigger to the same AS (i.e. they should share the same ServerName), which is the only one allowed to update it.

An instance of initial filter criteria shall be included into the Service-Profile sent through the Cx Interface according to the operations described in 3GPP TS 29.228 [6] if at least one of the following conditions applies:

- No DSAI is bound to those initial filter criteria;
- At least one of the DSAIs bound to those initial filter criteria is set to ACTIVE.

### 7.6.12 Aliases Repository Data

This information element contains transparent data associated to a set of Alias IMS Public User Identities (see 3GPP TS 23.228 [1] for the definition of Alias Public User Identities). A data repository may be shared by more than one AS implementing the same service.

## 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.

## 7.11 Requested Identity Set

This information element indicates the set of IMS Public Identities that the AS wishes to download. See 3GPP TS 29.329 [5] for the detailed definition of the AVP.

## 7.12 Expiry Time

This information element indicates the expiry time of the subscription to notifications in the HSS. See 3GPP TS 29.329 [5] for the detailed definition of this AVP.

## 7.13 Send Data Indication

This information element indicates the request that the User Data is sent in the response. See 3GPP TS 29.329 [5] for the detailed definition of this AVP.

## 7.14 DSAI Tag

An instance of Dynamic Service Activation Info is uniquely identified by the Public User/Service Identity and a DSAI tag. The same DSAI tag may be used for all the user profiles when indicating the same type of information, but not all the user profiles may contain the same set of tags.

Application Servers shall signal that they are not interested in being involved in new sessions by manipulating Dynamic Service Activation Info (DSAI) inside of dynamic service information data, see section 7.6.11.

# 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.

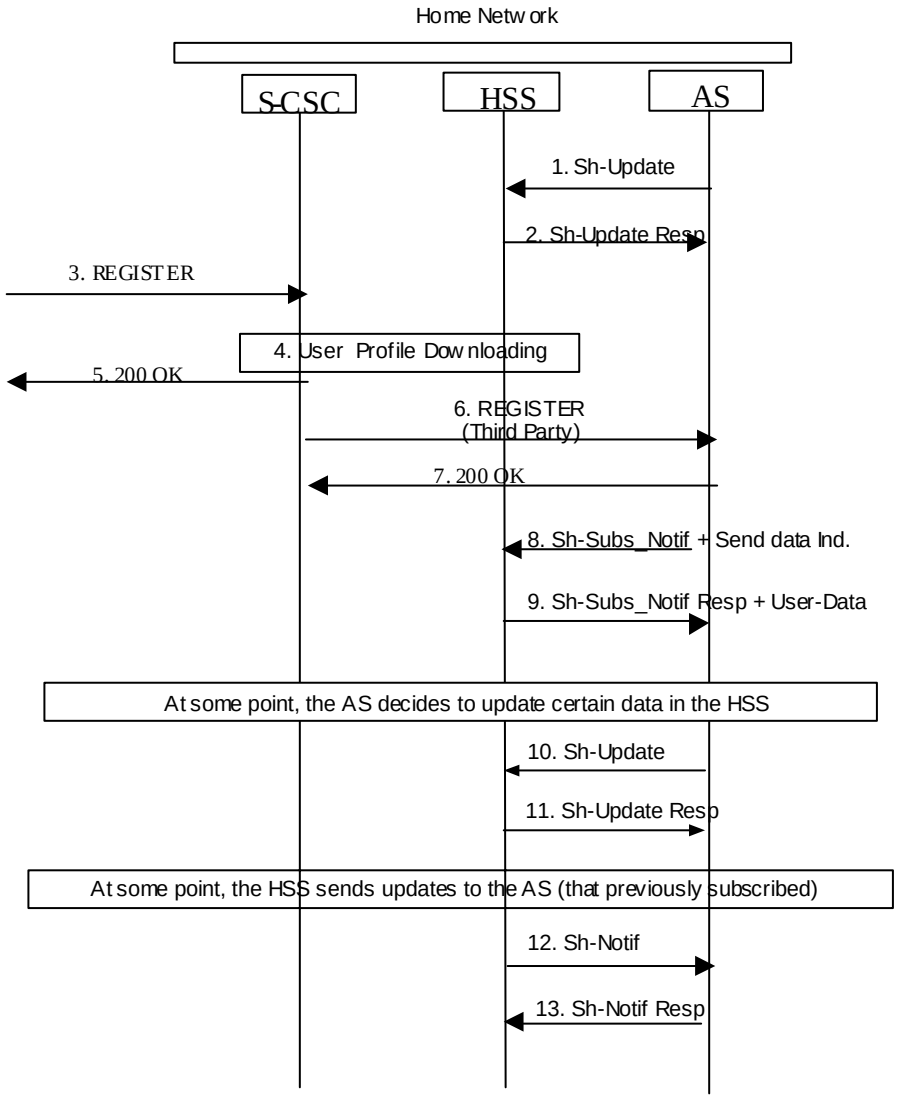


**Figure B.1.1: Data Update, Registration, Notification Subscription**

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 subscribes to notifications and downloads data needed for providing service from HSS, by means of Sh-Subs-Notif (user identity, requested data, service information and send data indication).
9. HSS confirms the subscription request and sends data to AS
10. At some moment, the AS decides to update user"s service data e.g. repository data in the HSS, by means of Sh-Update (user identity, updated data).
11. The HSS confirms the service data is updated.
12. At some moment, user data is updated in the HSS. As the AS subscribed to notifications (step 8), the HSS sends to the AS the requested updates, by means of Sh-Notif (user identity, updated data).
13. The AS acknowledges the notification.

# Annex C (informative): UML model of the data downloaded over Sh interface

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:

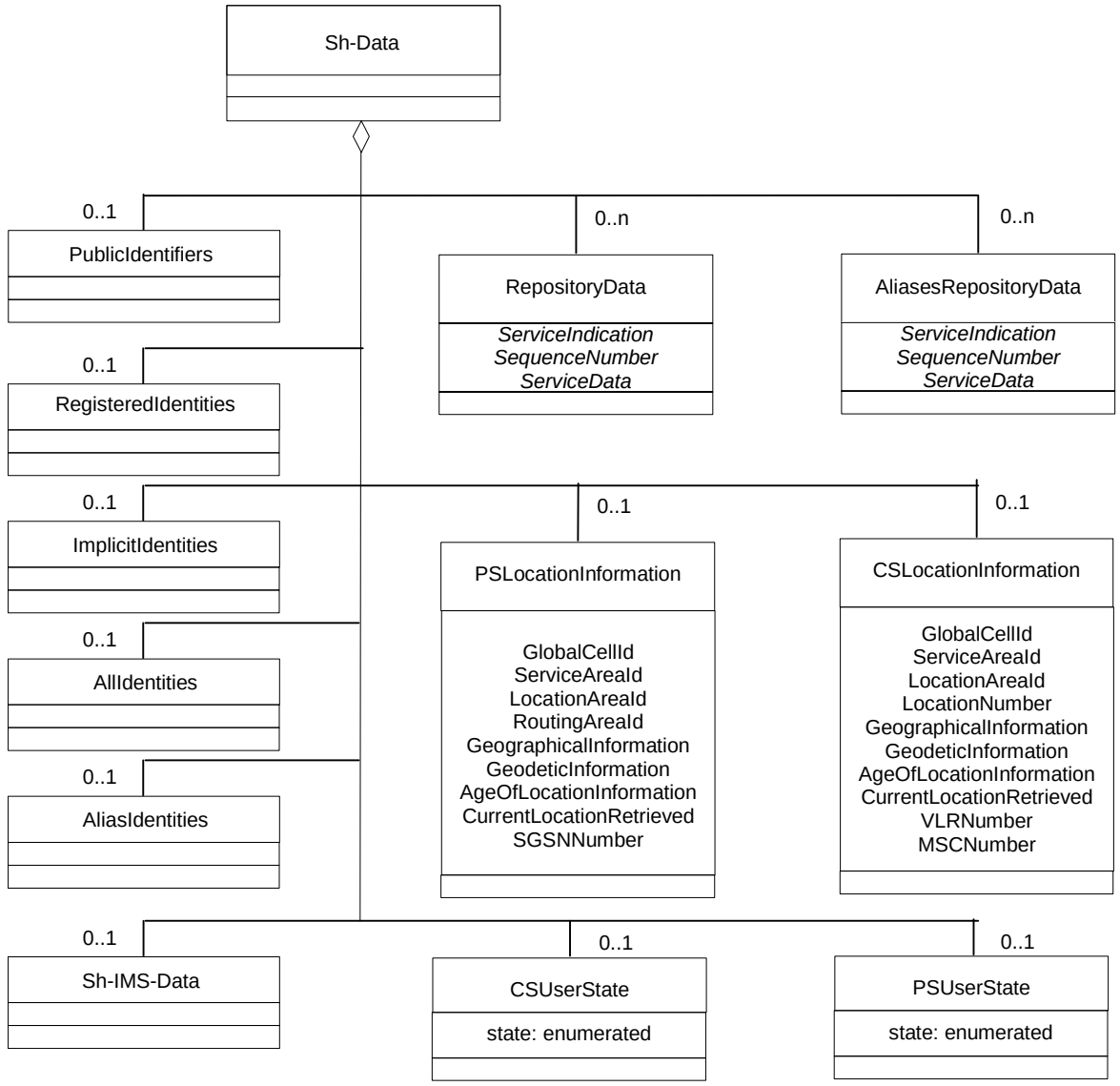


**Figure C.1.1: Sh-Data**

Each instance of the Sh-Data class contains 0 or 1 instance of the class PublicIdentifiers, 0 or n instances of the class RepositoryData, 0 or n instances of the class AliasesRepositoryData, 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 0 or 1 instance of the class CSLocationInformation and 0 or 1 instance of the class PSLocationInformation, 0 or 1 instance of the class

RegisteredIdentities, 0 or 1 instance of the class ImplicitIdentities, 0 or 1 instance of the class AllIdentities, and 0 or 1 instance of the class AliasIdentities.

If AS and HSS both support the Notif-Eff feature and AS requires more than one identity sets of a public identity, or it has subscribed to be notifed of changes to IMSPublicIdentity (see table 7.6.1), the class PublicIdentifiers shall not be used. Instead the classes RegisteredIdentities, ImplicitIdentities, AllIdentities and AliasIdentities shall be used and they contain the REGISTERED_IDENTITIES, IMPLICIT_IDENTITIES, ALL_IDENTITIES and ALIAS_IDENTITIES associated with the IMS Public Identity included in the request respectively, See Table 6.1.1.1 for the detailed information. The class PublicIdentifiers or the one among the four which may be used to contain the correspongding identity set can both be used when AS requires only one identity set of a public identity.

If AS or HSS do not support the Notif-Eff feature, the classes RegisteredIdentities, ImplicitIdentities and AllIdentities shall not be used. Instead the class PublicIdentifiers shall be used.

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

Class AliasesRepositoryData contains repository data (transparent data) for a given service that are associated to a group of Public User Identities. 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 section 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 section 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:

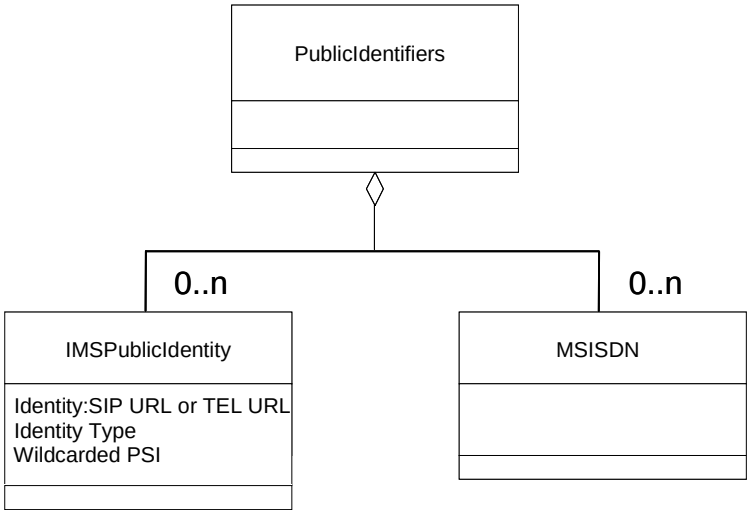


**Figure C.2.1: The UML model of the class PublicIdentifiers**

Class PublicIdentifiers contains 0 or more public user identities which may be either of class IMSPublicIdentity or of class MSISDN. The identifiers are of format SIP URL, tel URI or MSISDN. Instances of class IMSPublicIdentity shall

contain either a Public User Identity, a distinct PSI and they shall contain the Identity Type and the wildcarded PSI if the Identity in the request matches a Wildcarded PSI in the HSS.

## C.3 Sh-IMS-Data

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

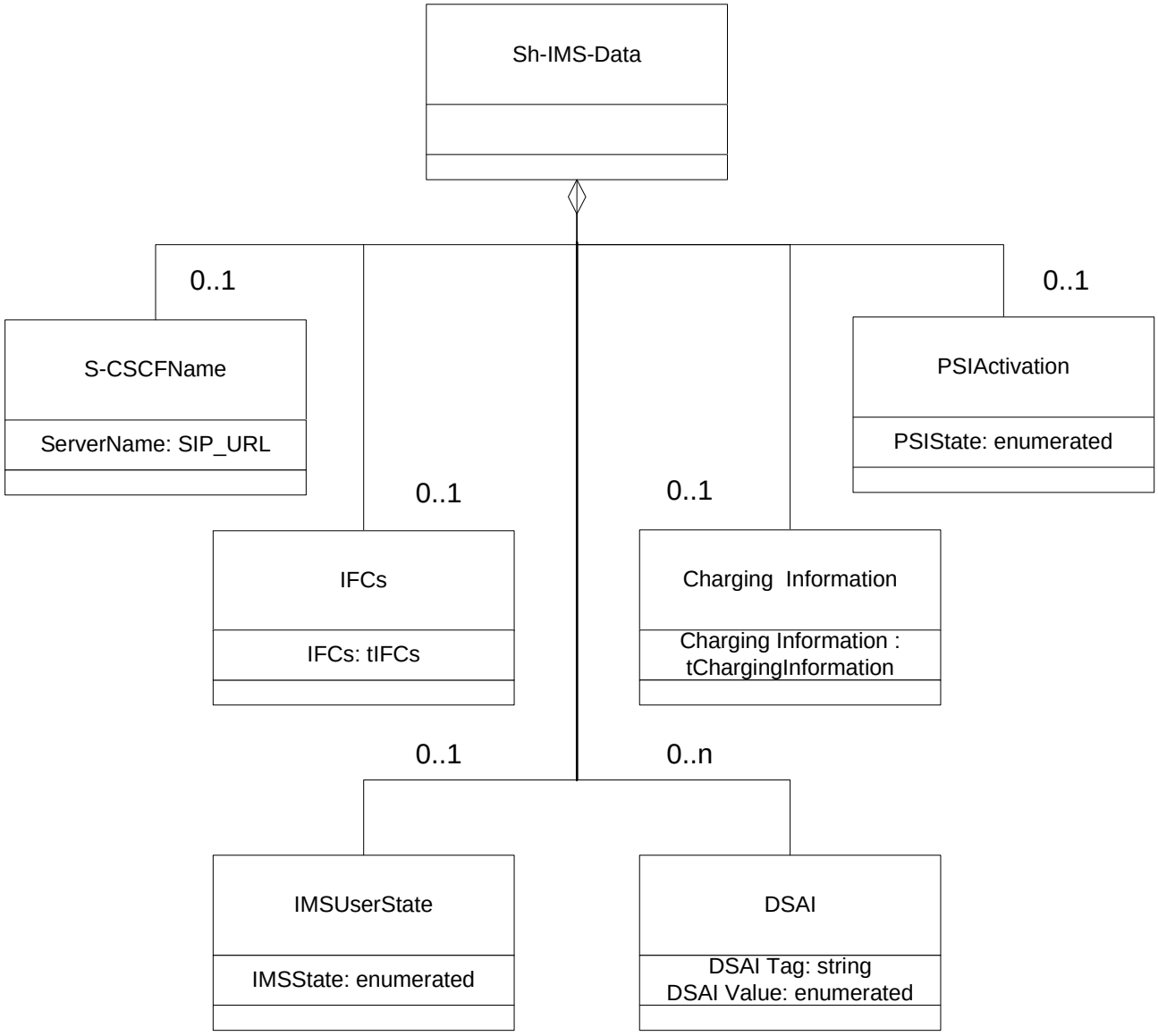


**Figure C.3.1: Sh-IMS-Data**

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

Class S-CSCFName contains a SIP URI. See section 7.6.4 for further details.

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 section 7.6 for possible values.

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

Class PSIActivation contains the activation state of the Public Service Identity given by the attribute of class Sh-IMS-Data. See section 7.6 for possible values.

Class DSAI contains the DSAI Tag and a DSAI Value (reflecting the activation state for services the user is subscribed to. See section 7.14 for contents and usage.

# 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 user profile that is sent over the Sh interface. The user profile XML schema defines the data types that are used in the user profile XML. The data that is allowed to be sent in the user profile may vary depending on the features supported by the Diameter end points, see 3GPP TS 29.329 [5]. The user profile XML schema file is intended to be used by an XML parser. The version of the Sh application sending the user profile XML shall be the same as the version of the sent user profile XML and thus it implies the version of the user profile XML schema to be used to validate it.

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

**Table D.1: XML schema for the Sh user profile interface: simple data types**

| Data type | Tag | Base type | Comments |
|---|---|---|---|
| tPriority | Priority | integer | >= 0 |
| tProfilePartIndicator | ProfilePartIndicator | enumerated | Possible values:<br>0 (REGISTERED)<br>1 (UNREGISTERED) |
| tGroupID | Group | integer | >= 0 |
| tRegistrationType | RegistrationType | enumerated | Possible values:<br>0 (INITIAL_REGISTRATION)<br>1 (RE-REGISTRATION)<br>2 (DE-REGISTRATION) |
| tDefaultHandling | DefaultHandling | enumerated | Possible values:<br>0 (SESSION_CONTINUED)<br>1 (SESSION_TERMINATED) |
| tDirectionOfRequest | SessionCase | enumerated | Possible values:<br>0 (ORIGINATING_SESSION)<br>1 TERMINATING_SESSION<br>2 (TERMINATING_UNREGISTERED)<br>3 (ORIGINATING_UNREGISTERED) |
| tIMSUserState | IMSUserState | Enumerated | Possible values:<br>0 (NOT_REGISTERED)<br>1 (REGISTERED)<br>2 (REGISTERED_UNREG_SERVICES)<br>3 (AUTHENTICATION_PENDING) |
| tCSUserState | CSUserState | Enumerated | Possible values (as defined in 3GPP TS 23.078 [14]):<br>0 (CAMELBusy)<br>1 (NetworkDeterminedNotReachable)<br>2 (AssumedIdle)<br>3 (NotProvidedfromVLR) |
| tPSUserState | PSUserState | Enumerated | Possible values (as defined in 3GPP TS 23.078 [14]):<br>0 (Detached)<br>1 (AttachedNotReachableForPaging)<br>2 (AttachedReachableForPaging)<br>3 (ConnectedNotReachableForPaging)<br>4 (ConnectedReachableForPaging)<br>5 (NotProvidedFromSGSN)<br>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]).<br>Length = 12. |
| tServiceAreaId | ServiceAreaId | string | Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]).<br>Length = 12. |
| tLocationAreaId | LocationAreaId | string | Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]).<br>Length = 8. |
| tRoutingAreaId | RoutingAreaId | string | Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]).<br>Length = 8. |
| tGeographicalInformation | GeographicalInformation | string | Syntax described in 3GPP TS 29.002 (base 64 encoded according to RFC 2045).<br>Length = 12. |
| tGeodeticInformation | GeodeticInformation | string | Syntax described in 3GPP TS 29.002 [13] (Base64 encoded according to RFC 2045 [15]).<br>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]).<br>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 [20]. |
| tSIP_URL | IMSPublicIdentity | anyURI | Syntax described in RFC 3261 [16] |
| tTEL_URL | IMSPublicIdentity | anyURI | Syntax described in IETF RFC 3966 [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 |
| tIdentityType | IdentityType | enumerated | Possible values:<br>0 (PUBLIC_USER_IDENTITY)<br>1 (DISTINCT_PSI)<br>2 (WILDCARDED_PSI) |
| tWildcardedPSI | WildcardedPSI | anyURI | Syntax described in 3GPP TS 23.003 [11]. |
| tServiceInfo | ServiceInfo | string | |
| tDSAI-Tag | DSAI-Tag | string | |
| tString | RequestURI, Method, Header, Content, Line | string | |
| tBool | ConditionTypeCNF, ConditionNegated | boolean | Possible values:<br>0 (false) |

| | | | |
|---|---|---|---|
| | | | 1 (true) |
| tSequenceNumber | SequenceNumber | integer | >=0, <=65535 |
| tPSIActivation | PSIActivation | Enumerated | Possible Values:<br>0 (INACTIVE)<br>1 (ACTIVE) |
| tDSAI-Value | DSAI-Value | enumerated | Possible values are:<br>0 (ACTIVE)<br>1 (INACTIVE) |

**Table D.2: XML schema for the Sh user profile 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 n |
| | | 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 |
| | | Extension | tSh-Data-Extension | 0 to 1 |
| tSh-Data-Extension | Extension | RegisteredIdentites | tPublicIdentity | 0 to 1 |
| | | ImplicitIdentities | tPublicIdentity | 0 to 1 |
| | | AllIdentities | tPublicIdentity | 0 to 1 |
| | | AliasIdentities | tPublicIdentity | 0 to 1 |
| | | AliasesRepositoryData | tTransparentData | 0 to n |
| tTransparentData | RepositoryData | ServiceIndication | string | 1 |
| | | SequenceNumber | tSequenceNumber | 1 |
| | | ServiceData | tServiceData | 0 to 1 |
| tTransparentData | AliasesRepositoryData | 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 |
| | | Extension | tShIMSDataExtension | (0 to 1) |
| tShIMSDataExtension | Extension | PSIActivation | tPSIActivation | (0 to 1) |
| | | Extension | tShIMSDataExtension2 | 0 to 1 |
| tShIMSDataExtension2 | Extension | DSAI | tDSAI | 0 to n |
| 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 |
| | | Extension | | tPublicIdentityExtension | (0 to 1) |
| tPublicIdentityExtension | Extension | IdentityType | | tIdentityType | (0 to 1) |
| | | WildcardedPSI | | tWildcardedPSI | (0 to 1) |
| 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 | 0 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 |

| | | | | |
|---|---|---|---|---|
| | | Extension | tSePoTriExtension | (0 to 1) |
| tSePoTriExtension | Extension | RegistrationType | tRegistrationType | (0 to 2) |
| 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<br>Note 1 |
| | | SecondaryEventChargingFunctionName | tDiameterURI | 0 to 1 |
| | | PrimaryChargingCollectionFunctionName | tDiameterURI | 0 to 1<br>Note 1 |
| | | SecondaryChargingCollectionFunctionName | tDiameterURI | 0 to 1 |
| tDSAI | DSAI | DSAI-Tag | tDSAI-Tag | 1 |
| | | DSAI-Value | tDSAI-Value | 1 |

NOTE: 'n' shall be interpreted as non-bounded.
NOTE 1: At least one of these two information elements (PrimaryEventChargingFunctionName or PrimaryChargingCollectionFunctionName) shall be present.

# Annex E:
# (void)

# Annex F (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 |
| Dec 2003 | CN#22 | NP-030510 | 026 | 3 | Introduction of Presence Stage 3 (Ph) to the Sh interface | 5.6.0 | 6.0.0 |
| Mar 2004 | CN#23 | NP-040055 | 036 | 2 | Dh interface | 6.0.0 | 6.1.0 |
| Mar 2004 | CN#23 | NP-040055 | 043 | 2 | Clarification of the AS Permissions List and its relevance to table 7.6.1 | 6.0.0 | 6.1.0 |
| Mar 2004 | CN#23 | NP-040135 | 045 | 3 | Clarification of which Public Identities are downloaded | 6.0.0 | 6.1.0 |
| June 2004 | CN#24 | NP-040220 | 0085 | 2 | Mapping to Diameter AVP for Requested Identity Set | 6.1.0 | 6.2.0 |
| Sep 2004 | CN#25 | NP-040401 | 094 | 1 | Triggering initial REGISTER messages | 6.2.0 | 6.3.0 |
| Sep 2004 | CN#25 | NP-040401 | 088 | 1 | XML versioning | 6.2.0 | 6.3.0 |
| Dec 2004 | CN#26 | NP-040531 | 097 | 2 | Removal of Notification of the Authentication Pending State upon Registration | 6.3.0 | 6.4.0 |
| Dec 2004 | CN#26 | NP-040531 | 102 | 2 | Only One Error Required for the AS Permissions Table Checking Procedure | 6.3.0 | 6.4.0 |
| Dec 2004 | CN#26 | NP-040531 | 103 | - | Default Handling of Error Cases | 6.3.0 | 6.4.0 |
| Dec 2004 | CN#26 | NP-040578 | 104 | - | Access Key for Charging Information | 6.3.0 | 6.4.0 |
| Dec 2004 | CN#26 | NP-040578 | 108 | 2 | Handling of Information Element marked as (M), (C) or (O) | 6.3.0 | 6.4.0 |
| Dec 2004 | CN#26 | NP-040531 | 101 | 1 | Sh-Pull Data Download | 6.3.0 | 6.4.0 |
| Mar 2005 | CN#27 | NP-050031 | 099 | 5 | Sh-Update needs to include Data-Reference to be future proof | 6.4.0 | 6.5.0 |
| Mar 2005 | CN#27 | NP-050038 | 111 | 1 | Clarification on requested identity set | 6.4.0 | 6.5.0 |
| Mar 2005 | CN#27 | NP-050031 | 113 | - | Align UML Model and the XML schema for Public Identity | 6.4.0 | 6.5.0 |
| Mar 2005 | CN#27 | NP-050031 | 116 | 1 | Conditional Service indication in Sh-Subs-Notif | 6.4.0 | 6.5.0 |

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|---|---|---|---|---|---|---|---|
| Mar 2005 | CN#27 | NP-050031 | 118 | - | Sh Diameter AVP Mapping Correction | 6.4.0 | 6.5.0 |
| Mar 2005 | CN#27 | NP-050031 | 121 | 2 | Clarification of Sh Access Keys | 6.4.0 | 6.5.0 |
| Mar 2005 | CN#27 | NP-050038 | 122 | 2 | Multiple Terminals in Sh | 6.4.0 | 6.5.0 |
| Jun 2005 | CT#28 | CP-050082 | 127 | - | Sh user-data correction | 6.5.0 | 6.6.0 |
| Jun 2005 | CT#28 | CP-050087 | 130 | 1 | Sh procedures applicable to Public Service Identity | 6.5.0 | 6.6.0 |
| Jun 2005 | CT#28 | CP-050082 | 134 | 1 | Behavior of HSS when it accepts Sh-Subs-Notif message | 6.5.0 | 6.6.0 |
| Jun 2005 | CT#28 | CP-050087 | 137 | 1 | Editorial corrections | 6.5.0 | 6.6.0 |
| Jun 2005 | CT#28 | CP-050082 | 139 | - | XML correction for iFC | 6.5.0 | 6.6.0 |
| Sep 2005 | CT#29 | CP-050283 | 146 | - | Correction to Sh-IMS-Data for Intial Filter Criteria | 6.6.0 | 6.7.0 |
| Sep 2005 | CT#29 | CP-050283 | 152 | 1 | ISDN-address correction | 6.6.0 | 6.7.0 |
| Sep 2005 | CT#29 | CP-050424 | 154 | - | Update of the IETF RFC for tel URI | 6.6.0 | 6.7.0 |
| Sep 2005 | CT#29 | CP-050294 | 155 | 2 | PSI Activation | 6.6.0 | 6.7.0 |
| Sep 2005 | CT#29 | CP-050282 | 160 | - | Charging-Information correction | 6.6.0 | 6.7.0 |
| Dec 2005 | CT#30 | CP-050604 | 144 | 5 | XML syntax correction | 6.7.0 | 6.8.0 |
| Dec 2005 | CT#30 | CP-050611 | 161 | 2 | Correction of the use of Data Reference 10 for Public Service Identities | 6.7.0 | 6.8.0 |
| Dec 2005 | CT#30 | CP-050605 | 167 | - | PSUserState correction | 6.7.0 | 6.8.0 |
| Dec 2005 | CT#30 | CP-050625 | 162 | 3 | Notification Efficiency | 6.8.0 | 7.0.0 |
| Dec 2005 | CT#30 | CP-050625 | 163 | 3 | Management of Sh subscriptions | 6.8.0 | 7.0.0 |
| Mar 2006 | CT#31 | CP-060084 | 0168 | 2 | User-Data in the response to Sh-Subs-Notif | 7.0.0 | 7.1.0 |
| Mar 2006 | CT#31 | CP-060084 | 0169 | 1 | New error indications for the Sh-Subs-Notif procedure | 7.0.0 | 7.1.0 |
| Mar 2006 | CT#31 | CP-060065 | 0172 | 2 | Handling of unknown errors | 7.0.0 | 7.1.0 |
| Mar 2006 | CT#31 | CP-060154 | 0176 | 2 | PSI Activation | 7.0.0 | 7.1.0 |
| Jun 2006 | CT#32 | CP-060319 | 0178 | 2 | Returning Null Data | 7.1.0 | 7.2.0 |
| Jun 2006 | CT#32 | CP-060319 | 0181 | 2 | Modify description of clause 6.1.3 Subscription to notifications | 7.1.0 | 7.2.0 |
| Jun 2006 | CT#32 | CP-060319 | 0182 | 2 | Sh interface efficiency improvement | 7.1.0 | 7.2.0 |
| Jun 2006 | CT#32 | CP-060319 | 0183 | 2 | Sh result-code correction | 7.1.0 | 7.2.0 |
| Jun 2006 | CT#32 | CP-060308 | 0186 | 1 | PSI Activation schema correction | 7.1.0 | 7.2.0 |
| Sep 2006 | CT#33 | CP-060417 | 0188 | 3 | Definition of Activation State Information for IMS (DSAI) | 7.2.0 | 7.3.0 |
| Sep 2006 | CT#33 | CP-060417 | 0190 | - | Applying ORIGINATING_UNREGISTERED state to Sh | 7.2.0 | 7.3.0 |
| Sep 2006 | CT#33 | CP-060417 | 0191 | 2 | Sh-Subs-Notif without Expiry Time | 7.2.0 | 7.3.0 |
| Sep 2006 | CT#33 | CP-060417 | 0195 | 4 | S-CSCF name in Sh | 7.2.0 | 7.3.0 |
| Sep 2006 | CT#33 | CP-060417 | 0196 | 1 | Public User Identity Grouping Information | 7.2.0 | 7.3.0 |
| Sep 2006 | CT#33 | CP-060399 | 0198 | 2 | Correction of the relationship between Repository Data and Public Identities | 7.2.0 | 7.3.0 |
| Sep 2006 | CT#33 | CP-060417 | 0199 | | Error to be sent if the identity can not be used for data reference | 7.2.0 | 7.3.0 |
| Sep 2006 | CT#33 | CP-060417 | 0200 | 1 | Errors to be sent in response to Sh-Notif | 7.2.0 | 7.3.0 |
| Dec 2006 | CT#34 | CP-060555 | 0204 | 1 | Activation Status of a PSI | 7.3.0 | 7.4.0 |
| Dec 2006 | CT#34 | CP-060566 | 0207 | 1 | UDA correction for the case that data does not exist in the HSS | 7.3.0 | 7.4.0 |
| Dec 2006 | CT#34 | CP-060566 | 0208 | - | Grouping identities update | 7.3.0 | 7.4.0 |
| Dec 2006 | CT#34 | CP-060735 | 0209 | 3 | Clarification regarding URI canonicalization – 29.328 | 7.3.0 | 7.4.0 |
| Mar 2007 | CT#35 | CP-070020 | 0211 | - | CurrentLocation is a required Access Key for LocationInformation DataRef | 7.4.0 | 7.5.0 |
| Mar 2007 | CT#35 | CP-070020 | 0212 | - | Clarification on interaction between DSAI and wildcarded PSI | 7.4.0 | 7.5.0 |
| Mar 2007 | CT#35 | CP-070020 | 0215 | - | Presence of Information Elements in Sh-Subs-Notif | 7.4.0 | 7.5.0 |
| Mar 2007 | CT#35 | CP-070020 | 0219 | 1 | Restriction in the instances of repository data | 7.4.0 | 7.5.0 |
| Jun 2007 | CT#36 | CP-070309 | 0221 | - | Correction of XML schema | 7.5.0 | 7.6.0 |
| Jun 2007 | CT#36 | CP-070318 | 0224 | - | Adding the Ability to Notify an AS with Charging Information | 7.5.0 | 7.6.0 |
| Jun 2007 | CT#36 | CP-070318 | 0227 | 1 | Application Server subscription for Implicit Identities | 7.5.0 | 7.6.0 |
| Sep 2007 | CT#37 | CP-070527 | 0231 | 1 | Handling of Empty Repository Data | 7.6.0 | 7.7.0 |
| Sep 2007 | CT#37 | CP-070527 | 0234 | - | Handling of Charging Data by the HSS | 7.6.0 | 7.7.0 |
| Sep 2007 | CT#37 | CP-070527 | 0235 | 1 | Wildcarded PSI as key in the Sh Interface | 7.6.0 | 7.7.0 |
| Sep 2007 | CT#37 | CP-070522 | 0238 | 1 | Repository Data and Subscriptions for Wildcarded PSIs | 7.6.0 | 7.7.0 |
| Sep 2007 | CT#37 | CP-070527 | 0239 | 1 | Aliases definition alignment with 23.228 | 7.6.0 | 7.7.0 |
| Nov 2007 | CT#38 | CP-070743 | 0241 | - | PNR for Subscriptions to Notifications for all Identity Sets | 7.7.0 | 7.8.0 |
| Jun 2008 | CT#40 | CP-080267 | 0250 | - | DSAI Corrections | 7.8.0 | 7.9.0 |

# History

| Document history | | |
|---|---|---|
| V7.6.0 | June 2007 | Publication |
| V7.7.0 | October 2007 | Publication |
| V7.8.0 | January 2008 | Publication |
| V7.9.0 | July 2008 | Publication |
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