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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
IP Multimedia Subsystem (IMS)
Sh interface signalling flows and message contents
(3GPP TS 29.328 version 5.0.0 Release 5)**

**GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS**

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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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1 Scope

This 3GPP Technical Specification (TS) specifies the interactions between the HSS (Home Subscriber Server) and the SIP AS (Application Server) and between the HSS and the OSA SCS (Service Capability Server). This interface is referred to as the Sh reference point.

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

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

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

2 References

[1]   3GPP TS 23.228: "IP Multimedia (IM) Subsystem – Stage 2".

[2]   3GPP TS 24.228: "Signalling flows for the IP multimedia call control based on SIP and SDP".

[3]   3GPP TS 23.002 "Network architecture".

[4]   3GPP TS 23.218: "IP Multimedia (IM) Session Handling; IP Multimedia (IM) call model"

[5]   3GPP TS 29.329: "Sh Interface based on Diameter – Protocol details"

[6]   3GPP TS 29.228: "IP multimedia (IM) Subsystem Cx Interface; Signalling flows and Message Elements".

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

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SIP   Session Initiation Protocol
S-CSCF   Serving CSCF

4   Main Concept

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

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

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

5   General Architecture

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

5.1   Functional requirements of network entities

5.1.1   Functional Requirements of the Application Server

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

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

5.1.2   Functional requirements of HSS

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

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

5.2   Functional classification of Sh interface procedures

Operations on the Sh interface are classified in functional groups:

1. Data handling procedures

    -   The download of data from the HSS to an AS.

    -   The update of data in the HSS.

2. Subscription/notification procedures

    -   An AS can subscribe to receive notifications from the HSS of changes in data.

    -   The HSS can notify an AS of changes in data for which the AS previously had subscribed.

6   Procedure Descriptions

6.1   User data handling procedures

6.1.1   Data read (Sh-Pull)

This procedure is used by an AS to read transparent and/or non-transparent data from the HSS. 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	Identity of the user for whom the data is required.
Requested data (See 7.2)	Data-Reference	M	This information element indicates the list of references to the requested information. The set of valid reference values are defined in 7.5.
Service Indication (See 7.3)	Service-Indication	O	IE that identifies, together with the User-Identity and Data-Reference, the set of service related transparent data that is being requested..
Application Server Identity	Origin-Host	M	IE that identifies the AS originator of the request and that is used, together with the user identity and Data-Reference, as key to identify the filter criteria.

Table 6.1.1.2: Sh-Pull Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Data request result (See 7.4)	Result-Code	M	Result of the request.
Requested data (See 7.5)	User-Data	O	Requested data.

6.1.1.1 Detailed behaviour

Upon reception of the Sh-Pull request, the HSS may check that the user for whom data is asked exists in HSS. The HSS shall check that the AS sending the request (identified by the Origin-Host AVP) has Sh-Pull permission in the AS Permissions List (See 6.2).

The HSS shall return the requested data identified by User-Identity and Data-Reference. If repository data are requested Service-Indication shall be present in the request. If filter criteria are requested the Origin-Host AVP identifies the AS that initiates the request.

6.1.2 Data Update (Sh-Update)

This procedure is used by an AS to update data in the HSS. 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 identity of the user which data is updated.
Updated data (See 7.5)	User-Data	M	Updated data.
Application Server Identity	Origin-Host	M	IE that identifies the AS originator of the request and that is used, together with the user identity and Data-Reference, as key to identify the updated filter criteria.

Table 6.1.2.2: Sh-Update Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Data update result (See 7.4)	Result-Code	M	Result of the update of data in the HSS.

6.1.2.1 Detailed behaviour

Upon reception of the Sh-Update request, the HSS may check that the user for whom data is asked exists in HSS. The HSS shall check that the AS sending the request (identified by the Origin-Host AVP) has Sh-Update permission in the AS Permissions List (See 6.2).

The keys to determine the updated data are part of the information element User-Data (See Annex X). When data repository is updated Service-Indication is also part of the information element User-Data. When initial filter criteria are updated the Origin-Host AVP identifies the AS that initiates the request.

6.1.3 Subscription to notifications (Sh-Subs-Notif)

This procedure is used by an AS to subscribe to notifications from the HSS of changes in data. Tables 6.1.3.1 and 6.1.3.2 detail the involved information elements.

Table 6.1.3.1: Sh-Subs-Notif

Information element name	Mapping to Diameter AVP	Cat.	Description
User Identity (See 7.1)	User-Identity	M	IMS public identity of the user for whom notifications of data changes are requested.
Requested data (See 7.2)	Data-Reference	M	This information element includes the list of references to the data on which notifications of change are required (valid reference values are defined in 7.5).
Service Indication (See 7.3)	Service-Indication	O	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..
Application Server Identity	Origin-Host	M	IE that identifies the AS originator of the request and that is used, together with the user identity and Data-Reference, as key to identify the filter criteria.

Table 6.1.3.2: Sh-Subs-Notif Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Data request result (See 7.4)	Result-Code	M	Result of the request.

6.1.3.1 Detailed behaviour

Upon reception of the Sh-Subs-Notif request, the HSS may check that the user for whom notifications are asked exists in HSS. The HSS shall check that the AS sending the request (identified by the Origin-Host AVP) has Sh-Subs-Notif permission in the AS Permissions List (See 6.2).

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 Origin-Host AVP shall be used as key to the filter criteria.

6.1.4 Notifications (Sh-Notif)

This procedure is used by the HSS to send to an AS notifications of changes in data to which the AS has previously subscribed using Sh-Subs-Notif. 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 identity of the user which data has changed.
Changed data (See 7.5)	User-Data	M	Changed data.

Table 6.1.4.2: Sh-Notif Resp

Information element name	Mapping to Diameter AVP	Cat.	Description
Data request result (See 7.4)	Result-Code	M	Result of the request.

6.1.4.1 Detailed behaviour

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

6.2 AS permissions list

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

7 Information element contents

7.1 User Identity

This information element contains a user public identity (either SIP-URL, TEL-URL or MSISDN).

7.3 Data Reference

Reference to the data that an AS is requesting from the HSS. Reference to the data which if changed, an AS wants to be notified of. See chapter 7.6.

7.4 Service Indication

Identifier of one set of service related transparent data,]), which is stored in an HSS in an operator network. It shall be unique within an operator network. Per user and value of Service Indication the HSS may allocate memory space to implement a data repository to store transparent data.

7.5 Result

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

7.6 Data

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

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

Table 7.5.1 defines the reference values, access key and recommended access rights for the data accessible via the Sh interface. It is a matter of operator policy to relax or further restrict the access rights defined in table 7.5.1.

Table 7.6.1: Data accessible via Sh interface

Data Ref.	XML tag	Defined in	Access key	May be included in the operations:
0	RepositoryData	7.6.1	Public-Identity + Data-Reference + Service-Indication	Sh-Pull, Sh-Update, Sh-Subs-Notif
10	PublicIdentifiers	7.6.2	User-Identity + Data-Reference	Sh-Pull
11	RegistrationState	7.6.3		Sh-Pull, Sh-Subs-Notif
12	S-CSCFName	7.6.4		Sh-Pull, Sh-Subs-Notif
13	InitialFilterCriteria	7.6.5	User-Identity + Data-Reference + Origin-Host	Sh-Pull, Sh-Update, Sh-Subs-Notif
14	LocationInformation	7.6.6	User-Identity + Data-Reference	Sh-Pull
15	SubscriberState	7.6.7		

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 PublicIdentifiers

List of public identities of the user.

7.6.3 Registration State

This information element contains the IMS Registration State of the public identifier referenced. Its possible values are: REGISTERED, NOT_REGISTERED, AUTHENTICATION_PENDING and REGISTERED_UNREG_SERVICES.

7.6.4 S-CSCF Name

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

7.6.5 Initial Filter Criteria

This information element contains the triggering information for a service.

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

7.6.6 Location Information

This IE contains geographical and/or geodetic location of the user and/or the age of location information. Geographical information is defined in 3GPP TS 23.032. Geodetic information is defined in ITU-T Recommendation Q.763. The age of location information is defined in 3GPP TS 23.018.

7.6.7 Subscriber state

The exact nature of this information element is FFS.

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 Sh message parameters to Diameter AVP mapping

The following table gives an overview about the mapping:

Table A.3.1: Sh message parameters to Diameter AVP mapping

Sh parameter	AVP Name
User identity	User-Identity
Requested data, Changed data	Data-Reference
Service Indication	Service-Indication
Result	Result-Code / Vendor-Specific-Result
Requested Data, Updated data	User-Data

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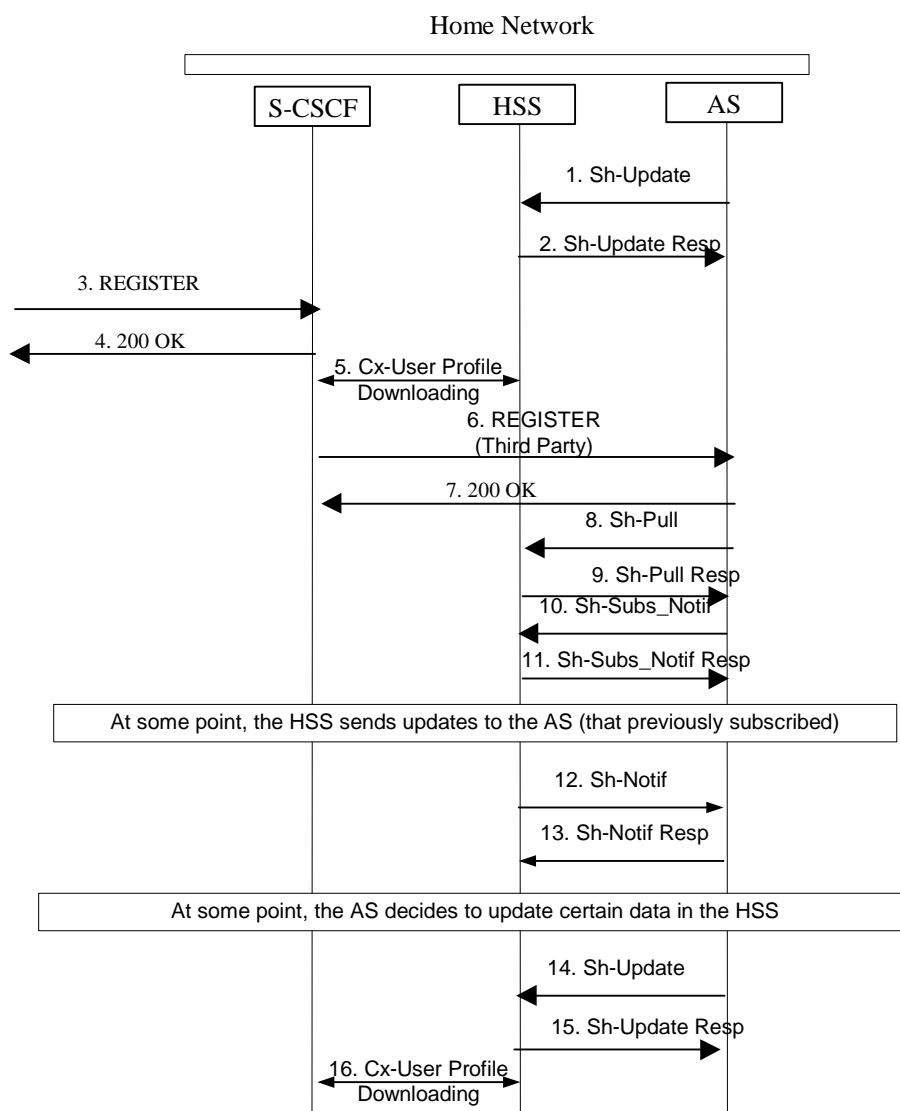
Figure B.1.1: Data Update, Registration, Notification Subscription

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. filter criteria, repository data.

2. HSS confirms the data is updated

3. Some time later, user registers with the network

4. 200 OK

5. S-CSCF downloads the data from the HSS. Filter criteria specify that the AS wants to be notified that the end user is registered.

6. S-CSCF sends third party registration message to the application server to notify that user is registered.

7. 200 OK

8. The AS downloads data needed for providing service from HSS, by means of Sh-Pull (user identity, requested data, and service information).

9. HSS sends data to AS

10. The AS subscribes to notifications from the HSS of changes in data, by means of Sh-Subs-Notif (user identity, requested data, and/or service information).

11. The HSS confirms the subscription request.

12. At some moment, user data is updated in the HSS. As the AS subscribed to notifications (step 10), the HSS sends to the AS the requested updates, by means of Sh-Notif (user identity, updated data).

13. The AS acknowledges the notification.

14. At some moment, the AS decides to update user's service data e.g. filter criteria in the HSS, by means of Cx-Update (user identity, updated data).

15. The HSS confirms the service data is updated.

16. If the updated data is needed in the S-CSCF, e.g. filter criteria, the HSS updates the data in the S-CSCF.

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

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

C.1   General description

The following picture gives an outline of the UML model of the user profile, which is exchanged between the HSS and an AS:
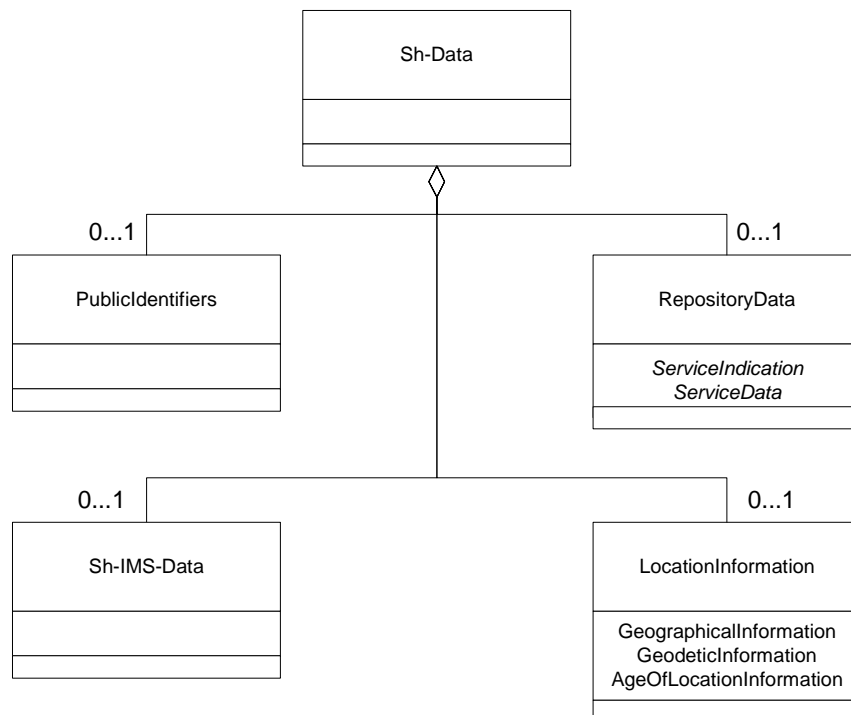
Figure C.1.1: Sh-Data

Each instance of the Sh-Data class contains 0 or 1 instance of the class PublicIdentifiers, 0 or 1 instance of the class Repository, 0 or 1 instance of the class Sh-IMS-Data, and/or 0 or 1 instance of the class LocationInformation.

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

Class LocationInformation has the attributes GeographicalInformation, GeodeticInformation, AgeOfLocationInformation. They are defined in 7.6. The exact coding of the location information for its transport over XML is for further study.

C.2   PublicIdentifiers

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

```
┌─────────────────────────┐
│     PublicIdentifiers    │
├─────────────────────────┤
│                         │
├─────────────────────────┤
│                         │
└─────────────────────────┘
             ◇
             │
            0..n
             │
┌─────────────────────────┐
│     IMSPublicIdentity    │
├─────────────────────────┤
│  Identity: SIP URL or TEL│
│    URL or MSISDN         │
├─────────────────────────┤
│                         │
└─────────────────────────┘
```
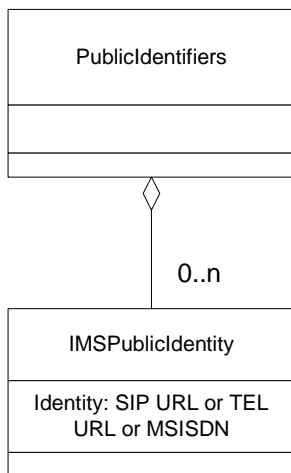
Figure C.2.1: The UML model of the class PublicIdentifiers

Class PublicIdentifiers contains 0 to n user public identities. The identifiers are of format SIP URL, TEL URL or MSISDN.

C.3 Sh-IMS-Data

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

```
                  ┌─────────────────────┐
                  │     Sh-IMS-Data     │
                  ├─────────────────────┤
                  │                     │
                  ├─────────────────────┤
                  │                     │
                  └─────────────────────┘
                            ◇
              ┌─────────────┼──────────────┐
            0..1          0..n            0..1
              │             │               │
   ┌─────────────────┐ ┌──────────────────┐ ┌─────────────────┐
   │   S-CSCFName    │ │InitialFilterCriteria│ │  IMSUserState   │
   ├─────────────────┤ ├──────────────────┤ ├─────────────────┤
   │ServerName: SIP_URL│ │  FilterCriteria: │ │IMSState: enumerated│
   │                 │ │tInitialFilterCriteria│ │                 │
   ├─────────────────┤ ├──────────────────┤ ├─────────────────┤
   │                 │ │                  │ │                 │
   └─────────────────┘ └──────────────────┘ └─────────────────┘
```
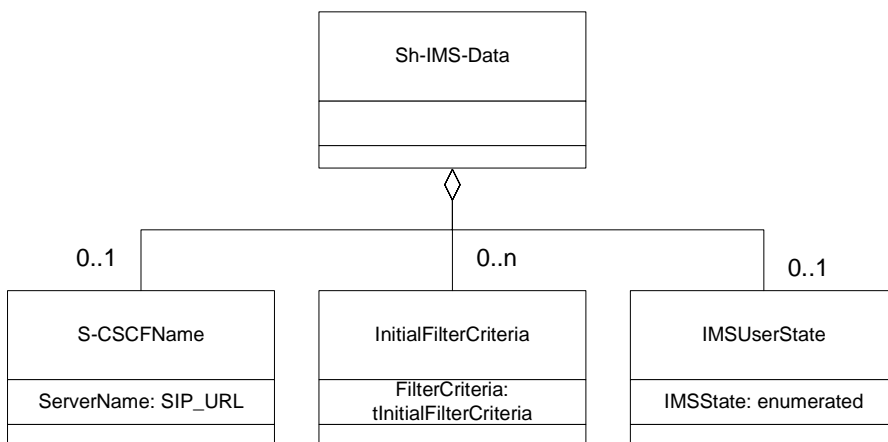
Figure C.3.1: Sh-IMS-Data

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

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

Class InitialFilterCriteria is defined in 3GPP TS 29.228 [6] and contains the initial filter criteria of the multimedia public identity that the AS included in the request.

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

Annex D (informative):
Change history

<table>
<tr><th colspan="8">Change history</th></tr>
<tr><th>Date</th><th>TSG #</th><th>TSG Doc.</th><th>CR</th><th>Rev</th><th>Subject/Comment</th><th>Old</th><th>New</th></tr>
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