3GPP TSG SA WG3 Security — S3#20 **S3-010524**

16 - 19 October, 2001

Sydney, Australia

Source:	**TSG-SA WG3**
To:	**TSG-CN WG1**
Cc:	**TSG CN WG4, SA WG1, SA WG2, SA WG5**
Title:	**Response to LS from CN1 (N1-011430/S3-010452) Liaison Statement on Usage of Private ID**
Contact person:	**Krister Boman**
	Krister.Boman@emw.ericsson.se

Attachments: S3-010410, S3-010452

SA3 would kindly like to thank CN1 for their LS contained in N1-0111430.

The latest version of TS33.203 (v060) has up this date adopted the current working assumption in CN1 that the IMPI shall be transported in the From field in the REGISTER message.

The change of working assumption in CN1 to transport the user identity e.g. the IMPI in an EAP packet rather than in the From field does not introduce any security implications that concern SA3. Hence it is the current understanding of SA3 that CN1 can adopt this new working assumption and that the Release 5 date is not affected by this change from an SA3 point of view.

The TS33.203 will be updated accordingly and in line with another request from CN1 that SA3 shall not define protocol solutions and keep the signalling flow at an informational level, cf. S3-010410. It is recognised by SA3 that where to put the IMPI in a SIP message is a Stage 3 issue.

However SA3 would like to point out that the scenario with 3rd party registrations proposed by CN1 do create some security considerations e.g. authentication issues. SA3 kindly require CN1 to keep SA3 informed on this issue such that the security requirements can be defined appropriately. The current understanding of SA3 is that for Release 5 3rd party registrations are not allowed.

For the groups that have been copied the S3-010452 is for your information.

S3 thanks CN1 for the continued attention to IMS security issues and looks forward to continued fruitful activities with CN1 on these issues.

3GPP TSG SA WG3 Security — S3#20 **S3-010410**

16 - 19 October, 2001

Sydney, Australia

3GPP TSG CN WG1#18
10-12 July, 2001
Dresden, Germany

Tdoc N1-011052

Title: Reply LS on "Using a generic authentication scheme for SIP"

Source: TSG CN WG1

To: TSG SA WG3

CC;

Contact Person:

Name: Andrew Allen

Email: CAA019@email.mot.com

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Attachments: None

CN1 thanks SA3 for their LS contained in S3-010287 (N1-010977) on using a generic authentication scheme for SIP and also would like to thank Krister Boman from Ericsson for kindly attending part of the CN1 meeting to present an overview of the IMS work within SA3.

CN1 notes that in their LS SA3 state that in the proposed security architecture the "*407 Proxy Authentication Required*" response is used, however in the presentation by Krister Boman it was indicated that a "*401 Unauthorized*" is now assumed to be used by SA3 based on their most recent meeting.

It is the view of CN1 that except where there is a specific security problem involved with the use of a specific SIP response or SIP message header that SA3 should keep the security architecture and flows at an information flow level and avoid specifying particular SIP responses and headers since these are SIP protocol issues which may have protocol impacts and as such are in the scope of the stage 3 work of CN1. It is the assumption of CN1 that the choice of either 401 or 407 response does not from a security problem point of view matter and therefore would prefer to see an information level label such as "*Authentication Challenge Response*" in the flows and documentation from SA3. CN1 does not yet have an agreed position regarding 401 vs 407 response but as indicated would like to make this particular decision which does have potential protocol impacts on the behaviour of the S-CSCFat a latter date.

CN1 also notes SA3's proposed use of the "*WWW-Authenticate*" and "*Authorization*" headers and has no problem at this time with this assumption at this time but would like to continue to be regularly informed and consulted by SA3 concerning proposed SIP header useage for security. CN1 continues to study the matter further.

CN1 also notes the recommendation of SA3 that EAP (Extensible Authentication Protocol) be used in the SIP security related headers. Unfortunately the referenced S3 document (S3-010263) was not attached to the LS and was not available to CN1 at their meeting so it is not possible to make detailed comments at this time. CN1 members will study S3-010263 and the related internet drafts and will provide SA3 with any comments later but suggest that SA3 continue with their working assumption on the use of EAP.

CN1 appreciates SA3 keeping them informed of their SIP protocol security assumptions and would also like to be kept well informed of any internet drafts that SA3 is depending on for SIP security mechanisms as CN1 is tracking all the SIP related IETF internet drafts that 3GPP is dependent on.

3GPP TSG SA WG3 Security — S3#20 **S3-010410**

16 - 19 October, 2001

Sydney, Australia

3GPP TSG CN WG1#18
10-12 July, 2001
Dresden, Germany

Tdoc N1-011052

CN1 looks forward to very close cooperation with SA3 on SIP security for Rel 5.

CN1 has their next meeting in Helsinki Finland on the week of 27th August.

3GPP TSG SA WG3 Security — S3#20 **S3-010452**

16 - 19 October, 2001

Sydney, Australia

3GPP TSG-CN1 Meeting #19bis ***Tdoc N1-011430***
Sophia Antipolis, France, 2.- 4. October 2001

Title: **Liaison Statement on Usage of Private ID**
Source: **CN1**
To: **CN4, SA1, SA2, SA3, SA5**
Cc: **-**

Contact Person:
Name: Miguel A. Garcia
E-mail Address: Miguel.A.Garcia@ericsson.com

Attachments: **N1-011355**

1. Overall Description:

Currently CN1 assumes that the private user ID is carried in the From header value of the SIP REGISTER message. This assumption is based on the syntax of a third party registration according to the draft-ietf-sip-rfc2543bis-04 draft. While true third party registration is precluded from release 5, it may be desirable to obtain such a capability in future releases. It is not yet clear whether the above usage would preclude future third party registration.

CN1 has received the attached contribution N1-011355 which proposes that the private user ID is instead of the From: header transported in the user ID field of an authentication protocol within the Authentication header. This can be viewed as moving the private user ID from a mandatory field available in the Initial message from the UE (Register) and to another (optional) field which may not always be visible at intermediate SIP nodes (e.g. P-CSCF). From the SIP protocol perspective, 3GPP mandates information elements that are optional in SIP, but this is already applied to other information elements. However, 3GPP can not mandate the behaviour of non-3GPP SIP clients. The motivation is:

1. To allow the possibility of 3rd Party Registration. This allows a different entity or user in the network to perform SIP Registration on behalf of another user. A typical example of third party registration is when a secretary registers his boss to the network. The working assumption solution adopted for Release 5 is aligned with the standard SIP behaviour for SIP third party registrations and uses the From field to contain the private identity to identify the user performing the SIP registration. In first party registrations the To: and From: headers should contain the same identity (i.e. identify the same user). In third party registrations the To: and From field contain different identities.
2. To provide an access to IMS from non-3GPP networks, Private Identity needs to be provided to the 3GPP network (P-CSCF, S-CSCF). The current IMS SIP third party registration mechanism may create complications in enabling standard off-the-shelf SIP clients to register with the IMS using the same registration procedures as in Rel 5, as non-3GPP SIP clients normally perform first party registration and may not be configurable to perform third party registrations.
3. In the case of a decomposed TE/MT scenario, the current IMS registration mechanism may create complications for a standard SIP User Agent running in the TE to register to the network, as non-3GPP SIP User Agents are not aware of Private Identity and perform first party registrations and may not be configurable to perform third party registrations.

During the discussion of the attached contribution, the Stage 2 TS 23.228 description on Private Identity was considered and some questions were raised regarding the standardization impacts on other working groups and on service requirements for SIP 3rd Party Registrations, use of the Private Identity in charging records and any security aspects.

2. Actions:

To SA1:

1. To clarify if there is a need to support third party SIP registration for IMS i.e. to allow SIP Registration other than the subscriber. CN1 believes that this capability is not needed for Release 5.
2. CN1 will be interested to know if the 3rd party registration requirement will be required in subsequent releases.

To SA2:

It is believed that IMS stage 2 TS23.228 implies that that 3rd party registration not required.

1. To confirm that the 3rd Party SIP Registration capability is not required for Release 5.
2. CN1 will be interested to know if the 3rd party registration requirement will be required in subsequent releases
3. To identify what other usages of the private user identity exist outside those mentioned in stage 2.
4. To identify which entities require access to the private user identity in order to carry out these functions. In particular, does the functionality of the P-CSCF depend on knowledge of the private user identity.

To SA3:

1. To verify whether it is acceptable to transport the private user identifier in the optional (from the SIP perspective) Authentication header value of the REGISTER message instead of the mandatory (from the SIP perspective) From header value. This will effectively mandate the Authorization header in 3GPP-IMS UEs.
2. Does SA3 foresee any additional security issues with the proposed approach?
3. To respond regarding whether there is an impact to the date when the specification/documentation containing the Authentication Protocol and header details including the transport of the Private User ID would be available for Rel 5 if the approach contained in N1-011355 was adopted by CN1.

To SA2/SA5:

1. The P-CSCF may use the Private Identity for charging and it this is included in the CDR generated by P-CSCF. Currently the P-CSCF has access to the private identity carried in the FROM field. To confirm that the Private Identity should be available at the P-CSCF

2. To verify whether the attached contribution contradicts any charging assumptions.

To CN4:

1. To verify whether it is acceptable to transport the private user identifier in the Authentication header value of the REGISTER message instead of the From header value.
2. To confirm that Private Identity is required to be available in the S-SCSF before the UE has been authenticated.

3. Date of Next CN1 Meetings:

CN1_20	15th - 19th October 2001	Brighton, UK
CN1_20bis	13th – 15th November 2001	Seattle, US

3GPP TSG-CN1 Meeting #19bis ***Tdoc N1-011355***
Sophia Antipolis, France, 2.- 4. October 2001

Source: Ericsson

Title: Usage of the Private ID in registration scenarios

Agenda item: 8.4 IMS registration

Document for: APPROVAL

Introduction

The current flows in 24.228 v1.4.0 shows the registration procedure in sections 6 and 16. The use of the public and private user IDs constitute a third party registration, even when the case is a first party registration.

Ericsson demonstrates in this contribution thatthere is no reason to do third party registrations for first party ones.

Discussion

The current flows in 24.228 v1.4.0 shows the registration procedures in sections 6 and 16. When a user wants to register a public ID, the SIP User Agent populates the From: header with the private user ID, and the To: header with the public user ID. This effectively, from the SIP point of view, constitutes a third party registration.

Third party registrations in SIP are defined as those which a third party entity registers a user on his/her behalf. In the call flows in sections 6 and 16 in 24.228, all the registrations are third party ones. A regular SIP registrar will consider that the private user ID is trying to register another user: the public user ID.

Third party registrations, as 24.228 shows, have the following problems:

1. It is not aligned with the standard SIP behaviour for first party registrations. In first party registrations the To: and From: headers should be the same identity.

2. As the IMS is an access independent network, access must be granted from non 3GPP access networks. The third party registration mechanism precludes standard off-the-shelf SIP clients to register the IMS, as regular SIP clients perform first party registration and cannot be configured to perform third party registrations.

3. In the case of a decomposed TE/MT scenario, it prevents also a standard client running in the TE to register to the network, as regular SIP clients perform first party registrations and cannot be configured to perform third party registrations

TS 23.228 v5.1.0 states in section 4.3.3.1, the following, regarding the private user identity:

Every IM CN subsystem subscriber shall have a private user identity. The private identity is assigned by the home network operator, and used, for example, for Registration, Authorisation, Administration, and Accounting purposes. This identity shall take the form of a Network Access Identifier (NAI) as defined in RFC 2486 [14]. It is possible for a representation of the IMSI to be contained within the NAI for the private identity.

- *The Private User Identity is not used for routing of SIP messages.*

- *The Private User Identity shall be contained in all Registration requests, (including Re-registration and De-registration requests) passed from the UE to the home network.*

- *The Private User Identity shall be securely stored on the USIM (it shall not be possible for the UE to modify the Private User Identity)*

- *The Private User Identity is a unique global identity defined by the Home Network Operator, which may be used within the home network to uniquely identify the user from a network perspective.*
- *The Private User Identity shall be permanently allocated to a user (it is not a dynamic identity), and is valid for the duration of the user's subscription with the home network.*
- *The Private User Identity is used to identify the user's information (for example authentication information) stored within the HSS (for use for example during Registration).*
- *The Private User Identity may be present in charging records based on operator policies.*
- *The Private User Identity identifies the subscription (e.g. IM service capability) not the user.*
- *The Private User Identity is authenticated only during registration of the subscriber, (including re-registration and de-registration).*
- *The HSS and S-CSCF need to obtain and store the Private User Identity.*

An analysis of 24.228 has revealed that the private ID is only used at registration time for purpose of authenticating the user. There is no substantial reason to transport the private user ID in the From header. It seems more natural that the private user ID, which is used to authenticate the user, is conveyed in an authentication header.

SIP already has developped the *Authorization* header. The main purpose of the *Authorization* value field is, according to rfc2543bis [4], to convey the credentials containing the authentication information of the user agent for the realm of the resource being requested. Therefore, it seems natural, to place the private user ID in the Authorization header.

TS 24.228 v1.4.0 does not show any authentication examples at the moment. However, the current assumption in S3 is to use the Extensible Authentication Protocol [1] as the authentication protocol within SIP. The EAP packet includes a user ID field, that in the case of 3GPP, should carry the private user ID. The EAP packet is base64 encoded and included in an Authorization header. An example of an EAP packet included in the Authentication header of SIP looks like:

```
Authorization: eap eap-p=AQAAEwFqYXJpQGFya2tvLmNvbQ==
```

The base64 string above encodes an EAP packet which includes a private user ID in the user ID field.

The current proposal of carrying the private user ID in the user ID field of the authentication protocol does not depend on the actual authentication protocol. The proposed changes are in line with the current assumption in S3 that EAP [1] is the protocol used to authenticate users. EAP may be used in HTTP and SIP, as defined in [2] and can reuse the existing AKA mechanisms, as described in [3]. Typically all authentication protocols contain a field to supply the user ID, independent of the actual protocol. In the case of SIP, this is also true when the authentication mechanism is HTTP Basic or HTTP Digest.

Proposal

Ericsson proposes to align the registration with standard SIP procedures according to the following principles:

1. The From: header is populated with the public user ID, the same one that is in the To: header
2. The private user ID is conveyed in the user ID field of the authentication protocol (independently of the actual authentication protocol). The authentication protocol s carried in SIP in the Authentication header.

Note that the proposed solution meets the requirement to carry the private user ID at registration time and does not depend on the actual authentication protocol.

********** FIRST PROPOSED CHANGE **********

6 Signalling flows for REGISTER (non hiding)

6.1 Introduction

6.2 Registration signalling: user not registered

Figure 6.2-1 shows the registration signalling flow for the scenario when the user is not registered. For the purpose of this registration signalling flow, the subscriber is considered to be roaming. In this signalling flow, the home network does not have network configuration hiding active.

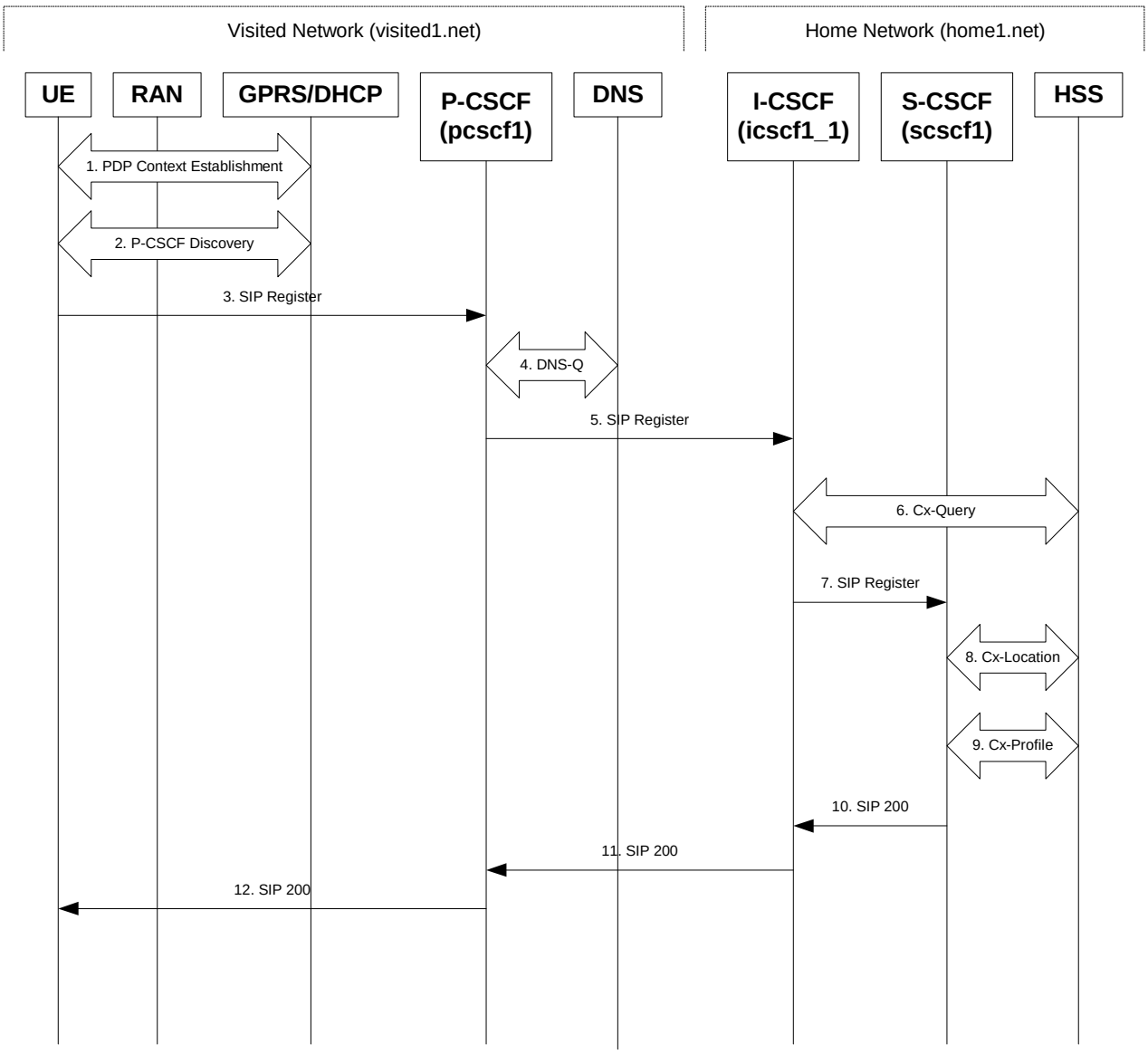

Figure 6.2-1: Registration signalling: user not registered

1. **GPRS Attach / PDP Context Establishment (UE to GPRS)**

   This signalling flow is shown to indicate the GPRS Attach and PDP Context Activation procedures that must be completed prior to application registration. When complete, the UE will have acquired an IP address (provided by the GGSN) which serves as the host address for the duration of the PDP context.

2. **CSCF Discovery (UE to GPRS/ DHCP)**

This signalling flow is the procedure to discover the Proxy CSCF in the visited IM CN subsystem.

The UE should be able to obtain the IP address of the P-CSCF during the PDP Context Activation procedure. At the PDP Context Activation time, the IP address of the P-CSCF shall be conveyed to the UE in the Activate PDP Context Accept message. The UEs that do not support DHCP shall use this P-CSCF discovery procedure.

Additionally, the UEs that incorporate the DNS and DHCP client software that supports DHCP extensions (specified in draft-ietf-sip-dhcp-03.txt) may employ the DHCP mechanism to discover the P-CSCF in the visited IM CN subsystem. When allocating an IP address to the UE, the DHCP server may provide the UE with the fully-qualified domain name (FQDN) of the P-CSCF and the address of the DNS server in the visited IM CN subsystem. Subsequently, the DNS client in the UE will utilise the provided FQDN and perform an address-record lookup (i.e. type A DNS access) to obtain the IP address of the P-CSCF in the visited IM CN subsystem.

NOTE: A UE may be roaming within the home network.

Editor's Note: IANA Considerations - Currently the IANA has not assigned an "DHCP option number" for the *SIP Servers DHCP Option* defined in the draft-ietf-sip-dhcp-03.txt. Therefore, the DHCP alternative can not be currently implemented.
[19 Jul. 2001]
This draft is currently with the IESG and approval is expected. It is therefore reasonable to expect publication by year end. It is also standards track so normative references could be made. It is also reasonable to expect the necessary IANA registration to occur in that timeframe.

Editor's Note: Second approach needs further study on the interactions with the restrictions on the Signalling PDP Context, TS 23.228 subclause 4.2.6.

3. **SIP REGISTER request (UE to P-CSCF) – see example in Table 6.2-3**

The purpose of this request is to register the user's SIP URI with a S-CSCF in the home network. This request is routed to the P-CSCF because it is the only SIP server known to the UE. In the following SIP request, the Contact field contains the user's host address.

The P-CSCF will perform two actions, binding and forwarding. The binding is between the User's SIP address (user1_public1@home1.net) and the host (terminal) address ([5555::aaa:bbb:ccc:ddd]) which was acquired during PDP context activation process.

Table 6.2-3 SIP REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From: <sip:user1_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <Sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
Authorization:
CSeq: 1 REGISTER
Expires: 7200
Content-Length: 0
```

Request-URI: The Request-URI (the URI that follows the method name, "REGISTER", in the first line) indicates the destination domain of this REGISTER request. The rules for routeing a SIP request describe how to use DNS to resolve this domain name ("home1.net") into an address or entry point into the home operator's network (the I-CSCF). This information is stored in the USIM.

Via: IPv6 PDP address of the SIP session allocated during the PDP Context Activation process.

From: This indicates the SIP public identity of the user ~~(stored in the USIM)~~ originating the REGISTER request. The public identity of the user may be obtained from the USIM. ~~In SIP, this can be a third-party.~~

~~Editor's note: One proposal is: "This is a natural place for the private user identity or NAI for the subscriber. Forming a SIP URL from the NAI is a simple matter of prepending "sip:". For example, if the subscriber's NAI is 19725835472@operator.com, then the From: header would be sip:19725835472@operator.com." Alternatively it could be the SIP-URL of the party registering.~~

To: This indicates the SIP public identity of the user ~~identifier~~ being registered. This is the identity by which other parties know this subscriber. It ~~is~~ may be obtained from the USIM.

~~Editor's note: One proposed additional text: "In this case, this is the public user identity for the subscriber."~~

Contact: This indicates the point-of-presence for the subscriber – the IP address of the UE. This is the temporary point of contact for the subscriber that is being registered. Subsequent requests destined for this subscriber will be sent to this address. This information is stored in the P-CSCF.

Editor's note: It is for further study whether this information is stored in the HSS and the S-CSCF for the subscriber in order to support multiple registrations.

Call Id: Call Identifier for this Registration generated as per [3]

Authorization: It carries authentication information. The private user ID is carried in the user ID field of the authenticaion protocol.

Cseq: Cseq for this Registration generated as per [3]

Upon receiving this request the P-CSCF will set it's SIP registration timer for this UE to the Expires time in this request.

4. **DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs a DNS query to locate the I-CSCF in the home network. The look up in the DNS is based on the address specified in the Request URI.

The P-CSCF sends the REGISTRATION request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTRATION request the P-CSCF needs to specify the protocol, port number and IP address of the I-CSCF server in the home network to which to send the REGISTRATION request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify the transport protocol the, P-CSCF selects the UDP.

Table 6.2-4a DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=_sip.udp.registrar.home1.net, QCLASS=IN, QTYPE=SRV
```

The DNS records are retrieved according to RFC2782 [4].

Table 6.2-4b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=_sip.udp.registrar.home1.net, QCLASS=IN, QTYPE=SRV

_sip._udp.registrar.home1.net           0 IN SRV 1 10 5060 icscf1_1.home1.net
                                        0 IN SRV 1  0 5060 icscf7_1.home1.net

icscf1_1.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_1.home1.net                 0 IN AAAA     5555::a1a:b2b:c3c:d4d
```

In the Answer field of the query-response each I-CSCF is identified by its host domain name. The returned SRV Resource Records (RRs) are merged and ordered, and the selection technique (employing the Priority and Weight parameters returned in the RRs) as specified in RFC2782 [4] is used to select the I-CSCF (i.e., the icscf1_1.home1.net). Since the Additional Data field of the query-response also contains the IP address of the selected I-CSCF (i.e., 5555::aba:dab:aaa:daa), a new query to the DNS is not required.

Once the IP address of the I-CSCF is obtained, the P-CSCF forwards the REGISTRATION request to this IP address (i.e., 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

5. **SIP REGISTER request (P-CSCF to I-CSCF) – see example in Table 6.2-5**

Since this P-CSCF is a stateful proxy, it is required to be in the path for all Mobile Originated and Mobile Terminated requests for this user. To ensure this, the P-CSCF has to put itself into the path for future requests. One solution of achieving this is to have the P-CSCF as the contact point for this user at the home registrar.

To do this the P-CSCF creates a temporary SIP URI for the user called user1%40home1.net@pcscf1.visited1.net. As part of its internal registration procedure the P-CSCF binds the temporary SIP URI to the user's SIP URI which was also bound to the IP address of the UE as shown in signalling flow 3. The P-CSCF then forwards the REGISTER request for user1_public1@home1.net, to the home registrar, using a contact address of user1_public1%40home1.net@pcscf1.visited1.net.

This signalling flow shows the SIP REGISTER being forward from the P-CSCF to the I-CSCF in the home domain.

Table 6.2-5 SIP REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
From:
To:
Contact: <sip:user1_public1%40home1.net@pcscf1.visited1.net>
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: This is the address of the P-CSCF and is included to inform the S-CSCF where to route terminating sessions.

Require, Proxy-Require: These headers are included to ensure that the recipient correctly handles the Path header. If the recipient does not support the path header, a response will be received with a status code of 420 and an Unsupported header indicating "path". Such a response indicates a misconfiguration of the routing tables and the request has been routed outside the IM CN subsystem.

6. **Cx-Query**

   The I-CSCF requests information related to the required S-CSCF capabilities from the HSS. The HSS provides the I-CSCF with either the S-CSCF address for the subscriber (if the subscriber is currently registered) or the S-CSCF required capabilities (if the subscriber is not currently registered.) Since the subscriber is not registered in this case, the HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

7. **SIP REGISTER request (I-CSCF to S-CSCF) – see example in Table 6.2-7**

   I-CSCF does not modify the Path header.

   This signalling flow forwards the SIP REGISTER from the I-CSCF to the S-CSCF selected. The Request-URI is changed to the address of the S-CSCF.

Table 6.2-7 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: The S-CSCF stores the contents of the Path headers and uses these addresses for routing mobile terminated sessions.

Upon receiving this request the S-CSCF will set it's SIP registration timer for this UE to the Expires time in this request.

8. **Cx-Location**

   The S-CSCF shall send its location information to the HSS. The HSS stores the S-CSCF name for that subscriber. The HSS sends a response to the S-CSCF to acknowledge the sending of location information.

9. **Cx-Profile**

   The S-CSCF shall send the subscriber's identity to the HSS in order to be able to download the subscriber profile to the S-CSCF. The HSS returns the subscriber's profile to the S-CSCF. The S-CSCF shall store the subscriber profile for that indicated user.

10. **SIP 200 OK response (S-CSCF to I-CSCF) – see example in Table 6.2-10**

    The S-CSCF sends acknowledgment to the I-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 6.2-10 SIP 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:scscf1.home1.net>, <sip:pcscf1.visited1.net>
From:
To: <sip:user1_public1@home1.net>;tag=7899
Call-ID:
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires:
Content-Length:
```

Path: The S-CSCF inserts its own name to the front of the list.

11. **SIP 200 OK response (I-CSCF to P-CSCF) – see example in Table 6.2-11**

    The I-CSCF forwards acknowledgment from the S-CSCF to the P-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 6.2-11 SIP 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:scscf1.home1.net, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

12. **SIP 200 OK response (P-CSCF to UE) – see example in Table 6.2-12**

    The P-CSCF removes its address from the Path header, reverses the order of the fields, saves the resulting Path header and associates it with the UE. The P-CSCF then removes the Path header from the 200 OK response. The P-CSCF then forwards acknowledgment from the I-CSCF to the UE indicating that Registration was successful.

Table 6.2-12 SIP 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

********** NEXT PROPOSED CHANGE **********

6.3 Registration signalling: re-registration – user currently registered

For the purpose of the re-registration signalling flow shown in figure 6.3-1, the subscriber is considered to be roaming. In this signalling flow, the home network does not have network configuration hiding active.

This signalling flow assumes:

1. That the same PDP Context allocated during the initial registration scenario is still used for re-registration. For the case when the UE does not still have an active PDP context then PDP context procedures from subclause 16.2 is completed first.

Editor's Note: If the same PDP-Context is not available, is it guaranteed that the UE will get back the same IP address at this point? If this is not possible, would there be a problem with the binding in the P-CSCF (user_public1@home1.net and [5555::aaa:bbb:ccc:ddd])?

2. The DHCP procedure employed for P-CSCF discovery is not needed.

3. The S-CSCF selection procedure invoked by the I-CSCF is not needed.

Periodic application level re-registration is initiated by the UE either in response to the expiration of the existing registration information or in response to a change in the registration status of the UE. Re-registration follows the same path as described in subclause 16.2.

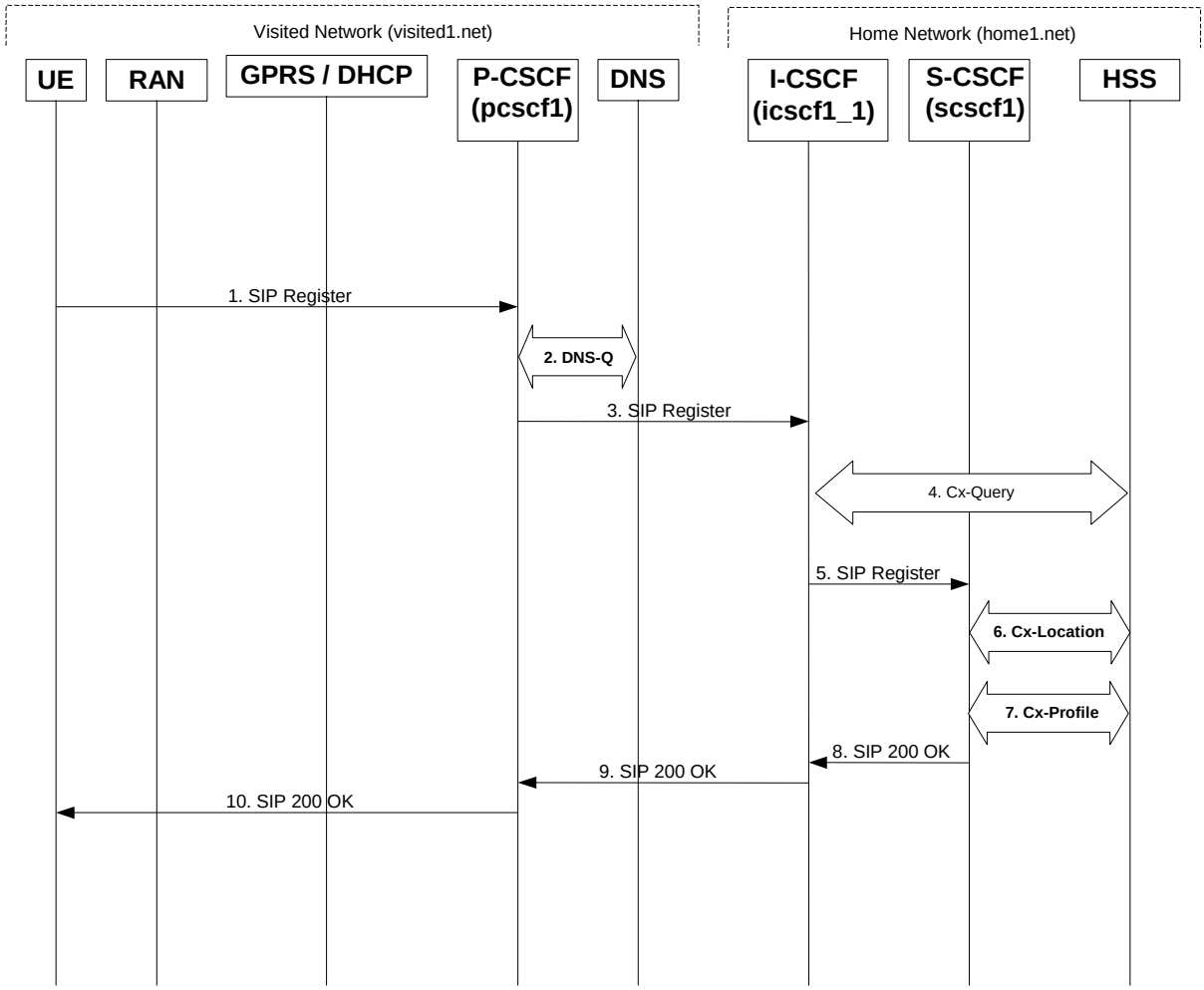

Figure 6.3-1: Re-registration when UE roaming

1. **SIP REGISTER request (UE to P-CSCF) – see example in Table 6.3-1**

   The registration expires in the UE. The UE re-registers by sending a new REGISTER request. This request is sent to the same P-CSCF with which the UE initially registered. The P-CSCF maintains the same binding between the User's SIP public address (user1_public1@home1.net) and the host (terminal) address ([5555::aaa:bbb:ccc:ddd]) which it established during the original registration.

Table 6.3-1 SIP REGISTER (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From: <sip:user_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
Authorization:
CSeq: 7 REGISTER
Expires: 7200
Content-Length: 0
```

The header field usage is the same as for the initial registration scenario:

From: This indicates the ~~private~~ SIP public identity of the user ~~(stored in the USIM)~~ originating the REGISTER request. The public identity of the user may be obtained from the USIM.

To: This indicates ~~the target of the REGISTER request~~SIP public identity of the user being registered. ~~The target is the public identity that is being registered.~~ This is the identity by which other parties know this subscriber.

Contact: This indicates the point-of-presence for the subscriber – the IP address of the UE. This is the temporary identifier for the subscriber that is being registered. Subsequent requests destined for this subscriber will be sent to this address. This information is stored in the P-CSCF.

Editor's note: It is for further study whether this information is stored in the HSS and the S-CSCF for the subscriber in order to support multiple registrations.

Authorization: It carries authentication information. The private user ID is carried in the user ID field of the authentication protocol.

Request-URI: The Request-URI (the URI that follows the method name, "REGISTER", in the first line) indicates the destination domain of this REGISTER request. The rules for routeing a SIP request describe how to use DNS to resolve this domain name ("home1.net") into an address or entry point into the home operator's network (the I-CSCF). This information is stored in the USIM.

Upon receiving this request the P-CSCF will detect that it already has a registration record for this UE and will reset it's SIP registration timer for this UE to the Expires time in this request.

2. **DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs a DNS query to locate the I-CSCF in the home network. The look up in the DNS is based on the address specified in the Request URI. The DNS provides the P-CSCF with an address of the I-CSCF in the home network. The P-CSCF must not use the I-CSCF address cached as a result of the previous registration.

3. **SIP REGISTER request (P-CSCF to I-CSCF) – see example in Table 6.3-3**

This signalling flow shows the SIP Register request being forward from the P-CSCF to the I-CSCF in the home domain.

Table 6.3-3 SIP REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: This is the address of the P-CSCF and is included to inform the S-CSCF where to route terminating sessions.

Require, Proxy-Require: These headers are included to ensure that the recipient correctly handles the Path header. If the recipient does not support the path header, a response will be received with a status code of 420 and an Unsupported header indicating "path". Such a response indicates a misconfiguration of the routing tables and the request has been routed outside the IM CN subsystem.

4. **Cx-Query**

The I-CSCF requests information related to the required S-CSCF capabilities from the HSS. The HSS shall determine that the user is currently registered, and send an indication of current S-CSCF to the I-CSCF. Hence, the S-CSCF selection procedure is not needed.

5. **SIP REGISTER request (I-CSCF to S-CSCF) – see example in Table 6.3-5**

This signalling flow forwards the SIP REGISTER request from the I-CSCF to the S-CSCF selected. The Request-URI is changed to the address of the S-CSCF.

Table 6.3-5 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip: pcscf1.visited1.net>
Proxy-require:
Require:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: The S-CSCF stores the contents of the Path headers and uses these addresses for routing mobile terminated sessions.

Upon receiving this request the S-CSCF will detect that it already has a registration record for this UE and will reset it's SIP registration timer for this UE to the Expires time in this request.

6. **Cx-Location**

   The S-CSCF shall send its location information to the HSS. The HSS stores the S-CSCF name for that subscriber. The HSS sends a response to the S-CSCF to acknowledge the sending of location information.

   If the S-CSCF can detect that this is a reregistration, then this flow need not be performed, and the currently saved information is used instead.

7. **Cx-Profile**

   The S-CSCF shall send the subscriber's identity to the HSS in order to be able to download the subscriber profile to the S-CSCF. The HSS returns the subscriber's profile to the S-CSCF. The S-CSCF shall store the subscriber profile for that indicated user.

   If the S-CSCF can detect that this is a reregistration, then this flow need not be performed, and the currently saved information is used instead.

8. **SIP 200 OK response (S-CSCF to I-CSCF) – see example in Table 6.3-8**

   The S-CSCF sends acknowledgment to the I-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 6.3-8 SIP 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip: scscf1.home1.net>, <sip: pcscf1.visited1.net>
From:
To: <sip:user1_public1@home1.net>;tag=7899
Call-ID:
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires:
Content-Length:
```

Path: The S-CSCF inserts its own name to the front of the list.

9. **SIP 200 OK response (I-CSCF to P-CSCF) – see example in Table 6.3-9**

   The I-CSCF forwards acknowledgment from the S-CSCF to the P-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 6.3-9 SIP 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:scscf1.home1.net, <sip: pcscf1.visited1.net>
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

10. **SIP 200 OK response (P-CSCF to UE) – see example in Table 6.3-10**

    The P-CSCF removes its address from the Path header, reverses the order of the fields, saves the resulting Path header and associates it with the UE. The P-CSCF then removes the Path header from the 200 OK response. The P-CSCF then forwards acknowledgment from the I-CSCF to the UE indicating that Registration was successful.

Table 6.3-10 SIP 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

********** NEXT PROPOSED CHANGE **********

6.8 Registration error conditions.

6.8.1 Re-registration – failure of re-registration

This signalling flow (see figure 6.8.1-1) is a continuation of the signalling flow in subsubclause 16.3 “Registration Signalling: Re-Registration – User Currently Registered” after reception of signalling flow 4. This signalling flow shows the recovery after a failure of the S-CSCF that had been assigned to the subscriber in a previous registration.

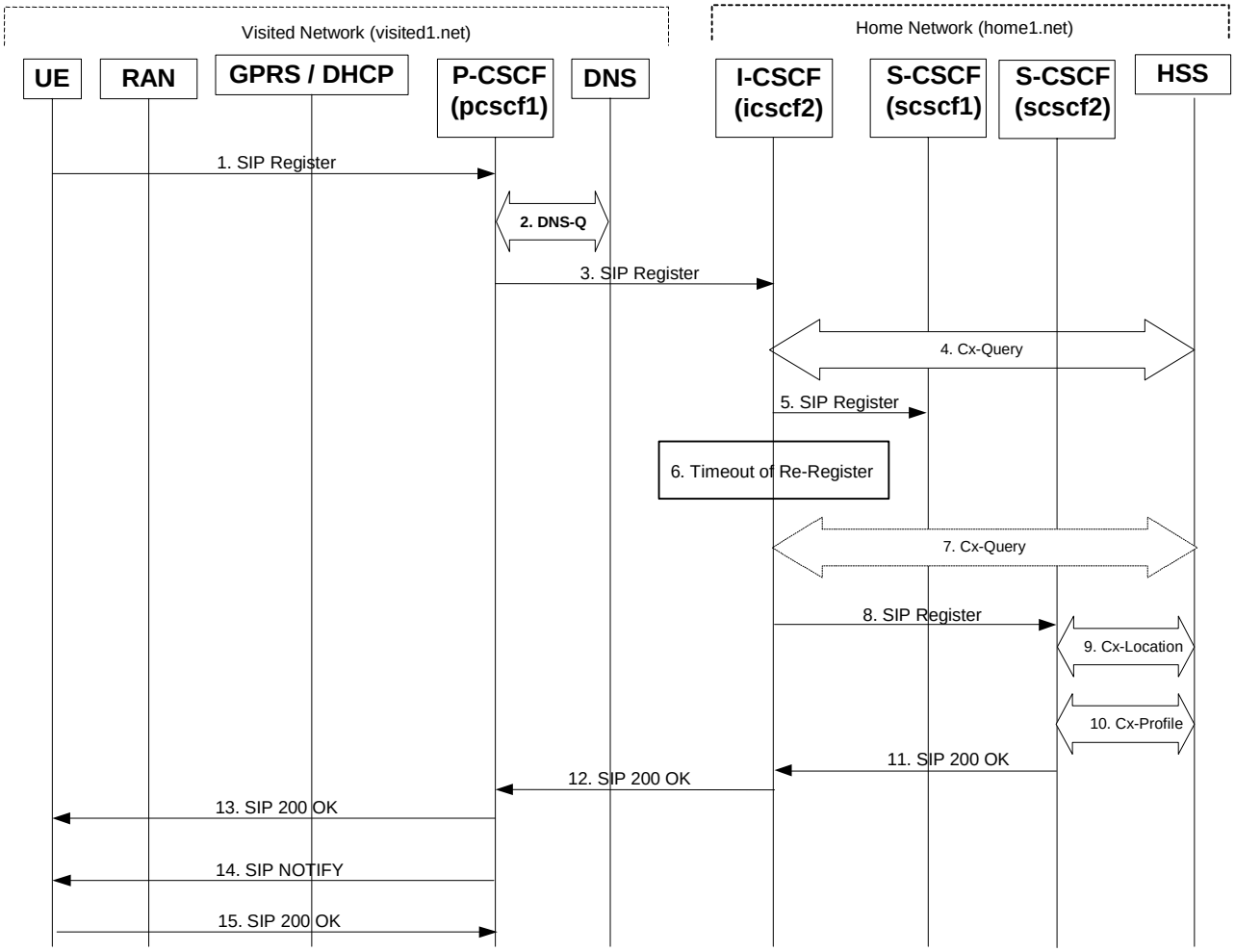

Figure 6.8.1-1: Failure of previous S-CSCF during re-registration

Steps 1 through 4 are the same as the signalling flow in subclause 16.3.

5 **SIP REGISTER (I-CSCF to S-CSCF) – see example in Table 6.8.1-5**

This signalling flow forwards the SIP REGISTER request from the I-CSCF to the S-CSCF selected. The Request-URI is changed to the address of the S-CSCF.

I-CSCF adds a proper I-CSCF name to the Path header.

Table 6.8.1-5 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:icscf1_1.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
From: <sip:user1_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:user1%40home1.net@pcscf.visited1.net>
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
Authorization:
CSeq: 10 REGISTER
Expires: 7200
Content-Length: 0
```

6 **Timeout of Re-Register**

The I-CSCF times out, waiting for the response from the S-CSCF.

Editor's Note: The value of the timer in this particular instance is FFS. Clearly the value of the timers in the P-CSCF and UE waiting for the response must be considered when choosing this value.

7 **Cx-Query (Optional)**

The I-CSCF informs the HSS that the S-CSCF for the subscriber is unreachable and requests information related to the required S-CSCF capabilities from the HSS, The HSS sends the capability information required for S-CSCF selection. The I-CSCF uses this information to select a suitable S-CSCF.

This step is optional. Depending on implementation, sufficient information may be available to the I-CSCF from Step 4, to allow the I-CSCF select an alternate S-CSCF. Alternative mechanisms (for example a CSCF management plane) would be used to enable the HSS learn of S-CSCF failure. In addition, the HSS will learn about the assignment of a new S-CSCF in Step 9.

8 **SIP REGISTER (I-CSCF to S-CSCF) – see example in Table 6.8.1-8**

This signalling flow forwards the SIP REGISTER request from the I-CSCF to the newly selected S-CSCF. The Request-URI is changed to the address of the new S-CSCF.

Table 6.8.1-8 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf2.home1.net SIP/2.0
Via:
Via:
Via:
Path:
Path:
Proxy-require:
Require:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

The remaining steps (9-15) are the same as in the normal re-registration case (steps 6-12 in subclause 16.3)

********** NEXT PROPOSED CHANGE **********

16 Signalling flows for REGISTER (hiding)

16.1 Introduction (see 6.1)

16.2 Registration signalling: user not registered

Figure 16.2-1 shows the registration signalling flow for the scenario when the user is not registered. For the purpose of this signalling flow, the subscriber is considered to be roaming. In this signalling flow, the home network has network configuration hiding active.

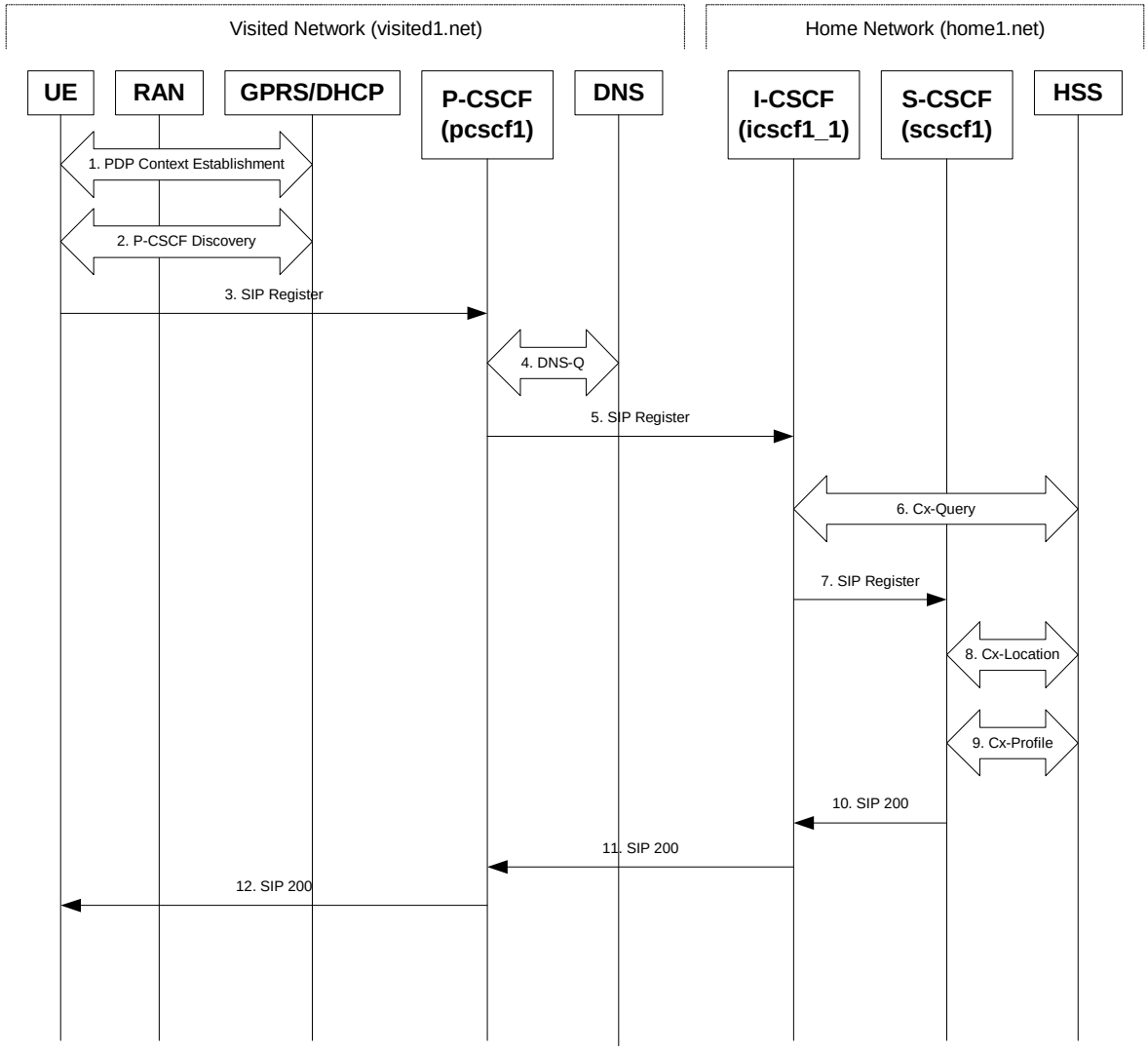

Figure 16.2-1: Registration when UE roaming

1. **GPRS Attach / PDP Context Establishment (UE to GPRS)**

   This signalling flow is shown to indicate the GPRS Attach and PDP Context Activation procedures that must be completed prior to application registration. When complete, the UE will have acquired an IP address (provided by the GGSN) which serves as the host address for the duration of the PDP context.

2. P-**CSCF Discovery (UE to GPRS/ DHCP)**

   This signalling flow is the procedure to discover the Proxy CSCF in the visited IM CN subsystem.

   The UE should be able to obtain the IP address of the P-CSCF during the PDP Context Activation procedure. At the PDP Context Activation time, the IP address of the P-CSCF shall be conveyed to the UE in the Activate PDP Context Accept message. The UEs that do not support DHCP shall use this P-CSCF discovery procedure.

   Additionally, the UEs that incorporate the DNS and DHCP client software that supports DHCP extensions (specified in draft-ietf-sip-dhcp-03.txt) may employ the DHCP mechanism to discover the P-CSCF in the visited IM CN subsystem. When allocating an IP address to the UE, the DHCP server may provide the UE with the fully-qualified domain name (FQDN) of the P-CSCF and the address of the DNS server in the visited IM CN subsystem. Subsequently, the DNS client in the UE will utilise the provided FQDN and perform an address-record lookup (i.e. type A DNS access) to obtain the IP address of the P-CSCF in the visited IM CN subsystem.

   NOTE: A UE may be roaming within the home network.

Editor's Note: IANA Considerations - Currently the IANA has not assigned an "DHCP option number" for the *SIP Servers DHCP Option* defined in the draft-ietf-sip-dhcp-03.txt. Therefore, the DHCP alternative can not be currently implemented.
[19 Jul. 2001]
This draft is currently with the IESG and approval is expected. It is therefore reasonable to expect publication by year end. It is also standards track so normative references could be made. It is also reasonable to expect the necessary IANA registration to occur in that timeframe.

Editor's Note: Second approach needs further study on the interactions with the restrictions on the Signalling PDP Context, TS 23.228 subclause 4.2.6.

3. **SIP REGISTER request (UE to P-CSCF) – see example in Table 16.2-3**

The purpose of this request is to register the user's SIP URI with a S-CSCF in the home network. This request is routed to the P-CSCF because it is the only SIP server known to the UE. In the following SIP request, the Contact field contains the user's host address.

The P-CSCF will perform two actions, binding and forwarding. The binding is between the User's SIP address (user1_public1@home1.net) and the host (terminal) address ([5555::aaa:bbb:ccc:ddd]) which was acquired during PDP context activation process.

Table 16.2-3 SIP REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From: <sip:user1_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <Sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
Authorization:
CSeq: 1 REGISTER
Expires: 7200
Content-Length: 0
```

Request-URI: The Request-URI (the URI that follows the method name, "REGISTER", in the first line) indicates the destination domain of this REGISTER request. The rules for routeing a SIP request describe how to use DNS to resolve this domain name ("home1.net") into an address or entry point into the home operator's network (the I-CSCF). This information is stored in the USIM.

Via: IPv6 PDP address of the SIP session allocated during the PDP Context Activation process.

From: This indicates the SIP public identity of the user ~~(stored in the USIM)~~ originating the REGISTER request. The public identity of the user may be obtained from the USIM .~~In SIP, this can be a third-party.~~

~~Editor's note: One proposal is: "This is a natural place for the private user identity or NAI for the subscriber. Forming a SIP URL from the NAI is a simple matter of prepending "sip:". For example, if the subscriber's NAI is 19725835472@operator.com, then the From: header would be sip:19725835472@operator.com." Alternatively it could be the SIP-URL of the party registering.~~

To: This indicates the SIP public identity of the user ~~identifier~~ being registered. This is the identity by which other parties know this subscriber. It ~~is~~ may be obtained from the USIM.

Editor's note: One proposed additional text: "In this case, this is the public user identity for the subscriber."

Contact: This indicates the point-of-presence for the subscriber – the IP address of the UE. This is the temporary point of contact for the subscriber that is being registered. Subsequent requests destined for this subscriber will be sent to this address. This information is stored in the P-CSCF.

Editor's note: It is for further study whether this information is stored in the HSS and the S-CSCF for the subscriber in order to support multiple registrations.

Call Id: Call Identifier for this Registration generated as per [3]

Authorization: It carries authentication information. The private user ID is carried in the user ID field of the authentication protocol.

Cseq: Cseq for this Registration generated as per [3]

Upon receiving this request the P-CSCF will set it's SIP registration timer for this UE to the Expires time in this request.

4. **DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs a DNS query to locate the I-CSCF in the home network. The look up in the DNS is based on the address specified in the Request URI.

The P-CSCF sends the REGISTRATION request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTRATION request the P-CSCF needs to specify the protocol, port number and IP address of the I-CSCF server in the home network to which to send the REGISTRATION request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify the transport protocol the, P-CSCF selects the UDP.

Table 16.2-4a DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=_sip.udp.registrar.home1.net, QCLASS=IN, QTYPE=SRV
```

The DNS records are retrieved according to RFC2782 [4].

Table 16.2-4b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=_sip.udp.registrar.home1.net, QCLASS=IN, QTYPE=SRV

_sip._udp.registrar.home1.net           0 IN SRV 1 10 5060 icscf1_1.home1.com
                                        0 IN SRV 1  0 5060 icscf7_1.home1.com

icscf1_1.home1.net                      0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_1.home1.net                      0 IN AAAA     5555::a1a:b2b:c3c:d4d
```

In the Answer field of the query-response each I-CSCF is identified by its host domain name. The returned SRV Resource Records (RRs) are merged and ordered, and the selection technique (employing the Priority and Weight parameters returned in the RRs) as specified in RFC2782 [4] is used to select the I-CSCF (i.e. the icscf1_1.home1.net). Since the Additional Data field of the query-response also contains the IP address of the selected I-CSCF (i.e., 5555::aba:dab:aaa:daa), a new query to the DNS is not required.

Once the IP address of the I-CSCF is obtained, the P-CSCF forwards the REGISTRATION request to this IP address (i.e., 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

5. **SIP REGISTER request (P-CSCF to I-CSCF) – see example in Table 16.2-5**

Since this P-CSCF is a stateful proxy, it is required to be in the path for all Mobile Originated and Mobile Terminated requests for this user. To ensure this, the P-CSCF has to put itself into the path for future requests. One solution of achieving this is to have the P-CSCF as the contact point for this user at the home registrar.

To do this the P-CSCF creates a temporary SIP URI for the user called user1%40home1.net@pcscf1.visited1.net. As part of its internal registration procedure the P-CSCF binds the temporary SIP URI to the user's SIP URI which was also bound to the IP address of the UE as shown in signalling flow 3. The P-CSCF then forwards the REGISTER request for user1_public1@home1.net, to the home registrar, using a contact address of user1_public1%40home1.net@pcscf1.visited1.net.

This signalling flow shows the SIP REGISTER being forward from the P-CSCF to the I-CSCF in the home domain.

Table 16.2-5 SIP REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
From:
To:
Contact: <sip:user1%40home1.net@pcscf1.visited1.net>
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: This is the address of the P-CSCF and is included to inform the S-CSCF where to route terminating sessions.

Require, Proxy-Require: These headers are included to ensure that the recipient correctly handles the Path header. If the recipient does not support the path header, a response will be received with a status code of 420 and an Unsupported header indicating "path". Such a response indicates a misconfiguration of the routing tables and the request has been routed outside the IM CN subsystem.

6. **Cx-Query**

   The I-CSCF requests information related to the required S-CSCF capabilities from the HSS. The HSS provides the I-CSCF with either the S-CSCF address for the subscriber (if the subscriber is currently registered) or the S-CSCF required capabilities (if the subscriber is not currently registered.) Since the subscriber is not registered in this case, the HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

7. **SIP REGISTER request (I-CSCF to S-CSCF) – see example in Table 16.2-7**

   I-CSCF adds a proper I-CSCF name to the Path header.

   This signalling flow forwards the SIP REGISTER from the I-CSCF to the S-CSCF selected. The Request-URI is changed to the address of the S-CSCF.

Table 16.2-7 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
       [5555::aaa:bbb:ccc:ddd]
Path: <sip:icscf1_1.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require:
Require:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: The S-CSCF stores the contents of the Path headers and uses these addresses for routing mobile terminated sessions.

Upon receiving this request the S-CSCF will set it's SIP registration timer for this UE to the Expires time in this request.

8. **Cx-Location**

   The S-CSCF shall send its location information to the HSS. The HSS stores the S-CSCF name for that subscriber. The HSS sends a response to the S-CSCF to acknowledge the sending of location information.

9. **Cx-Profile**

The S-CSCF shall send the subscriber's identity to the HSS in order to be able to download the subscriber profile to the S-CSCF. The HSS returns the subscriber's profile to the S-CSCF. The S-CSCF shall store the subscriber profile for that indicated user.

10. **SIP 200 OK response (S-CSCF to I-CSCF) – see example in Table 16.2-10**

The S-CSCF sends acknowledgment to the I-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 16.2-10 SIP 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:scscf1.home1.net>, <sip:icscf1_1.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires:
Content-Length:
```

Path: The S-CSCF inserts its own name to the front of the list.

11. **SIP 200 OK response (I-CSCF to P-CSCF) – see example in Table 16.2-11**

The I-CSCF translates the S-CSCF name in the Path header. The I-CSCF forwards acknowledgment from the S-CSCF to the P-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 16.2-11 SIP 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:token(scscf1.home1.net)>, <sip:icscf1_1.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

12. **SIP 200 OK response (P-CSCF to UE) – see example in Table 16.2-12**

The P-CSCF removes its address from the Path header, reverses the order of the fields, saves the resulting Path header and associates it with the UE. The P-CSCF then removes the Path header from the 200 OK response. The P-CSCF then forwards acknowledgment from the I-CSCF to the UE indicating that Registration was successful.

Table 16.2-12 SIP 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

********** NEXT PROPOSED CHANGE **********

16.3 Registration signalling: re-registration – user currently registered

For the purpose of the re-registration signalling flow shown in figure 16.3-1, the subscriber is considered to be roaming. In this signalling flow, the home network has network configuration hiding active.

This signalling flow assumes :

1. That the same PDP Context allocated during the initial registration scenario is still used for re-registration. For the case when the UE does not still have an active PDP context then PDP context procedures from subclause 16.2 is completed first.

Editor's Note: If the same PDP-Context is not available, is it guaranteed that the UE will get back the same IP address at this point? If this is not possible, would there be a problem with the binding in the P-CSCF (user_public1@home1.net and [5555::aaa:bbb:ccc:ddd])?2. The DHCP procedure employed for P-CSCF discovery is not needed.

3. The S-CSCF selection procedure invoked by the I-CSCF is not needed.

Periodic application level re-registration is initiated by the UE either in response to the expiration of the existing registration information or in response to a change in the registration status of the UE. Re-registration follows the same path as described in subclause 16.2.

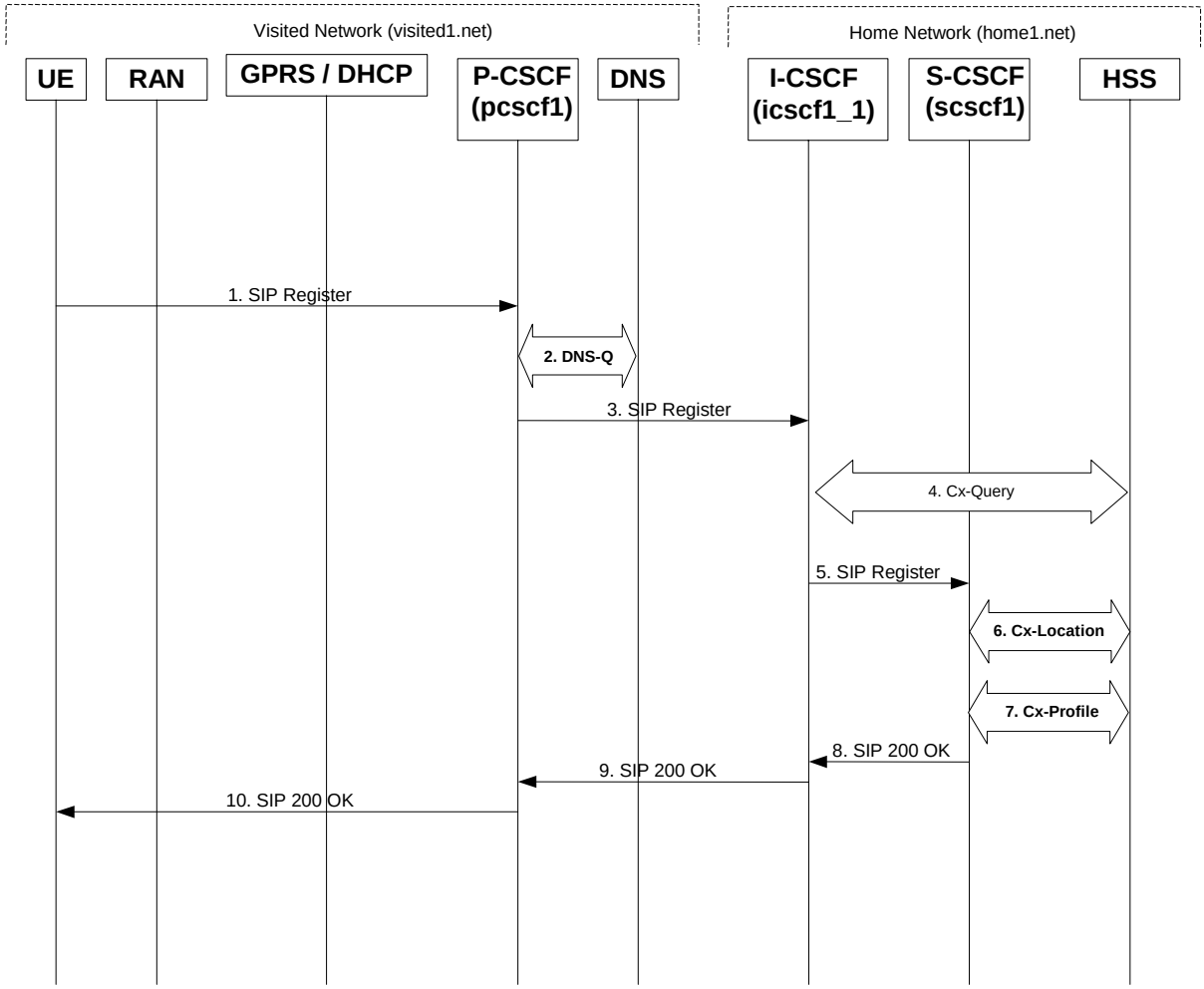

Figure 16.3-1: Re-registration when UE roaming

1. **SIP REGISTER request (UE to P-CSCF) – see example in Table 16.3-1**

The registration expires in the UE. The UE re-registers by sending a new REGISTER request. This request is sent to the same P-CSCF with which the UE initially registered. The P-CSCF maintains the same binding between the User's SIP public address (user1_public1@home1.net) and the host (terminal) address ([5555::aaa:bbb:ccc:ddd]) which it established during the original registration.

Table 16.3-1 SIP REGISTER (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From: <sip:user_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <Sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
Authorization:
CSeq: 7 REGISTER
Expires: 7200
Content-Length: 0
```

The header field usage is the same as for the initial registration scenario:

From: This indicates the ~~private~~ SIP public identity of the user ~~(stored in the USIM)~~ originating the REGISTER request. The public identity of the user may be obtained from the USIM.

To: This indicates ~~the target of the REGISTER request~~ SIP public identity of the user being registered. ~~The target is the public identity that is being registered.~~ This is the identity by which other parties know this subscriber.

Contact: This indicates the point-of-presence for the subscriber – the IP address of the UE. This is the temporary identifier for the subscriber that is being registered. Subsequent requests destined for this subscriber will be sent to this address. This information is stored in the P-CSCF.

Editor's note: It is for further study whether this information is stored in the HSS and the S-CSCF for the subscriber in order to support multiple registrations.

Authorization: It carries authentication information. The private user ID is carried in the user ID field of the authentication protocol.

Request-URI: The Request-URI (the URI that follows the method name, "REGISTER", in the first line) indicates the destination domain of this REGISTER request. The rules for routeing a SIP request describe how to use DNS to resolve this domain name ("home1.net") into an address or entry point into the home operator's network (the I-CSCF). This information is stored in the USIM.

Upon receiving this request the P-CSCF will detect that it already has a registration record for this UE and will reset it's SIP registration timer for this UE to the Expires time in this request.

2. **DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs a DNS query to locate the I-CSCF in the home network. The look up in the DNS is based on the address specified in the Request URI. The DNS provides the P-CSCF with an address of the I-CSCF in the home network. The P-CSCF must not use the I-CSCF address cached as a result of the previous registration.

3. **SIP REGISTER request (P-CSCF to I-CSCF) – see example in Table 16.3-3**

This signalling flow shows the SIP Register request being forward from the P-CSCF to the I-CSCF in the home domain.

Table 16.3-3 SIP REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
From:
To:
Contact: <sip:user1%40home1.net@pcscf1.visited1.net>
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: This is the address of the P-CSCF and is included to inform the S-CSCF where to route terminating sessions.

Require, Proxy-Require: These headers are included to ensure that the recipient correctly handles the Path header. If the recipient does not support the path header, a response will be received with a status code of 420 and an Unsupported header indicating "path". Such a response indicates a misconfiguration of the routing tables and the request has been routed outside the IM CN subsystem.

4. **Cx-Query**

   The I-CSCF requests information related to the required S-CSCF capabilities from the HSS. The HSS shall determine that the user is currently registered, and send an indication of current S-CSCF to the I-CSCF. Hence, the S-CSCF selection procedure is not needed.

5. **SIP REGISTER request (I-CSCF to S-CSCF) – see example in Table 16.3-5**

   This signalling flow forwards the SIP REGISTER request from the I-CSCF to the S-CSCF selected. The Request-URI is changed to the address of the S-CSCF.

   I-CSCF adds a proper I-CSCF name to the Path header.

Table 16.3-5 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:icscf1_1.home1.net>, <sip: pcscf1.visited1.net>
Proxy-require:
Require:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: The S-CSCF stores the contents of the Path headers and uses these addresses for routing mobile terminated sessions.

Upon receiving this request the S-CSCF will detect that it already has a registration record for this UE and will reset it's SIP registration timer for this UE to the Expires time in this request.

6. **Cx-Location**

   The S-CSCF shall send its location information to the HSS. The HSS stores the S-CSCF name for that subscriber. The HSS sends a response to the S-CSCF to acknowledge the sending of location information.

   If the S-CSCF can detect that this is a reregistration, then this flow need not be performed, and the currently saved information is used instead.

7. **Cx-Profile**

The S-CSCF shall send the subscriber's identity to the HSS in order to be able to download the subscriber profile to the S-CSCF. The HSS returns the subscriber's profile to the S-CSCF. The S-CSCF shall store the subscriber profile for that indicated user.

If the S-CSCF can detect that this is a reregistration, then this flow need not be performed, and the currently saved information is used instead.

8. **SIP 200 OK response (S-CSCF to I-CSCF) – see example in Table 16.3-8**

   The S-CSCF sends acknowledgment to the I-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 16.3-8 SIP 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip: scscf1.home1.net>, <sip: icscf1_1.home1.net>, <sip: pcscf1.visited1.net>
From:
To:
Call-ID:
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires:
Content-Length:
```

Path: The S-CSCF inserts its own name to the front of the list.

9. **SIP 200 OK response (I-CSCF to P-CSCF) – see example in Table 16.3-9**

   The I-CSCF translates the S-CSCF name in the Path header. The I-CSCF forwards acknowledgment from the S-CSCF to the P-CSCF indicating that Registration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 16.3-9 SIP 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:token(scscf1.home1.net)>, <sip: icscf1_1.home1.net>, <sip: pcscf1.visited1.net>
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

10. **SIP 200 OK response (P-CSCF to UE) – see example in Table 16.3-10**

    The P-CSCF removes its address from the Path header, reverses the order of the fields, saves the resulting Path header and associates it with the UE. The P-CSCF then removes the Path header from the 200 OK response. The P-CSCF then forwards acknowledgment from the I-CSCF to the UE indicating that Registration was successful.

Table 16.3-10 SIP 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

********** NEXT PROPOSED CHANGE **********

16.4 Registration signalling: mobile initiated deregistration

Figure 16.4-1 shows a signalling flow for mobile initiated deregistration. For the purposes of this deregistration signalling flow, the subscriber is considered to be roaming. In this signalling flow, the home network has configuration hiding active.

This signalling flow assumes:

1. That the same PDP Context allocated during the initial registration scenario is still used for deregistration. For the case when the UE does not still have an active PDP context then PDP context procedures from subclause 16.2 must first be completed.

Editor's Note: If the same PDP-Context is not available, is it guaranteed that the UE will get back the same IP address at this point? If this is not possible, would there be a problem with the binding in the P-CSCF (user_public1@home1.net and [5555::aaa:bbb:ccc:ddd])?

2. The procedure employed for P-CSCF discovery is not needed.

3. The S-CSCF selection procedure invoked by the I-CSCF is not needed.

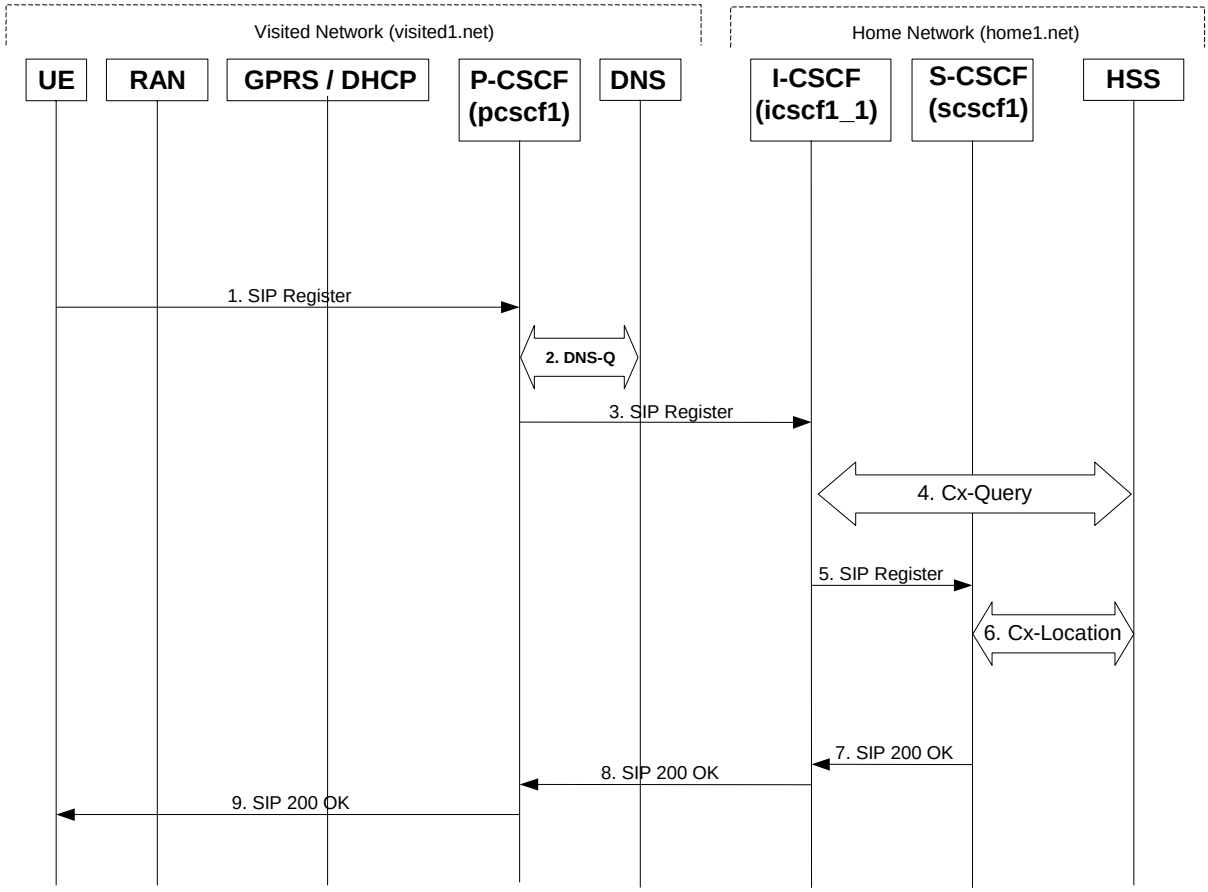

Figure 16.4-1: Registration signalling: mobile initiated deregistration

1. **SIP REGISTER request (UE to P-CSCF) – see example in Table 16.4-1**

   The UE intends to de-register itself. It does so by sending a new REGISTER request. This request looks similar as in re-register case, but the Expires header contains zero. This request is sent to the same P-CSCF with which the UE initially registered.

Table 16.4-1 SIP REGISTER (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From: <sip:user_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <Sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
Authorization:
CSeq: 7 REGISTER
Expires: 0
Content-Length: 0
```

The header field usage is the same as for the initial registration scenario:

From: This indicates the ~~private~~ SIP public identity of the user ~~(stored in the USIM)~~ originating the REGISTER request. The public identity of the user may be obtained from the USIM.

To: This indicates ~~the target of the REGISTER request~~SIP public identity of the user. ~~The target is the public identity that is~~ being de-registered. This is the identity by which other parties know this subscriber.

Contact: This indicates the point-of-presence for the subscriber – the IP address of the UE. This is the temporary identifier for the subscriber that is being de-registered.

Authorization: It carries authentication information. The private user ID is carried in the user ID field of the authentication protocol.

Request-URI: The Request-URI (the URI that follows the method name, “REGISTER”, in the first line) indicates the destination domain of this REGISTER request. The rules for routing a SIP request describe how to use DNS to resolve this domain name (“home1.net”) into an address or entry point into the home operator’s network (the I-CSCF). This information is stored in the USIM.

Expires: The 0 value indicates the registration is being cancelled.

Upon receiving this request the P-CSCF will reset the SIP registration timer for this UE to 0.

2. **DNS-Q**

Based on the user’s URI, the P-CSCF determines that UE is registering from a visiting domain and performs a DNS query to locate the I-CSCF in the home network. The look up in the DNS is based on the address specified in the Request URI. The DNS provides the P-CSCF with an address of the I-CSCF in the home network. The P-CSCF must not use the I-CSCF address cached as a result of the previous registration.

3. **SIP REGISTER request (P-CSCF to I-CSCF) – see example in Table 16.4-3**

This signalling flow shows the SIP Register request being forward from the P-CSCF to the I-CSCF in the home domain.

Table 16.4-3 SIP REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

Path: This is the address of the P-CSCF and is included to inform the S-CSCF where to route terminating sessions.

Require, Proxy-Require: These headers are included to ensure that the recipient correctly handles the Path header. If the recipient does not support the path header, a response will be received with a status code of 420 and an Unsupported header indicating "path". Such a response indicates a misconfiguration of the routing tables and the request has been routed outside the IM CN subsystem.

4. **Cx-Query**

   The I-CSCF requests information related to the required S-CSCF capabilities from the HSS. The HSS shall determine that the user is currently registered, and send an indication of current S-CSCF to the I-CSCF. Hence, the S-CSCF selection procedure is not needed.

5. **SIP REGISTER (I-CSCF to S-CSCF) – see example in Table 16.4-5**

   I-CSCF adds a proper I-CSCF name to the Path header.

   This signalling flow forwards the SIP REGISTER request from the I-CSCF to the S-CSCF selected. The Request-URI is changed to the address of the S-CSCF.

Table 16.4-5 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:icscf1_1.home1.net> <sip:pcscf1.visited1.net>
Proxy-require:
Require:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

   Upon receiving this request the S-CSCF will reset the SIP registration timer for this UE to 0.

6. **Cx-Location**

   The S-CSCF shall notify the HSS to clear its location information for that subscriber. The HSS deletes the S-CSCF name for that subscriber. The HSS sends a response to the S-CSCF to acknowledge the clearing of location information.

7. **SIP 200 OK (S-CSCF to I-CSCF) – see example in Table 16.4-7**

   The S-CSCF sends acknowledgment to the I-CSCF indicating that deregistration was successful. This request will traverse the path that the REGISTER request took as described in the Via list. The S-CSCF clears its information for that subscriber.

Table 16.4-7 SIP 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:scscf1.home1.net>, <sip:icscf1_1.home1.net>, <sip:pcscf1.visited1.net>
From: <sip:user1_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>;tag=7899
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
CSeq: 3 REGISTER
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 0
Content-Length: 0
```

Path: The S-CSCF inserts its own name to the front of the list.

8. **SIP 200 OK (I-CSCF to P-CSCF) – see example in Table 16.4-8**

   The I-CSCF forwards acknowledgment from the S-CSCF to the P-CSCF indicating that deregistration was successful. This response will traverse the path that the REGISTER request took as described in the Via list.

Table 16.4-8 SIP 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
Path: <sip:token(scscf1.home1.net)>, <sip:icscf1_1.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

9. **SIP 200 OK (P-CSCF to UE) – see example in Table 16.4-9**

   The P-CSCF forwards the acknowledgment from the I-CSCF to the UE indicating that deregistration was successful. The P-CSCF clears its information for that subscriber after sending the acknowledgment to the UE.

Table 16.4-9 SIP 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd]
From:
To:
Call-ID:
CSeq:
Date:
Expires:
Content-Length:
```

********** NEXT PROPOSED CHANGE **********

Annex A-8: Proposed additions to clauses 6, 16

6.8 Error handling: Registration signalling

6.8.1 Re-registration: failure of re-registration

This signalling flow is a continuation of the signalling flow in subclause 16.3 “Registration Signalling: Re-Registration – User Currently Registered” after reception of signalling flow 4. This signalling flow shows the recovery after a failure of the S-CSCF that had been assigned to the subscriber in a previous registration.

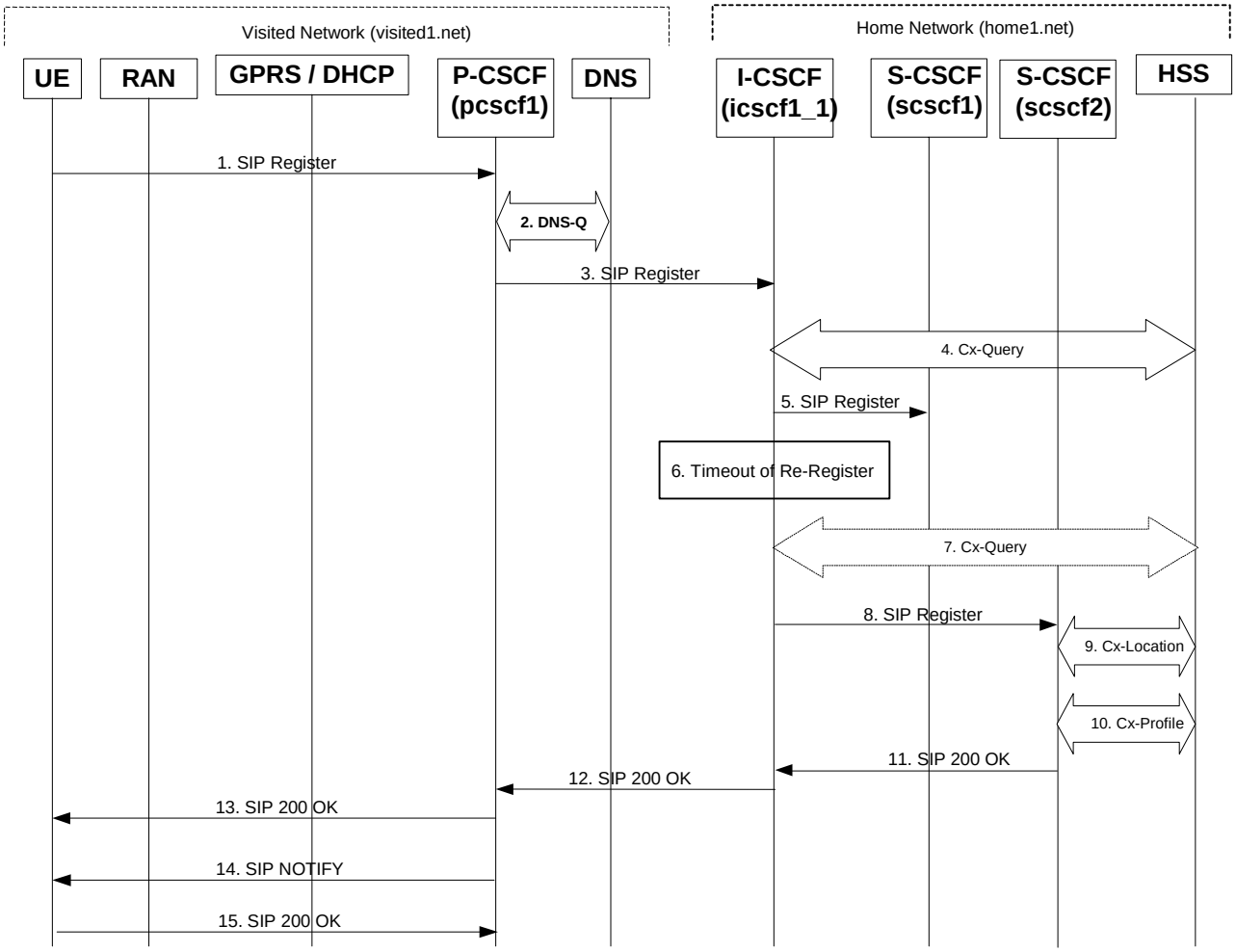

Figure 6.8.1-1: Failure of previous S-CSCF during re-registration

Steps 1 through 4 are the same as the signalling flow in subclause 16.3 “Registration Signalling: Re-Registration – User Currently Registered”

5 **SIP REGISTER (I-CSCF to S-CSCF) – see example in Table 6.8.1-5**

This signalling flow forwards the SIP REGISTER request from the I-CSCF to the S-CSCF selected. The Request-URI is changed to the address of the S-CSCF.

I-CSCF adds a proper I-CSCF name to the Path header.

Table 6.8.1-5 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_1.home1.net, SIP/2.0/UDP pcscf1.visited1.net, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]
Path: <sip:icscf1_1.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
From: <sip:user1_private@home1.net> <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:user1%40home1.net@pcscf.visited1.net>
Call-ID: 123456789@[5555::aaa:bbb:ccc:ddd]
Authorization:
CSeq: 10 REGISTER
Expires: 7200
Content-Length: 0
```

6 **Timeout of Re-Register**

The I-CSCF times out, waiting for the response from the S-CSCF.

Editor's Note: The value of the timer in this particular instance is FFS. Clearly the value of the timers in the P-CSCF and UE waiting for the response must be considered when choosing this value.

Editor's note: "Whether it is appropriate or not to send the Register request to S-CSCF2 when I-CSCF times out waiting for a response from S-CSCF1 is FFS. While doing a new HSS query or performing a new S-CSCF selection the UE might time out and resend the Register request.

If this step is found to be not a problem for the UE, then the issue of having one subscriber registered to only one S-CSCF must be clarified."

7 **Cx-Query (Optional)**

The I-CSCF informs the HSS that the S-CSCF for the subscriber is unreachable and requests information related to the required S-CSCF capabilities from the HSS, The HSS sends the capability information required for S-CSCF selection. The I-CSCF uses this information to select a suitable S-CSCF.

This step is optional. Depending on implementation, sufficient information may be available to the I-CSCF from Step 4, to allow the I-CSCF select an alternate S-CSCF. Alternative mechanisms (for example a CSCF management plane) would be used to enable the HSS learn of S-CSCF failure. In addition, the HSS will learn about the assignment of a new S-CSCF in Step 9.

8 **SIP REGISTER (I-CSCF to S-CSCF) – see example in Table 6.8.1-8**

This signalling flow forwards the SIP REGISTER request from the I-CSCF to the newly selected S-CSCF. The Request-URI is changed to the address of the new S-CSCF.

Table 6.8.1-8 SIP REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip: scscf2.home1.net SIP/2.0
Via:
Via:
Via:
Path:
Path:
Proxy-require:
Require:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

The remaining steps (9-15) are the same as in the normal re-registration case (steps 6-12 in subclause 16.3)

********** END OF PROPOSED CHANGES **********

References

1. L. Blunk, J. Vollbrecht: "PPP Extensible Authentication Protocol (EAP)", RFC 2284.
2. V. Torvinen, J. Arkko, A. Niemi, "HTTP Authentication with EAP", draft-torvinen-http-eap-00.txt, work in progress.
3. J. Arkko, H. Haverinen, "EAP AKA authentication", draft-arkko-pppext-eap-aka-00.txt, work in progress.
4. Handley, Schulzrinne, Schooler, Rosenberg: "SIP: Session Initiation Protocol", draft-ietf-sip-rfc2543bis-04.txt, work in progress.