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All-IP Core Network Multimedia Domain

IP Multimedia Subsystem Cx Interface Signaling flows and Message Contents

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IP Multimedia Subsystem Cx Interface
Signaling flows and Message Contents**

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10 **Revision History**

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Revision	Changes	Date
0, v1.0	Initial Publication	December 2003
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1 Scope

This Specification specifies the interactions between the HSS (Home Subscriber Server) and the CSCF (Call Session Control Functions), referred to as the Cx interface.

This document addresses the signalling flows for the Cx interface.

The IP Multimedia (IM) Subsystem stage 2 is specified in [1] and the protocol for the IP multimedia call control based on SIP and SDP are specified in [8].

2 References

- [1] 3GPP2 X.S0013-002-0 v1.0: "IP Multimedia (IM) Subsystem – Stage 2".
- [2] Void
- [3] 3GPP2 S.RS0086-A0: "3GPP2 IMS Security Framework".
- [4] 3GPP2 S.R0037-0, "3GPP2 All-IP Network Architecture Model Version 2.0, May 14, 2002".
- [5] 3GPP2 X.S0013-006-0 v2.0: "Cx Interface based on Diameter Protocol; Protocol details"
- [6] 3GPP2 X.S0013-003-0 v2.0: "IP Multimedia Subsystem – IP Multimedia Call Model; Stage 2".
- [7] IETF RFC 2045, "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies", November 1996.
- [8] 3GPP2 X.S0013-004-0 v2.0: "IP Multimedia Call Control Protocol Based on SIP and SDP Stage 3".
- [9] IETF RFC 3588, "Diameter Base Protocol", September 2003.
- [10] IETF RFC 3261, "SIP: Session Initiation Protocol", June 2002.
- [11] –IETF RFC 2327 "SDP: Session Description Protocol"
- [12] –IEEE 1003.1-2004, Part 1: Base Definitions

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Common Part (of a user profile): Contains Initial Filter Criteria instances that should be evaluated both for registered and unregistered Public User Identities in the S-CSCF.

Complete user profile: Contains the Initial Filter Criteria instances of all three different user profile parts: registered part, unregistered part and common part.

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

Charging information: Data that is sent in the Charging-Information AVP.

Implicitly registered Public User Identity set: A set of Public User Identities, which are registered and de-registered simultaneously when any of the Public User Identities belonging to that set is registered or de-registered.

Not Registered State: User is not Registered and has no S-CSCF assigned.

1 Registered Part (of a user profile): Contains Initial Filter Criteria instances that should be evaluated only
 2 for registered Public User Identities in the S-CSCF. iFCs from the registered part need not be evaluated
 3 when the user is unregistered.

4 Registered State: User is Registered at the request of the user and has an S-CSCF assigned.

5 Unregistered part (of a user profile): Contains Initial Filter Criteria instances that should be evaluated
 6 only for unregistered Public User Identities in the S-CSCF. iFCs from the unregistered part need not be
 7 evaluated when the user is registered.

8 Unregistered State: User is not Registered but has a serving S-CSCF assigned to execute Unregistered
 9 state services as a consequence of a terminating call or there is an S-CSCF keeping the user profile stored.

10 User information: The user related data that the S-CSCF requests from the HSS or HSS pushes to the S-
 11 CSCF, e.g. user profile and charging information.

12 User profile: Data that is sent in the User-Data AVP.

13 **3.2 Abbreviations**

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

15	AVP	Attribute Value Pair
16	CSCF	Call Session Control Function
17	HSS	Home Subscriber Server
18	IE	Information Element
19	IP	Internet Protocol
20	I-CSCF	Interrogating CSCF
21	IM	IP Multimedia
22	IMS	IP Multimedia Subsystem
23	LIA	Location Information Answer
24	LIR	Location Information Request
25	MAA	Multimedia Authentication Answer
26	MAR	Multimedia Authentication Request
27	MO	Mobile Originating
28	MT	Mobile Terminating
29	P-CSCF	Proxy CSCF
30	PPA	Push Profile Answer
31	PPR	Push Profile Request
32	RTA	Registration Termination Answer
33	RTR	Registration Termination Request
34	SAA	Server Assignment Answer
35	SAR	Server Assignment Request
36	SIP	Session Initiation Protocol
37	S-CSCF	Serving CSCF
38	UAA	User Authorization Answer
39	UAR	User Authorization Request

40 **4 Main Concept**

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

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

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

5 General Architecture

This clause further specifies the architectural assumptions associated with the Cx reference point, building on [1].

5.1 Functional requirements of network entities

5.1.1 Functional requirements of P-CSCF

There is no requirement for the interaction between the P-CSCF and the HSS.

5.1.2 Functional requirements of I-CSCF

The I-CSCF communicates with the HSS over the Cx interface.

For functionality of the I-CSCF refer to [4].

5.1.3 Functional requirements of S-CSCF

The S-CSCF communicates with the HSS over the Cx interface.

For functionality of the S-CSCF refer to [4].

5.1.4 Functional requirements of HSS

The HSS communicates with the I-CSCF and the S-CSCF over the Cx interface.

5.1.5 Functional classification of Cx interface procedures

Operations on the Cx interface are classified in functional groups:

1. Location management procedures
 - The operations regarding registration and de-registration.
 - Location retrieval operation.
2. User data handling procedures
 - The download of user information during registration and to support recovery mechanisms.
 - Operations to support the updating of user data.
3. User authentication procedures

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.

- 1 - If the receiver detects that those conditions are fulfilled and the Information Element is absent,
 2 an application error occurs and an answer message shall be sent back to the originator of the
 3 request with the Result-Code set to DIAMETER_MISSING_AVP. This answer message shall
 4 also include a Failed-AVP AVP containing the missing Information Element i.e. the
 5 corresponding Diameter AVP defined by the AVP Code and the other fields set as expected for
 6 this Information Element.
- 7 - If those conditions are not fulfilled, the Information Element shall be absent. If however this
 8 Information Element appears in the message, it shall not cause an application error and it may be
 9 ignored by the receiver if this is not explicitly defined as an error case. Otherwise, an application
 10 error occurs at the receiver and an answer message with the Result-Code set to
 11 DIAMETER_AVP_NOT_ALLOWED shall be sent back to the originator of the request. A
 12 Failed-AVP AVP containing a copy of the corresponding Diameter AVP shall be included in this
 13 message.
- 14 - An optional Information Element (marked as (O) in the table) may be present or absent in the
 15 command, at the discretion of the application at the sending entity. Absence or presence of this
 16 Information Element shall not cause an application error and may be ignored by the receiver. In
 17 the tables that describe the information elements transported by each command, each
 18 Information Element is marked as (M) Mandatory, (C) Conditional or (O) Optional. A
 19 mandatory information element shall always be present. A conditional information shall be
 20 present if certain conditions are fulfilled; if those conditions are not fulfilled it shall be absent.
 21 An optional information element may be present or absent in the command, at the discretion of
 22 the application at the sending entity.

23 When a procedure is required to determine whether two S-CSCF names are equal, the rules for SIP URI
 24 comparison specified in [10] chapter 19.1.4 shall apply.

25 6.1 Location management procedures

26 6.1.1 User registration status query

27 This procedure is used between the I-CSCF and the HSS during SIP registrations. The procedure is invoked
 28 by the I-CSCF, corresponds to the combination of the functional level operations Cx-Query and Cx-Select-
 29 Pull (see [1]) and is used:

- 30 - To authorize the registration of the user, checking multimedia subsystem access permissions and
 31 roaming agreements.
- 32 - To perform a first security check, determining whether the public and ~~private identities~~ Private
 33 User Identities sent in the message belong to the same user.
- 34 - To obtain either the S-CSCF where the user is registered or unregistered (i.e. registered as a
 35 consequence of a terminating call or there is a S-CSCF keeping the user profile stored), or the list of
 36 capabilities that the S-CSCF has to support.

37 This procedure is mapped to the commands User-Authorization-Request/Answer in the Diameter
 38 application specified in [5]. Tables 6.1.1.1 and 6.1.1.2 detail the involved information elements.

39 **Table 6.1.1.1 : User registration status query**

Information element name	Mapping to Diameter AVP	Cat.	Description
Public User Identity (See 7.2)	Public-Identity	M	User public identity <u>Public User Identity</u> to be registered

Visited Network Identifier (See 7.1)	Visited-Network-Identifier	M	Identifier that allows the home network to identify the visited network
Type of Authorization (See 7.14)	User-Authorization-Type	C	Type of authorization requested by the I-CSCF. If the request corresponds to a de-registration, i.e. Expires field <u>or expires parameter in Contact field</u> in the REGISTER method is equal to zero, this AVP shall be present in the command and the value shall be set to DE_REGISTRATION. If the request corresponds to an initial registration or a re-registration, i.e. Expires field <u>or expires parameter in Contact field</u> in the REGISTER method is not equal to zero then this AVP may be absent from the command. If present its value shall be set to REGISTRATION. If the request corresponds to an initial registration or a re-registration, and the I-CSCF explicitly queries the S-CSCF capabilities, then this AVP shall be present in the command and the value shall be set to REGISTRATION_AND_CAPABILITIES. The I-CSCF shall use this value when the user's current S-CSCF, which is stored in the HSS, cannot be contacted and a new S-CSCF needs to be selected.
Private User Identity (See 7.3)	User-Name	M	User private identity Private User Identity
Routing Information (See 7.13)	Destination-Host, Destination-Realm	C	If the I-CSCF knows HSS name Destination-Host AVP shall be present in the command. Otherwise, only Destination-Realm AVP shall be present and the command shall be routed to the next Diameter node.

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Table 6.1.1.2 : User registration status response

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.6)	Result-Code / Experimental-Result	M	Result of the operation Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Cx 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.
S-CSCF capabilities (See 7.5)	Server-Capabilities	O	Required capabilities of the S-CSCF to be assigned to the user.
S-CSCF Name (See 7.4)	Server-Name	C	Name of the assigned S-CSCF.

3

6.1.1.1 Detailed behaviour

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 [5]):

6

- 1 1. Check that the user exists in the HSS. If not, Experimental-Result-Code shall be set to
2 DIAMETER_ERROR_USER_UNKNOWN.
- 3 2. Check that the private and ~~public identities~~Public User Identities received in the request belong to the
4 same user. If not, Experimental-Result-Code shall be set to DIAMETER_ERROR
5 _IDENTITIES_DONT_MATCH.
- 6 3. Check whether the ~~public identity~~Public User Identity received in the request is barred for the
7 establishment of multimedia sessions.
- 8 + If it is, the HSS shall check whether there are other non-barred ~~public identities~~Public User Identities
9 to be implicitly registered with that one.
- 10 -- If so, continue to step 4.
- 11 -- If not, Result-Code shall be set to DIAMETER_AUTHORIZATION_REJECTED.
- 12 4. Check the User-Authorization-Type received in the request:
- 13 + If it is REGISTRATION or if User-Authorization-Type is absent from the request, the HSS shall
14 check that the user is allowed to roam in the visited network (if not, Experimental-Result-Code shall
15 be set to DIAMETER_ERROR_ROAMING_NOT_ALLOWED and processing should stop) and
16 authorized to register (if not, Result-Code shall be set to
17 DIAMETER_AUTHORIZATION_REJECTED and processing should stop). Continue to step 5.
- 18 + If it is DE_REGISTRATION, the HSS may not perform any check regarding roaming. Continue to
19 step 5.
- 20 + If it is REGISTRATION_AND_CAPABILITIES, the HSS shall check that the user is allowed to
21 roam in the visited network (if not, Experimental-Result-Code shall be set to DIAMETER_ERROR
22 _ROAMING_NOT_ALLOWED) and authorized to register (if not Result-Code shall be set to
23 DIAMETER_AUTHORIZATION_REJECTED). The HSS shall return the Server-Capabilities
24 AVP list of S-CSCF capabilities, which enables the I-CSCF to select an S-CSCF. The returned
25 capabilities must satisfy the most restrictive service profile of the user. The Server-Capabilities AVP
26 may be absentThe list of capabilities may be empty, to indicate to the I-CSCF that it can select any
27 available S-CSCF. Result-Code shall be set to DIAMETER_SUCCESS. The HSS shall not return
28 any S-CSCF name. Stop processing.
- 29 5. Check the state of the ~~public identity~~Public User Identity received in the request:
- 30 + If it is registered, the HSS shall return the stored S-CSCF name. No S-CSCF capabilities shall be
31 present in the response. In case the User-Authorization-Type is equal to REGISTRATION,
32 Experimental-Result-Code shall be set to DIAMETER_SUBSEQUENT_REGISTRATION. If User-
33 Authorization-Type is equal to DE_REGISTRATION, Result-Code shall be set to
34 DIAMETER_SUCCESS.
- 35
- 36 + If it is unregistered (i.e registered as a consequence of a terminating call or there is a S-CSCF
37 keeping the user profile stored) and User-Authorization-Type is equal to DE_REGISTRATION,
38 Result-Code shall be set to DIAMETER_SUCCESS. If the User-Authorization-Type is equal to
39 REGISTRATION, then:
- 40 o If the selection of a new S-CSCF is not necessary, the HSS shall return the stored S-CSCF
41 name and the Experimental-Result-Code set to
42 DIAMETER_SUBSEQUENT_REGISTRATION. The HSS shall not return any S-CSCF
43 capabilities.
- 44 o Otherwise, the HSS shall return the name of the S-CSCF assigned to the unregistered user, the
45 S-CSCF capabilities and the Experimental-Result-Code set to
46 DIAMETER_SERVER_SELECTION. Considering the information received from the HSS,
47 the I-CSCF shall determine whether or not it has to select a new S-CSCF.

1 |

2 | + If it is not registered yet, the HSS shall check the value of User-Authorization-Type received in the

3 | request:

4 | -- If the value of User-Authorization-Type is DE_REGISTRATION, then the HSS shall not return

5 | any S-CSCF name or S-CSCF capabilities. The HSS shall set the Experimental-Result-Code to

6 | DIAMETER_ERROR_IDENTITY_NOT_REGISTERED in the response.

7 | -- If the value of User-Authorization-Type is REGISTRATION, then the HSS shall check if there is

8 | at least one identity of the user with an S-CSCF name assigned.

9 | --- If there is at least one identity of the user that is registered the HSS shall return the S-CSCF

10 | name assigned for the user and Experimental-Result-Code set to

11 | DIAMETER_SUBSEQUENT_REGISTRATION. The HSS shall not return any S-CSCF

12 | capabilities.

13 | --- If there is at least one identity of the user that is unregistered (i.e registered as a consequence

14 | of a terminating call or there is an S-CSCF keeping the user profile stored), then:

15 | ▪ If the selection of a new S-CSCF is not necessary, the HSS shall return the stored S-

16 | CSCF name and the Experimental-Result-Code set to

17 | DIAMETER_SUBSEQUENT_REGISTRATION. The HSS shall not return any S-

18 | CSCF capabilities.

19 | ▪ Otherwise, the HSS shall return the name of the S-CSCF assigned to the unregistered

20 | user, the S-CSCF capabilities and the Experimental-Result-Code set to

21 | DIAMETER_SERVER_SELECTION. Considering the information received from

22 | the HSS, the I-CSCF shall determine whether or not it has to select a new S-CSCF.

23 |

24 | --- If there is not any identity of the user with an S-CSCF name assigned, then the HSS shall

25 | return the Server-Capabilities AVP~~list of S-CSCF capabilities~~, which enables the I-CSCF to

26 | select an S-CSCF. The Server-Capabilities AVP may be absent~~The list of S-CSCF capabilities~~

27 | may be empty, to indicate to the I-CSCF that it may select any available S-CSCF. Experimental-

28 | Result-Code shall be set to DIAMETER_FIRST_REGISTRATION. The HSS shall not return

29 | any S-CSCF name-.

30 | If the HSS cannot fulfill received request, e.g. due to database error, it shall set Result-Code to

31 | DIAMETER_UNABLE_TO_COMPLY. No S-CSCF name or S-CSCF capabilities shall be present in the

32 | response.

33 | **6.1.2 S-CSCF registration/deregistration notification**

34 | This procedure is used between the S-CSCF and the HSS. The procedure is invoked by the S-CSCF,

35 | corresponds to the combination of the operations Cx-Put and Cx-Pull (see [1]) and is used:

- 36 | - To assign an S-CSCF to a ~~public identity~~Public User Identity, or to clear the name of the S-CSCF
- 37 | assigned to one or more ~~public identities~~Public User Identities.
- 38 | - To download from HSS the relevant user ~~profile~~ information that the S-CSCF needs to serve the
- 39 | user.

40 | This procedure is mapped to the commands Server-Assignment-Request/Answer in the Diameter

41 | application specified in [5]. Tables 6.1.2.1 and 6.1.2.2 describe the involved information elements.

42 | **Table 6.1.2.1: S-CSCF registration/deregistration notification request**

Information element name	Mapping to Diameter	Cat.	Description
--------------------------	---------------------	------	-------------

	AVP		
Public User Identity (See 7.2)	Public-Identity	C	<p>User private identityPublic User Identity or list of user public identitiesPublic User Identities.</p> <p>One and only one public identityPublic User Identity shall be present if the Server-Assignment-Type is any value other than <u>TIMEOUT_DEREGISTRATION, USER_DEREGISTRATION or ADMINISTRATIVE_DEREGISTRATION</u>.</p> <p>If Server-Assignment-Type indicates deregistration of some type and Private User Identity-User Name is not present in the request, aAt least one public identityPublic User Identity shall be present if User-Name is not present in the request.</p>
S-CSCF Name (See 7.4)	Server-Name	M	Name of the S-CSCF.
Private User Identity (See 7.3)	User-Name	C	<p>User private identityPrivate User Identity.</p> <p>It shall be present if it is available when the S-CSCF issues the request.</p> <p>It may be absent during the initiation of a session to an unregistered user. In such a situation, Server-Assignment-Type shall contain the value UNREGISTERED_USER.</p> <p>In case of de-registration, Server-Assignment-Type equal to <u>TIMEOUT_DEREGISTRATION, USER_DEREGISTRATION or ADMINISTRATIVE_DEREGISTRATION</u>, if no Public-User Identity AVPs are present then <u>Private User-Name Identity</u> AVP shall be present.</p>
Server Assignment Type (See 7.8)	Server-Assignment-Type	M	Type of update the S-CSCF requests in the HSS (e.g: de-registration). See [5] for all the possible values.
User Data Already Available (See 7.16)	User-Data-Already-Available	M	This indicates if the user profile is already available in the S-CSCF.
Routing Information (See 7.13)	Destination-Host	C	<p>If the S-CSCF knows <u>the</u> HSS name, <u>the</u> Destination-Host AVP shall be present in the command.</p> <p>This information is available if the request belongs to an already existing registration, e.g. in case of the re-registration, where the HSS name is stored in the S-CSCF. The HSS name is obtained from the Origin-Host AVP, which is received from the HSS, e.g. included in the MAA command.</p> <p>This information may not be available if the command is sent in as a consequence of a session termination for an unregistered user. In this case the Destination-Host AVP is not present and the command is routed to the next Diameter node based on the Diameter routing table in the S-CSCF.</p>

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2

Table 6.1.2.2: S-CSCF registration/deregistration notification response

Information element name	Mapping to Diameter AVP	Cat.	Description
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Private User Identity (See 7.3)	User-Name	C	User-private-identity Private User Identity. It shall be present if it is available when the HSS sends the response. It may be absent in the following error case: when the Server-Assignment-Type of the request is UNREGISTERED_USER and the received public user-identity Public User Identity is not known by the HSS.
Registration result (See 7.6)	Result-Code / Experimental-Result	M	Result of registration. Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Cx 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.
User Profile (See 7.7)	User-Data	C	Relevant user profile. It shall be present when Server-Assignment-Type in the request is equal to NO_ASSIGNMENT, If the Server Assignment Type in the request is equal to REGISTRATION, RE_REGISTRATION or UNREGISTERED_USER the User Data AVP shall be present according to the rules defined in the section 6.6. If the S-CSCF receives more data than it is prepared to accept, it shall perform the de-registration of the user with User-Authorization-Type set to DEREGISTRATION_TOO_MUCH_DATA and send back a SIP 3xx or 480 (Temporarily Unavailable) response, which will trigger the selection of a new S-CSCF by the I-CSCF, as specified in [8].
Charging Information (See 7.12)	Charging-Information	C	Addresses of the charging functions. It shall be present when the User-Data AVP is sent to the S-CSCF. When this parameter is included, the Primary Charging Collection Function name shall be included. All other elements shall be included if they are available. Addresses of the charging functions. It shall be present when the User Data AVP is sent to the S-CSCF.

1

2 6.1.2.1 Detailed behaviour

3 On registering/deregistering a ~~public-identity~~Public User Identity the S-CSCF shall inform the HSS. The
4 same procedure is used by the S-CSCF to get ~~the user information which contains~~ the user profile ~~and the~~
5 ~~charging information~~. The relevant user profile downloaded is described in more detailed in ~~the~~ sections
6 ~~6.5.1 and~~ 6.6. The HSS holds information about the state of registration of all the identities of the user. The
7 S-CSCF uses this procedure to update such states. ~~For implicitly registered identities, the rules defined in~~
8 ~~Section 6.5.1 shall apply~~. The HSS shall, in the following order (in case of an error in any of the steps the
9 HSS shall stop processing and return the corresponding error code, see [5]):

10 1. Check that the user is known. If not Experimental-Result-Code shall be set to
11 DIAMETER_ERROR_USER_UNKNOWN.

12 2. ~~The HSS may check whether~~ ~~Check that whether~~ the private and ~~public-identities~~Public User Identities
13 received in the request belong to the same user. If not Experimental-Result-Code shall be set to
14 DIAMETER_ERROR_IDENTITIES_DONT_MATCH.

15 3. Check the Server Assignment Type value received in the request:

16 + If it indicates REGISTRATION or RE_REGISTRATION, the HSS shall download the relevant ~~user~~
17 ~~public-identity~~user information based on the description in section 6.6. If set, the flag that indicates
18 that the identity is pending of the confirmation of the authentication shall be cleared. The Result-
19 Code shall be set to DIAMETER_SUCCESS ~~and the HSS shall set the registration state of the~~

~~public identity~~Public User Identity and associated ~~public identities~~ as registered (if not already registered).

Only one ~~P~~public ~~U~~user ~~I~~identity shall be present in the request. If more than one identity is present the Result-Code shall be set to DIAMETER_AVP_OCCURS_TOO_MANY_TIMES and no user information shall be returned.

- + If it indicates UNREGISTERED_USER, the HSS shall store the S-CSCF name, set the registration state of the ~~public identity~~Public User Identity as unregistered, i.e. registered as a consequence of a terminating call and download the relevant ~~user public identity~~user information. The Result-Code shall be set to DIAMETER_SUCCESS.

Only one ~~P~~public ~~U~~user ~~I~~identity shall be present in the request. If more than one identity is present the Result-Code shall be set to DIAMETER_AVP_OCCURS_TOO_MANY_TIMES and the modifications specified in the previous paragraph shall not be performed.

- + If it indicates TIMEOUT_DEREGISTRATION, USER_DEREGISTRATION, DEREGISTRATION_TOO_MUCH_DATA or ADMINISTRATIVE_DEREGISTRATION, the HSS shall clear the S-CSCF name for all the ~~public identities~~Public User Identities that the S-CSCF indicated in the request and set the registration state of the identities as not registered. If no ~~public identity~~Public User Identity is present in the request, the ~~private identity~~Private User Identity shall be present; in this case the HSS shall clear the S-CSCF name for all the identities of the user and set their registration state to not registered. The Result-Code shall be set to DIAMETER_SUCCESS.
- + If it indicates TIMEOUT_DEREGISTRATION_STORE_SERVER_NAME or USER_DEREGISTRATION_STORE_SERVER_NAME the HSS decides whether to keep the S-CSCF name stored or not for all the ~~public identities~~Public User Identities that the S-CSCF indicated in the request and ~~set the registration state of the identities as unregistered~~. If no ~~public identity~~Public User Identity is present in the request, the ~~private identity~~Private User Identity shall be present. If the HSS decided to keep the S-CSCF name stored, the HSS shall keep the S-CSCF name stored for all the identities of the user and set their registration state to unregistered.

~~If the HSS decides to keep the S-CSCF name t~~The Result-Code shall be set to DIAMETER_SUCCESS.

If the HSS decides not to keep the S-CSCF name the Experimental-Result-Code shall be set to DIAMETER_SUCCESS_SERVER_NAME_NOT_STORED. If the HSS received ~~public identities~~Public User Identities in the request, the HSS shall set the registration state to not registered for the ~~public identity~~Public User Identity(ies) that the S-CSCF indicated in the request. If the HSS received a ~~private identity~~Private User Identity in the request, the HSS shall set the registration state of all ~~Public User Identities~~ related to the ~~private identity~~Private User Identity to not registered.

- + If it indicates NO_ASSIGNMENT, the HSS checks whether the user is assigned for the S-CSCF requesting the data and download the ~~user public identity information requested in the User Data Request Type AVP~~relevant user information. The Result-Code shall be set to DIAMETER_SUCCESS. If the requesting S-CSCF is not the same as the assigned S-CSCF, the Result-Code shall be set to DIAMETER_UNABLE_TO_COMPLY.

Only one ~~public user identity~~Public User Identity shall be present in the request. If more than one ~~public identity~~Public User Identity is present the Result-Code shall be set to DIAMETER_AVP_OCCURS_TOO_MANY_TIMES and no user information shall be returned.

- + If it indicates AUTHENTICATION_FAILURE or AUTHENTICATION_TIMEOUT, the HSS shall clear the S-CSCF name for the ~~public identity~~Public User Identity that the S-CSCF indicated in the request and set the registration state of the identity as not registered. The flag that indicates that the identity is pending ~~of the~~ confirmation of the authentication shall be cleared. The Result-Code shall be set to DIAMETER_SUCCESS.

Only one ~~public user identity~~Public User Identity shall be present in the request. If more than one identity is present the Result-Code shall be set to

1 DIAMETER_AVP_OCCURS_TOO_MANY_TIMES and the modifications specified in the
2 previous paragraph shall not be performed.

3 If the HSS cannot fulfill the received request, e.g. due to database error, it shall set the Result-Code to
4 DIAMETER_UNABLE_TO_COMPLY. The HSS shall not modify any user state nor download any ~~user~~
5 ~~public identity~~user information to the S-CSCF.

6 See chapter 8.1.2 and 8.1.3 for the description of the handling of the error situations: reception of an S-
7 CSCF name different from the one stored in the HSS and reception of a Server-Assignment-Type value not
8 compatible with the registration state of the user.

9 6.1.3 Network initiated de-registration by the HSS, administrative

10 In case of network initiated de-registration of the user initiated by the HSS, the HSS shall de-register the
11 user and send a notification to the S-CSCF indicating the identities that shall be de-registered. The
12 procedure is invoked by the HSS and corresponds to the functional level operation Cx-Deregister (see [1]).

13 HSS may decide to de-register:

- 14 - Only one ~~public identity~~Public User Identity or a list of ~~public identities~~Public User Identities
- 15 - All the ~~public identities~~Public User Identities of a user.

16 This procedure is mapped to the commands Registration-Termination-Request/Answer in the Diameter
17 application specified in [5]. Tables 6.1.3.1 and 6.1.3.2 describe the involved information elements.

18 **Table 6.1.3.1 : Network Initiated Deregistration by HSS request**

Information element name	Mapping to Diameter AVP	Cat.	Description
Public User Identity (See 7.2)	Public-Identity	O	It contains the list of public user identities that are de-registered, in the form of SIP URL or TEL URL.
Private User Identity (See 7.3)	User-Name	M	It contains the private user identity Private User Identity in the form of a NAI.
Reason for de-registration (See 7.11)	Deregistration-Reason	M	The HSS shall send to the S-CSCF a reason for the de-registration. The de-registration reason is composed of two parts: one textual message (if available) that is intended to be forwarded to the user that is de-registered, and one reason code (see [5]) that determines the behaviour of the S-CSCF.
Routing Information (See 7.13)	Destination-Host	M	It contains the name of the S-CSCF which originated the last update of the name of the multimedia server stored in the HSS for a given multimedia user. The address of the S-CSCF is the same as the Origin-Host AVP in the message sent from the S-CSCF.

19

20 **Table 6.1.3.2 : Network Initiated Deregistration by HSS response**

Information element name	Mapping to Diameter AVP	Cat.	Description
--------------------------	-------------------------	------	-------------

Result (See 7.6)	Result-Code / Experimental- Result	M	This information element indicates the result of de-registration. Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Cx 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.
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1

2 6.1.3.1 Detailed behaviour

3 The HSS shall de-register the affected identities and invoke this procedure to inform the S-CSCF. The HSS
4 can determine in different cases that the user (only one ~~public identity~~Public User Identity, one or more
5 ~~public identities~~Public User Identities or all the ~~public identities~~Public User Identities registered) has to be
6 de-registered.

7 The HSS may de-register:

- 8 - Only one ~~public identity~~Public User Identity or a list of ~~public identities~~Public User Identities. In
9 this case the S-CSCF shall remove all the information stored in the S-CSCF for those ~~public~~
10 ~~identities~~Public User Identities.
- 11 - The user with all his/her ~~public identities~~Public User Identities (no ~~public identity~~Public User
12 ~~Identity~~ sent in the Cx-Deregister request). In this case the S-CSCF shall remove all the
13 information stored for that user.

14 The HSS shall send in the Deregistration-Reason AVP the reason for the de-registration, composed by a
15 textual message (if available) aimed for the user and a reason code that determines the action the S-CSCF
16 has to perform. The possible reason codes are:

- 17 - ~~PERMANENT TERMINATION: The IMS subscription or service profile(s) has been permanently~~
18 ~~terminated. The S-CSCF should start the network initiated de-registration towards the user.~~
- 19 - ~~NEW SERVER ASSIGNED: new S-CSCF has been allocated to the user due to some reason, e.g.~~
20 ~~an error case, where the SIP registration is terminated in a new S-CSCF. The S-CSCF shall not start~~
21 ~~the network initiated de-registration towards the user but only clears its registration state and~~
22 ~~information regarding the user, i.e. all service profiles are cleared.~~
- 23 - ~~SERVER CHANGE: A new S-CSCF shall be allocated to the user when the user's S-CSCF~~
24 ~~capabilities are changed in the HSS or when the S-CSCF indicates that it has not enough memory~~
25 ~~for the updated User Profile. The S-CSCF should start the network initiated de-registration towards~~
26 ~~the user, i.e. all registrations are de-registered and the user is asked to re-register to all existing~~
27 ~~registrations.~~
- 28 - ~~REMOVE S-CSCF: The HSS indicates to the S-CSCF that the S-CSCF should no longer be used~~
29 ~~for a given user. The S-CSCF shall not start the network initiated de-registration towards the user~~
30 ~~when the user is not currently registered but clears all information regarding the user and responds~~
31 ~~to the HSS. The HSS then removes the S-CSCF for that user.~~
32 ~~PERMANENT TERMINATION: the HSS indicates to the S-CSCF that the S-CSCF will no longer be assigned to the Public User Identity~~
33 ~~and associated implicitly registered Public User Identities for a given user (e.g. due IMS~~
34 ~~subscription cancellation). In this case, the S-CSCF initiates the de-registration of the user's Public~~
35 ~~User Identities.~~
- 36 - ~~NEW SERVER ASSIGNED: The HSS indicates to the S-CSCF that a new S-CSCF has been~~
37 ~~allocated to the user e.g. because the previous assigned S-CSCF was unavailable during a~~
38 ~~registration procedure. In this case, the S-CSCF initiates the de-registration of the Public User~~
39 ~~Identity and the associated implicitly registered Public User Identities for that user.~~

~~SERVER_CHANGE: The HSS indicates to the S-CSCF that the de-registration is requested to force the selection of new S-CSCF to assign to the user (e.g. when the user's S-CSCF capabilities are changed in the HSS or when the S-CSCF indicates that it has not enough memory for the updated User Profile). In this case, the S-CSCF initiates the de-registration of the registered Public User Identity and the associated implicitly registered Public User Identities.~~

~~REMOVE_S-CSCF: The HSS indicates to the S-CSCF that the S-CSCF will no longer be assigned to an unregistered Public User Identity(ies) (i.e registered as a consequence of a terminating call or there is a S-CSCF keeping the user profile stored) for a given user. In this case, the S-CSCF initiates the de-registration of this user's Public User Identity(ies).~~

~~The detailed de-registration procedures performed by the S-CSCF for each reason code are described in the 3GPP TS 24.229 [8]. PERMANENT_TERMINATION: The IMS subscription or service profile(s) has been permanently terminated. The S-CSCF should start the network initiated de-registration towards the user.~~

~~NEW_SERVER_ASSIGNED: A new S-CSCF has been allocated to the user due to some reason, e.g. an error case, where the SIP registration is terminated in a new S-CSCF. The S-CSCF shall not start the network initiated de-registration towards the user but only clears its registration state and information regarding the user, i.e. all service profiles are cleared.~~

~~SERVER_CHANGE: A new S-CSCF shall be allocated to the user when the user's S-CSCF capabilities are changed in the HSS or when the S-CSCF indicates that it has not enough memory for the updated User Profile. The S-CSCF should start the network initiated de-registration towards the user, i.e. all registrations are de-registered and the user is asked to re-register to all existing registrations.~~

~~REMOVE_S-CSCF: The HSS indicates to the S-CSCF that the S-CSCF should no longer be used for a given user. The S-CSCF shall not start the network initiated de-registration towards the user when the user is not currently registered but clears all information regarding the user and responds to the HSS. The HSS then removes the S-CSCF for that user.~~

6.1.4 User location query

This procedure is used between the I-CSCF and the HSS to obtain the name of the S-CSCF where a public identityPublic User Identity is registered. The procedure is invoked by the I-CSCF per public identityPublic User Identity.

This procedure is mapped to the commands Location-Info-Request/Answer in the Diameter application specified in [5]. Tables 6.1.4.1 and 6.1.4.2 detail the involved information elements.

Table 6.1.4.1 : User Location query

Information element name	Mapping to Diameter AVP	Cat.	Description
Public User Identity (See 7.2)	Public-Identity	M	<u>User public identityPublic User Identity</u>
Routing information (See 7.13)	Destination-Host, Destination-Realm	C	If the I-CSCF knows HSS name Destination-Host AVP shall be present in the command. Otherwise, only Destination-Realm AVP shall be present and the command shall be routed to the next Diameter node based on the Diameter routing table in the I-CSCF.

1

Table 6.1.4.2 : User Location response

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.6)	Result-Code / Experimental- Result	M	Result of the operation Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Cx 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.
S-CSCF Name (See 7.4)	Server-Name	C	Name of the assigned S-CSCF.
S-CSCF capabilities (See 7.5)	Server-Capabilities	O	It contains the information to help the I-CSCF in the selection of the S-CSCF.

2

6.1.4.1 Detailed behaviour

3 The HSS shall, in the following order (~~if in case of~~ an error occurs in any of the steps the HSS shall stop
4 processing and return the corresponding error code, see [5]):

- 5 1. Check that the user is known. If not the Experimental-Result-Code shall be set to
6 DIAMETER_ERROR_USER_UNKNOWN.
- 7 2. Check the state of the ~~public identity~~ Public User Identity received in the request, and where necessary,
8 check if the Public User Identity has services related to the unregistered state.
9
 - 10 + If it is registered, or unregistered (i.e. registered as a consequence of a terminating call or there is a
11 S-CSCF keeping the user profile stored) and has services related to the unregistered state, the HSS
12 shall return the stored S-CSCF name. The Server-Name AVP shall contain the SIP URL of the
13 server. The Server-Capabilities AVP shall not be present. The Result-Code AVP shall be set to
14 DIAMETER_SUCCESS.
 - 15 + If it is not registered, but has services related to unregistered state, the HSS shall check if there is
16 at least one identity of the user with an S-CSCF name assigned. ~~;~~ If this is the case the HSS
17 shall return the S-CSCF name assigned for that user. The Server-Name AVP shall contain the SIP
18 URL of the server. The Server-Capabilities AVP shall not be present. The Result-Code shall be set
19 to DIAMETER_SUCCESS.
 - 20 -- If there is not any S-CSCF name assigned for that user, the HSS may return information
21 about the required S-CSCF capabilities, which enables the I-CSCF to select an S-CSCF.
22 The Server-Capabilities AVP may be present. The HSS shall send the same server
23 capability set that is sent in the user registration status response during the registration. If
24 Server-Capabilities AVP is not present, the I-CSCF shall understand that any S-CSCF is
25 suitable to serve the user. The Server-Name AVP shall not be present. The Experimental-
26 Result-Code shall be set to DIAMETER_UNREGISTERED_SERVICE.
 - 27 + If it is not registered or unregistered, and has no services related to the unregistered state
28 unregistered services related data, the response shall contain Experimental-Result-Code set to
29 DIAMETER_ERROR_IDENTITY_NOT_REGISTERED.

30 If the HSS cannot fulfill received request, e.g. due to database error, it shall set Result-Code to
31 DIAMETER_UNABLE_TO_COMPLY. No S-CSCF name or S-CSCF capabilities shall be present in the
32 response.

1 6.2 User data handling procedures

2 6.2.1 User Profile download

3 As part of the registration procedure ([1]) S-CSCF obtains user data and service related information by
4 means of the Cx-Put Resp operation (see 6.1.2).

5 6.2.2 HSS initiated update of User Profile

6 This procedure is initiated by the HSS to update user ~~profile~~ profile information and/or charging information in the
7 S-CSCF. This procedure corresponds to the functional level operation Cx-Update_Subscr_Data (see [1]).

8 This procedure is mapped to the commands Push-Profile-Request/Answer in the Diameter application
9 specified in [5]. Tables 6.2.2.1 and 6.2.2.2 describe the involved information elements.

10 **Table 6.2.2.1: User Profile Update request**

Information element name	Mapping to Diameter AVP	Cat.	Description
Private User Identity (See 7.3)	User-Name	M	User private identity Private User Identity.
User Profile (See 7.7)	User-Data	<u>CM</u>	Updated user profile (see sections <u>6.5.2.1 and 6.6.1</u>), with the format defined in chapter 7.7. <u>It shall be present if the user profile is changed in the HSS. If the User-Data AVP is not present, the Charging-Information AVP shall be present.</u>
<u>Charging Information</u> (See 7.12)	<u>Charging-Information</u>	<u>C</u>	<u>Addresses of the charging functions.</u> <u>It shall be present if the charging information is changed in the HSS. If the Charging-Information AVP is not present, the User-Data AVP shall be present.</u> <u>When this parameter is included, the Primary-Charging-Collection-Function-Name AVP shall be included. All other charging information shall be included if they are available.</u>
Routing Information (See 7.13)	Destination-Host	M	It contains the name of the S-CSCF which originated the last update of the name of the multimedia server stored in the HSS for a given multimedia user. The address of the S-CSCF is the same as the Origin-Host AVP in the message sent from the S-CSCF.

11

12

Table 6.2.2.2: User Profile Update response

Information element name	Mapping to Diameter AVP	Cat.	Description
Result (See 7.6)	Result-Code / Experimental-Result	M	This information element indicates the result of the update of User Profile in the S-CSCF. Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Cx 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.

13

6.2.2.1 Detailed behaviour

The HSS shall make use of this procedure to update relevant user ~~profile~~-information and/or the charging information in the S-CSCF. The user information contains the user profile. See chapters 6.5.2.1 and 6.6.1 for the rules of user profile updating.

If the User-Data AVP is present in the request, ~~t~~The S-CSCF shall overwrite, for the ~~P~~public ~~U~~user ~~i~~identities indicated in the request, current user information with the information received from the HSS, except in the error situations detailed in table 6.2.2.1.1.

If the S-CSCF receives more data than it can accept, it shall return the corresponding error code to the HSS as indicated in table 6.2.2.1.1. The S-CSCF shall not overwrite the data that it already has to give service to the user. The HSS shall initiate a network-initiated de-registration procedure towards the S-CSCF with Deregistration-Reason set to SERVER_CHANGE, which will trigger the assignment of a new S-CSCF. If the Charging-Information AVP is present in the request, the S-CSCF shall replace the existing charging address information with the information received from the HSS.

The Charging-Information AVP and/or the User-Data AVP shall be present in the request.

Table 6.2.2.1.1 details the valid result codes that the S-CSCF can return in the response.

Table 6.2.2.1.1: User Profile response valid result codes

Result-Code/Experimental-Result-Code AVP value	Condition
DIAMETER_SUCCESS	The request succeeded.
DIAMETER_ERROR_NOT_SUPPORTED_USER_DATA	The request failed. The S-CSCF informs the HSS that the received user information subscription data contained data information, which was not recognised or supported, i.e. user profile information -which is not correctly encoded according to the XML schema or standardised profile information which cannot be interpreted by the S-CSCF due to unsupported S-CSCF capabilities.
DIAMETER_ERROR_USER_UNKNOWN	The request failed because the user is not found in S-CSCF.
DIAMETER_ERROR_TOO_MUCH_DATA	The request failed. The S-CSCF informs to the HSS that it tried to push too much data into the S-CSCF.
DIAMETER_UNABLE_TO_COMPLY	The request failed.

6.3 Authentication procedures

This procedure is used between the S-CSCF and the HSS to exchange information to support the authentication between the end user and the home IMS network. The procedure is invoked by the S-CSCF, corresponds to the combination of the operations Cx-AV-Req and Cx-Put (see [3]):

- To retrieve authentication vectors from the HSS.
- To resolve synchronization failures between the sequence numbers in the UE and the HSS.

This procedure is mapped to the commands Multimedia-Auth-Request/Answer in the Diameter application specified in [5]. Tables 6.3.1 – 6.3.5 detail the involved information elements.

Table 6.3.1: Authentication request

Information element name	Mapping to Diameter AVP	Cat.	Description

Public User Identity (See 7.2)	Public-Identity	M	This information element contains the public-identity Public User Identity of the user
Private User Identity (See 7.3)	User-Name	M	This information element contains the user-private-identity Private User Identity
Number Authentication Items (See 7.10)	SIP-Number-Auth-Items	M	This information element indicates the number of authentication vectors requested
Authentication Data (See 7.9)	SIP-Auth-Data-Item	M	See Tables 6.3.2 and 6.3.3 for the contents of this information element. The content shown in table 6.3.2 shall be used for a normal authentication request; the content shown in table 6.3.3 shall be used for an authentication request after synchronization failure.
S-CSCF Name (See 7.4)	Server-Name	M	This information element contains the name (SIP URL) of the S-CSCF.
Routing Information (See 7.13)	Destination-Host	C	If the S-CSCF knows the HSS name this AVP shall be present. This information is available if the MAR belongs to an already existing registration, e.g. in case of the re-registration, where the HSS name is stored in the S-CSCF. The HSS name is obtained from the Origin-Host AVP, which is received from the HSS, e.g. included in the MAA command. This information may not be available if the command is sent in case of the initial registration. In this case the Destination-Host AVP is not present and the command is routed to the next Diameter node based on the Diameter routing table in the client.

1

2

Table 6.3.2: Authentication Data content – request

Information element name	Mapping to Diameter AVP	Cat.	Description
Authentication Scheme (See 7.9.2)	SIP-Authentication-Scheme	M	This information element indicates the authentication scheme. For this release it shall contain “Digest-AKAv1-MD5”.

3

4

Table 6.3.3: Authentication Data content – request, synchronization failure

Information element name	Mapping to Diameter AVP	Cat.	Description
Authentication Scheme (See 7.9.2)	SIP-Authentication-Scheme	M	Authentication scheme. For this release it shall contain “Digest-AKAv1-MD5”.

Authorization Information (See 7.9.4)	SIP- Authorization	M	It shall contain the concatenation of nonce, <u>as sent to the terminal</u> , -and AUTS, <u>as received from the terminal</u> . <u>Nonce and AUTS shall both be binary encoded.</u>

1

2

Table 6.3.4: Authentication answer

Information element name	Mapping to Diameter AVP	Cat.	Description
User Identity (See 7.2)	Public-Identity	C M	User public identity Public User Identity. It shall be present when the result is <u>DIAMETER_SUCCESS</u> .
Private User Identity (See 7.3)	User-Name	C M	User private identity Private User Identity. It shall be present when the result is <u>DIAMETER_SUCCESS</u> .
Number Authentication Items (See 7.10)	SIP-Number-Auth-Items	C M	This AVP indicates the N number of authentication vectors delivered in the Authentication Data information element. <u>It shall be present when the result is DIAMETER_SUCCESS.</u>
Authentication Data (See 7.9)	SIP-Auth-Data-Item	C	If the SIP-Number-Auth-Items AVP is equal to zero <u>or it is not present</u> , then this AVP shall not be present. See Table 6.3.5 for the contents of this information element.
Result (See 7.6)	Result-Code / Experimental-Result	M	Result of the operation Result-Code AVP shall be used for errors defined in the Diameter Base Protocol. Experimental-Result AVP shall be used for Cx 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.

3

4

Table 6.3.5: Authentication Data content – response

Information element name	Mapping to Diameter AVP	Cat.	Description
Item Number (See 7.9.1)	SIP-Item-Number	C	This information element shall be present in a SIP-Auth-Data-Item grouped AVP in circumstances where there are multiple occurrences of SIP-Auth-Data-Item AVPs, and the order in which they should be processed is significant. In this scenario, SIP-Auth-Data-Item AVPs with a low SIP-Item-Number value should be processed before SIP-Auth-Data-Items AVPs with a high SIP-Item-Number value.
Authentication Scheme (See 7.9.2)	SIP-Authentication-Scheme	M	Authentication scheme. For this release it shall contain “Digest-AKAv1-MD5”.

Authentication Information (See 7.9.3)	SIP-Authenticate	M	It shall contain, binary encoded, the concatenation of the authentication challenge RAND and the token AUTN. See [3] for further details about RAND and AUTN.
Authorization Information (See 7.9.4)	SIP-Authorization	M	It shall contain, binary encoded, the expected response XRES. See [3] for further details about XRES.
Confidentiality Key (See 7.9.5)	Confidentiality-Key	O	This information element, if present, shall contain the confidentiality key. It shall be binary encoded. -
Integrity Key (See 7.9.6)	Integrity-Key	M	This information element shall contain the integrity key. It shall be binary encoded. -

1

2 6.3.1 Detailed behaviour

3 The HSS shall, in the following order (in case of an error in any of the steps the HSS shall stop processing
4 and return the corresponding error code, see [5]):

- 5 1. Check that the user exists in the HSS. If not Experimental-Result-Code shall be set to
6 DIAMETER_ERROR_USER_UNKNOWN.
- 7 2. Check that the private and [public identitiesPublic User Identities](#) belong to the same user. If not
8 Experimental-Result-Code shall be set to DIAMETER_ERROR_IDENTITIES_DONT_MATCH.
- 9 3. Check that the authentication scheme indicated in the request is supported. If not Experimental-Result-
10 Code shall be set to DIAMETER_ERROR_AUTH_SCHEME_NOT_SUPPORTED.
- 11
- 12 4. 4.—If the request indicates there is a synchronization failure, the HSS shall compare the S-CSCF name
13 received in the request to the S-CSCF name stored in the HSS:
 - 14 - If they are identical the HSS shall process AUTS as described in [3] and return the requested
15 authentication information. The Result-Code shall be set to DIAMETER_SUCCESS.
 - 16 5. Check the registration status of the [public identityPublic User Identity](#) received in the request:
 - 17 + If it is registered, the HSS shall compare the S-CSCF name received in the request to the S-CSCF
18 name stored in the HSS:
 - 19 -- If they are different, the HSS shall store the S-CSCF name. The HSS shall download
20 Authentication-Data-Item stored up to a maximum specified in SIP-Number-Auth-Items
21 received in the command Multimedia-Auth-Request. It shall also set for this [public](#)
22 [identityPublic User Identity](#) the flag that indicates the identity is pending of the confirmation of
23 the authentication. The Result-Code shall be set to DIAMETER_SUCCESS.
 - 24 -- If they are identical, the HSS shall download Authentication-Data-Item stored up to a maximum
25 specified in SIP-Number-Auth-Items received in the command Multimedia-Auth-Request. The
26 Result-Code shall be set to DIAMETER_SUCCESS.
 - 27 + If it is unregistered (i.e. registered as a consequence of a terminating call to unregistered user or
28 there is an S-CSCF keeping the user profile stored) or not registered, the HSS shall compare the S-
29 CSCF name received in the request to the S-CSCF name stored in the HSS:
 - 30 -- If they are different or if there is no S-CSCF name stored in the HSS for any identity of the IMS
31 subscription, the HSS shall store the S-CSCF name. The HSS shall download Authentication-
32 Data-Item stored up to a maximum specified in SIP-Number-Auth-Items received in the

1 | command Multimedia-Auth-Request. It shall also set for this ~~public identity~~Public User Identity
 2 | the flag that indicates the identity is pending of the confirmation of the authentication. The
 3 | Result-Code shall be set to DIAMETER_SUCCESS.

4 | -- If they are identical, the HSS shall download Authentication-Data-Item stored up to a maximum
 5 | specified in SIP-Number-Auth-Items received in the command Multimedia-Auth-Request. It
 6 | shall also set for this ~~public identity~~Public User Identity the flag that indicates the identity is
 7 | pending of the confirmation of the authentication. The Result-Code shall be set to
 8 | DIAMETER_SUCCESS.

9 | ~~+ If it is not registered, the HSS shall store the S-CSCF name. The HSS shall download~~
 10 | ~~Authentication-Data-Item stored up to a maximum specified in SIP-Number-Auth-Items~~
 11 | ~~received in the command Multimedia-Auth-Request. It shall also set for this public identity the~~
 12 | ~~flag that indicates the identity is pending of the confirmation of the authentication. The Result-~~
 13 | ~~Code shall be set to DIAMETER_SUCCESS.~~

14 | Exceptions to the cases specified here shall be treated by HSS as error situations; the Result-Code shall be
 15 | set to DIAMETER_UNABLE_TO_COMPLY. No authentication information shall be returned.

16 | 6.4 void

17 | 6.5 Implicit registration

18 | Implicit registration is the mechanism by which a user is allowed to register simultaneously more than one
 19 | of his/her ~~public identities~~Public User Identities. The HSS knows the identities that are to be implicitly
 20 | registered when it receives the indication of the registration of an individual identity.

21 | What follows is an extension of the affected basic procedures.

22 | 6.5.1 S-CSCF initiated procedures

23 | ~~The result of the S-CSCF initiated procedures affects all the Public User Identities that are configured in the~~
 24 | ~~HSS to be in the same implicitly registered Public User Identity set with the targeted individual Public User~~
 25 | ~~Identity. Where the S-CSCF initiated procedure affects the Registration state of the targeted Public User~~
 26 | ~~Identity, the Registration states of the Public User Identities in the associated implicitly registered Public~~
 27 | ~~User Identity set are affected in the same way. The result of the S-CSCF initiated procedures affects all the~~
 28 | ~~public identities that are configured in the HSS to be registered implicitly.~~

29 | 6.5.1.1 Registration

30 | ~~The notification of a registration of a Public User Identity implies the registration of the corresponding~~
 31 | ~~implicitly registered Public User Identity set. The user information downloaded in the response contains the~~
 32 | ~~Public User Identities of the implicitly registered Public User Identity set with the associated service~~
 33 | ~~profiles. This allows the S-CSCF to know which Public User Identities belong to the implicitly registered~~
 34 | ~~Public User Identity set. The S-CSCF shall take from the set of implicitly registered Public User Identities~~
 35 | ~~the first identity which has the syntax of a SIP URI and which is not barred, and use this as the default~~
 36 | ~~Public User Identity. The notification of a registration of a public identity affects all the public identities that~~
 37 | ~~are configured in the HSS to be registered implicitly. The profile information downloaded in the response~~
 38 | ~~contains the list of implicitly registered public identities. This allows the S-CSCF to know the implicitly~~
 39 | ~~registered public identities. The S-CSCF shall take from the list of implicitly registered public user~~
 40 | ~~identities the first identity which has the syntax of a SIP URI and which is not barred, and use this as the~~
 41 | ~~default public user identity.~~

42 | 6.5.1.2 De-registration

43 | The de-registration of a ~~public identity~~Public User Identity implies the de-registration of ~~all~~the
 44 | corresponding implicitly registered ~~public identities~~Public User Identity set, both in the HSS and in the S-
 45 | CSCF. The S-CSCF shall include in the request ~~a single public identity~~Public User Identity ~~to~~~~for~~

1 deregistering all the Public User Identities that belong to the corresponding ~~implicitly registered public~~
 2 ~~identities in the~~ implicitly registered Public User Identity set.

3 The de-registration of a ~~private identity~~Private User Identity implies the de-registration of all the
 4 corresponding ~~public identities~~Public User Identities, both in the HSS and in the S-CSCF.

5 **6.5.1.3 Authentication**

6 Setting the flag for a ~~public identity~~Public User Identity that indicates a pending authentication implies
 7 setting the "authentication pending" flag for each corresponding implicitly registered ~~public identity~~Public
 8 User Identity in the HSS.

9 **6.5.1.4 Downloading the user profile**

10 If the S-CSCF requests to download a user profile from HSS, the user profile ~~information~~ in the response
 11 shall contain the Public User Identities list of the corresponding implicitly registered ~~public identities~~Public
 12 User Identity set with the associated service profiles.

13 **6.5.2 HSS initiated procedures**

14 **6.5.2.1 Update of User Profile**

15 A request sent by the HSS to update the ~~userservice~~ profile ~~associated to a user public identity~~ shall include
 16 ~~only~~ the Public User Identities of the corresponding implicitly registered ~~public identities~~Public User
 17 Identity set, with the ~~in respective~~associated service profiles (even if not updated). If other Public User
 18 Identities not associated with the implicitly registered Public User Identity set are affected, they shall be
 19 downloaded in separate commands.

20 **6.5.2.2 De-registration**

21 A request sent by the HSS to de-register a an implicitly registered Public User Identity set ~~public identity~~
 22 shall ~~contain~~include all the ~~corresponding implicitly registered public identities~~Public User Identities of the
 23 deregistered set.

24 The de-registration of a ~~private identity~~Private User Identity implies the de-registration of all the
 25 corresponding ~~public identities~~Public User Identities, both in the HSS and in the S-CSCF.

26 **6.5.2.3 Update of the Charging information**

27 A request sent by the HSS to update the charging information shall include the private user identity for
 28 whom the charging information changed.

29 **6.6 Download of Rrelevant User Profiledata**

30 The download of the relevant user profile data from the HSS to the S-CSCF depends on whether the user
 31 profile data is already stored in the S-CSCF, ~~and/or on the user data requested from the S-CSCF and/or~~
 32 ~~whether the requested user data is up to date in the S-CSCF.~~

33 If User-Data-Already-Available is set to USER_DATA_NOT_AVAILABLE the HSS shall download the
 34 requested user profile, ~~if the Public User Identity in the request is included in an implicitly registered~~
 35 Public User Identity set, the HSS shall include in the response the service profiles associated with all Public
 36 User Identities within the implicitly registered Public User Identity set to which the received Public User
 37 Identity belongs, according to the value of User-Data-Request-Type.

38 ~~If User-Data-Already-Available is set to USER_DATA_ALREADY_AVAILABLE and the requested~~
 39 ~~profile is not up to date (according to the indications stored in HSS defined in 6.6.1) the HSS shall~~
 40 ~~download the requested profile, according to the value of User-Data-Request-Type.~~

1 | ~~Otherwise, If User-Data-Already-Available is set to USER_DATA_ALREADY_AVAILABLE,~~ the HSS
2 | shall not return any user profile ~~data~~.

3 | **6.6.1 HSS initiated update of User Profile**

4 | The ~~request to update the of~~ user profile ~~information~~ in the S-CSCF includes ~~all-only~~ the Public User
5 | ~~Identities in any of the~~ implicitly registered Public User Identity set with the associated service profiles. See
6 | 6.5.2.1.

7 | If the Public User Identity user is registered or unregistered (i.e. registered as a consequence of a
8 | terminating call or there is a S-CSCF keeping the user profile stored), and there are changes in ~~the~~
9 | ~~registered part of~~ the user profile, the HSS shall immediately push the complete user profile to the S-CSCF
10 | ~~the registered part of the user profile~~.

11 | ~~If the user is unregistered (i.e. registered as a consequence of a terminating call or there is a S-CSCF~~
12 | ~~keeping the user profile stored) and there is a change in the unregistered part of the user profile, the HSS~~
13 | ~~shall immediately push to the S-CSCF the unregistered part of the user profile.~~

14 | ~~If the user is unregistered (i.e. registered as a consequence of a terminating call or there is a S-CSCF~~
15 | ~~keeping the user profile stored) and there is a change in the registered part of the user profile, the HSS shall~~
16 | ~~set a flag indicating that the registered part of the profile is not up to date in the S-CSCF. The HSS shall~~
17 | ~~not initiate any push toward the S-CSCF.~~

18 | **6.6.2 S-CSCF operation**

19 | ~~At deregistration of a Public User Identity,~~ the S-CSCF shall store the user information ~~data~~ if it sends
20 | Server-Assignment-Request command including Server-Assignment-Type AVP set to value
21 | USER_DEREGISTRATION_STORE_SERVER_NAME or
22 | TIMEOUT_DEREGISTRATION_STORE_SERVER_NAME and the HSS responds with
23 | DIAMETER_SUCCESS. Otherwise the S-CSCF shall not keep user information ~~data~~.

24 | **6.7 S-CSCF Assignment**

25 | The list of mandatory and optional capabilities received by an I-CSCF from the HSS allows operators to
26 | distribute users between S-CSCFs depending on the different capabilities (features, role, etc.) that each S-
27 | CSCF may have. Alternatively, an operator has the possibility to steer users to certain S-CSCFs.

28 | The operator shall define (possibly based on the functionality offered by each S-CSCF installed in the
29 | network) the exact meaning of the mandatory and optional capabilities. It is a configuration task for the
30 | operator to ensure that the I-CSCF has a correct record of the capabilities of each S-CSCF available in his
31 | network. The I-CSCF does not need to know the semantic of the capabilities received from the HSS. This
32 | semantic is exclusively an operator issue.

33 | As a first choice, the I-CSCF shall select an S-CSCF that has all the mandatory and optional capabilities for
34 | the user. Only if that is not possible shall the I-CSCF apply a ‘best-fit’ algorithm. If more than one S-CSCF
35 | is identified that supports all mandatory capabilities the I-CSCF may then consider optional capabilities in
36 | selecting a specific S-CSCF. The ‘best-fit’ algorithm is implementation dependent and out of the scope of
37 | this specification.

38 | It is the responsibility of the operator to ensure that there are S-CSCFs which have the “mandatory”
39 | capabilities indicated by the HSS for any given user. However, configuration errors may occur. If such
40 | errors occur and they prevent the I-CSCF from selecting an S-CSCF which meets the “mandatory”
41 | capabilities indicated by the HSS, the I-CSCF shall inform the HSS via the O&M subsystem.

42 | As an alternative to selecting an S-CSCF based on the list of capabilities received from the HSS, it is
43 | possible to steer users to certain S-CSCFs. To do this, the operator may include one or more S-CSCF
44 | names as part of the capabilities of the user profile. The reason for the selection (e.g. all the users belonging
45 | to the same company/group could be in the same S-CSCF to implement a VPN service) and the method of
46 | selection are operator issues and out of the scope of this specification.

1 **7 Information element contents**

2 **7.1 Visited Network Identifier**

3 This information element contains the domain name of the visited network.

4 **7.2 Public User Identity**

5 This information element contains the ~~public identity~~Public User Identity of the user.

6 **7.3 Private User Identity**

7 This information element contains the ~~private identity~~Private User Identity of the user.

8 **7.4 S-CSCF Name**

9 This information element contains the SIP Address of S-CSCF.

10 **7.5 S-CSCF Capabilities**

11 This information element carries information to assist the I-CSCF during the process of selecting an S-
12 CSCF for a certain user.

13 **7.6 Result**

14 This information element contains result of an operation. See [5] for the possible values.

15 **7.7 User Profile**

16 This information element contains the profile of a user as an XML documents conformant to the XML
17 schema defined in Annex D.

18 Annex B specifies the UML logical model of the user profile downloaded via the Cx interface.

19 Annex C contains an informative, high level representation, of the wire representation of user profile data.

20 **7.8 Server Assignment Type**

21 Indicates the type of server assignment. See [5] for the list of existing values.

22 **7.9 Authentication Data**

23 This information element is composed of the following sub-elements.

24 **7.9.1 Item Number**

25 This information element indicates the order in which the authentication vectors are to be consumed.

26 **7.9.2 Authentication Scheme**

27 This information element contains the authentication scheme, which is used to encode the authentication
28 parameters.

29 For the current release this scheme is “Digest-AKAv1-MD5”.

1 **7.9.3 Authentication Information**

2 This information element is used to convey the challenge and authentication token used during the
3 authentication procedure. See [3] for details.

4 **7.9.4 Authorization Information**

5 This information element is used, in an authentication request, to indicate a failure of synchronization. In a
6 response, it is used to convey the expected response to the challenge used to authenticate the user. See [3].

7 **7.9.5 Confidentiality Key**

8 This information element contains the confidentiality key. See [3].

9 **7.9.6 Integrity Key**

10 This information element contains the integrity key. See [3].

11 **7.10 Number Authentication Items**

12 This information element contains the number of authentication vectors requested or delivered.

13 **7.11 Reason for de-registration**

14 This information element contains the reason for a de-registration procedure.

15 **7.12 Charging information**

16 Addresses of the charging functions (primary event charging function name, secondary event charging
17 function name, primary charging collection function name, secondary charging collection function name).

18 **7.13 Routing information**

19 Information to route requests.

20 **7.14 Type of authorization**

21 Type of authorization requested by the I-CSCF. See [5] for a list of values.

22 **7.15 ~~User Data Request TypeVoid~~**

23 ~~Part of the user profile the S-CSCF requests from the HSS. See [5] for a list of values.~~

24 **7.16 User Data Already Available**

25 This information element indicates to the HSS if the user profile is already available in the S-CSCF. See [5]
26 for a list of values.

27 **8 Error handling procedures**

28 **8.1 Registration error cases**

29 This section describes the handling of ~~the error cases~~, which can occur during the registration process, ~~by~~
30 ~~which the name of the S-CSCF received in a request is different from the one stored in HSS. If the new~~
31 ~~and previously assigned S-CSCF names sent in the Multimedia-Auth-Request command are different, and~~

1 the Multimedia-Auth-Request is not indicating synchronisation failure (i.e. the request does not contain
 2 auts parameter) then the HSS shall overwrite the S-CSCF name.

3 If the new and previously assigned S-CSCF names sent in a command other than the Multimedia-Auth-
 4 Request command are different, then the HSS shall not overwrite the S-CSCF name; instead it shall send a
 5 response to the S-CSCF indicating an error.

7 **8.1.1 Cancellation of the old S-CSCF**

8 It is possible that in certain situations the HSS receives a Multimedia-Auth-Request (MAR) command
 9 including a S-CSCF name, which is not the same as the previously assigned S-CSCF for the user. This can
 10 happen e.g. in case the new S-CSCF is selected due to a failure in the re-registration if the previously
 11 assigned S-CSCF does not respond to REGISTER message sent from the I-CSCF after a timeout.

12 In this case the new S-CSCF is assigned for the user and if registrations in the previously assigned S-CSCF
 13 exist for the user, these registrations in the old S-CSCF are handled locally in the old S-CSCF, e.g. re-
 14 registration timers in the old S-CSCF will cancel the registrations. Alternatively, the HSS may de-register
 15 the registrations in the old S-CSCF by using the Registration-Termination-Request command. In this case
 16 the HSS shall first check whether the deregistration is really required by comparing the Diameter client
 17 address of the newly assigned S-CSCF received in the MAR command to the Diameter client address
 18 stored in the HSS. If the Diameter client addresses match, the deregistration shall not be initiated.
 19 Otherwise the deregistration may be initiated and it ~~de-registration~~ must be done in the following order:

- 20 1. Deregistration-Reason AVP value set to NEW_SERVER_ASSIGNED, for the public
 21 identityPublic User Identity, which is registered in the new S-CSCF.
- 22 2. Deregistration-Reason AVP value set to SERVER_CHANGE, for the user-public-identitiesPublic
 23 User Identities, which are not registered in the new S-CSCF.

24 **8.1.2 Error in S-CSCF name**

25 If the new and previously assigned S-CSCFs are different, the HSS shall not overwrite the S-CSCF name
 26 unless it is sent in the Multimedia-Auth-Request command but send a response to the S-CSCF indicating
 27 error. The Result-Code value is set to:

28 ———— DIAMETER_ERROR_IDENTITY_ALREADY_REGISTERED if the S-CSCF name sent in the
 29 Server Assignment Request command is different than assigned S-CSCF name, and therefore the
 30 request cannot be successfully processed.

31 ———— DIAMETER_ERROR_IN_ASSIGNMENT_TYPE if the S-CSCF name sent in the Server-
 32 Assignment Request command is the same S-CSCF name as the assigned S-CSCF name, but Server-
 33 Assignment Type is not allowed, e.g. the user is registered and the S-CSCF sends Server Assignment-
 34 Request indicating the assignment for the unregistered user. If the S-CSCF name sent in the Server-
 35 Assignment-Request command and the previously assigned S-CSCF name stored in the HSS are different,
 36 then, the HSS shall not overwrite the S-CSCF name; instead it shall send a response to the S-CSCF with the
 37 Experimental-Result-Code value set to DIAMETER_ERROR_IDENTITY_ALREADY_REGISTERED.

38 **8.1.3 Error in S-CSCF assignment type**

39 If the Server-Assignment-Type in the Server-Assignment-Request command sent by the S-CSCF to the
 40 HSS is not allowed, e.g. Server-Assignment-Request indicating the assignment for the unregistered
 41 user Server-Assignment-Type set to UNREGISTERED_USER for a user already registered, the HSS shall
 42 send a response to the S-CSCF with the Experimental-Result-Code value set to
 43 DIAMETER_ERROR_IN_ASSIGNMENT_TYPE.

1 **9 Protocol version identification**

2 See [5].

3 **10 Operational Aspects**

4 See [5].

1 **Annex A (normative):** 2 **Mapping of Cx operations and terminology to Diameter**

3 **A.1 Introduction**

4 This appendix gives mappings from Cx to Diameter protocol elements. Diameter protocol elements are
5 defined in [5].

6 **A.2 Cx message to Diameter command mapping**

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

8
9

Table A.2.1: Cx message to Diameter command mapping

Cx message	Source	Destination	Command-Name	Abbreviation
Cx-Query + Cx-Select-Pull	I-CSCF	HSS	User-Authorization-Request	UAR
Cx-Query Resp + Cx-Select-Pull Resp	HSS	I-CSCF	User-Authorization-Answer	UAA
Cx-Put + Cx-Pull	S-CSCF	HSS	Server-Assignment-Request	SAR
Cx-Put Resp + Cx-Pull Resp	HSS	S-CSCF	Server-Assignment-Answer	SAA
Cx-Location-Query + Location Query + Cx-LocQuery	I-CSCF	HSS	Location-Info-Request	LIR
Cx-Location-Query Resp + Response	HSS	I-CSCF	Location-Info-Answer	LIA
Cx-AuthDataReq	S-CSCF	HSS	Multimedia-Authentication-Request	MAR
Cx-AuthDataResp	HSS	S-CSCF	Multimedia-Authentication-Answer	MAA
Cx-Deregister	HSS	S-CSCF	Registration-Termination-Request	RTR
Cx-Deregister Resp	S-CSCF	HSS	Registration-Termination-Answer	RTA
Cx-Update_Subscr_Data	HSS	S-CSCF	Push-Profile-Request	PPR
Cx-Update_Subscr_Data Resp	S-CSCF	HSS	Push-Profile-Answer	PPA

10

11 **A.3 Cx message parameters to Diameter AVP mapping**

12 The following table gives an overview about the mapping:

1

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

Cx parameter	AVP Name
Visited Network Identifier	Visited-Network-Identifier
Public User Identity	Public-Identity
Private User Identity	User-Name
S-CSCF Name	Server-Name
S-CSCF Capabilities	Server-Capabilities
Result	Result-Code / Experimental-Result
User Profile	User-Data
Server Assignment Type	Server-Assignment-Type
Authentication data	SIP-Auth-Data-Item
Item Number	SIP-Item-Number
Authentication Scheme	SIP-Authentication-Scheme
Authentication Information	SIP-Authenticate
Authorization Information	SIP-Authorization
Confidentiality Key	Confidentiality-Key
Integrity Key	Integrity-Key
Number Authentication Items	SIP-Number-Auth-Items
Reason for de-registration	Deregistration-Reason
Charging Information	Charging-Information
Routing Information	Destination-Host
Type of Authorization	Authorization-Type

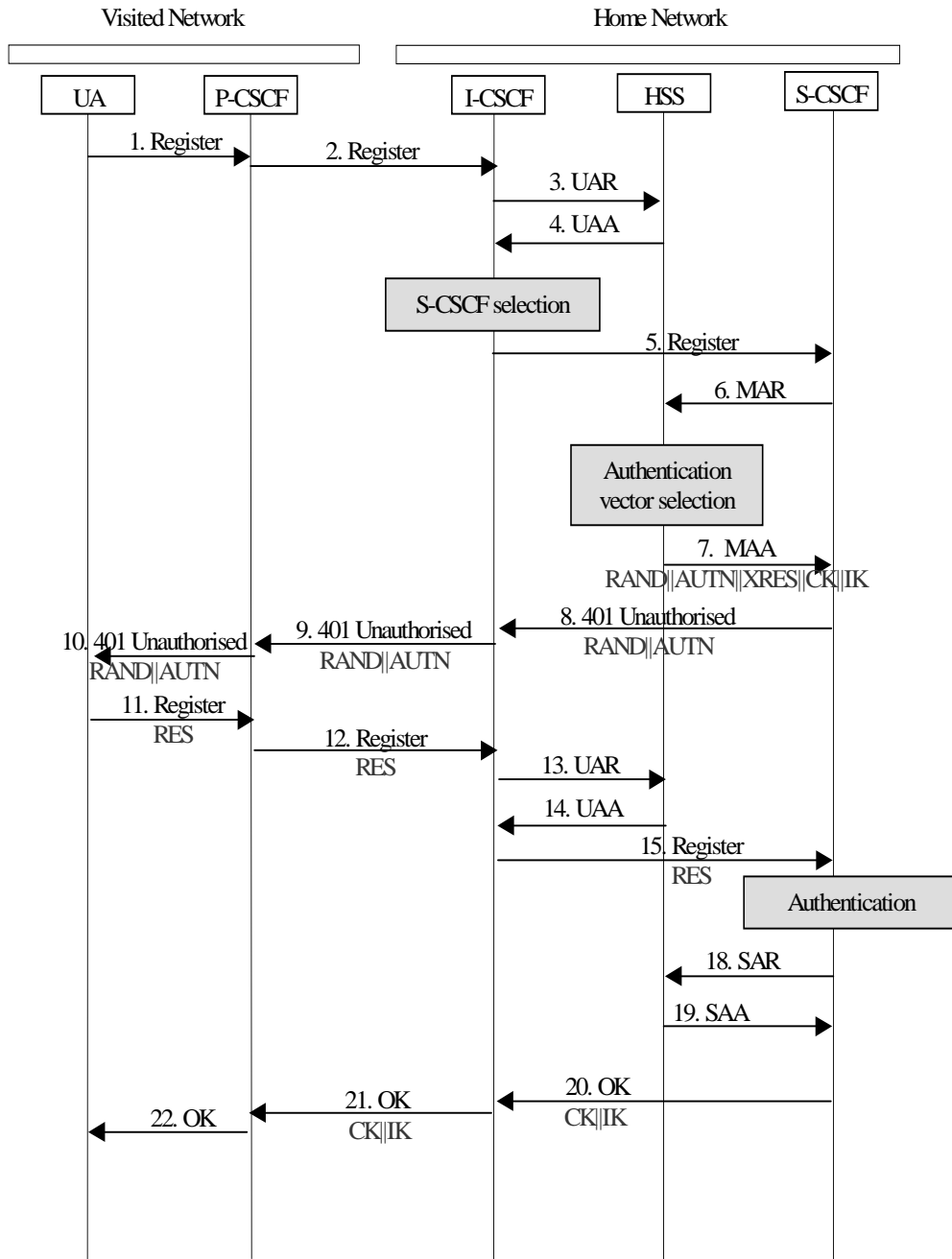
2

3 **A.4 Message flows**

4 The following message flows give examples regarding which Diameter messages shall be sent in scenarios
5 described in [1].

6

1 **A.4.1 Registration– user not registered**

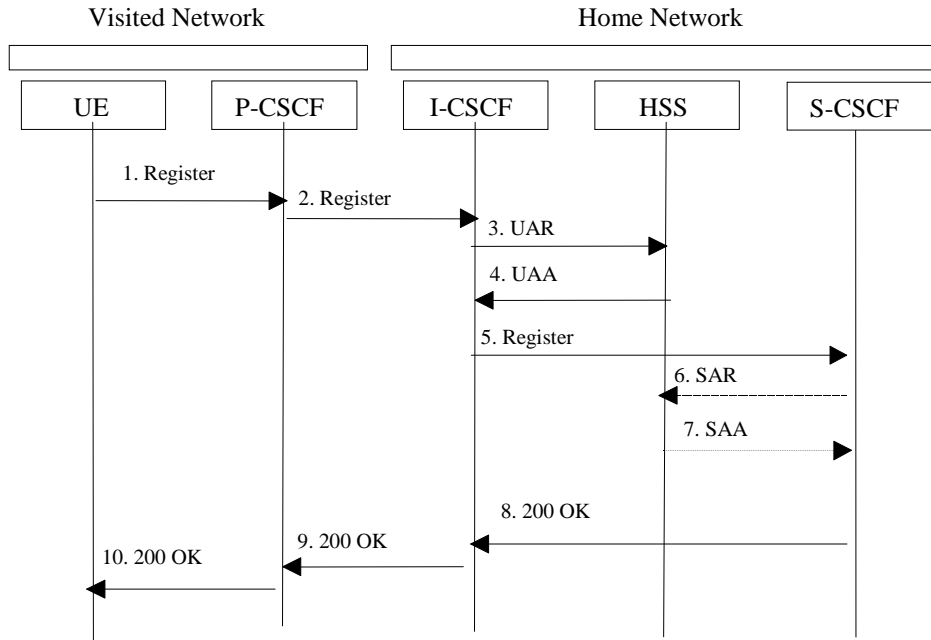


2

3

Figure A.4.1.1: Registration – user not registered

1 **A.4.2 Registration – user currently registered**

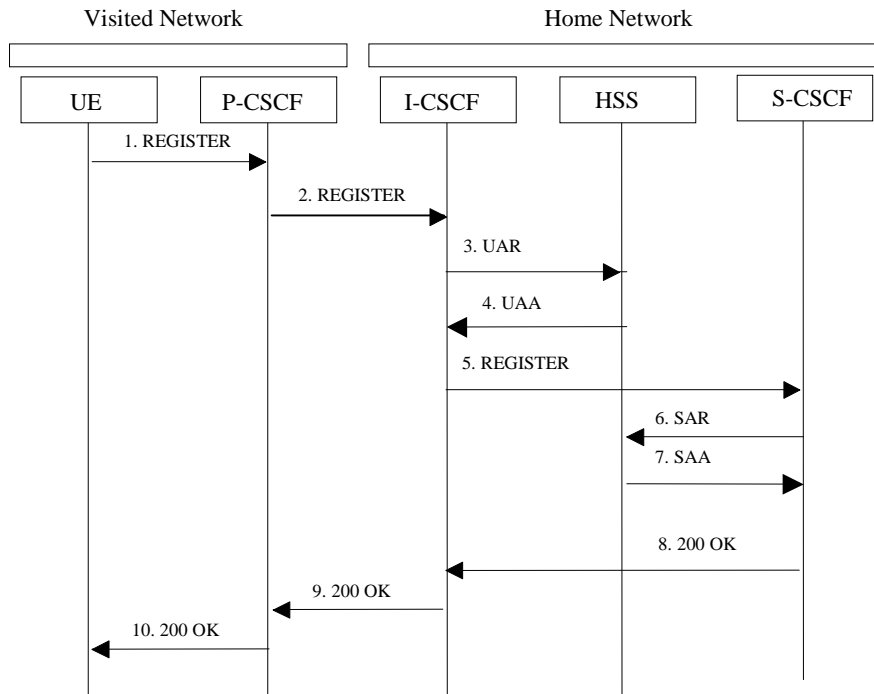


2

3

Figure A.4.2.1: Re-registration

4 **A.4.3 Mobile initiated de-registration**



5

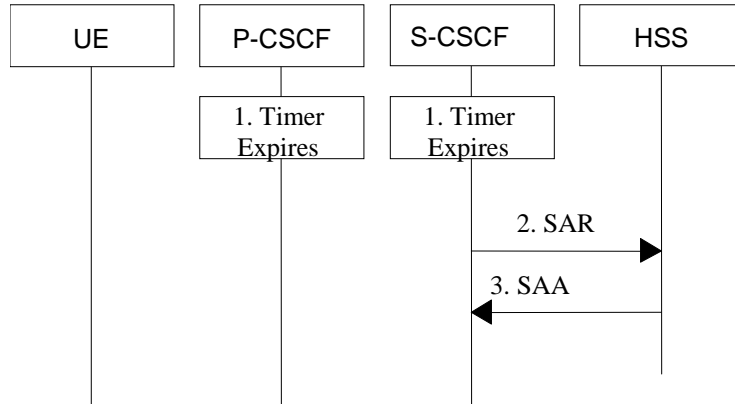
6

Figure A.4.3.1: Mobile initiated de-registration

1 **A.4.4 Network initiated de-registration**

2 **A.4.4.1 Registration timeout**

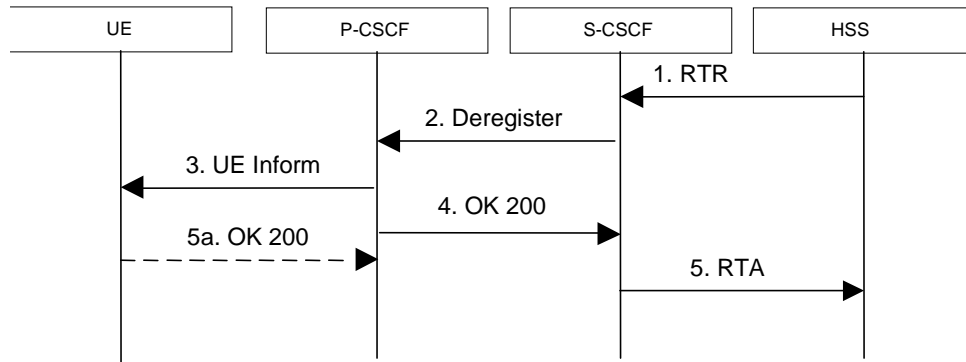
3



4

5 **Figure A.4.4.1.1: Network initiated de-registration – registration timeout**

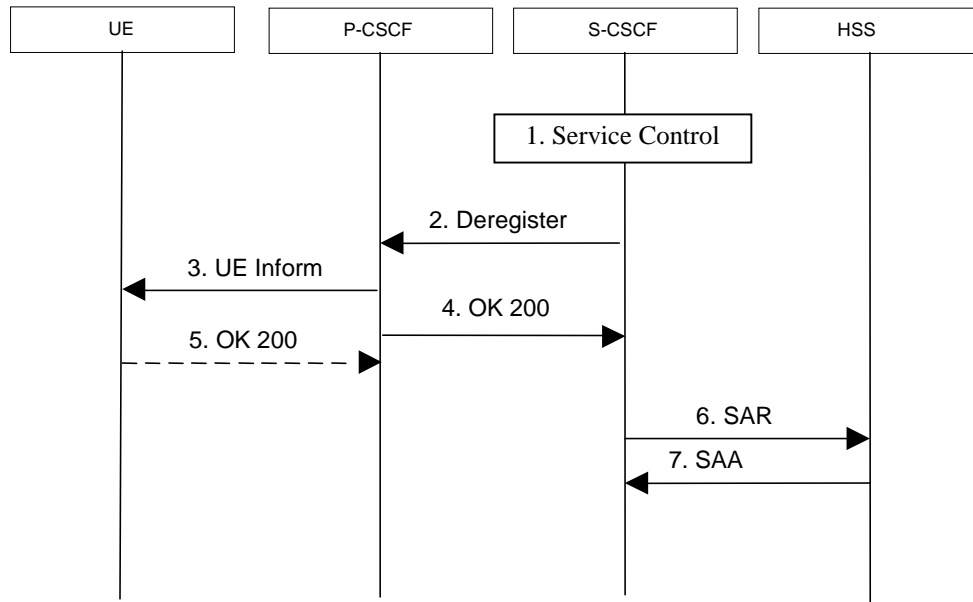
6 **A.4.4.2 Administrative de-registration**



7

8 **Figure A.4.4.2.1: Network initiated de-registration – administrative de-registration**

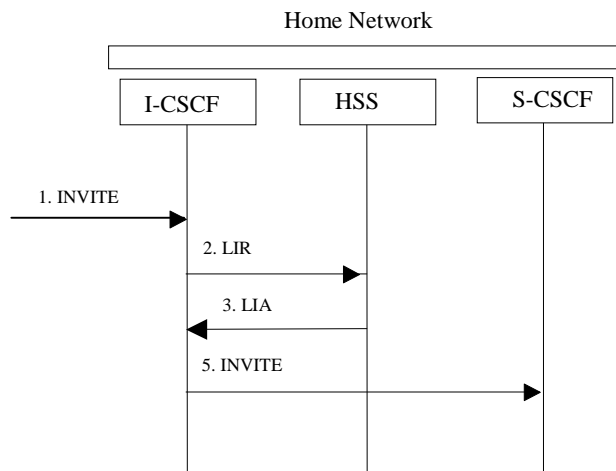
1 **A.4.4.3 De-registration initiated by service platform**



2

3 **Figure A.4.4.3.1: Network initiated de-registration – initiated by service platform**

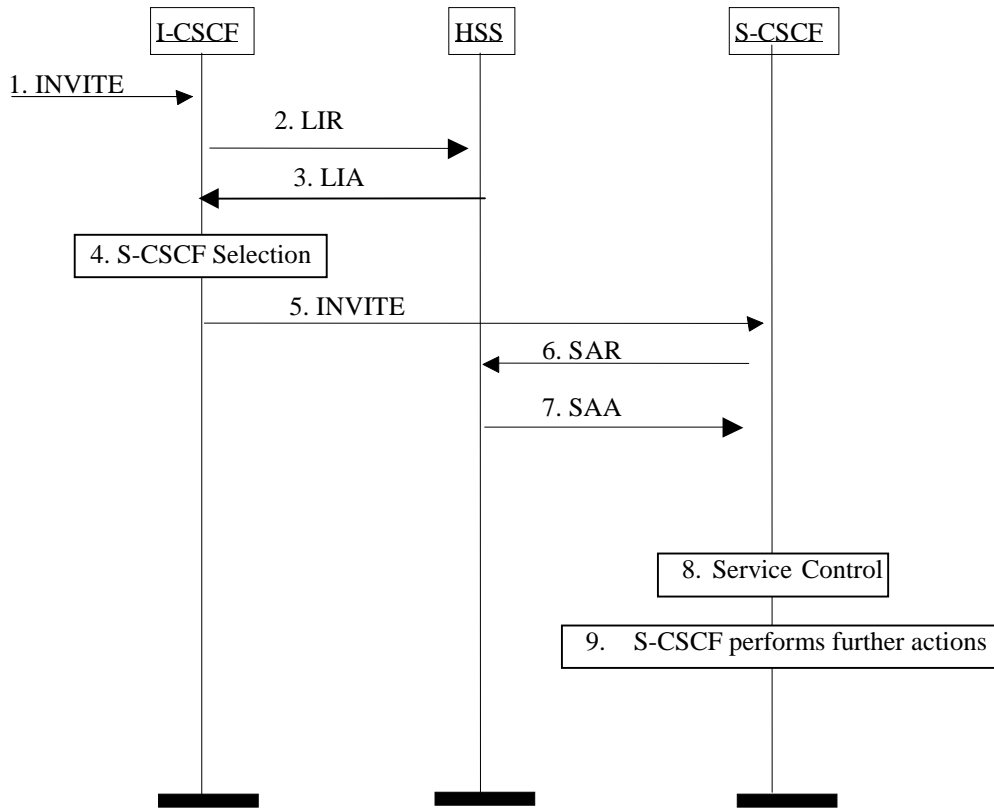
4 **A.4.5 MT SIP session set-up**



5

6 **Figure A.4.5.1: MT SIP session set-up**

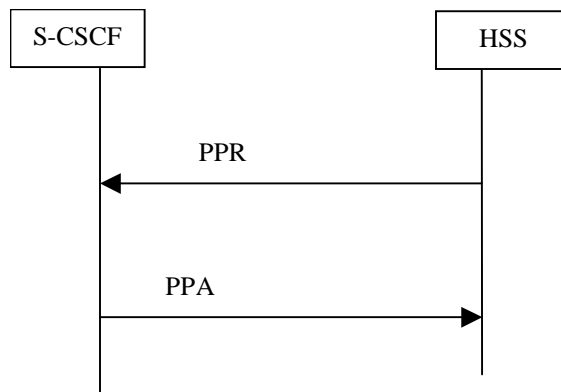
1 **A.4.6 Initiation of a session to a non-registered user**



2
3

Figure A.4.6.1: Initiation of a session to a non-registered user

4 **A.4.7 User Profile update**



5
6

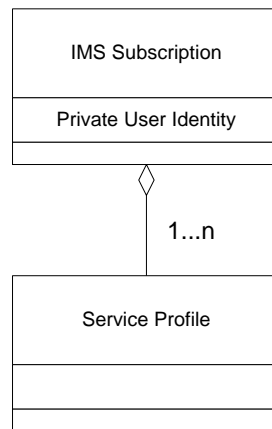
Figure A.4.7.1: User Profile update

1 **Annex B (informative):** 2 **User Profile UML model**

3 The purpose of this UML model is to define in an abstract level the structure of the user profile downloaded
4 over the Cx interface and describe the purpose of the different information classes included in the user
5 profile.

6 **B.1 General description**

7 The following picture gives an outline of the UML model of the user profile, which is downloaded from
8 HSS to S-CSCF:



9

10

Figure B.1.1: User Profile

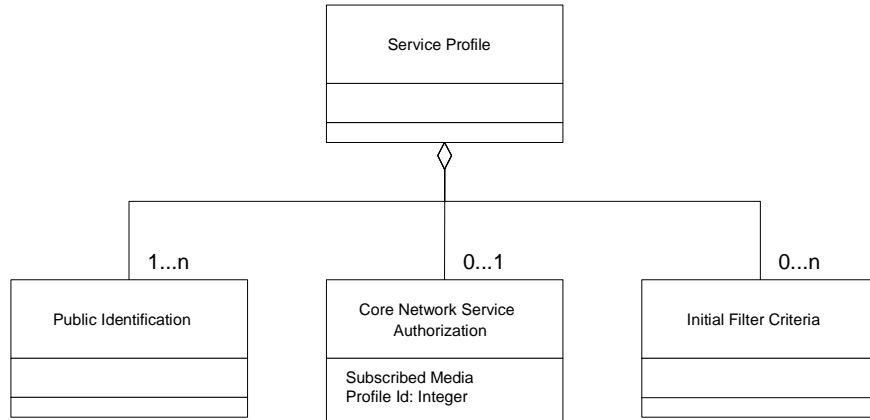
11 | IMS Subscription class contains as a parameter the ~~private user identity~~ Private User Identity of the user in
12 NAI format.

13 Each instance of the IMS Subscription class contains one or several instances of the class Service Profile.
14 Service Profile class contains the meaningful data in the user profile: Public Identification, Core Network
15 Service Authorization and Initial Filter Criteria.

16 **B.2 Service profile**

17 The following picture gives an outline of the UML model of the Service Profile class:

18 :



1
2

Figure B.2.1: Service Profile

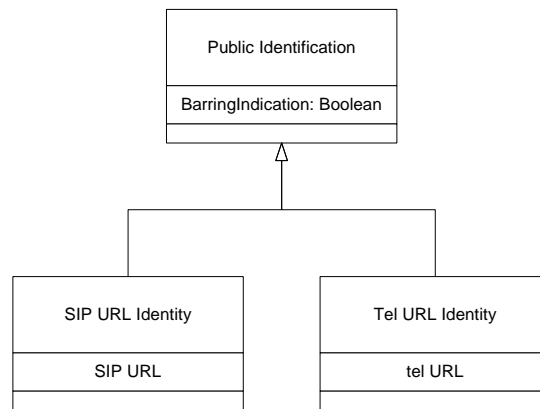
3 Each instance of the Service Profile class consists of one or several instances of the class Public
 4 Identification. Public Identification class contains the **public identities**Public User Identities of the user
 5 associated with that service profile. The information in the Core Network Service Authorization and Initial
 6 Filter Criteria classes apply to all **public identity**Public User Identity instances, which are included in one
 7 Service profile class. If no instance of the class Core Network Service Authorization is present, no filtering
 8 related to subscribed media applies in S-CSCF.

9 Each instance of the Service Profile class contains zero or one instance of the class Core Network Service
 10 Authorization. If no instance of the class Core Network Service Authorization is present, no filtering
 11 related to subscribed media applies in S-CSCF.

12 Each instance of the class Service Profile contains zero or several instances of the class Initial Filter
 13 Criteria.

14 **B.2.1 Public Identification**

15 The following picture gives an outline of the UML model of Public Identification class:



16
17

Figure B.2.1.1: Public Identification

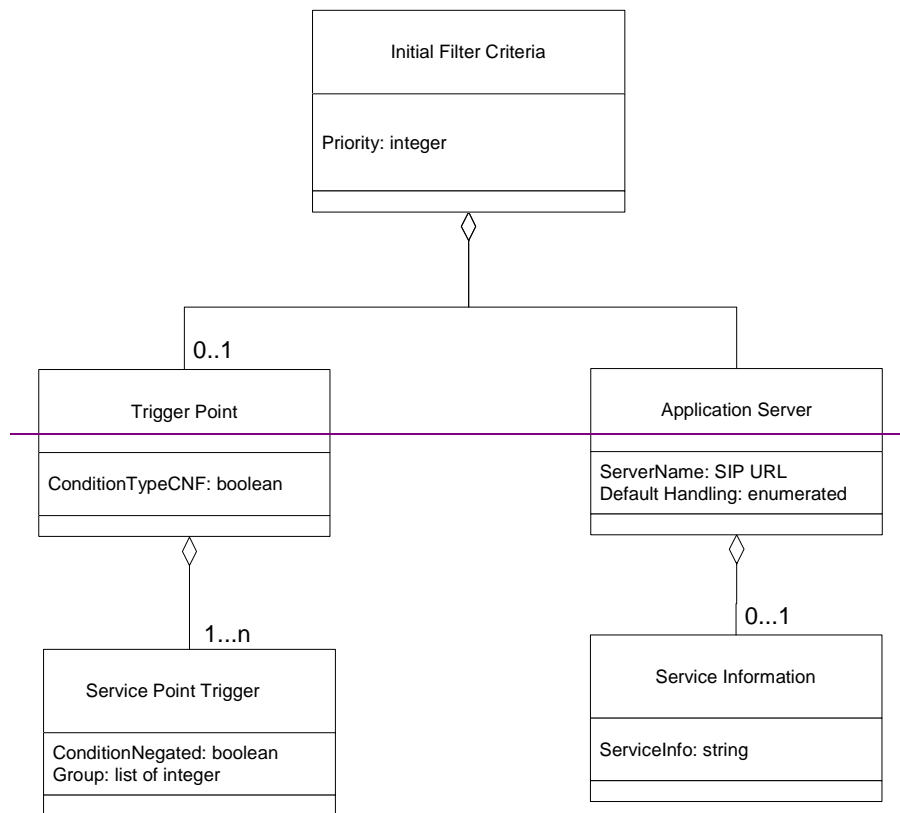
18 Public Identification class can contain either SIP URL Identity, i.e. SIP URL, or Tel URL Identity class, i.e.
 19 tel URL.

20 The attribute BarringIndication is of type Boolean. If it is set to TRUE, the S-CSCF shall prevent that
 21 **public identity**Public User Identity from being used in any IMS communication except registrations and re-
 22 registrations, as specified in [8].

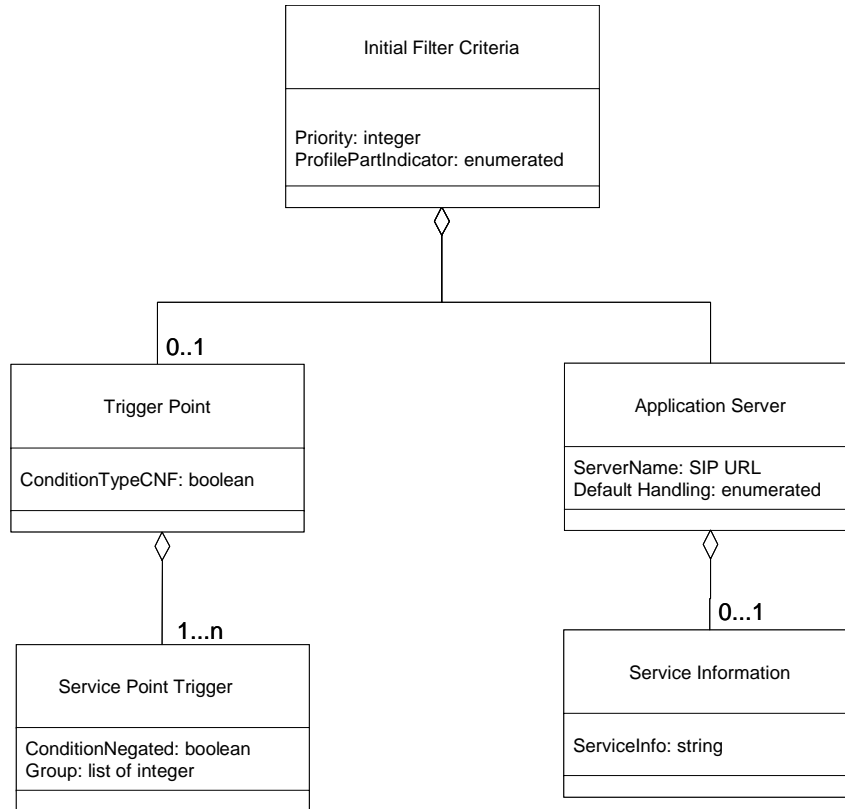
1 **B.2.2 Initial Filter Criteria**

2 The following picture gives an outline of the UML model of Initial Filter Criteria class:

3



4



1

2

Figure B.2.2.1: Initial Filter Criteria

3 Each instance of the Initial Filter Criteria class is composed of zero or one instance of a Trigger Point class
 4 and one instance of an Application Server class. Priority indicates the priority of the Filter Criteria. The
 5 higher the Priority Number the lower the priority of the Filter Criteria is; i.e., a Filter Criteria with a higher
 6 value of Priority Number shall be assessed after the Filter Criteria with a smaller Priority Number have
 7 been assessed. The same priority shall not be assigned to more than one initial Filter Criterion.

8 ConditionTypeCNF is a boolean that is TRUE when the Trigger Point associated with the FilterCriteria is a
 9 boolean expression in Conjunctive Normal Form (CNF) and FALSE if the Trigger Point is expressed in
 10 Disjunctive Normal Form (DNF) (see Annex C).

11 ProfilePartIndicator attribute is an enumerated type, with possible values "REGISTERED and
 12 UNREGISTERED, indicating if the iFC is a part of the registered or unregistered user profile. If
 13 ProfilePartIndicator is missing from the iFC, the iFC is considered to be relevant to both the registered and
 14 unregistered parts of the user profile, i.e. belongs to the common part of the user profile.

15 Trigger Point class describes the trigger points that should be checked in order to find out if the indicated
 16 Application Server should be contacted or not. Each TriggerPoint is a boolean expression in Conjunctive or
 17 Disjunctive Normal form (CNF or DNF). The absence of Trigger Point instance will indicate an
 18 unconditional triggering to Application Server.

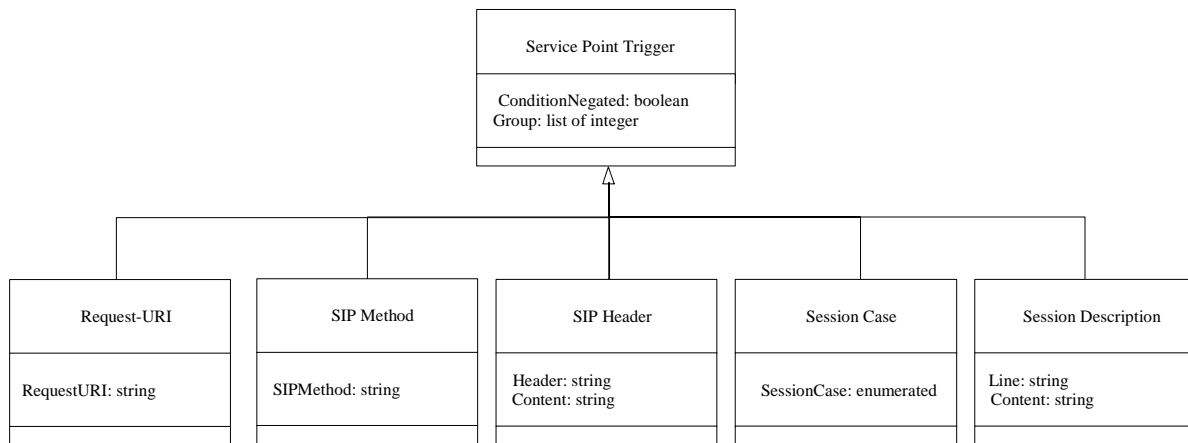
19 The attribute ConditionTypeCNF attribute defines how the set of SPTs are expressed, i.e. either an Ored set
 20 of ANDed sets of SPT statements or an ANDed set of Ored sets of statements. Individual SPTI statements
 21 can also be negated. These combinations are termed, respectively, Disjunctive Normal Form (DNF) and
 22 Conjunctive Normal Form (CNF) for the SPT (see Annex C). Both DNF and CNF forms can be used.

23 ConditionTypeCNF is a boolean that is TRUE when the Trigger Point associated with the FilterCriteria is a
 24 boolean expression in Conjunctive Normal Form (CNF) and FALSE if the Trigger Point is expressed in
 25 Disjunctive Normal Form (DNF) (see Annex C).

- 1 Each Trigger Point is composed by 1 to n instances of the class Service Point Trigger.
 2 Application Server class defines the application server, which is contacted, if the trigger points are met.
 3 Server Name is the SIP URL of the application server to contact. Default Handling determines whether the
 4 dialog should be released if the Application Server could not be reached or not; it is of type enumerated and
 5 can take the values: SESSION_CONTINUED or SESSION_TERMINATED.
 6 The Application Server class contains zero or one instance of the Service Information class. Service
 7 Information class allows to download to S-CSCF information that is to be transferred transparently to an
 8 Application Server when the trigger points of a filter criterion are satisfied. ServiceInformation is a string
 9 conveying that information.

10 **B.2.3 Service Point Trigger**

11 The following picture gives an outline of the UML model of Service Point Trigger class:



12
13

14 **Figure B.2.3.1: Service Point Trigger**

15 The attribute Group of the class Service Point Trigger allows the grouping of SPTs that will configure the
 16 sub-expressions inside a CNF or DNF expression. For instance, in the following CNF expression
 17 (A+B).(C+D), A+B and C+D would correspond to different groups.

18 In CNF, the attribute Group identifies the ORed sets of SPT instances. If the SPT belongs to different
 19 ORed sets, SPT can have more than one Group values assigned. At least one Group must be assigned for
 20 each SPT.

21 In DNF, the attribute Group identifies the ANDed sets of SPT instances. If the SPT belongs to different
 22 ANDed sets, SPT can have more than one Group values assigned. At least one Group must be assigned for
 23 each SPT.

24 The attribute ConditionNegated of the class Service Point Trigger defines whether the individual SPT
 25 instance is negated (i.e. NOT logical expression).

26 Request-URI class defines SPT for the Request-URI. Request-URI contains attribute RequestURI.

27 SIP Method class defines SPT for the SIP method. SIP Method contains attribute SIPMethod which can
 28 evaluate to any existent SIP method.

29 SIP Header class defines SPT for the presence or absence of any SIP header or for the content of any SIP
 30 header. SIP Header contains attribute SIP-Header which identifies the SIP Header, which is the SPT, and
 31 the Content attribute defines the value of the SIP Header if required. The value of the Content attribute is a
 32 string that shall be interpreted as a regular expression. Perl-like regular expressions shall be taken as a
 33 model for legal regular expressions for this function. A regular expression would be as simple as a literal

1 | ~~(e.g. “john”) or a more elaborated one, allowing to match a string “containing” a substring, beginning with~~
 2 | ~~a substring, etc. Examples of regular expressions valid for the “Match” attribute could be:~~

3 | ~~(“Joe”: meaning that a given header matches exactly with the string “Joe”.~~

4 | ~~(“^(Jo).*”: meaning that a given header contains a value that begins with “Jo”.~~

5 | (1 ~~“.*Jo.*”: meaning that a given header contains the substring “Jo” at any position.~~

6 | The absence of the Content attribute and ConditionNegated = TRUE indicates that the SPT is the absence
 7 | of a determined SIP header.

8 | Session Case class represents an enumerated type, with possible values “Originating”,
 9 | “Terminating Registered”, “Terminating_Unregistered” indicating if the filter should be used by the S-
 10 | CSCF handling the Originating, Terminating for a registered end user or Terminating for an unregistered
 11 | end user services.

12 | Session Description Information class defines SPT for the content of any SDP field within the body of a
 13 | SIP Method. The Line attribute identifies the line inside the session description. Content is a string defining
 14 | the content of the line identified by Line. ~~Perl like regular expressions shall be taken as a model for regular~~
 15 | ~~expressions for this function (as described above).~~

16

1 **Annex C (informative):**

2 **Conjunctive and Disjunctive Normal Form**

3 A Trigger Point expression is constructed out of atomic expressions (i.e. Service Point Trigger) linked by
4 Boolean operators AND, OR and NOT. Any logical expression constructed in that way can be transformed
5 to forms called Conjunctive Normal Form (CNF) and Disjunctive Normal Form (DNF).

6 A Boolean expression is said to be in Conjunctive Normal Form if it is expressed as a conjunction of
7 disjunctions of literals (positive or negative atoms), i.e. as an AND of clauses, each of which is the OR of
8 one of more atomic expressions.

9 Taking as an example the following trigger:

10 Method = "INVITE" OR Method = "MESSAGE" OR (Method="SUBSCRIBE" AND NOT Header =
11 "from" MatchContent = "joe")

12 *The trigger can be split into the following atomic expressions:*

- 13 • *Method="INVITE"*
- 14 • *Method="MESSAGE"*
- 15 • *Method="SUBSCRIBE"*
- 16 • *NOT header="from" ContentMatch="joe"*

17

18 *Grouping the atomic expressions, the CNF expression equivalent to the previous example looks like:*

19

20 *(Method="INVITE" OR Method = "MESSAGE" OR Method="SUBSCRIBE") AND (Method="INVITE"*
21 *OR Method = "MESSAGE" OR (NOT Header = "from" ContentMatch = "joe"))*

22

23 *This result in two "OR" groups linked by "AND" (CNF):*

- 24 • *(Method="INVITE" OR Method = "MESSAGE" OR Method="SUBSCRIBE")*
- 25 • *(Method="INVITE" OR Method = "MESSAGE" OR (NOT Header = "from" Content =*
26 *"joe"))*

27

28 *The XML representation of the trigger is:*

29

30 `<?xml version="1.0" encoding="UTF-8"?>`

31 `<testDatatype xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"`
32 `xsi:noNamespaceSchemaLocation="D:\CxDataType.xsd">`

33 `<IMSSubscription>`

34 `<PrivateID >IMPII@homedomain.com</PrivateID>`

35 `<ServiceProfile >`

```

1      <PublicIdentity >
2          <BarringIndication >1</BarringIndication>
3          <Identity > sip:IMPU1@homedomain.com </Identity>
4      </PublicIdentity>
5      <PublicIdentity >
6          <Identity > sip:IMPU2@homedomain.com </Identity>
7      </PublicIdentity>
8      """" <InitialFilterCriteria >
9      ""    <Priority >0</Priority>
10         <TriggerPoint >
11             <ConditionTypeCNF >1</ConditionTypeCNF>
12             <SPT >
13                 <ConditionNegated >0</ConditionNegated>
14                 <Group >0</Group>
15                 <Method >INVITE</Method>
16             </SPT>
17             <SPT >
18                 <ConditionNegated >0</ConditionNegated>
19                 <Group >0</Group>
20                 <Method >MESSAGE</Method>
21             </SPT>
22             <SPT >
23                 <ConditionNegated >0</ConditionNegated>
24                 <Group >0</Group>
25                 <Method >SUBSCRIBE</Method>
26             </SPT>
27             <SPT >
28                 <ConditionNegated >0</ConditionNegated>
29                 <Group >1</Group>
30                 <Method >INVITE</Method>
31             </SPT>
32         </SPT >

```

```

1         <ConditionNegated >0</ConditionNegated>
2         <Group >1</Group>
3         <Method >MESSAGE</Method>
4     </SPT>
5
6     <SPT >
7         <ConditionNegated >1</ConditionNegated>
8         <Group >1</Group>
9         <SIPHeader >
10            <Header >From</Header>
11            <Content >"joe"</Content>
12        </SIPHeader>
13    </SPT>
14 </TriggerPoint>
15 <ApplicationServer >
16     <ServerName >sip:ASI@homedomain.com</ServerName>
17     <DefaultHandling >0</DefaultHandling>
18 </ApplicationServer>
19 </InitialFilterCriteria>
20 </ServiceProfile>
21 </IMSSubscription>
22 </testDatatype>

```

24 A Boolean expression is said to be in Disjunctive Normal Form if it is expressed as a disjunction of
 25 conjunctions of literals (positive or negative atoms), i.e. as an OR of clauses, each of which is the AND of
 26 one of more atomic expressions.

27 *The previous example is already in DNF, composed by the following groups:*

- 28 • *Method="INVITE"*
- 29 • *Method="MESSAGE"*
- 30 • *Method="SUBSCRIBE" AND (NOT header="from" ContentMatch="joe")*

31
 32 *The XML representation of the trigger is:*

```

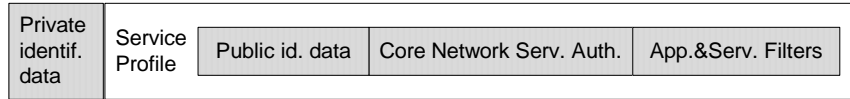
1
2 <?xml version="1.0" encoding="UTF-8"?>
3 <testDatatype xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4 xsi:noNamespaceSchemaLocation="D:\CxDataType.xsd">
5     <IMSSubscription>
6         <PrivateID >IMPI1@homedomain.com</PrivateID>
7         <ServiceProfile >
8             <PublicIdentity >
9                 <BarringIndication >1</BarringIndication>
10                <Identity > sip:IMPU1@homedomain.com </Identity>
11            </PublicIdentity>
12            <PublicIdentity >
13                <Identity > sip:IMPU2@homedomain.com </Identity>
14            </PublicIdentity>""""
15            <InitialFilterCriteria >
16                ""
17                <Priority >0</Priority>
18                <TriggerPoint >
19                    <ConditionTypeCNF >0</ConditionTypeCNF>
20                    <SPT >
21                        <ConditionNegated >0</ConditionNegated>
22                        <Group >0</Group>
23                        <Method >INVITE</Method>
24                    </SPT>
25                    <SPT >
26                        <ConditionNegated >0</ConditionNegated>
27                        <Group >1</Group>
28                        <Method >MESSAGE</Method>
29                    </SPT>
30                    <SPT >
31                        <ConditionNegated >0</ConditionNegated>
32                        <Group >2</Group>
33                        <Method >SUBSCRIBE</Method>

```

```
1      </SPT>
2      <SPT >
3          <ConditionNegated >1</ConditionNegated>
4          <Group >2</Group>
5          <SIPHeader >
6              <Header >From</Header>
7              <Content >"joe"</Content>
8          </SIPHeader>
9      </SPT>
10     </TriggerPoint>
11     <ApplicationServer >
12         <ServerName >sip:AS1@homedomain.com</ServerName>
13         <DefaultHandling >0</DefaultHandling>
14     </ApplicationServer>
15     </InitialFilterCriteria>
16 </ServiceProfile>
17 </IMSSubscription>
18 </testDatatype>
```

1 **Annex D (informative):**
 2 **High-level format for the User Profile**

3 The way the information will be transferred through the Cx interface can be seen from a high-level point of
 4 view in the following picture:



5

6

Figure C.1: Example of in-line format of user profile

7

8 If more than one service profile is created, for example to assign a different set of filters to **public**
 9 **identitiesPublic User Identities** 1 and 2 and **public identityPublic User Identity** 3, the information will be
 10 packaged in the following way:



11

12

Figure C.2: Example of in-line format of user profile

1 **Annex E (normative):**
2 **XML schema for the Cx interface user profile**

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

6 Table E.1 describes the data types and the dependencies among them that configure the XML schema.

1

Table E.1: XML schema for Cx interface: simple data types

Data type	Tag	Base type	Comments
tPriority	Priority	integer	>= 0
tProfilePartIndicator	ProfilePartIndicator	enumerated	Possible values: 0 (REGISTERED) 1 (UNREGISTERED)
tGroupID	Group	integer	>= 0
tDefaultHandling	DefaultHandling	enumerated	Possible values: 0 (SESSION_CONTINUE) 1 (SESSION_TERMINATED)
tDirectionOfRequest	SessionCase	enumerated	Possible values: 0 (ORIGINATING_SESSION) 1 (TERMINATING_REGISTERED_SESSION) 2 (TERMINATING_UNREGISTERED)
tPrivateID	PrivateID	anyURI	Syntax described in RFC 2486
tSIP_URL	Identity	anyURI	Syntax described in RFC 3261
tTEL_URL	Identity	anyURI	Syntax described in RFC 2806
tIdentity	Identity	(union)	Union of tSIP_URL and tTEL_URL
tServiceInfo	ServiceInfo	string	
tString	RequestURI, Method, Header, Content, Line	string	
tBool	ConditionTypeCNF, ConditionNegated, BarringIndication	boolean	Possible values: 0 (false) 1 (true)
tSubscribedMediaProfileID	SubscribedMediaProfileID	integer	>=0

2

1

Table E.2: XML schema for Cx interface: complex data types

Data type	Tag	Compound of		
		Tag	Type	Cardinality
tIMSSubscription	IMSSubscription	PrivateID	tPrivateID	1
		ServiceProfile	tServiceProfile	(1 to n)
tServiceProfile	ServiceProfile	PublicIdentity	tPublicIdentity	(1 to n)
		InitialFilterCriteria	tInitialFilterCriteria	(1 to n)
		CoreNetworkServicesAuthorization	CoreNetworkServicesAuthorization	(0 to 1)
tCoreNetworkServicesAuthorization	CoreNetworkServicesAuthorization	SubscribedMediaProfileId	tSubscribedMediaProfileId	(0 to 1)
tPublicIdentity	PublicIdentity	BarringIndication	tBool	1
		Identity	tIdentity	1

tInitialFilterCriteria	InitialFilterCriteria	Priority	tPriority	1	
		TriggerPoint	tTrigger	(0 to 1)	
		ApplicationServer	tApplicationServer	1	
		<u>ProfilePartIndicator</u>	<u>tProfilePartIndicator</u>	<u>(0 to 1)</u>	
tTrigger	TriggerPoint	SPT	tSePoTri	(1 to n)	
		ConditionTypeCNF	tBool	1	
tSePoTri	SPT	ConditionNegated	tBool	(0 to 1)	
		Group	tGroupID	(1 to n)	
		Choice of	RequestURI	tString	1
			Method	tString	1
			SIPHeader	tHeader	1
			SessionCase	tDirectionOfRequest	1
SessionDescription	tSessionDescription		1		
tHeader	SIPHeader	Header	tString	1	
		Content	tString	(0 to 1)	
tSessionDescription	SessionDescription	Line	tString	1	
		Content	tString	(0 to 1)	
tApplicationServer	ApplicationServer	ServerName	tSIP_URL	1	
		DefaultHandling	tDefaultHandling	(0 to 1)	
		ServiceInfo	tServiceInfo	(0 to 1)	
NOTE: "n" shall be interpreted as non-bounded.					

1

2 Annex F (normative):

3 Definition of parameters for service point trigger matching

4 Table F.1 defines the parameters that are transported in the user profile XML.

5 **Table F.1: Definition of parameters in the user profile XML**

<u>Tag</u>	<u>Description</u>
<u>SIPHeader</u>	<u>A SIP Header SPT shall be evaluated separately against each header instance within the SIP message. The SIP Header SPT matches if at least one header occurrence matches the SPT.</u>
<u>Header (of SIPHeader)</u>	<u>Header tag shall include a regular expression in a form of <u>ExtendedBasic</u> Regular Expressions (<u>BERE</u>) as defined in chapter 9 in IEEE 1003.1-2004 Part 1 [12]. The regular expression shall be matched against the header-name of the SIP header. For definition of header and header-name, see IETF RFC 3261 [10]. Before matching the header-name to the pattern, all SWSs shall be removed from the header-name and all LWSs in the header-name shall be reduced to a single white space character (SP). For definition of SWS and LWS, see IETF RFC 3261 [10].</u>
<u>Content (of SIPHeader)</u>	<u>Content tag shall include a regular expression in a form of <u>BasicExtended</u> Regular Expressions (<u>EBRE</u>) as defined in chapter 9 in IEEE 1003.1-2004 Part 1 [12]. The regular expression shall be matched against the header-value of the SIP header. For definition of header and header-value, see IETF RFC 3261 [10]. If the SIP header contains several header-values in a comma-separated list, each of the header-value shall be matched against the pattern for the Content separately. Before matching the header-value to the pattern, all SWSs shall be removed from the header-value and all LWSs in the header-value shall be reduced to a single white space character (SP). For definition of SWS and LWS, see IETF RFC 3261 [10].</u>
<u>SessionDescription</u>	<u>A Session Description SPT shall be evaluated separately against each SDP field instance within the SIP message. The Session Description SPT matches if at least one field occurrence matches the SPT.</u>
<u>Line (of SessionDescription)</u>	<u>Line tag shall include a regular expression in a form of <u>ExtendedBasic</u> Regular Expressions (<u>EBRE</u>) as defined in chapter 9 in IEEE 1003.1-2004 Part 1 [12]. The regular expression shall be matched against the type of the field inside the session description. For definition of type, see chapter 6 in IETF RFC 2327 [11].</u>
<u>Content (of SessionDescription)</u>	<u>Content tag shall include a regular expression in a form of <u>ExtendedBasic</u> Regular Expressions (<u>EBRE</u>) as defined in chapter 9 in IEEE 1003.1-2004 Part 1 [12]. The regular expression shall be matched against the value of the field inside the session description. For definition of -value, see chapter 6 in IETF RFC 2327 [11].</u>

6

1 Annex GF (CxDataType.xsd):

```

2
3 <?xml version="1.0" encoding="UTF-8"?>
4 <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
5 elementFormDefault="qualified" attributeFormDefault="unqualified">
6   <xs:simpleType name="tPriority" final="list restriction">
7     <xs:restriction base="xs:int">
8       <xs:minInclusive value="0"/>
9     </xs:restriction>
10  </xs:simpleType>
11
12   <xs:simpleType name="tProfilePartIndicator" final="list
13 restriction">
14     <xs:restriction base="xs:unsignedByte">
15       <xs:maxInclusive value="1"/>
16       <xs:enumeration value="0">
17         <xs:annotation>
18           <xs:documentation>
19             <label xml:lang="en">REGISTERED</label>
20             <definition xml:lang="en">iFC is part of the
21 registered profile</definition>
22           </xs:documentation>
23         </xs:annotation>
24       </xs:enumeration>
25       <xs:enumeration value="1">
26         <xs:annotation>
27           <xs:documentation>
28             <label xml:lang="en">UNREGISTERED</label>
29             <definition xml:lang="en">iFC is part of the
30 unregistered profile</definition>
31           </xs:documentation>
32         </xs:annotation>
33       </xs:enumeration>
34     </xs:restriction>
35   </xs:simpleType>
36
37   <xs:simpleType name="tGroupID" final="list restriction">
38     <xs:restriction base="xs:int">
39       <xs:minInclusive value="0"/>
40     </xs:restriction>
41   </xs:simpleType>
42   <xs:simpleType name="tDefaultHandling" final="list restriction">
43     <xs:restriction base="xs:unsignedByte">
44       <xs:maxInclusive value="1"/>
45       <xs:enumeration value="0">
46         <xs:annotation>
47           <xs:documentation>
48             <label
49 xml:lang="en">SESSION_CONTINUED</label>
50             <definition xml:lang="en">Session
51 Continued</definition>
52           </xs:documentation>
53         </xs:annotation>
54       </xs:enumeration>
55       <xs:enumeration value="1">

```

```

1             <xs:annotation>
2                 <xs:documentation>
3                     <label
4 xml:lang="en">SESSION_TERMINATED</label>
5                     <definition xml:lang="en">Session
6 Terminated</definition>
7                 </xs:documentation>
8             </xs:annotation>
9         </xs:enumeration>
10    </xs:restriction>
11 </xs:simpleType>
12 <xs:simpleType name="tDirectionOfRequest" final="list
13 restriction">
14     <xs:restriction base="xs:unsignedByte">
15         <xs:maxInclusive value="3"/>
16         <xs:enumeration value="0">
17             <xs:annotation>
18                 <xs:documentation>
19                     <label
20 xml:lang="en">ORIGINATING_SESSION</label>
21                     <definition
22 xml:lang="en">Originating Session</definition>
23                 </xs:documentation>
24             </xs:annotation>
25         </xs:enumeration>
26         <xs:enumeration value="1">
27             <xs:annotation>
28                 <xs:documentation>
29                     <label
30 | xml:lang="en">TERMINATING_REGISTERED_SESSION</label>
31                     <definition
32 | xml:lang="en">Terminating Session for registered user</definition>
33                 </xs:documentation>
34             </xs:annotation>
35         </xs:enumeration>
36         <xs:enumeration value="2">
37             <xs:annotation>
38                 <xs:documentation>
39                     <label
40 xml:lang="en">TERMINATING_UNREGISTERED</label>
41                     <definition
42 xml:lang="en">Terminating Session for unregistered user</definition>
43                 </xs:documentation>
44             </xs:annotation>
45         </xs:enumeration>
46     </xs:restriction>
47 </xs:simpleType>
48 <xs:simpleType name="tPrivateID" final="list restriction">
49     <xs:restriction base="xs:anyURI"/>
50 </xs:simpleType>
51 <xs:simpleType name="tSIP_URL" final="list restriction">
52     <xs:restriction base="xs:anyURI"/>
53 </xs:simpleType>
54 <xs:simpleType name="tTEL_URL" final="list restriction">
55     <xs:restriction base="xs:anyURI"/>
56 </xs:simpleType>
57 <xs:simpleType name="tIdentity" final="list restriction">

```

```

1         <xs:union memberTypes="tSIP_URL tTEL_URL"/>
2     </xs:simpleType>
3     <xs:simpleType name="tServiceInfo" final="list restriction">
4         <xs:restriction base="xs:string">
5             <xs:minLength value="0"/>
6         </xs:restriction>
7     </xs:simpleType>
8     <xs:simpleType name="tString" final="list restriction">
9         <xs:restriction base="xs:string">
10            <xs:minLength value="0"/>
11        </xs:restriction>
12    </xs:simpleType>
13    <xs:simpleType name="tBool">
14        <xs:restriction base="xs:boolean"/>
15    </xs:simpleType>
16    <xs:simpleType name="tSubscribedMediaProfileId" final="list
17 restriction">
18        <xs:restriction base="xs:int">
19            <xs:minInclusive value="0"/>
20        </xs:restriction>
21    </xs:simpleType>
22    <xs:complexType name="tIMSSubscription">
23        <xs:sequence>
24            <xs:element name="PrivateID" type="tPrivateID"/>
25            <xs:element name="ServiceProfile"
26 type="tServiceProfile" maxOccurs="unbounded"/>
27 | <xs:any namespace="##Other" processContents="lax"
28 minOccurs="0" maxOccurs="unbounded"/>
29        </xs:sequence>
30    </xs:complexType>
31    <xs:complexType name="tServiceProfile">
32        <xs:sequence>
33            <xs:element name="PublicIdentity"
34 type="tPublicIdentity" maxOccurs="unbounded"/>
35            <xs:element name="CoreNetworkServicesAuthorization"
36 type="tCoreNetworkServicesAuthorization" minOccurs="0"/>
37            <xs:element name="InitialFilterCriteria"
38 type="tInitialFilterCriteria" minOccurs="0" maxOccurs="unbounded"/>
39 | <xs:any namespace="##Other" processContents="lax"
40 minOccurs="0" maxOccurs="unbounded"/>
41        </xs:sequence>
42    </xs:complexType>
43    <xs:complexType name="tCoreNetworkServicesAuthorization">
44        <xs:sequence>
45            <xs:element name="SubscribedMediaProfileId"
46 type="tSubscribedMediaProfileId" minOccurs="0"/>
47 | <xs:any namespace="##Other" processContents="lax"
48 minOccurs="0" maxOccurs="unbounded"/>
49        </xs:sequence>
50    </xs:complexType>
51    <xs:complexType name="tInitialFilterCriteria">
52        <xs:sequence>
53            <xs:element name="Priority" type="tPriority"/>
54            <xs:element name="TriggerPoint" type="tTrigger"
55 minOccurs="0"/>
56            <xs:element name="ApplicationServer"
57 | type="tApplicationServer"/>

```

```

1 |         <xs:element name="ProfilePartIndicator"
2 |         type="tProfilePartIndicator" minOccurs="0"/>
3 |         <xs:any namespace="##Other" processContents="lax"
4 | minOccurs="0" maxOccurs="unbounded"/>
5 |         </xs:sequence>
6 |     </xs:complexType>
7 |     <xs:complexType name="tTrigger">
8 |         <xs:sequence>
9 |             <xs:element name="ConditionTypeCNF" type="tBool"/>
10 |             <xs:element name="SPT" type="tSePoTri"
11 | maxOccurs="unbounded"/>
12 |             <xs:any namespace="##Other" processContents="lax"
13 | minOccurs="0" maxOccurs="unbounded"/>
14 |             </xs:sequence>
15 |         </xs:complexType>
16 |         <xs:complexType name="tSePoTri">
17 |             <xs:sequence>
18 |                 <xs:element name="ConditionNegated" type="tBool"
19 | default="0" minOccurs="0"/>
20 |                 <xs:element name="Group" type="tGroupID"
21 | maxOccurs="unbounded"/>
22 |                 <xs:choice>
23 |                     <xs:element name="RequestURI" type="tString"/>
24 |                     <xs:element name="Method" type="tString"/>
25 |                     <xs:element name="SIPHeader" type="tHeader"/>
26 |                     <xs:element name="SessionCase"
27 | type="tDirectionOfRequest"/>
28 |                     <xs:element name="SessionDescription"
29 | type="tSessionDescription"/>
30 |                 </xs:choice>
31 |                 <xs:any namespace="##Other" processContents="lax"
32 | minOccurs="0" maxOccurs="unbounded"/>
33 |             </xs:sequence>
34 |         </xs:complexType>
35 |         <xs:complexType name="tHeader">
36 |             <xs:sequence>
37 |                 <xs:element name="Header" type="tString"/>
38 |                 <xs:element name="Content" type="tString"
39 | minOccurs="0"/>
40 |             </xs:sequence>
41 |         </xs:complexType>
42 |         <xs:complexType name="tSessionDescription">
43 |             <xs:sequence>
44 |                 <xs:element name="Line" type="tString"/>
45 |                 <xs:element name="Content" type="tString"
46 | minOccurs="0"/>
47 |             </xs:sequence>
48 |         </xs:complexType>
49 |         <xs:complexType name="tApplicationServer">
50 |             <xs:sequence>
51 |                 <xs:element name="ServerName" type="tSIP_URL"/>
52 |                 <xs:element name="DefaultHandling"
53 | type="tDefaultHandling" minOccurs="0"/>
54 |                 <xs:element name="ServiceInfo" type="tServiceInfo"
55 | minOccurs="0"/>
56 |             <xs:any namespace="##Other" processContents="lax"
57 | minOccurs="0" maxOccurs="unbounded"/>

```

```
1         </xs:sequence>
2     </xs:complexType>
3     <xs:complexType name="tPublicIdentity">
4         <xs:sequence>
5             <xs:element name="BarringIndication" type="tBool"
6 default="0" minOccurs="0"/>
7             <xs:element name="Identity" type="tIdentity"/>
8         </xs:sequence>
9     </xs:complexType>
10    <xs:element name="IMSSubscription" type="tIMSSubscription"/>
11 </xs:schema>
12
13
```