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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements at the interface between SUP-FE and I/S-CSC-FE

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Supplement 54 to ITU-T Q-series Recommendations

Signalling requirements at the interface between SUP-FE and I/S-CSC-FE

Summary

Supplement 54 to ITU-T Q-series Recommendations defines the signalling requirements at the interface between SUP-FE and I/S-CSC-FE.

Source

Supplement 54 to ITU-T Q-series Recommendations was agreed on 27 April 2007 by ITU-T Study Group 11 (2005-2008).

Keywords

Interface, NGN, signalling requirements.

FOREWORD

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Supplement 54 to ITU-T Q-series Recommendations

Signalling requirements at the interface between SUP-FE and I/S-CSC-FE

1 Scope

This Supplement defines signalling requirements and information flows at the interface between service user profile functional entity (SUP-FE) and I/S-CSC-FE.

The interface between I/S-CSC-FE and SUP-FE defined in [ITU-T Y.2012] can be mapped to the following interfaces:

1) the Cx interface between I/S-CSCF and SUP-FE (with SAA-FE) in IP Multimedia Subsystem, as identified in [ITU-T Y.2021];
2) the Cx interface between I/S-CSCF and SUP-FE (with SAA-FE) in IMS-based emulation architecture, as defined in [ITU-T Y.2031];
3) the I11 interface between CCF and SUP-FE in CS-based PSTN/ISDN emulation architecture, as defined in [ITU-T Y.2031].

This Supplement specifies the signalling requirements for the above three interfaces.

2 References

[ITU-T G.964] ITU-T Recommendation G.964 (2001), *V-Interfaces at the digital local exchange (LE) – V5.1 interface (based on 2048 kbit/s) for the support of access network (AN)*.

[ITU-T Q.1290] ITU-T Recommendation Q.1290 (1998), *Glossary of terms used in the definition of intelligent networks*.

[ITU-T Q.2931] ITU-T Recommendation Q.2931 (1995), *Digital Subscriber Signalling System No. 2 – User-Network Interface (UNI) layer 3 specification for basic call/connection control*.

[ITU-T Q.Sup56] ITU-T Q-series Supplement 56 (2007), *Organization of NGN service user data*.

[ITU-T Y.2012] ITU-T Recommendation Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.

[ITU-T Y.2021] ITU-T Recommendation Y.2021 (2006), *IMS for Next Generation Networks*.

[ITU-T Y.2031] ITU-T Recommendation Y.2031 (2006), *PSTN/ISDN emulation architecture*.

[IETF RFC 2617] IETF RFC 2617 (1999), *HTTP Authentication: Basic and Digest Access Authentication*.

[IETF RFC 3310] IETF RFC 3310 (2002), *Hypertext Transfer Protocol (HTTP) Digest Authentication Using Authentication and Key Agreement (AKA).*

[IETF RFC 4740] IETF RFC 4740 (2006), *Diameter Session Initiation Protocol (SIP) Application*.

[ETSI TS 129 229] ETSI TS 129 229 V7.5.0 (2007), *Cx and Dx interfaces based on the Diameter protocol; Protocol details*.

3 Definitions

3.1 Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

3.1.1 information flow [ITU-T Q.1290]: An interaction between a communicating pair of functional entities.

3.1.2 information element [ITU-T Q.2931]: The components of a message are information elements. A particular information element type may be a component of more than one message type. An information element is composed of one or more octet groups.

3.1.3 conditional information element (C) [ITU-T G.964]: Conditional information element which is considered: a) mandatory if the presence conditions are fulfilled; or b) optional otherwise.

NOTE – In error-handling procedures, a conditional IE is handled as a mandatory or a conditional IE depending on the presence conditions. The absence of a conditional IE in a message is a protocol error only if the presence conditions of the IE are met.

3.1.4 optional information element (O) [ITU-T G.964]: An optional information element may be present in the message. The absence of an optional IE in a message is not a protocol error in any case.

3.2 Terms defined in this Supplement

This Supplement defines the following term:

3.2.1 mandatory information element (M): A mandatory information element must be present in the message. The absence of a mandatory IE in a message is a protocol error.

4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

AGCF	Access Gateway Control Function
AKA	Authentication and Key Agreement
AUTN	Authentication Token (128-bit value)
AUTS	Authentication Token (112-bit value)
CCF	Call Control Function
FE	Functional Entity
HSS	Home Subscriber Server
HTTP	Hyper Text Transfer Protocol
I-CSCF	Interrogating Call Session Control Function
I-CSC-FE	Interrogating Call Session Control Functional Entity
IE	Information Element
IMS	IP Multimedia Subsystem
ISDN	Integrated Services Digital Network
NAI	Network Access Identifier
NASS	Network Attachment Subsystem
NGN	Next Generation Network

P-CSCF Proxy Call Session Control Function

PSTN Public Switched Telephone Network

RAND Random challenge

RFC Request for Comments

SAA-FE Service Authentication and Authorization Functional Entity

S-CSCF Serving Call Session Control Function

S-CSC-FE Serving Call Session Control Functional Entity

SCTP Stream Control Transport Protocol

SIP Session Initiation Protocol

SUP-FE Service User Profile Functional Entity

URL Uniform Resource Locator

XRES Expected Authentication Response

5 Conventions

None.

6 General requirements

6.1 Functional requirements of related network entities

The interface between I/S-CSC-FE and SUP-FE defined in [ITU-T Y.2012] can be mapped into three interfaces identified in [ITU-T Y.2021] and [ITU-T Y.2031]. The functional requirements of the related functional entities are also specified in the related Recommendations.

Table 6-1 shows the interfaces and related FEs among NGN architectures specified in related Recommendations.

Table 6-1 – Related functional entities among NGN architectures

NGN architecture	Interfaces	Related functional entities	Recommendations which identify the functional requirements of the FEs
Functional architecture of the NGN	Interface between I/S-CSC-FE and SUP-FE	I/S-CSC-FE SUP-FE	All the FEs are specified in [ITU-T Y.2012].
IMS for next generation networks	Cx	I/S-CSCF SUP-FE (with SAA-FE)	I/S-CSCF is identified in [ITU-T Y.2021]. SUP-FE (with SAA-FE) is specified in [ITU-T Y.2012].
IMS-based PSTN/ISDN emulation architecture	Cx	I/S-CSCF SUP-FE (with SAA-FE)	I/S-CSCF is identified in [ITU-T Y.2031]. SUP-FE (with SAA-FE) is specified in [ITU-T Y.2012].
CS-based PSTN/ISDN emulation architecture	I11	CCF SUP-FE	CCF is specified in [ITU-T Y.2031]. SUP-FE is specified in [ITU-T Y.2012].

6.2 General requirements

General signalling requirements at the above three interfaces are classified in functional groups:

1) Location management

   The Location management requirements include:

   a) the operations regarding registration and deregistration.

   b) Location retrieval operations which may be required to:

      – obtain the information of S-CSC-FE which serves the user or to obtain the list of capabilities that the S-CSC-FE has to support;

      – perform authorization and security check during the process of registration/ deregistration on receipt of the registration message from P-CSC-FE or AGC-FE.

2) User-data handling

   The user-data handling requirements include:

   – the download of user information during registration and in support of recovery mechanisms;

   – operations to support the updating of user data.

3) Authentication

   The authentication requirements include operations regarding user authentication.

4) Error handling

   The error-handling requirements include operations regarding error handling.

7 Procedure requirements

7.1 Procedure requirements for interface between I/S-CSCF and SUP-FE in IP multimedia subsystem

7.1.1 Location management procedures

The Cx interface shall implement the user registration/location-related procedures as follows.

7.1.1.1 User registration status query procedure

This procedure is used between the I-CSCF and the SUP-FE during SIP registrations. The procedure is invoked by the I-CSCF:

– to authorize the registration of the public user identity, checking multimedia subsystem access permissions and roaming agreements;

– to perform an initial security check, determining whether the public user identity in the message is associated with the private user identity sent in the message;

– to obtain either the S-CSCF where the public user identity is registered or unregistered (i.e., registered as a consequence of a terminating call or there is a S-CSCF keeping the user profile stored), or the list of capabilities that the S-CSCF has to support.

Information flow is shown in Figure 7-1.

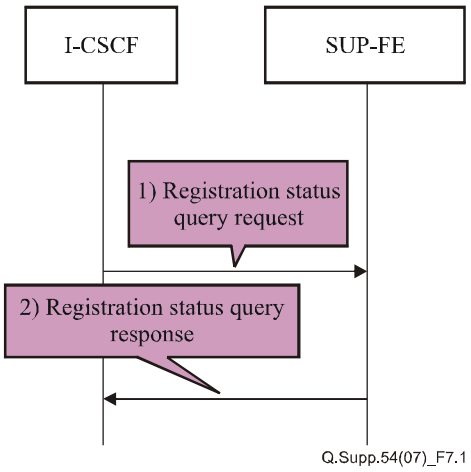

Figure 7-1 – Information flow for user registration status query procedure

1) On receiving the SIP register request from a user, the I-CSCF shall send the register status query information flow to the SUP-FE.
2) The SUP-FE shall return an assigned S-CSCF name or the list of capabilities that S-CSCF has to support.

Tables 7-1 and 7-2 detail the involved information elements.

Table 7-1 – User registration status query

Information element name	Cat.	Description
Public User Identity	M	Public user identity to be registered
Visited Network Identifier	M	Identifier that allows the home network to identify the visited network
Type of Authorization	C	Type of authorization requested by the I-CSCF
Private User Identity	M	Private user identity
Routing Information	C	Information to route requests

Table 7-2 – User registration status response

Information element name	Cat.	Description
Result	M	Result of the operation
S-CSCF capabilities	O	Required capabilities of the S-CSCF to be assigned to the IMS subscription
S-CSCF Name	C	Name of the assigned S-CSCF

7.1.1.2 S-CSCF-initiated registration/deregistration notification procedure

On registration or deregistration, the S-CSCF shall inform the SUP-FE. The SUP-FE holds the states of all identities under an IMS domain. The S-CSCF shall update these states by sending notification to SUP-FE.

This procedure is used between the S-CSCF and the SUP-FE. The procedure is invoked by the S-CSCF. SUP-FE associates the S-CSCF with the public user identity in the process of registration, or clears the name of the S-CSCF associated with one or more public user identities in the process of deregistration.

Information flow is shown in Figure 7-2.

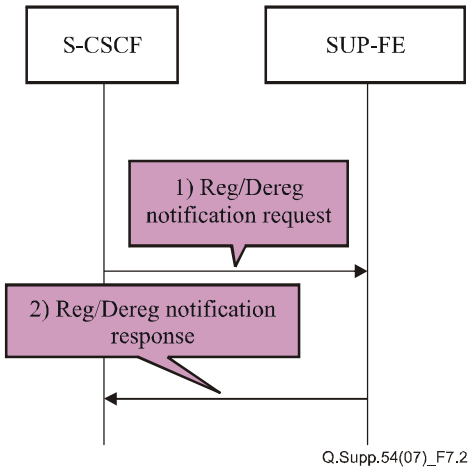

Figure 7-2 – Information flow for S-CSCF-initiated registration/ deregistration notification procedure

1) When registration/deregistration is completed, S-CSCF sends reg/dereg notification request to notify the SUP-FE that the S-CSCF name or the public user identity is no longer considered registered in the S-CSCF.

2) The SUP-FE sends response to acknowledge the sending of the request, including the relevant user information that the S-CSCF needs to serve the user.

Tables 7-3 and 7-4 describe the involved information elements.

Table 7-3 – S-CSCF registration/deregistration notification request

Information element name	Cat.	Description
Public User Identity/Public Service Identity	C	Public identity or list of public identities
S-CSCF Name	M	Name of the S-CSCF
Private User Identity/Private Service Identity	C	Private identity It shall be present if it is available when the S-CSCF issues the request
Server Assignment Type	M	Type of update that the S-CSCF requests in the SUP-FE (e.g., deregistration)
User Data Already Available	M	This indicates if the user profile is already available in the S-CSCF
Routing Information	C	Information to route requests

Table 7-4 – S-CSCF registration/deregistration notification response

Information element name	Cat.	Description
Private User Identity/Private Service Identity	C	Private identity It shall be present if it is available when the SUP-FE sends the response.
Result	M	Result of registration
User Profile	C	Relevant user profile
Charging Information	C	Addresses of the charging functions
Associated Private Identities	O	This information element indicates to the S-CSCF the private identities, which belong to the same IMS subscription as the private identity received in the request command.

7.1.1.3 SUP-FE-initiated deregistration notification procedure

On administrative deregistration, SUP-FE may change the user's status to "not registered" and send a notification to S-CSCF indicating the user shall be deregistered.

The procedure is invoked by the SUP-FE.

Information flow is shown in Figure 7-3:

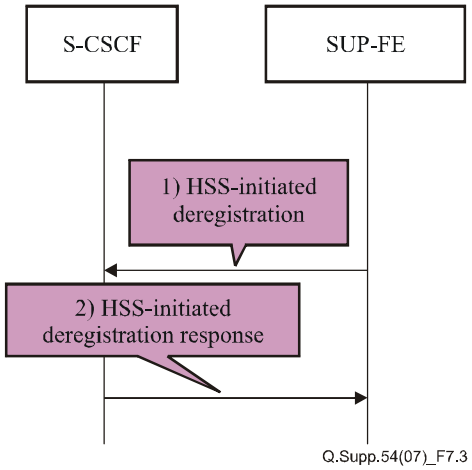

Figure 7-3 – Information flow for SUP-FE initiated deregistration notification procedure

1) In case of network-initiated deregistration by the SUP-FE, the SUP-FE changes the state of the Public Identities to Not Registered and sends a deregistration notification to the S-CSCF indicating the identities that shall be deregistered.

2) Based on the filter criteria, the S-CSCF shall send deregistration information to the service control platform and P-CSCF. Then, the S-CSCF sends back the response.

Tables 7-5 and 7-6 describe the involved information elements.

Table 7-5 – Network-initiated deregistration by SUP-FE request

Information element name	Cat.	Description
Public User Identity/Public Service Identity	C	It contains the list of public identities that are deregistered, in the form of SIP URL or TEL URL.
Private User Identity/Private Service Identity	M	It contains the private identity in the form of a NAI.
Reason for deregistration	M	The SUP-FE shall send to the S-CSCF a reason for deregistration.
Routing Information	M	It contains the name of the S-CSCF which originated the last update of the name of the multimedia server stored in the SUP-FE for a given IMS subscription.
Associated Private Identities	O	This information element indicates to the S-CSCF the private identities, which belong to the same IMS subscription as the private identity received in the request command. If the IMS subscription contains only a single private identity, this element shall not be present.

Table 7-6 – Network-initiated deregistration by SUP-FE response

Information element name	Cat.	Description
Result	M	This information element indicates the result of deregistration.
Associated Private Identities	C	This element shall be present if the S-CSCF deregistered more than one private identity with the request. It contains all private identities that have been deregistered together.

7.1.1.4 User location query procedure

This procedure is used between the I-CSCF and the SUP-FE to obtain the name of the S-CSCF assigned to a public identity. The procedure is invoked by the I-CSCF and is performed per public identity.

Information flow is shown in Figure 7-4.

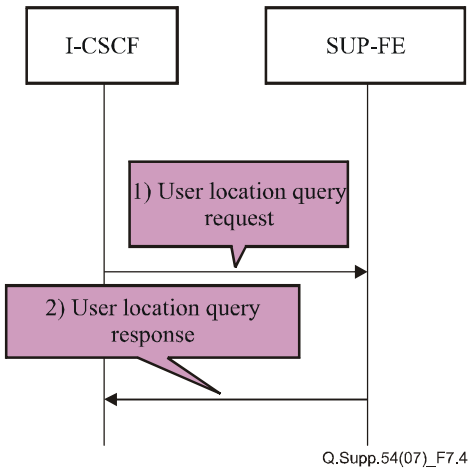

Figure 7-4 – Information flow for user location query procedure

1) I-CSCF (at the border of the terminating subscriber's network) queries the SUP-FE for current location information. It will send a user location query request to the SUP-FE to obtain the location information for the destination.

2) SUP-FE responds with the address of the current S-CSCF for the terminating subscriber.

Tables 7-7 and 7-8 detail the involved information elements.

Table 7-7 – User location query

Information element name	Cat.	Description
Public User Identity/Public Service Identity	M	Public identity
Routing information	C	Information to route requests

Table 7-8 – User location response

Information element name	Cat.	Description
Result	M	Result of the operation
S-CSCF Name/AS name	C	Name of the assigned S-CSCF for basic IMS routing or the name of the AS for direct routing
S-CSCF capabilities	O	It contains the information to help the I-CSCF in the selection of the S-CSCF

7.1.2 User data handling

The Cx interface shall implement the user data handling procedures as follows.

- S-CSCF-initiated user data downloading procedure:

  The S-CSCF shall get user-related data from the SUP-FE during the period of registration. The registration response from SUP-FE contains the user profile, charging information and other data if needed.

- SUP-FE-initiated user data updating procedure:

  The SUP-FE shall send user-related data to the S-CSCF for administrative management purposes. The data includes user profile, charging information and other data if needed.

7.1.2.1 S-CSCF-initiated user data downloading procedure

As part of the registration procedure, S-CSCF downloads the user data by means of the registration notification procedure (see clause 7.1.1.2).

7.1.2.2 SUP-FE-initiated user data updating procedure

This procedure is initiated by the SUP-FE to update user profile information and/or charging information in the S-CSCF.

Information flow is shown in Figure 7-5.

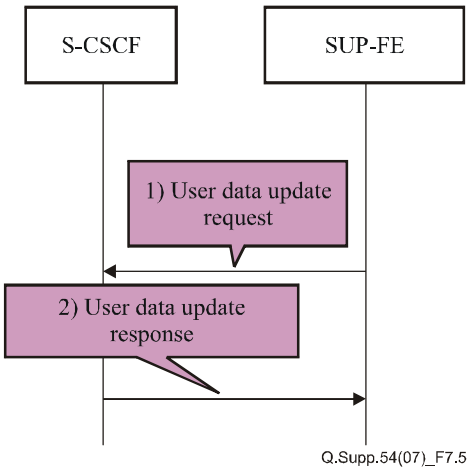

Figure 7-5 – Information flow for SUP-FE-initiated user data updating procedure

1) Whenever a modification has occurred in the subscription data of a user, the SUP-FE sends the user data update request with the subscription data to the S-CSCF.

2) The S-CSCF updates the subscription data of the user and sends user data update response to the SUP-FE to acknowledge the sending of user data update request.

Tables 7-9 and 7-10 describe the involved information elements.

Table 7-9 – User profile update request

Information element name	Cat.	Description
Private User Identity/Private Service Identity	M	Private identity
User profile	C	This information element contains the user profile.
Charging Information	C	Addresses of the charging functions
Routing Information	M	It contains the name of the S-CSCF which originated the last update of the name of the multimedia server stored in the SUP-FE for a given IMS subscription.

Table 7-10 – User profile update response

Information element name	Cat.	Description
Result	M	This information element indicates the result of the update of user profile in the S-CSCF.

7.1.3 Authentication

The Cx interface shall implement the authentication procedure which may be applied during the period of registration. End-user and home IMS network-related information used for authentication will be exchanged between S-CSCF and SUP-FE by the Cx interface.

There are possibly three types of authentication method to be used between end user and IMS network:

1) AKA (authentication and key agreement)-based authentication;

2) HTTP digest-based authentication;

3) user line identifier-based authentication.

The procedure is invoked by the S-CSCF, and is used:

– to retrieve authentication information from the SUP-FE;

– to resolve synchronization failures between the sequence numbers in the UE and the SUP-FE;

– to promote the result of the NASS-level authentication to the IMS level.

Information flow is shown in Figure 7-6.

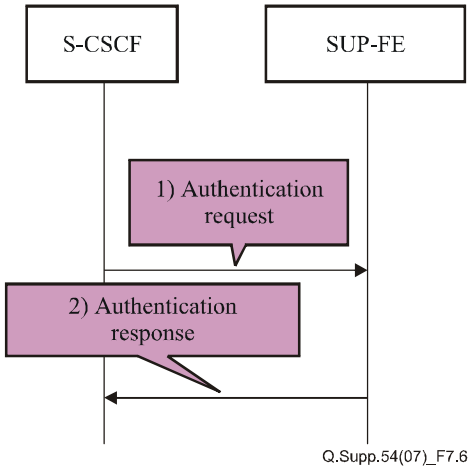

Figure 7-6 – Information flow for authentication

1) The authentication request is sent by S-CSCF to SUP-FE in order to request authentication information.

2) Upon receipt of the authentication request from the S-CSCF, the SUP-FE sends authentication information between the end user and the home IMS network to the S-CSCF using authentication response.

Tables 7-11 to 7-18 detail the involved information elements.

Table 7-11 – Authentication request

Information element name	Cat.	Description
Public User Identity	M	This information element contains the public user identity.
Private User Identity	M	This information element contains the private user identity.
Number Authentication Items	M	This information element indicates the number of authentication vectors requested.

Table 7-11 – Authentication request

Information element name	Cat.	Description
Authentication Data	M	See Tables 7-12, 7-13 and 7-14 for the contents of this information element. The content shown in Table 7-12 shall be used for a normal authentication request. Table 7-12 is applicable to AKA and user line identifier-based authentication. The content shown in Table 7-12 shall be used for an authentication request after synchronization failure. Table 7-13 is applicable to AKA-based authentication only. Table 7-14 is applicable to HTTP digest-based authentication only.
S-CSCF Name	M	This information element contains the name (SIP URL) of the S-CSCF.
Routing Information	C	Information to route requests

Table 7-12 – Authentication Data content – Request

Information element name	Cat.	Description
Authentication Scheme	M	This information element indicates the authentication scheme. If the S-CSCF may not know the authentication scheme at this point (e.g., in the non-IMS-AKA case), it should set the authentication-scheme field to "unknown".
Authentication Context	C	It shall contain authentication-related information relevant for performing the authentication. When the authentication scheme contains "Digest-AKAv1-MD5", this element is not used and shall be missing.

Table 7-13 – Authentication Data content – Request: Synchronization failure

Information element name	Cat.	Description
Authentication Scheme	M	Authentication scheme
Authorization Information	M	It shall contain the concatenation of RAND, as sent to the terminal, and AUTS, as received from the terminal. RAND and AUTS shall both be binary encoded. (See [IETF RFC 3310] for details.)

Table 7-14 – Authentication Data content – Request for HTTP digest-based authentication

Information element name	Cat.	Description
Authentication Scheme	M	This information element indicates the authentication scheme. It shall contain "HTTP_DIGEST_MD5".
Authorization Information	C	This information element shall be present under the conditions specified in [IETF RFC 4740]. It contains a reconstruction of either the SIP Authorization or Proxy-Authorization header fields specified in [IETF RFC 2617] for the HTTP digest authentication scheme.

Table 7-15 – Authentication request response

Information element name	Cat.	Description
Public User Identity	C	Public user identity
Private User Identity	C	Private user identity
Number Authentication Items	C	This element indicates the number of authentication vectors delivered in the authentication data information element.
Authentication Data	C	See Tables 7-16, 7-17 and 7-18 for the contents of this information element. Table 7-16 is applicable to AKA-based authentication. Table 7-17 is applicable to HTTP-digest-based authentication. Table 7-18 is applicable to user line identifier-based authentication.
Result	M	Result of the operation

Table 7-16 – Authentication Data content – Response for AKA-based authentication

Information element name	Cat.	Description
Item Number	C	This information element indicates the order in which the authentication vectors are to be consumed.
Authentication Scheme	M	Authentication scheme. It shall contain "Digest-AKAv1-MD5".
Authentication Information	M	It shall contain, binary encoded, the concatenation of the authentication challenge RAND and the token AUTN. (See [IETF RFC 3310] for details.)
Authorization Information	M	It shall contain, binary encoded, the expected response XRES. (See [IETF RFC 3310] for details.)
Confidentiality Key	O	This information element, if present, shall contain the confidentiality key.
Integrity Key	M	This information element shall contain the integrity key. It shall be binary encoded.

Table 7-17 – Authentication Data content – Response for HTTP digest authentication

Information element name	Cat.	Description
Authentication Scheme	M	This information element indicates the authentication scheme. It shall contain "HTTP_DIGEST_MD5".
Authentication Information	M	This element contains a reconstruction of either the SIP WWW-Authenticate or Proxy-Authentication header fields specified in [IETF RFC 2617].
Authentication Information	O	This element contains a reconstruction of the SIP Authentication-Info header specified in [IETF RFC 2617].

Table 7-18 – Authentication Data content – Response for user line identifier-based authentication

Information element name	Cat.	Description
Authentication Scheme	M	Authentication scheme. It shall contain "line identifier based authentication".
Line Identifier	M	This information element contains a fixed broadband access line identifier associated to the user.

7.1.4 Error-handling

The Cx interface shall implement the error-handling procedures which may be applied during the period of registration when an error occurs.

If the new and previously assigned S-CSCF names sent in an authentication request (see clause 7.1.3) are different and the authentication request is not indicating synchronization failure (e.g., the request does not contain authentication parameter), then the SUP-FE shall overwrite the S-CSCF name.

If the new and previously assigned S-CSCF names sent in a command other than the authentication request are different, then the SUP-FE shall not overwrite the S-CSCF name; instead, it shall send a response to the S-CSCF indicating an error.

7.1.4.1 Cancellation of the old S-CSCF

It is possible that in certain situations the SUP-FE receives an authentication request including a S-CSCF name which is not the same as the previously assigned S-CSCF for the user. This can happen, e.g., in case the new S-CSCF is selected due to a failure in the re-registration if the previously assigned S-CSCF does not respond to a REGISTER message sent from the I-CSCF after a timeout.

In this case, the new S-CSCF is assigned for the user and if registrations in the previously assigned S-CSCF exist for the user, these registrations in the old S-CSCF are handled locally in the old S-CSCF, e.g., re-registration timers in the old S-CSCF shall cancel the registrations. Alternatively, the SUP-FE may deregister the registrations in the old S-CSCF by using the SUP-FE-initiated deregistration notification request (see clause 7.1.1.3). In this case, the SUP-FE shall first check whether deregistration is really required by comparing the address of the newly assigned S-CSCF to the address stored in the SUP-FE. If the two addresses match, the deregistration shall not be initiated. Otherwise, deregistration may be initiated.

7.1.4.2 Error in S-CSCF name

If the S-CSCF name sent in the S-CSCF-initiated registration/deregistration notification request (see 7.1.1.2) and the previously assigned S-CSCF name stored in the SUP-FE are different, then, the SUP-FE shall not overwrite the S-CSCF name; instead it shall send a response to the S-CSCF indicating an error.

7.1.4.3 Error in S-CSCF assignment type

If the Server Assignment Type in the S-CSCF-initiated registration/deregistration notification request sent by the S-CSCF to the SUP-FE is not allowed, the SUP-FE shall send a response to the S-CSCF indicating an error.

7.1.4.4 Other error procedure requirements

Additionally, the Cx interface shall implement error-handling procedures under the following conditions:

1) A message was received for a user that is unknown.
2) A message was received with a public identity and a private identity for a user, and the server determines that the public identity does not correspond to the private identity.
3) A message received did not contain a private identity and/or a public identity.
4) A query for location information is received for a public identity that has not been registered before. The user to which this identity belongs cannot be given service in this situation.
5) The user is not allowed to roam in the visited network.
6) The authentication scheme indicated in an authentication request is not supported.

7.2 Procedure requirements for interface between S/I-CSCF and SUP-FE in IMS-based PSTN/ISDN emulation components

7.2.1 Location management procedures

The Cx interface shall implement the user registration-related procedures as follows.

7.2.1.1 User registration status query procedure

This procedure is used between the I-CSCF and the SUP-FE during SIP registrations. The procedure is invoked by the I-CSCF:

– To authorize the registration of the public user identity, checking multimedia subsystem access permissions. Since there is no roaming capability in PSTN/ISDN emulation, I-CSCF does not need to check roaming agreement in this procedure.
– To perform an initial security check, determining whether the public user identity in the message is associated with the private user identity sent in the message.
– To obtain either the S-CSCF where the public user identity is registered or unregistered (i.e., registered as a consequence of a terminating call, or there is an S-CSCF keeping the user profile stored), or the list of capabilities that the S-CSCF has to support.

Information flow is shown in Figure 7-7.

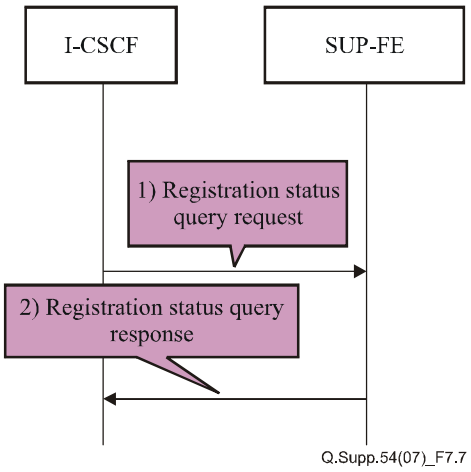

Figure 7-7 – Information flow for user registration status query procedure

1) On receiving the SIP register request from a user, the I-CSCF shall send the register status query information flow to the SUP-FE.
2) The SUP-FE shall return an assigned S-CSCF name or the list of capabilities that S-CSCF has to support.

Tables 7-19 and 7-20 detail the involved information elements.

Table 7-19 – User registration status query

Information element name	Cat.	Description
Public User Identity	M	Public user identity to be registered
Type of Authorization	C	Type of authorization requested by the I-CSCF
Private User Identity	M	Private user identity
Routing Information	C	Information to route requests

Table 7-20 – User registration status response

Information element name	Cat.	Description
Result	M	Result of the operation
S-CSCF capabilities	O	Required capabilities of the S-CSCF to be assigned to the IMS subscription.
S-CSCF Name	C	Name of the assigned S-CSCF

7.2.1.2 S-CSCF-initiated registration/deregistration notification procedure

In IMS-PES, there is no dynamic registration by terminals but a single registration by the network access point. Registration and deregistration procedures are initiated by VoIP gateways (VGWs) or AGCF on behalf of each line it serves. The rest of the procedures are identical in the IMS-PES and IMS components. Requirements for S-CSCF-initiated registration/deregistration notification procedure are also identical in IMS-PES and IMS components.

Procedure requirements refer to clause 7.1.1.2.

7.2.1.3 SUP-FE-initiated deregistration notification procedure

Procedure requirements are the same as those for IMS components. Refer to clause 7.1.1.3 for details.

7.2.1.4 User location query procedure

Procedure requirements are the same as those for IMS components. Refer to clause 7.1.1.4 for details.

7.2.2 User data handling

Procedure requirements are the same as those for IMS components. Refer to clause 7.1.2 for details.

7.2.3 Authentication

The Cx interface shall implement the authentication procedure which may be applied during the period of registration. End-user and home IMS network-related information used for authentication will be exchanged between S-CSCF and SUP-FE (with SAA-FE) by the Cx interface.

The Cx interface applies user line identifier-based authentication.

Information flow is shown in Figure 7-8.

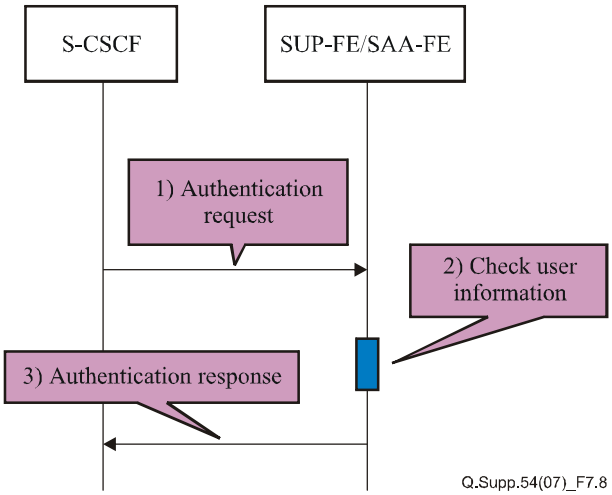

Figure 7-8 – Information flow for authentication

1) The procedure is invoked by the S-CSCF; S-CSCF sends the information authentication request to SUP-FE to achieve the authentication information under the following conditions:
   - during an initial registration;
   - during a deregistration.
2) SUP-FE checks if the user information, including the information of public user identity, private user identity, and the authentication scheme are correct.
3) SUP-FE sends an authentication response to S-CSCF. The authentication response shall include the authentication data for the user.

Tables 7-21, 7-22 and 7-23 detail the involved information elements.

Table 7-21 – Authentication request

Information element name	Cat.	Description
Public User Identity	M	This information element contains the public identity of the user. The syntax of this information element corresponds to a TEL URI.
Private User Identity	M	This information element contains the private user identity. It may correspond to a SIP URI or TEL URI.
Number Authentication Items	M	This information element indicates the number of authentication data requested.
Authentication Scheme	M	This information element indicates the authentication scheme. It shall contain "line identifier-based authentication".

Table 7-22 – Authentication response

Information element name	Cat.	Description
Public User Identity	C	User public identity. Present when the operation result is SUCCESS
Private User Identity	C	User private identity. Present when the operation result is SUCCESS
Number Authentication Items	C	This information element indicates the number of authentication data delivered in the Authentication Data information element. Present when the operation result is SUCCESS
Authentication Data	C	See Table 7-23 for the contents of this information element. Present when the "Number Authentication Items" is not equal to zero
Result	M	Result of the operation

Table 7-23 – Authentication Data content – Response

Information element name	Cat.	Description
Item Number	C	SIP-Item-Number value. Present when the "Number Authentication Items" is not equal to zero.
Authentication Scheme	M	This information element indicates the authentication scheme. It shall contain "line identifier-based authentication".
Line Identifier	M	It shall contain line identifier of the user.

7.2.4 Error handling

The Cx interface shall implement the error-handling procedures which may be applied during the period of registration when an error occurs. Following is a possible error case:

– S-CSCF receives a command which assigns a different S-CSCF name from the one in the command it previously received for the same user.

Additionally, the Cx interface shall implement the other error-handling procedures under the following conditions:

1) A message was received for a user that is unknown.

2) A message was received with a public identity and a private identity for a user, and SUP-FE determines that the public identity does not correspond to the private identity.

3) A message received did not contain a private identity and/or a public identity.

4) A query for location information is received for a public identity that has not been registered before. The user to which this identity belongs cannot be given service in this situation.

5) The authentication scheme indicated in an authentication request is not supported.

7.3 Procedure requirements for interface between CCF and SUP-FE in CS-based PSTN/ISDN emulation components

7.3.1 Location management procedures

7.3.1.1 User registration status query procedure

There is no requirement for user registration status query procedure at the interface between CCF and SUP-FE.

7.3.1.2 CCF-initiated registration/deregistration notification procedure

On registration or deregistration, the CCF shall inform the SUP-FE. The SUP-FE holds the states of all identities under a CS domain. The CCF shall update these states by sending notification to SUP-FE.

This procedure is used between the CCF and the SUP-FE. The procedure is invoked by the CCF, and is used to associate a CCF with a public identity, or to clear the name of the CCF associated with one or more public identities.

Information flow is shown in Figure 7-9:

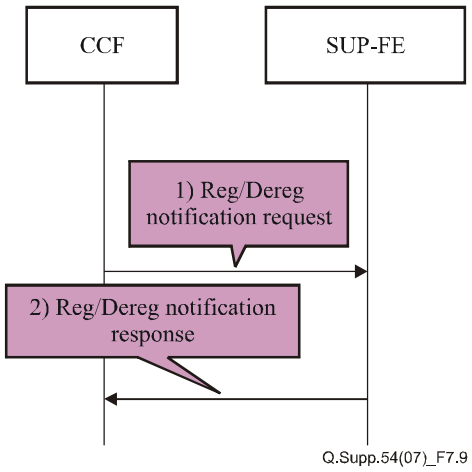

Figure 7-9 – Information flow for CCF-initiated registration/ deregistration notification procedure

1) When registration/deregistration is completed, CCF sends a registration/deregistration notification request to notify the SUP-FE of the CCF name or that the public user identity is no longer considered as registered in the CCF.

2) The SUP-FE sends a response to acknowledge the sending of the request.

Tables 7-24 and 7-25 describe the involved information elements.

Table 7-24 – CCF registration/deregistration notification request

Information element name	Cat.	Description
Public User Identity/Public Service Identity	C	Public identity or list of public identities
CCF Name	M	Name of the CCF
Server Assignment Type	M	Type of update that the CCF requests in the SUP-FE (e.g., deregistration)

Table 7-25 – CCF registration/deregistration notification response

Information element name	Cat.	Description
Result	M	Result of registration
User Profile	C	Relevant user profile
Charging Information	C	Addresses of the charging functions

7.3.1.3 SUP-FE initiated deregistration notification procedure

On administrative deregistration, SUP-FE may change the user's status to "not registered" and send a notification to CCF indicating the user shall be deregistered.

The procedure is invoked by the SUP-FE.

Information flow is shown in Figure 7-10:

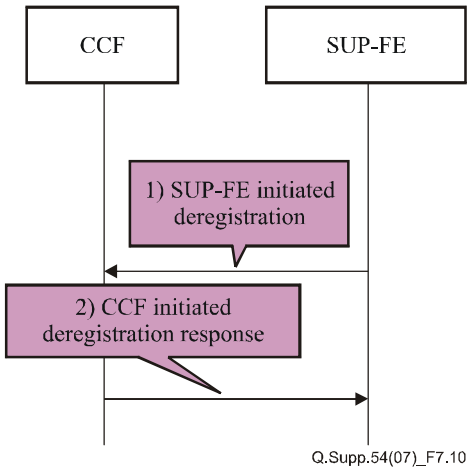

Figure 7-10 – Information flow for SUP-FE initiated deregistration notification procedure

1) In case of network-initiated deregistration by the SUP-FE, the SUP-FE changes the state of the User Identities to Not Registered and sends a deregistration notification to the CCF indicating the identities that shall be deregistered.
2) CCF shall send deregistration to AGCF and then send back the response to SUP-FE.

Tables 7-26 and 7-27 describe the involved information elements.

Table 7-26 – Network-initiated deregistration by SUP-FE request

Information element name	Cat.	Description
User Identity	C	It contains the list of user identities that are deregistered, in the form of TEL URI.
Reason for deregistration	M	The SUP-FE shall send to the CCF a reason for deregistration.
Routing Information	M	It contains the name of the CCF which originated the last update of the name of the multimedia server stored in the SUP-FE for a given user subscription.

Table 7-27 – Network-initiated deregistration by SUP-FE response

Information element name	Cat.	Description
Result	M	This information element indicates the result of deregistration.

7.3.1.4 User location query procedure

There is no requirement for user location query procedure at the interface between CCF and SUP-FE.

7.3.2 User data handling

The I11 interface shall implement the user data handling procedures as follows.

- CCF-initiated user data downloading procedure:

  The CCF shall get user-related data from the SUP-FE after the period of registration. The response from SUP-FE contains the user profile, charging information and other data if needed.

- SUP-FE-initiated user data updating procedure:

  The SUP-FE shall send user-related data to the CCF for administrative management purposes. The data includes user profile, charging information and other data if needed.

7.3.2.1 CCF-initiated user data downloading procedure

As part of the registration procedure, CCF downloads the user data by means of the registration notification procedure (see clause 7.3.1.2).

7.3.2.2 SUP-FE-initiated user data updating procedure

This procedure is initiated by the SUP-FE to update user profile information and/or charging information in the CCF.

Information flow is shown in Figure 7-11:

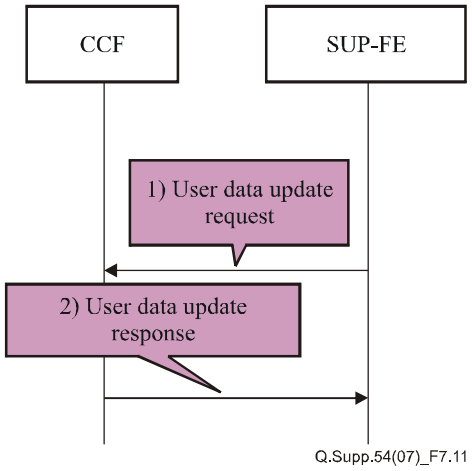

Figure 7-11 – Information flow for SUP-FE-initiated user data updating procedure

1) Whenever a modification has occurred in the subscription data of a user, the SUP-FE sends the user data update request with the subscription data to the CCF.

2) The CCF updates the subscription data of the user and sends user data update response to the SUP-FE to acknowledge the sending of user data update request.

Tables 7-28 and 7-29 describe the involved information elements.

Table 7-28 – User profile update request

Information element name	Cat.	Description
Public User Identity	C	Public identity or list of public identities
Server Assignment Type	M	Type of update that the CCF requests in the SUP-FE (e.g., deregistration).

Table 7-29 – User profile update response

Information element name	Cat.	Description
Result	M	This information element indicates the result of the update of the user profile in the CCF.

7.3.3 Authentication

There is no requirement for authentication procedure at the interface between CCF and SUP-FE.

7.3.4 Error handling

The I11 interface shall implement the error handling procedures under the following cases:

1) A message was received for a user that is unknown.

2) A message received did not contain a user identity.

8 Information elements

8.1 Information element contents in IP multimedia subsystem

An information element is a basic unit of information or message. Following are information element contents at the interface between SUP-FE and I/S-CSC-FE.

8.1.1 Visited network identifier

This information element contains the domain name of the visited network. See [ITU-T Q.Sup56] for details.

8.1.2 Public user identity

This information element contains the public user identity. For definition of public user identity, see [ITU-T Q.Sup56].

8.1.2.1 Public service identity

This information element contains a public service identity (PSI) that is hosted by an application server. For definition of PSI, see [ITU-T Q.Sup56].

8.1.3 Private user identity

This information element contains the private user identity. For definition of private user identity, see [ITU-T Q.Sup56].

8.1.3.1 Private service identity

This information element contains the private service identity. For definition of private service identity, see [ITU-T Q.Sup56].

8.1.4 S-CSCF name

This information element contains the S-CSCF name of the S-CSCF assigned to an IMS subscription. For definition of S-CSCF name, see [ITU-T Q.Sup56].

8.1.4.1 AS name

This information element contains the AS name of the AS hosting a public service identity. For definition of AS name, see [ITU-T Q.Sup56].

8.1.5 S-CSCF capabilities

This information element carries information to assist the I-CSCF during the process of selecting an S-CSCF for a certain IMS subscription. See [ITU-T Q.Sup56].

8.1.6 Result

This information element contains the result of an operation. See [ETSI TS 129 229] for the possible values.

8.1.7 User profile

This information element contains the relevant user profile. See [ITU-T Q.Sup56] for details.

8.1.8 Server assignment type

This information element indicates the type of server assignment. See [ETSI TS 129 229] for the list of existing values.

8.1.9 Authentication data

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

8.1.9.1 Item number

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

8.1.9.2 Authentication scheme

This information element contains the authentication scheme, which is used to encode the authentication parameters. See [ITU-T Q.Sup56].

8.1.9.3 Authentication information

This information element is used to convey the challenge and authentication token user during the authentication procedure. See [ITU-T Q.Sup56].

8.1.9.4 Authorization information

This information element is used, in an authentication request, to indicate a failure of synchronization. In a response, it is used to convey the expected response to the challenge used to authenticate the user. See [ITU-T Q.Sup56].

8.1.9.5 Confidentiality key

This information element contains the confidentiality key. See [ITU-T Q.Sup56].

8.1.9.6 Integrity key

This information element contains the integrity key. See [ITU-T Q.Sup56].

8.1.9.7 Authentication context

This information element contains authentication-related information relevant for performing the authentication.

8.1.9.8 Line identifier

This information element contains a fixed access line identifier associated to the user. See [ITU-T Q.Sup56].

8.1.10 Number authentication items

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

8.1.11 Reason for deregistration

This information element contains the reason for a deregistration procedure.

8.1.12 Charging information

This information element contains the addresses of the charging functions. See [ITU-T Q.Sup56].

8.1.13 Routing information

This information element contains the information to route requests.

8.1.14 Type of authorization

This information element contains the type of authorization requested by the I-CSCF. See [ETSI TS 129 229] for a list of values.

8.1.15 User data already available

This information element indicates to the SUP-FE if the user profile is already available in the S-CSCF. See [ETSI TS 129 229] for a list of values.

8.1.16 Associated private identities

This information element indicates to the S-CSCF the private identities, which belong to the same IMS subscription as the private identity received in the request command. See [ETSI TS 129 229].

8.2 Information element contents in IMS-based PSTN/ISDN emulation components

8.2.1 Public user identity

Refer to clause 8.1.2 for details.

8.2.1.1 Public service identity

Refer to clause 8.1.2.1 for details.

8.2.2 Private user identity

Refer to clause 8.1.3 for details.

8.2.2.1 Private service identity

Refer to clause 8.1.3.1 for details.

8.2.3 S-CSCF name

Refer to clause 8.1.4 for details.

8.2.3.1 AS name

Refer to clause 8.1.4.1 for details.

8.2.4 S-CSCF capabilities

Refer to clause 8.1.5 for details.

8.2.5 Result

Refer to clause 8.1.6 for details.

8.2.6 User profile

Refer to clause 8.1.7 for details.

8.2.7 Server assignment type

Refer to clause 8.1.8 for details.

8.2.8 Authentication data

8.2.8.1 Authentication scheme

Refer to clause 8.1.9.2 for details.

8.2.8.2 Line identifier

Refer to clause 8.1.9.8 for details.

8.2.9 Reason for deregistration

Refer to clause 8.1.11 for details.

8.2.10 Charging information

Refer to clause 8.1.12 for details.

8.2.11 Routing information

Refer to clause 8.1.13 for details.

8.2.12 Type of authorization

Refer to clause 8.1.14 for details.

8.2.13 User data already available

Refer to clause 8.1.15 for details.

8.2.14 Associated private identities

Refer to clause 8.1.16 for details.

8.3 Information element contents in CS-based PSTN/ISDN emulation components

8.3.1 Public user identity

This information element contains the user identity of the user which resides in call server-based PSTN/ISDN Emulation Component. For definition of user identity, see [ITU-T Q.Sup56].

8.3.1.1 Public service identity

Refer to clause 8.1.2.1 for details.

8.3.2 CCF name

This information element contains the CCF name which identifies the CCF allocated to the user when the user is registered to call server-based PSTN/ISDN emulation subsystem. See [ITU-T Q.Sup56].

8.3.3 Server assignment type

Refer to clause 8.1.8 for details.

8.3.4 Result

Refer to clause 8.1.6 for details.

8.3.5 User profile

Refer to clause 8.1.7 for details.

8.3.6 Charging information

Refer to clause 8.1.12 for details.

8.3.7 Routing information

Refer to clause 8.1.13 for details.

9 General signalling transport requirements

Flexible delivery and reliable transfer are required for messages transported over the interface between I/S-CSC-FE and SUP-FE. The requirements for signalling transporting include non-duplicated and sequenced delivery of messages, network-level fault tolerance, etc.

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