3GPP TSG CN Plenary Meeting #17 **NP-020374**
4th - 6th September 2002. Biarritz, France.

Source: **TSG CN WG 1**

Title: **CRs to Rel-5 on Work Item IMS-CCR towards 24.228**

Agenda item: **8.1**

Document for: **APPROVAL**

Introduction:

This document contains **6** CRs on **Rel-5 to** Work Item **"IMS-CCR"**, that have been agreed by **TSG CN WG1**, and are forwarded to TSG CN Plenary meeting #17 for approval.

Spec	CR #	Rev	CAT	Rel	Tdoc Title	Meeting	TDoc #	C_Version
24.228	063	1	F	Rel-5	Coreection of the dns procedure	N1-25	N1-021778	5.1.0
24.228	064	1	F	Rel-5	Add P-header examples to call flow MO#1a	N1-25	N1-021798	5.1.0
24.228	066	1	F	Rel-5	Add P-header examples to call flow MT#1a	N1-25	N1-021800	5.1.0
24.228	068		F	Rel-5	Addition of P-Visited-Network-ID to 24.228	N1-25	N1-021664	5.1.0
24.228	069	1	F	Rel-5	Corrections to 24.228 flows	N1-25	N1-021760	5.1.0
24.228	070		F	Rel-5	CallID of REGISTER requests	N1-25	N1-021712	5.1.0

3GPP TSG-CN1 Meeting #25
Helsinki, Finland, 29 July – 2 August

Tdoc N1-021664

CR-Form-v7

CHANGE REQUEST

⌘	24.228	CR	068	⌘ rev	-	⌘	Current version:	5.1.0	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Addition of P-Visited-Network-ID to 24.228		
Source:	⌘	Ericsson		
Work item code:	⌘	IMS-CCR	***Date:*** ⌘	22/07/2002
Category:	⌘	**F** *Use one of the following categories:* ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	***Release:*** ⌘	Rel-5 *Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)*

Reason for change:	⌘	The current name of the header is incorrect (Roaming-Info).
Summary of change:	⌘	The header Roaming-Info is replaced by P-Visited-Network-ID
Consequences if not approved:	⌘	Use of a non-registered, invented, SIP header name. The header may be defined later by a standard track RFC, resulting in incompatibility with 3GPP systems.

Clauses affected:	⌘	6, 16				
		Y	**N**			
Other specs affected:	⌘		X	Other core specifications	⌘	
			X	Test specifications		
			X	O&M Specifications		
Other comments:	⌘					

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

First proposed change

6 Signalling flows for REGISTER (non hiding)

6.1 Introduction

In IMS Authentication is performed at registration time. The following sections show examples of SIP registration and UMTS AKA authentication. It is possible for the home to require other types of authentication.

In the example below, Digest AKA is used within SIP headers to carry the information related to the authentication-challenge and response.

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. This flow also shows the authentication of the private user identity. In this signalling flow, the home network does not have network configuration hiding active.

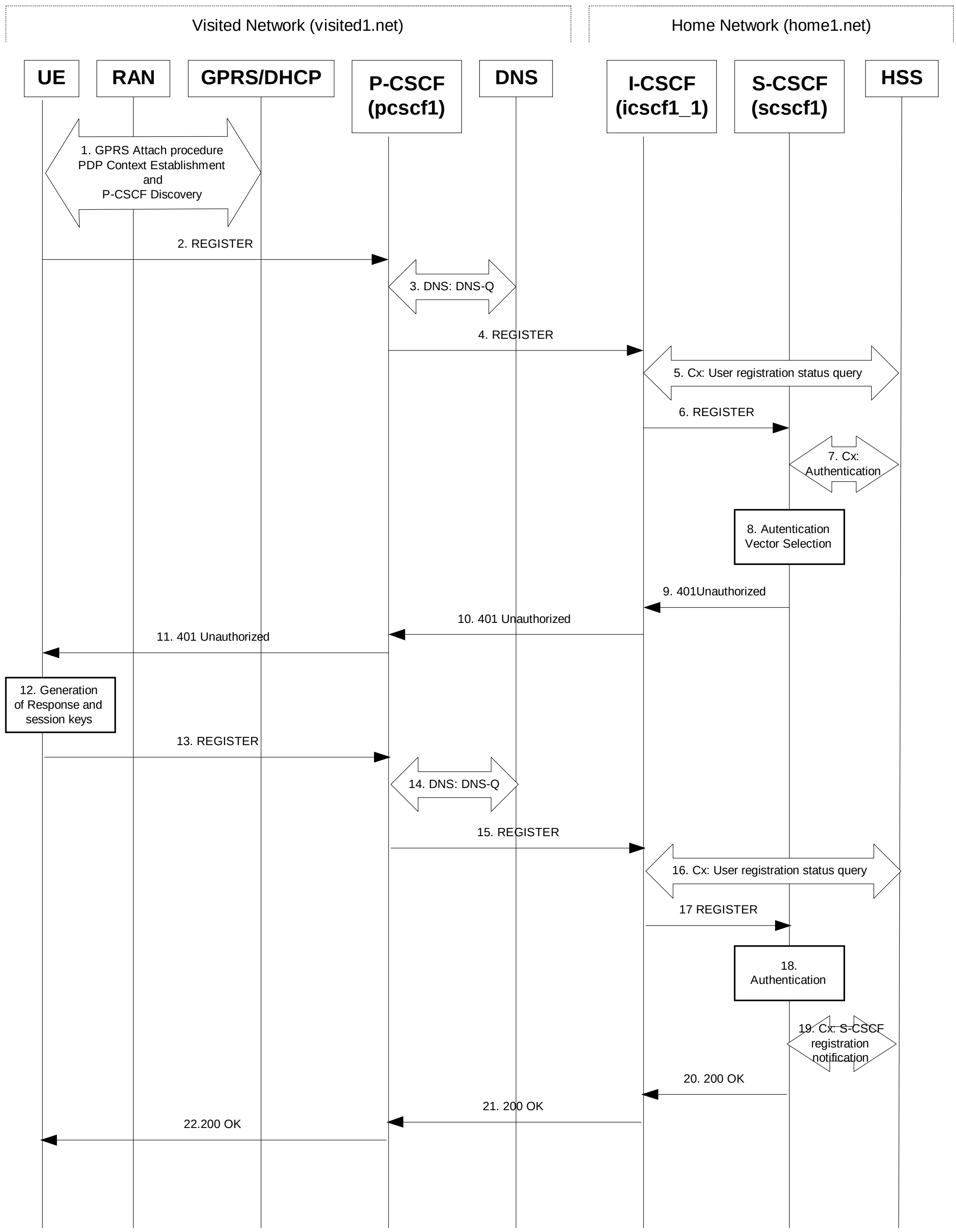


Figure 6.2-1: Registration signalling: user not registered

1. **GPRS Attach / PDP Context Establishment and P-CSCF Discovery (UE to GPRS)**

   This signalling flow is shown to indicate prerequisites for the registration signalling.

   See subclause 5.2 for details.

2. **REGISTER request (UE to P-CSCF) – see example in table 6.2-2**

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 6.2-2: REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce="", uri="sip:registrar.home1.net", response=""
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789;
   Port_U_UDP=1357; Port_U_TCP=1358
Require: sec-agree
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 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.

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

Max-Forwards: Set to 70 by the UE and used to prevent loops.

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

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

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 and S-CSCF.

Authorization: It carries authentication information. The private user identity (user1_private@home1.net) is carried in theusername field of the Digest AKA protocol. The uri parameter (directive) contains the same value as the Request-URI. The realm parameter (directive) contains the network name where the username is authenticated. The Request-URI and the realm parameter (directive) value are obtained from the same field in the USIM and therefore, are identical. In this example, it is assumed that a new UICC card was just inserted into the terminal, and there is no other cached information to send. Therefore, nonce and response parameters (directives) are empty.

Security-Client: lists the supported algorithm(s) by the UE. It encapsulates the detail of each mechanism to be negotiated.

SPI value is the UE's SA_ID. Two SA_IDs are inserted, one for the SA using transport UDP, the other for TCP. The UE needs to choose the SA_IDs in such a way that those uniquely identify the inbound SAs at the UE.

Port_U_UDP and Port_U_TCP contain the port number the UE would like receive the SA protected messages.

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

3. **DNS: DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs the DNS queries 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 REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port number are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.2-3a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.2-3b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net          0 IN NAPTR 50   50 "s" "SIP+D2U"    ""
     _sip._udp.registrar.home1.net
                     0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                             0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""
     _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 6.2-3c: DNS: 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 RFC 2782 [4].

Table 6.2-3d: 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_p.home1.net
                                     0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

4. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.2-4**

   The P-CSCF needs to be in the path for all mobile originated and mobile terminated requests for this user. To ensure this, the P-CSCF adds itself to the Path header value for future requests.

   The P-CSCF binds the public user identity under registration to the Contact header supplied by the user.

   The P-CSCF adds also the ~~Roaming-Info~~P-Visited-Network-ID header~~ (if not present). The P-CSCF adds the *vnid* parameter~~ with the contents of the identifier of the P-CSCF network. This may be the visited network domain name or any other identifier that identifies the visited network at the home network.

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

   P-CSCF removes the Security-Client and Require: sec-agree headers prior to forwarding the message.

Table 6.2-4: REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce="", uri="sip:registrar.home1.net", response="", integrity-protected="no"
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.

~~Roaming-Info~~P-Visited-Network-ID: ~~The *vnid* parameter~~ It contains the identifier of the P-CSCF network at the home network.

5. **Cx: User registration status query procedure**

   The I-CSCF makes a request for information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

   For detailed message flows see 3GPP TS 29.228.

   Table 6.2-5a provides the parameters in the REGISTER request (flow 4) which are sent to the HSS.

Table 6.2-5a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.

	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	~~Roaming Info: vnid~~P-Visited-Network-ID:	This information indicates the network identifier of the visited network

6. **REGISTER request (I-CSCF to S-CSCF) – see example in table 6.2-6**

I-CSCF does not modify the Path header.

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 6.2-6: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
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 may set its SIP registration timer for this UE to the Expires time in this request or the S-CSCF may assign another registration timer for this registration

7. **Cx: Authentication procedure**

As the REGISTER request arrived without integrity protection to the P-CSCF, the S-CSCF shall challenge it. For this, the S-CSCF requires at least one authentication vector to be used in the challenge to the user. If a valid AV is not available, then the S-CSCF requests at least one AV from the HSS.

The S-CSCF indicates to the HSS that it has been assigned to serve this user.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-7a provides the parameters in the REGISTER request (flow 6) which are sent to the HSS.

Table 6.2-7a Cx: S-CSCF authentication information procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.

	S-CSCF Name	Request-URI:	This information element contains the name of the S-CSCF. The presence of this IE indicates that the user has not been authenticated yet by the S-CSCF

8. **Authentication vector selection**

The S-CSCF selects an authentication vector for use in the authentication challenge. For detailed description of the authentication vector, see 3GPP TS 33.203.

NOTE 1: The authentication vector may be of the form as in 3GPP TS 33.203 (if IMS AKA is the selected authentication scheme):

- AV = $RAND_n||AUTN_n||XRES_n||CK_n||IK_n$ where:
  - RAND: random number used to generate the XRES, CK, IK, and part of the AUTN. It is also used to generate the RES at the UE.
  - AUTN: Authentication token (including MAC and SQN).
  - XRES: Expected (correct) result from the UE.
  - CK: Cipher key (optional).
  - IK: Integrity key.

9. **401 Unauthorized response (S-CSCF to I-CSCF) - see example in table 6.2-9**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.2-9: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID: apb03a0s09dkjdfglkj49111
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server
                specific data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
                ck="ffeeddccbbaa11223344556677889900"
CSeq: 1 REGISTER
Content-Length: 0
```

WWW-Authenticate: The S-CSCF challenges the user. The nonce includes the quoted string, base64 encoded value of the concatenation of the AKA RAND, AKA AUTN and server specific data. The S-CSCF appends also the Integrity Key (IK) and the Cyphering key (CK).

NOTE 2: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

10. **401 Unauthorized response (I-CSCF to P-CSCF) - see example in table 6.2-10**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.2-10: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
Content-Length:
```

11. **401 Unauthorized response (P-CSCF to UE) - see example in table 6.2-11**

The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 6.2-11: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server
                  specific data), algorithm=AKAv1-MD5
Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
                  Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

Security-Server: q is the preference value, 0.1 means IPsec is the first preferred choice. The q value represents only relative degradation of all mechanisms listed here. The lower value, the higher prority.

12. **Generation of response and session keys at UE**

Upon receiving the Unauthorised response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

13. **REGISTER request (UE to P-CSCF) - see example in table 6.2-13**

Table 6.2-13 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49112
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
              nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
              uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
              Port_P_TCP=8642
CSeq: 2 REGISTER
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 11 along with the private user identity, the realm, the nonce, the URI and the algorithm.

This message is protected by the IPsec SA negotiated.

14. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port number are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.2-14a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.2-14b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net          0 IN NAPTR 50   50 "s" "SIP+D2U"    ""
     _sip._udp.registrar.home1.net
                     0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                             0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""
     _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by an DNS SRV lookup according to RFC 2782 [4].

Table 6.2-14c DNS: 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 RFC 2782 [4].

Table 6.2-14d 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_p.home1.net
                                     0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

15. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.2-15**

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

Table 6.2-15 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
               nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
               uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1",
               integrity-protected="yes"
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.

16. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF name which was previously selected in step 5 (Cx: User registration status query procedure).

For detailed message flows see 3GPP TS 29.228.

Table 6.2-16a provides the parameters in the REGISTER request (flow 15), which are sent to the HSS.

Table 6.2-16a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	~~Roaming-Info~~P-Visited-Network-ID: ~~vnid~~	This information indicates the network identifier of the visited network

17. **REGISTER request (I-CSCF to S-CSCF) - see example in table 6.2-17**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF.

Table 6.2-17: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
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.

18. **Authentication**

Upon receiving an integrity protected REGISTER request carrying the authentication response, RES, the S-CSCF checks that the user's active, XRES matches the received RES. If the check is successful then the user has been authenticated and the public user identity is registered in the S-CSCF.

19. **Cx: S-CSCF registration notification procedure**

On registering a user the S-CSCF informs the HSS that the user has been registered at this instance. Upon being requested by the S-CSCF , the HSS will also include the user profile in the response sent to the S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-19a provides the parameters in the REGISTER request (flow 17), which are sent to the HSS.

Table 6.2-19a Cx: S-CSCF registration notification procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	S-CSCF name	Request-URI:	This information indicates the serving CSCF's name of that user

20. **200 OK response (S-CSCF to I-CSCF) - see example in table 6.2-20**

The S-CSCF sends acknowledgement to the I-CSCF indicating that Registration was successful.

Table 6.2-20: 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 7200
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-
   1111
Content-Length:
```

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

21. **200 OK response (I-CSCF to P-CSCF) - see example in table 6.2-21**

The I-CSCF forwards acknowledgement from the S-CSCF to the P-CSCF indicating that Registration was successful.

Table 6.2-21: 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

22. **200 OK response (P-CSCF to UE) - see example in table 6.2-22**

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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

Table 6.2-22: 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

6.3 Registration signalling: reregistration - user currently registered

For the purpose of the reregistration signalling flow shown in figure 6.3-1, the subscriber is considered to be roaming. The HSS information indicates that the subscriber is registered and authenticated, and that the S-CSCF has been allocated to this subscriber. In this signalling flow, the home network does not have network configuration hiding active. This flow also shows the authentication of the private user identity.

This signalling flow assumes:

1. That the same PDP Context allocated during the initial registration scenario is still used for reregistration. 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.

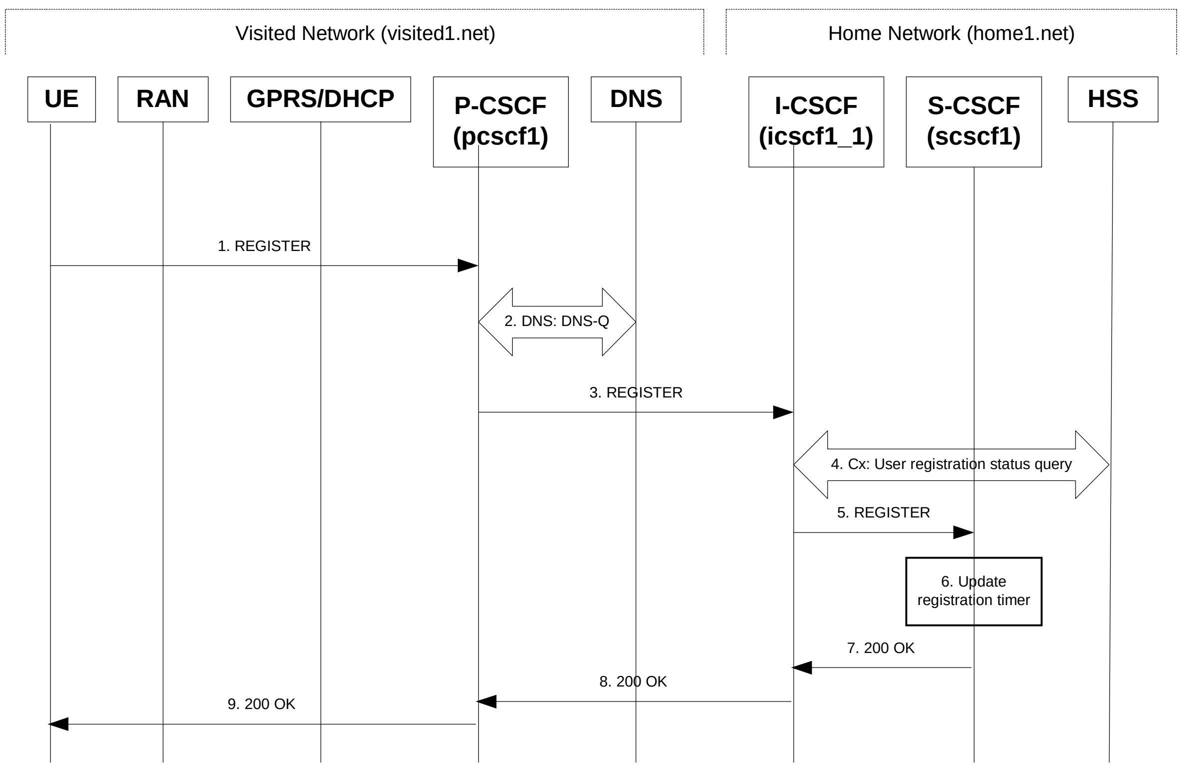


Figure 6.3-1: Reregistration when UE roaming

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

   The registration expires in the UE. The UE reregisters 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 public user 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: REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1", integrity-
   protected="yes"
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789; Port_U_UDP=1357; Port_U_TCP=1358
Require: sec-agree
CSeq: 3 REGISTER
Expires: 7200
Content-Length: 0
```

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

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

To: This indicates public user identity 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 and the S-CSCF.

Authorization: It carries authentication information. The private user identity (user1_private@home1.net) is carried in the username field of the Digest AKA protocol. As this is a re-registration process, the cached information (realm, nonce, algorithm, uri, response) is also sent.

NOTE 1: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

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.

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: DNS-Q**

   Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs the DNS queries to locate the I-CSCF in the home network. The look up in the DNS is based on the domain name specified in the Request URI. The DNS provides the P-CSCF with the 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. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.3-3**

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

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

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
                nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
                uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1",
                integrity-protected="yes"
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.

~~Roaming-Info~~P-Visited-Network-ID: ~~The *vnid* parameter~~ Itcontains the identifier of the P-CSCF network at the home network.

4. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. Because the user has registered, the HSS returns the I-CSCF with the S-CSCF address for the subscriber.

For detailed message flows see 3GPP TS 29.228.

For the parameters in the REGISTER request (flow 3) which need to be sent to HSS, see table 6.2-5a.

Table 6.3-4a provides the parameters in the REGISTER request (flow 5), which are obtained from the information sent back from the HSS.

Table 6.3-4a Cx: User registration status query procedure (HSS to I-CSCF)

Message source & destination	Cx Information element name	Mapping to SIP header in REGISTER	Description
HSS to I-CSCF	S-CSCF name	Request-URI:	This information indicates the serving CSCF's name of that user

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

This signalling flow forwards the 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: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming_Info:
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.

~~Roaming-Info~~P-Visited-Network-ID: ~~The *vnid* parameter~~ It contains the identifier of the P-CSCF network at the home network.

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. **Update registration timer**

   As the REGISTER request arrived integrity protected, the S-CSCF does not need to challenge the user, but just update the registration timer to the value requested by the user (if the policy of the network allows it).

NOTE: The S-CSCF is allowed to challenge the user. If S-CSCF decides to challenge the user, the call flow will be similar to the one presented in section 6.2.

7. **200 OK response (S-CSCF to I-CSCF) – see example in Table 6.3-7**

   The S-CSCF sends acknowledgement 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 6.3-7 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 7200
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-
   1111
Content-Length:
```

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

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

   The I-CSCF forwards acknowledgement 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 6.3-8 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

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

   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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

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

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

6.4 Registration signalling: mobile initiated deregistration (not provided)

An example of this flow is not shown in the present document.

6.5 UE subscription for the registration state event package

This subclause describes the subscription procedure for the registration state event , whereby the UE requests to be notified by the S-CSCF when the event has occurred. This is done using the information structure as indicated in 3GPP TS 24.229 [16].

It is assumed that the user has registered prior to initiating subscription of an event. Also, the subscriber is considered to be roaming and the home network operator does not desire to keep its internal configuration hidden from the visited network. For this example the trigger point at the P-CSCF for sending out the SUBSCRIBE request is the 200 OK response of the users registration.

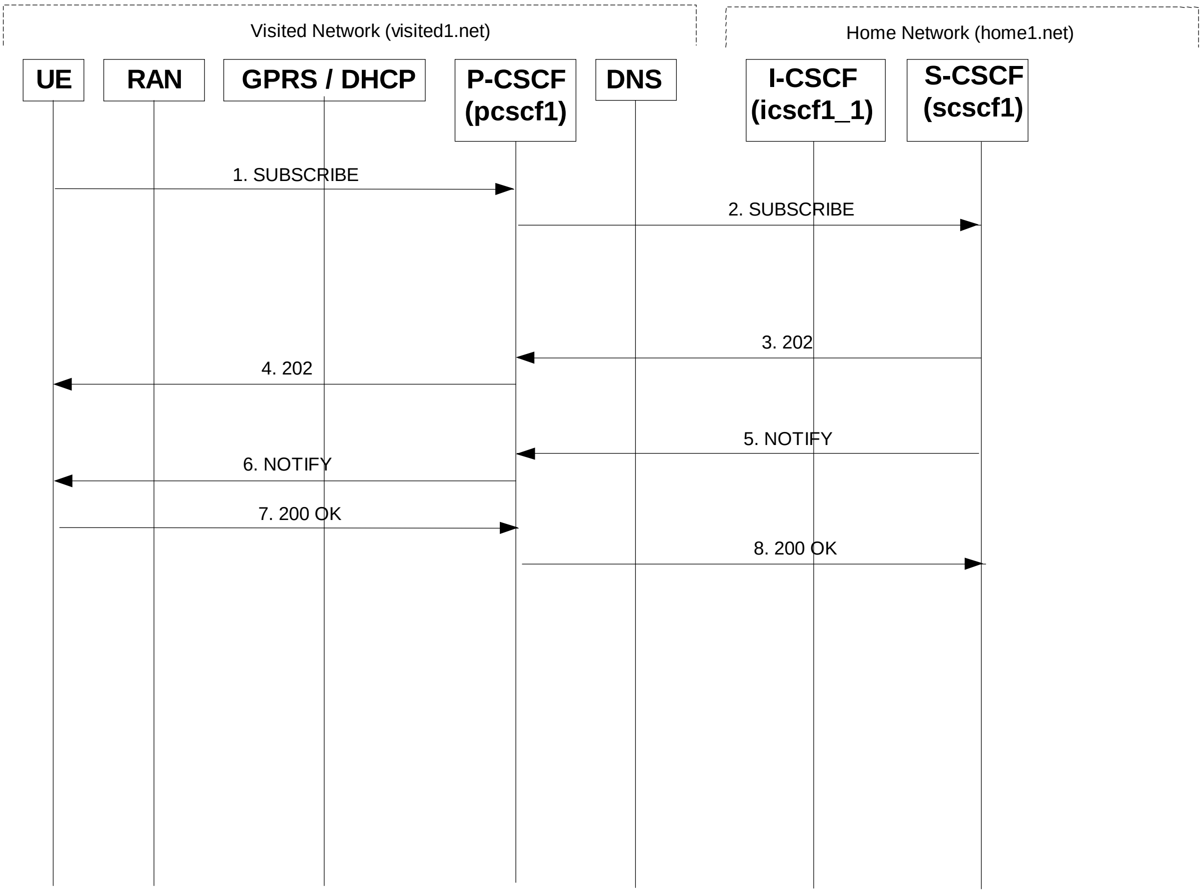


Figure 6.5-1: UE subscription for the registration state event package (without I-CSCF providing configuration independence)

1. **SUBSCRIBE request (UE to P-CSCF) - see example in table 6.5-1**

   The UE sends SUBSCRIBE request for the registration-state event package.

Table 6.5-1: SUBSCRIBE request (UE to P-CSCF)

```
SUBSCRIBE sip:user1_public1@home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=31415
To: <sip:user1_public@home1.net>
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 61 SUBSCRIBE
Event: registration-state
Expires: 7200
Accept: application/cpim-pidf+xml
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Content-Length: 0
```

From: This field is populated with logical representation (FQDN) for the entity sending the SUBSCRIBE.

Event: This field is populated with the value 'registration-state' to specify the use of the registration state package.

Accept: This field is populated with the value 'application/cpim-pidf+xml'.

2. **SUBSCRIBE request (P-CSCF to S-CSCF) - see example in table 6.5-2**

   P-CSCF looks up the serving network information for the public user identity that was stored during the registration procedure. The SUBSCRIBE request is forwarded to S-CSCF.

Table 6.5-2: SUBSCRIBE request (P-CSCF to S-CSCF)

```
SUBSCRIBE sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:user1_public1@home1.net
Record-Route: sip:431h23.1@pcscf1.home1.net
From:
To:
Call-ID:
CSeq:
Event:
Expires:
Accept:
Contact:
Content-Length:
```

Route: The Route: header is populated with the Request-URI received from the UE in the SUBSCRIBE.

3. **202 Accepted response (S-CSCF to P-CSCF) - see example in table 6.5-3**

   The S-CSCF sends an acknowledgement towards the UE indicating that the subscription was successful. This response will traverse the path that the SUBSCRIBE request took as described in the Via list.

NOTE 1: If the S-CSCF can process the SUBSCRIBE request and send the NOTIFY request immediately, it can send a 200 OK response instead of a 202 Accepted response.

Table 6.5-3: 202 Accepted response (S-CSCF to P-CSCF)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: scscf1.home1.net, pcscf1.home1.net
Remote-Party-ID: "Registrar" <sip:registrar.home1.net>
From:
To: <sip:user1_public1@home1.net>;tag=151170
Call-ID:
CSeq:
Event:
Expires:
Content-Length:
```

Expires: If the value of the Expires header in SUBSCRIBE request is different from the one received in REGISTER method, then the value of Expires header in 202 Accepted is set to match the value of Expires header in REGISTER method.

4. **202 Accepted response (P-CSCF to UE) - see example in table 6.5-4**

   P-CSCF sends the response to UE.

Table 6.5-4: 202 Accepted response (P-CSCF to UE)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Remote-Party-ID:
From:
To:
Call-ID:
CSeq:
Event:
Expires:
Content-Length:
```

5. **NOTIFY request (S-CSCF to P-CSCF) - see example in table 6.5-5**

   The S-CSCF sends a first NOTIFY request towards the UE in order to inform the UE about the registration status of the monitored user.

In the example below, the NOTIFY specifies the following public user identity as registered (i.e. status=open): sip:user1_public1@home1.net, tel: +498972233114.

The following public user identity has been de-registered (i.e. status=closed) sip:user1_public2@home1.net. They are arranged in the preferred order of priority in this example.

The Route header is constructed from the information saved at registration.

Table 6.5-5: NOTIFY request (S-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Remote-Party-ID:
From: <sip:user1_public1@home1.net>;tag=31415
To: <sip:user1_public1@home1.net>;tag=151170
Call-ID:
CSeq: 42 NOTIFY
Expires:
Event: registration-state
Content-Type: application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>open</basic></status>
        </tuple>

        <tuple name="sip:user1_public2@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

        <tuple name="tel:+498972233114">
          <status><basic>open</basic></status>
        </tuple>

      </presence>
```

From: The tag of this field matches that of the To; field in the received 200/202 for the SUBSCRIBE.

Content-Type: Set to the value of the Accept: header received in the subscribe or 'application/cpim-pidf+xml' if Accept: was not present in the SUBSCRIBE.

The message body in the NOTIFY request that carries the subscriber's registration state is formed as indicated in 3GPP TS 24.229 [16].

6. **NOTIFY request (P-CSCF to UE) - see example in table 6.5-6**

The P-CSCF forwards the NOTIFY request to the UE.

Table 6.5-6: NOTIFY request (P-CSCF to UE)

```
NOTIFY sip:[5555::aaa:bbb:ccc:ddd] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 69
Remote-Party-ID:
From:
To:
Call-ID:
CSeq:
Expires:
Event:
Content-Type:
Content-Length:
```

7. **200 OK response (UE to P-CSCF) – see example in table 6.5-7**

The UE generates a 200 OK response to the NOTIFY.

Table 6.5-7 200 OK response (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
From:
To:
Call-ID:
CSeq:Content-Length: 0
```

8. **200 OK response (P-CSCF to S-CSCF) - see example in table 6.5-8**

P-CSCF forwards the 200 OK to S-CSCF.

Table 6.5-8: 200 OK response (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

6.6 P-CSCF subscription for the registration state event package (without I-CSCF providing configuration independence)

This section describes the subscription procedure for the network initiated deregistration event, whereby the P-CSCF requests to be notified by the S-CSCF when the event has occurred. This is done using the 'registration-state' package as described in 3GPP TS 24.229 [16].

It is assumed that the user has registered prior to initiating subscription of an event. Also, the subscriber is considered to be roaming and the home network operator does not desire to keep its internal configuration hidden from the visited network. For this example the trigger point at the P-CSCF for sending out the SUBSCRIBE request is the 200 OK response of the users registration.

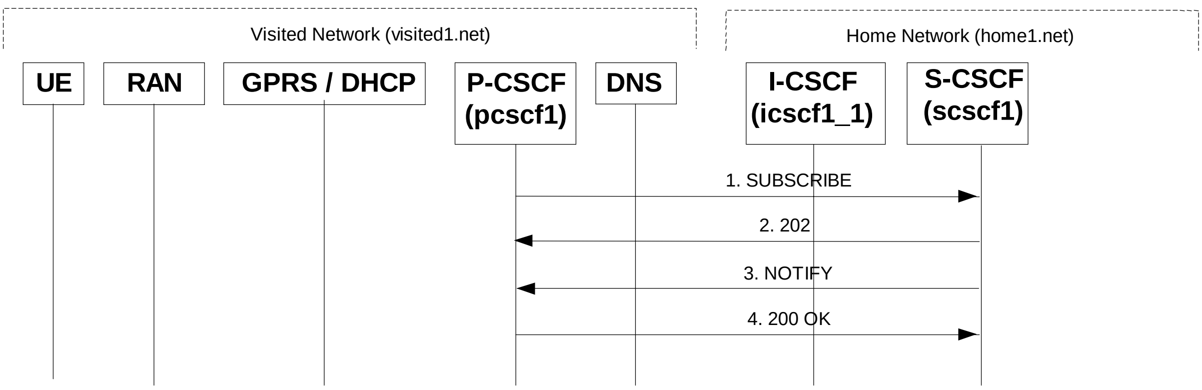


Figure 6.6-1: P-CSCF subscription for the registration state event package (without I-CSCF providing configuration independence)

1. **SUBSCRIBE request (P-CSCF to S-CSCF) - see example in table 6.6-1**

The P-CSCF sends SUBSCRIBE request for the registration-state event package.

Table 6.6-1: SUBSCRIBE request (P-CSCF to S-CSCF)

```
SUBSCRIBE scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 70
From: <sip:pcscf1.visited1.net>;tag=31415
To: <sip:user1_public1@home1.net>
Call-ID: 223456789@pcscf1.visited1.net
CSeq: 61 SUBSCRIBE
Event: registration-state
Expires: 7200
Accept: application/cpim-pidf+xml
Contact: <sip:pcscf1.visited1.net>
Content-Length: 0
```

From: This header is populated with the SIP URI that identifies the P-CSCF.

Contact: This is where the NOTIFY requests for this subscription will be sent. It consists of the SIP URL-escaped public user identity at the P-CSCF.

Event: This field shall be set to the value 'registration-state' to specify the use of the registration-state package.

Accept: This field shall be set to the value 'application/cpim-pidf+xml'.

2. **202 Accepted response (S-CSCF to P-CSCF) - see example in table 6.6-2**

   The S-CSCF sends an acknowledgement towards the P-CSCF indicating that the subscription was successful. This response will traverse the path that the SUBSCRIBE request took as described in the Via list.

NOTE 1: If the S-CSCF can process the SUBSCRIBE request and send the NOTIFY request immediately, it can send a 200 OK response instead of a 202 Accepted response.

Table 6.6-2: 202 Accepted response (S-CSCF to P-CSCF)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Remote-Party-ID: "Registrar" <sip:registrar.home1.net>
From:
To: <sip:user1_public1@home1.net>;tag=151170
Call-ID:
CSeq:
Event:
Expires:
Content-Length:
```

Expires: If value of the Expires header in SUBSCRIBE request is different from the one received in REGISTER method, then the value of Expires header in 202 Accepted is set to match the value of Expires header in REGISTER method.

3. **NOTIFY request (S-CSCF to P-CSCF) - see example in table 6.6-3**

   The S-CSCF sends a first NOTIFY request towards the P-CSCF in order to inform the P-CSCF about the registration status of monitored user.

Table 6.6-3: NOTIFY request (S-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.visited1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Remote-Party-ID: "Registrar" <sip:user1_public1@registrar.home1.net>
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:user1_public1@pcscf1.visited1.net>;tag=31415
Call-ID: 223456789@pcscf1.visited1.net
CSeq: 42 NOTIFY
Event: registration-state
Content-Type: application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

</presence>
```

From: The tag of this field matches that of the To; field in the received 200/202 for the SUBSCRIBE.

Content-Type: Set to the value of the Accept: header received in the subscribe or 'application/cpim-pidf+xml' if Accept: was not present in the SUBSCRIBE.

The message body in the NOTIFY request that carries the subscriber's registration state is formed as indicated in 3GPP TS 24.229 [16].

4. 200 OK response (P-CSCF to S-CSCF) - see example in table 6.6-4

P-CSCF forwards the 200 OK to S-CSCF.

Table 6.6-4: 200 OK response (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length: 0
```

6.7 Notifying of the network initiated deregistration event

6.7.1 Network Initiated Deregistration event occurs in the S-CSCF

Figure 6.7.1-1 assumes that the UE and the P-CSCF both have subscribed for the Users registration state event package according to subclause 6.5 and shows how the UE and the P-CSCF are notified when the Network Initiated Deregistration event occurs in the S-CSCF.

Also, it is assumed that the home network does not have network configuration hiding active.

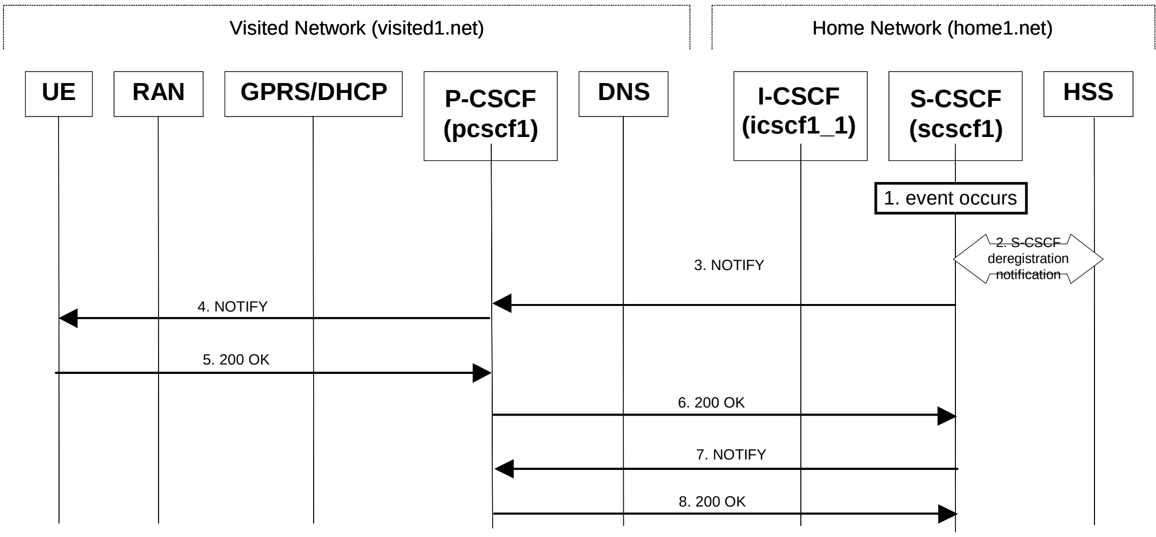


Figure 6.7.1-1: Network Initiated Deregistration event occurs in the S-CSCF

1. **Network Initiated Deregistration event occurs in the S-CSCF**

2. **S-CSCF deregistration notification**

   When the Network Initiated Deregistration Event occurs in the S-CSCF, the S-CSCF informs the HSS that the user is no longer registered. The S-CSCF either notifies the HSS to clear or requests to keep its location information for that subscriber. The HSS then either clears or keeps the S-CSCF name for that subscriber according to request. In both cases the state of the subscriber identity is stored as unregistered in the HSS and the S-CSCF. The HSS acknowledges the request.

   For detailed message flows see 3GPP TS 29.228.

3 **SIP NOTIFY (S-CSCF to P-CSCF) - see example in table 6.7.1-3**

   After the S-CSCF deregistration notification procedure the S-CSCF immediately sends a NOTIFY towards the UE in order to inform about the network initiated deregistration. The same Request URI, To, From, Call-ID are used as in the first NOTIFY. CSeq is incremented since this is the second NOTIFY request sent towards the UE.

Table 6.7.1-3: SIP NOTIFY (S-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 43 NOTIFY
Expires: 7200
Event: registration-state
Content-Type:  application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>closed</basic>
     <note>
         reason-phrase: "You have been deregistered from the network, please register again";
         registrar: registrar.home1.net
     </note>
     </status>
        </tuple>

   <tuple name="sip:user1_public2@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

   <tuple name="tel:+498972233114">
          <status><basic>closed</basic>
         <note>
         reason-phrase: "This ID has been automatically de-registered";
         registrar: registrar.home1.net
         </note>
     </status>
        </tuple>

      </presence>
```

4. **SIP NOTIFY (P-CSCF to UE) - see example in table 6.7.1-4**

   P-CSCF forwards the NOTIFY request to the UE.

Table 6.7.1-4: SIP NOTIFY (P-CSCF to UE)

```
NOTIFY sip:[5555::aaa:bbb:ccc:ddd] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 69
From:
To:
Call-ID:
CSeq:
Expires:
Event:
Content-Length:
```

5. **200 OK (UE to P-CSCF) - see example in table 6.7.1-5**

Table 6.7.1-5: SIP 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

6. **SIP 200 OK (P-CSCF to S-CSCF) - see example in table 6.7.1-6**

Table 6.7.1-6: SIP 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

7 **SIP NOTIFY (S-CSCF to P-CSCF) - see example in table 6.7.1-7**

After sending the Cx.Put request the S-CSCF also immediately sends a NOTIFY towards the P-CSCF to which the UE is attached to, in order to inform about the network initiated deregistration. The same Request URI, To, From, Call-ID are used as in the first NOTIFY. CSeq is incremented since this is the second NOTIFY request sent towards the P-CSCF.

Table 6.7.1-7: SIP NOTIFY (S-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:pcscf1.visisted1.net>;tag=31415
Call-ID: 1234567890@[5555::aaa:bbb:ccc:ddd]
CSeq: 43 NOTIFY
Expires: 7200
Event: registration-state
Content-Type: application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>closed</basic>
         <note>
         reason-phrase: "This public ID has been de-registered by the network";
         registrar: registrar.home1.net
         </note>
     </status>
        </tuple>

   <tuple name="sip:user1_public2@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

   <tuple name="tel:+498972233114">
          <status><basic>closed</basic>
         <note>
         reason-phrase: "This ID has been automatically de-registered";
         registrar: registrar.home1.net
         </note>
     </status>
        </tuple>

      </presence>
```

8. **SIP 200 OK (P-CSCF to S-CSCF) - see example in table 6.7.1-8**

Table 6.7.1-8: SIP 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

6.7.2 Network Initiated Deregistration event occurs in the HSS

Figure 6.7.2-1 assumes that the UE and the P-CSCF both have subscribed for the Users registration state event package according to subclause 6.5 and shows how the UE and the P-CSCF are notified when the Network Initiated Deregistration event occurs in the HSS.

Also, it is assumed that the home network does not have network configuration hiding active.

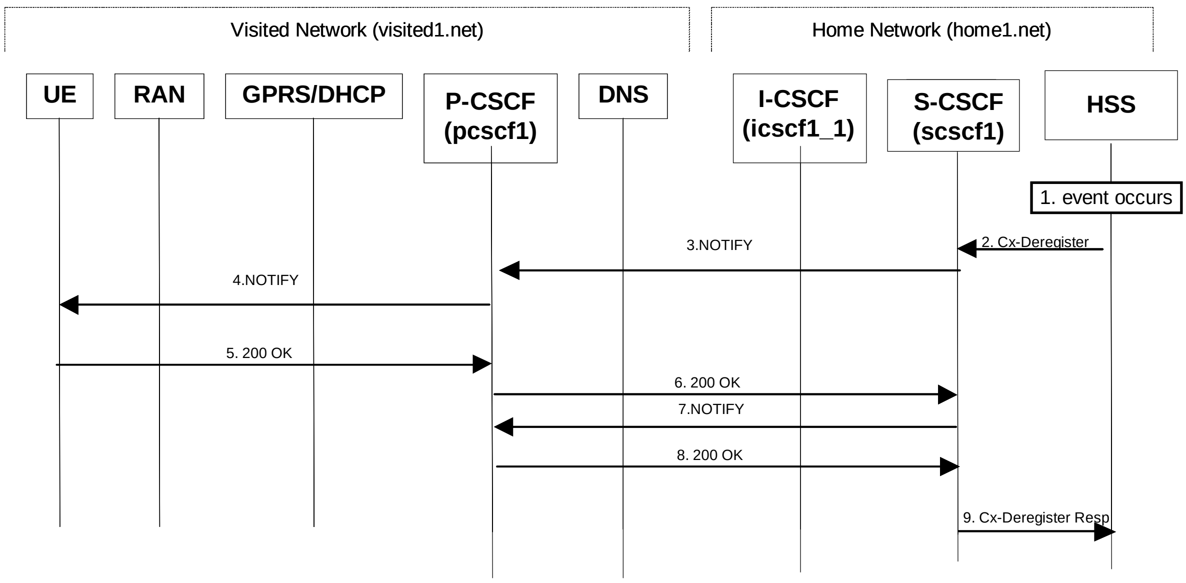


Figure 6.7.2-1: Network Initiated Deregistration event occurs in the HSS

1. **Network Initiated Deregistration event occurs in the HSS**
2. **Cx-Deregister**

   HSS initiates the de-registration, sending a Cx-Deregister (subscriber identity). For detailed message information see 3GPP TS 29.228.

3. **SIP NOTIFY (S-CSCF to P-CSCF) - see example in table 6.7.2-3**

   After getting the Cx-Deregister message the S-CSCF immediately sends a NOTIFY towards the UE order to inform about the network initiated deregistration. The same Request URI, To, From, Call-ID are used as in the first NOTIFY. CSeq is incremented since this is the second NOTIFY request sent towards the UE.

Table 6.7.2-3: SIP NOTIFY (S-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 43 NOTIFY
Expires: 7200
Event: registration-state
Content-Type: application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>closed</basic>
     <note>
         reason-phrase: "You have been deregistered from the network, please register again";
         registrar: registrar.home1.net
     </note>
     </status>
        </tuple>

   <tuple name="sip:user1_public2@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

   <tuple name="tel:+498972233114">
          <status><basic>closed</basic>
     <note>
         reason-phrase: "This ID has been automatically de-registered";
         registrar: registrar.home1.net
     </note>
     </status>
        </tuple>

      </presence>
```

4. **SIP NOTIFY (P-CSCF to UE) - see example in table 6.7.2-4**

   P-CSCF forwards the NOTIFY response to the UE.

Table 6.7.2-4: SIP NOTIFY (P-CSCF to UE)

```
NOTIFY sip:[5555::aaa:bbb:ccc:ddd] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 69
From:
To:
Call-ID:
CSeq:
Expires:
Event:
Content-Length:
```

5. **200 OK (UE to P-CSCF) - see example in table 6.7.2-5**

Table 6.7.2-5: SIP 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

6. **SIP 200 OK (P-CSCF to S-CSCF) - see example in table 6.7.2-6**

Table 6.7.2-6: SIP 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

7 **SIP NOTIFY (S-CSCF to P-CSCF) - see example in table 6.7.2-7**

After receiving the 200 OK from the UE the S-CSCF also immediately sends a NOTIFY towards the P-CSCF to which the UE is attached to, in order to inform about the network initiated deregistration. The same Request URI, To, From, Call-ID are used as in the first NOTIFY. CSeq is incremented since this is the second NOTIFY request sent towards the P-CSCF.

Table 6.7.2-7: SIP NOTIFY (S-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:pcscf1.visited1.net>;tag=31415
Call-ID: 1234567890@[5555::aaa:bbb:ccc:ddd]
CSeq: 43 NOTIFY
Expires: 7200
Event: registration-state
Content-Type: application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>closed</basic>
     <note>
         reason-phrase: "This public ID has been de-registered by the network";
         registrar: registrar.home1.net
     </note>
     </status>
        </tuple>

   <tuple name="sip:user1_public2@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

   <tuple name="tel:+498972233114">
          <status><basic>closed</basic>
     <note>
         reason-phrase: "This ID has been automatically de-registered";
         registrar: registrar.home1.net
     </note>
     </status>
        </tuple>

      </presence>
```

8. **SIP 200 OK (P-CSCF to S-CSCF) - see example in table 6.7.2-8**

Table 6.7.2-8 SIP 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

9. **Cx-Deregister Resp**

   After receiving the 200 OK from the P-CSCF, the S-CSCF sends Cx-Deregister Resp to the HSS. For detailed message information see 3GPP TS 29.228.

6.7.3 Network Initiated De-Registration Upon UE Roaming and Registration to a New Network. Assumes that the previous registration has not expired

This shows the registration signalling flow for the scenario that the UE loses the GPRS attachment in current visited access network and roams to makes a new GPRS attachment in a new visited access network without de-registration from its previous network the IMS. The GGSN and P-CSCF are assumed to be in the visited network. When the UE starts registration in via the new visited access network and P-CSCF, the home S-CSCF in the home IMS network initiates the de-registration to its the P-CSCF in the previous visited IMS network. It is assumed that the old P-CSCF has subscribed the event package to the S-CSCF and the subscription has not expired. For the reason of simplicity, the authentication procedure is not shown because it has no technical impact on this flow.

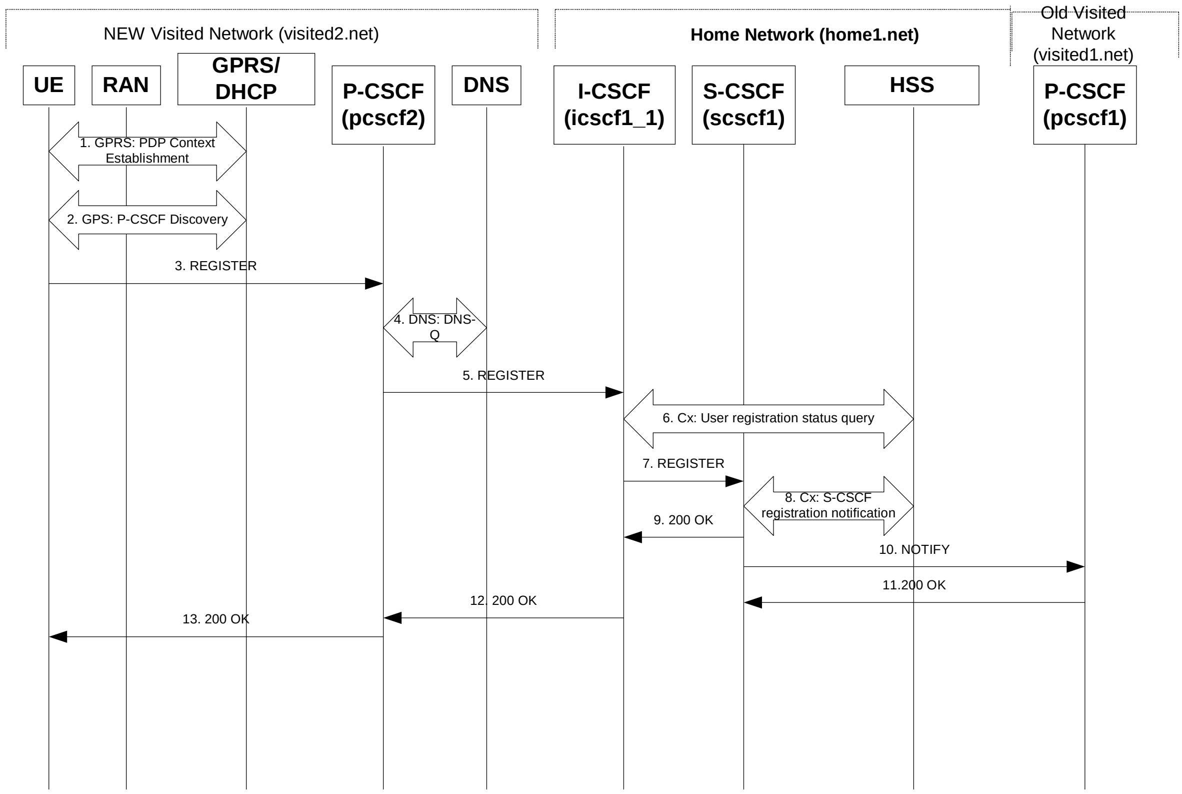


Figure 6.7.3-1: Network Initiated De-registration upon UE roaming without De-registration

Flows from 1 to 5 are the same as those in subclause 6.2.

6. **Cx: User Registration Status Query**

   The I-CSCF shall send the Cx-Query signalling flow to the HSS (Visited Network Identifier, subscriber identity, home domain name,). Because user has not de-registered with its previous network, so that HSS finds a S-CSCF assigned for that user and treats this as a re-registration procedure. Therefore, the HSS returns the S-CSCF name to the I-CSCF.For detailed message flows see 3GPP TS 29.228.

   For the parameters in the REGISTER request (flow 5) which need to be sent to HSS, see table 6.2-5a.

   Table 6.3-15a provides the parameters in the REGISTER (flow 7) message which are obtained from the information sent back from the HSS.

7. **REGISTER (I-CSCF to S-CSCF)**

   The I-CSCF forwards the REGISTER to S-CSCF assigned to that user.

8. **Cx-S-CSCF Registration Notification**

   The S-CSCF shall notify the HSS to update its location information for that subscriber. The HSS sends a response to the S-CSCF to acknowledge the update of location information and also with the user profile.

10. **NOTIFY (S-CSCF to Old P-CSCF) - see example in table 6.7.3-10**

    Upon receiving flow 7, the S-CSCF found that the P-CSCF address in that message is different with the one in its database, so that the S-CSCF knows that the UE has left its previous P-CSCF without de-register itself. And the old P-CSCF has subscribed with the registration event package for that user, therefore, the S-CSCF sends a NOTIFY to that P-CSCF.

Table 6.7.3-10: SIP NOTIFY (S-CSCF to Old P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:pcscf1.visisted1.net>;tag=31415
Call-ID: 1234567890@[5555::aaa:bbb:ccc:ddd]
CSeq: 43 NOTIFY
Expires: 7200
Event: registration-state
Content-Type:  application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>closed</basic>
     <note>
         reason-phrase: "This public ID has been de-registered by the network";
         registrar: registrar.home1.net
     </note>
     </status>
        </tuple>

   <tuple name="sip:user1_public2@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

   <tuple name="tel:+498972233114">
          <status><basic>closed</basic>
     <note>
         reason-phrase: "This ID has been automatically de-registered";
         registrar: registrar.home1.net
     </note>
     </status>
        </tuple>

      </presence>
```

11. **SIP 200 OK (Old P-CSCF to S-CSCF) - see example in table 6.7.3-11**

    Upon receiving the NOTIFY, the P-CSCF discards any information binding with that user.

Table 6.7.3-11: SIP 200 OK (Old P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

6.8 Network initiated re-authentication

This subclause describes the notification of a user that occurs when the S-CSCF assigned to that user requests re-authentication.

It is assumed that user has registered and also subscribed to the registration state event before. Also, the subscriber is considered to be roaming and the home network operator does not desire to keep its internal configuration hidden from the visited network.

After this procedure the users UE might automatically initiate re-registration procedures. If the user fails to re-register, the public user id for which re-authentication is requested, the public user id may be de-registered by S-CSCF.

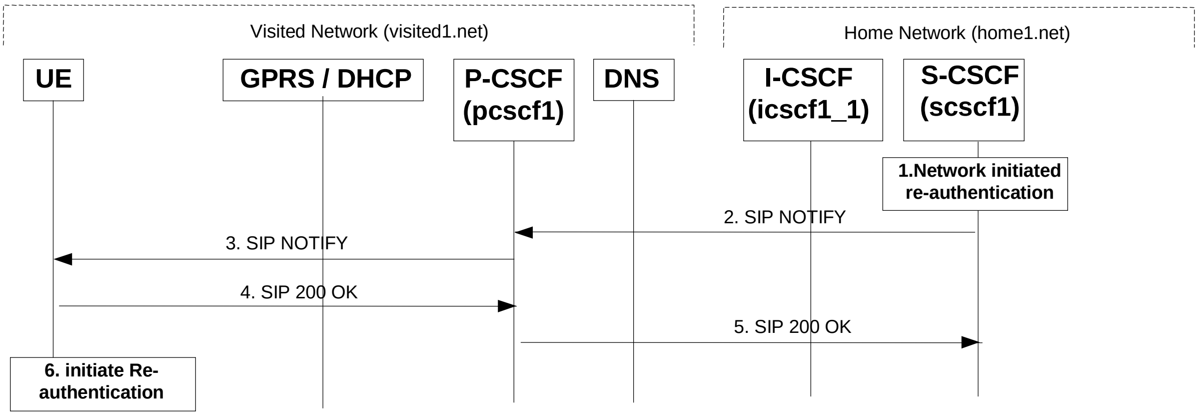


Figure 6.8-1: S-CSCF informs UE about network initiated re-authentication event (without I-CSCF providing configuration independence)

1. **Network initiated re-authentication (S-CSCF)**

   The network initiated re-authentication event for the private user identity of the user occurs at the S-CSCF. As the user has subscribed to the registration state event package this is the trigger point for the S-CSCF to notify the user about the event occurrence.

2. **SIP NOTIFY request (S-CSCF to P-CSCF) - see example in table 6.8-2**

   The S-CSCF sends a NOTIFY request towards the UE in order to inform the UE about the occurrence of the network initiated re-authentication event.

   The Route header is constructed from the information saved at registration.

Table 6.8-2: SIP NOTIFY request (S-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.visited1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Remote-Party-ID:
From: <sip:user1_public1@home1.net>;tag=31415
To: <sip:user1_public1@home1.net>;tag=151170
Call-ID:
CSeq: 43 NOTIFY
Expires:
Event: registration-state
Content-Type:  application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:"
      xmlns:registration="urn:ietf:params:xml:ns:cpim-pidf:registration">

        <tuple name="sip:user1_public1@home1.net">
          <status>
         <basic>open</basic>
         <registration>re-authenticate</registration>
     </status>
        </tuple>
      </presence>
```

From: The tag of this field matches that of the To; field in the received 200/202 for the SUBSCRIBE.

Content-Type: Set to the value of the Accept: header received in the subscribe or 'application/cpim-pidf+xml' if Accept: was not present in the SUBSCRIBE.

The message body in NOTIFY that carries the subscriber's registration state is formed as indicated in 3GPP TS 24.229 [16].

3. **SIP NOTIFY request (P-CSCF to UE) - see example in table 6.8-3**

   P-CSCF forwards the NOTIFY message to UE.

Table 6.8-3: SIP NOTIFY request (P-CSCF to UE)

```
NOTIFY sip:[5555::aaa:bbb:ccc:ddd] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 69
Remote-Party-ID:
From:
To:
Call-ID:
CSeq:
Expires:
Event:
Content-Type:
Content-Length:
```

4. **SIP 200 OK response (UE to P-CSCF) - see example in table 6.8-4**

   The UE generates a 200 OK response to the NOTIFY.

Table 6.8-4: SIP 200 OK response (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
From:
To:
Call-ID:
CSeq:Content-Length: 0
```

5. **SIP 200 OK response (P-CSCF to S-CSCF) - see example in table 6.8-5**

   P-CSCF forwards the 200 OK to S-CSCF.

Table 6.8-5: SIP 200 OK response (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

6. **Re-authentication (UE)**

   The UE shall now initiate re-authentication procedures.

6.9 Registration error conditions

6.9.1 Reregistration - failure of reregistration

See subclause 16.9.1.

6.9.2 User not registered, user not allowed to roam / user unknown

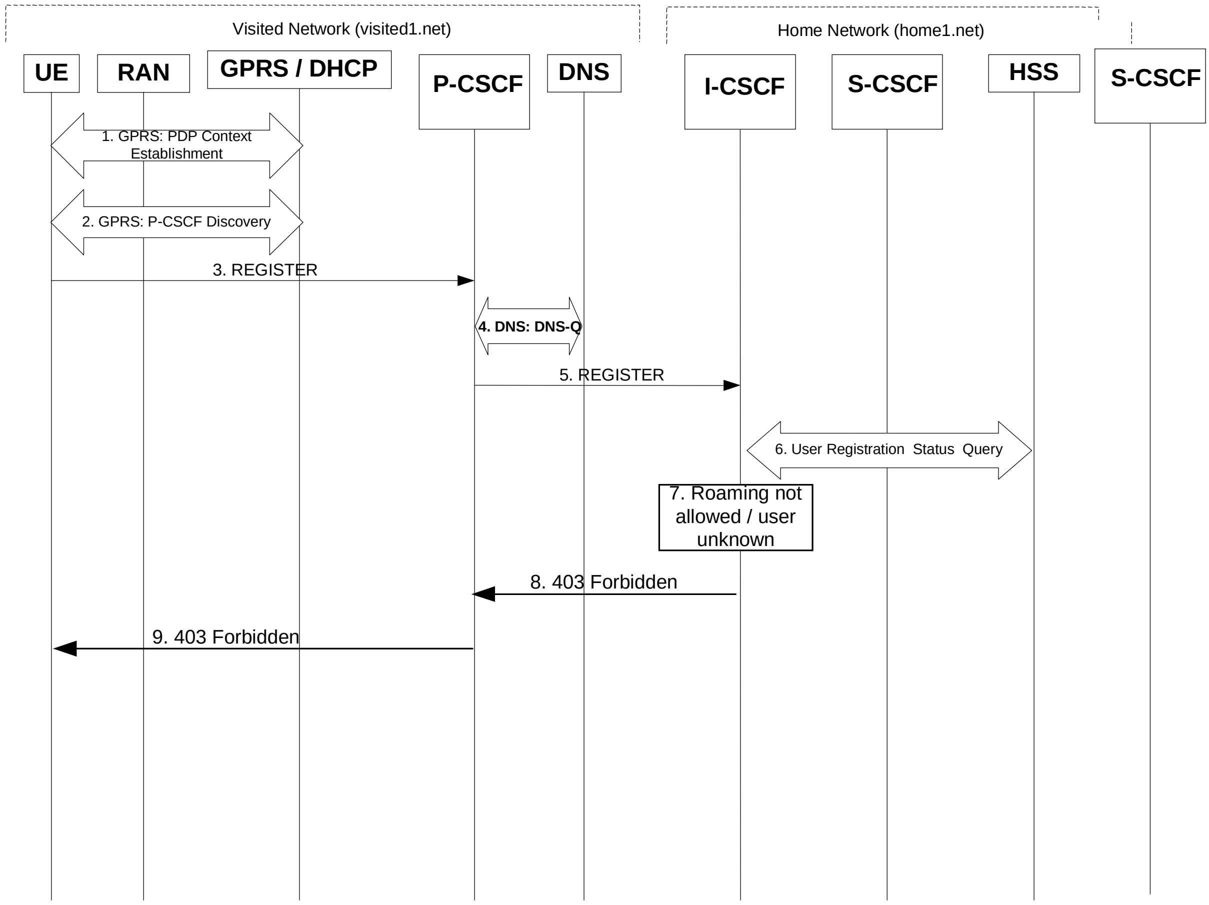


Figure 6.9.2-1: Registration failure: User not registered, user not allowed to roam

The first six steps are similar with the regular Registration signalling flows described in subclause 16.2.

The "Roaming not allowed" and "User unknown" error conditions would result in the same signalling flow (only the actions taken by I-CSCF will differ), thus the signalling flows are merged and only the I-CSCF action is described depending on the error condition.

7. **Roaming not allowed / User unknown**

    The information received as a response to the Cx-Query may indicate that "Roaming is not allowed" for the subscriber from the visited1.net network. In this case I-CSCF needs to send a 403 Forbidden response back to the UE. I-CSCF will insert a warning header in the response, indicating to the UE the reason of refusing the Registration request. Warning header will contain the name of the network inserting the warning header (warn-agent = home1.net) and in addition it may contain a warn-text.The warn-code inserted into the Warning header is 399.

    When the information received as a response to the Cx-Query indicates that the subscriber is unknown to the network or the subscriber does not have a valid subscription, the I-CSCF needs to send a 403 Forbidden response back to the UE. I-CSCF will insert a warning header in the response, indicating to the UE the reason of refusing the Registration request. Warning header will contain the name of the network inserting the warning header (warn-agent = home1.net) and in addition it may contain a warn-text. The warn-code inserted into the Warning header is 399.

8. **403 Forbidden (I-CSCF to P-CSCF) - see example in table 6.9.2-8**

Table 6.9.2-8: 403 Forbidden (I-CSCF to P-CSCF)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Roaming not allowed from this network"
From:
To:
Call-ID:
Cseq:
Content-Length:
```

9. **403 Forbidden (P-CSCF to UE) - see example in table 6.9.2-9**

Table 6.9.2-9: 403 Forbidden (P-CSCF to UE)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Roaming not allowed from this network"
From:
To:
Call-ID:
Cseq:
Content-Length:
```

6.9.3 Registration failure – user authentication failure

This clause (see figure 6.9.3-1) shows the signalling flow with user authentication failure at step 19 of subclause 6.2 "Signalling flows for REGISTER" and a final failure of the authentication at step 30.

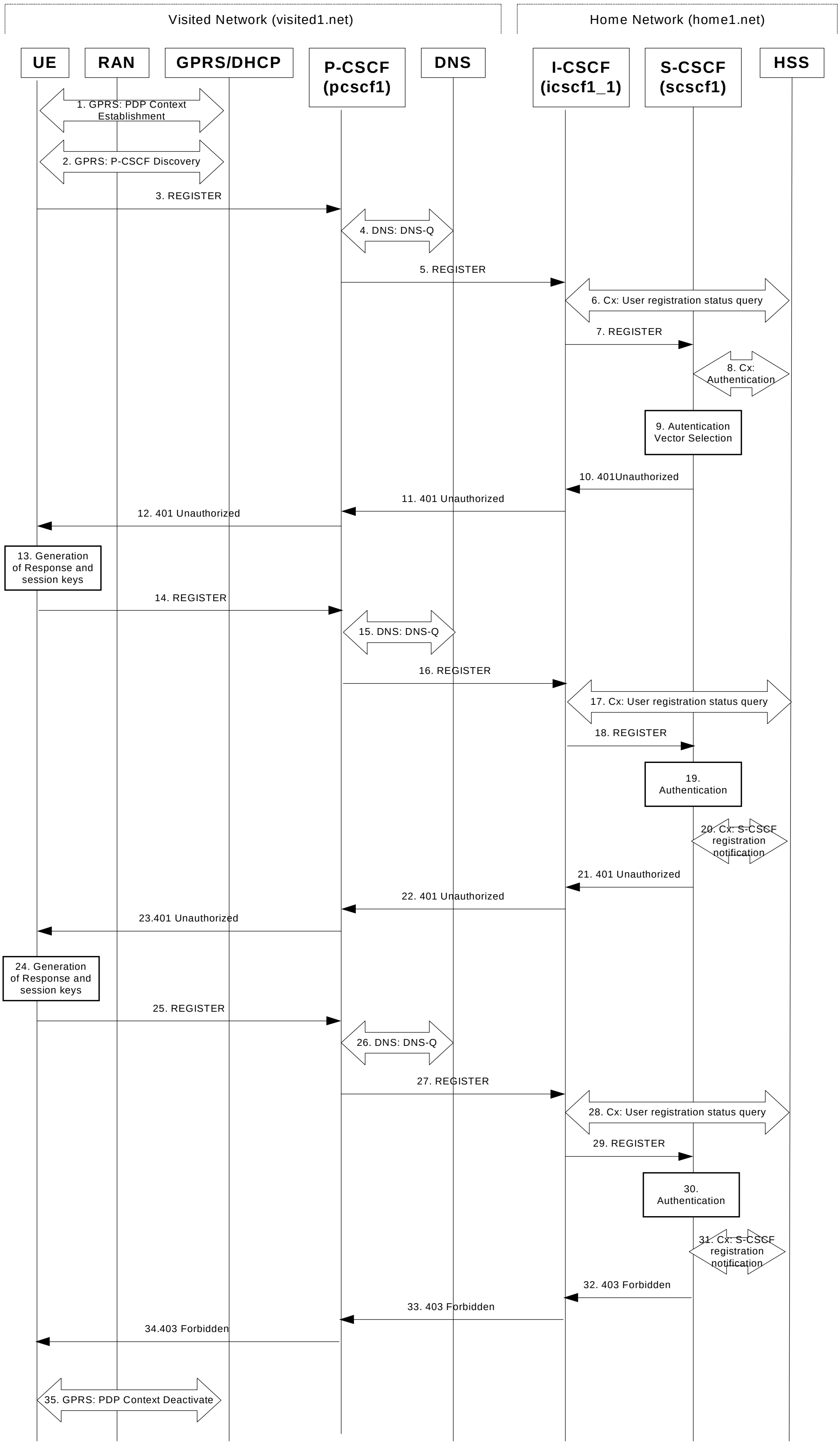


Figure 6.9.3-1: User Authentication Failure

Steps 1 through 18 are the same as the signalling flow in subclause 6.2.

19. **Authentication: User authentication fails**

    Upon receiving the REGISTER request carrying the authentication response, RES, the S-CSCF checks that the user's active, XRES matches the received RES. If the check is unsuccessful then this authentication challenge fails and the public user identity is not yet registered in the S-CSCF.

    At this point the S-CSCF has the option of repeating a number of authentication challenges as given in step 19 through 29. For the purposes of this flow, only one repetition is shown.

20. **Cx. SCGF registration notification**

    The S-CSCF selects new authentication vectors as specified in step 9, either from the list already within the S-CSCF, or by requesting new vectors from the HSS.

21. **401 Unauthorized response (S-CSCF to I-CSCF) - see example in table 6.9.3-21**

    The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.9.3-21: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID: apb03a0s09dkjdfglkj49111
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server
                specific data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
                ck="ffeeddccbbaa11223344556677889900"
CSeq: 2 REGISTER
Content-Length: 0
```

NOTE: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="AY+3fUYo021Qi1Mnv3C6qAzEp4502"

22. **401 Unauthorized response(I-CSCF to P-CSCF) - see example in table 6.9.3-22**

    The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.9.3-22: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
Content-Length:
```

23. **401 Unauthorized response (P-CSCF to UE) - see example in table 6.9.3-23**

    The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 6.9.3-23: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server
                specific data), algorithm=AKAv1-MD5
Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
                Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

24. **Generation of response and session keys at UE**

Upon receiving the Unauthorised response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

25. **REGISTER request (UE to P-CSCF) - see example in table 6.9.3-25**

Table 6.9.3-25: REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49112
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
             nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
             uri="sip:registrar.home1.net", response="0a1b04c89e54f09ab45e84d30e29f83a"
Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
             Port_P_TCP=8642
CSeq: 3 REGISTER
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 12 along with the private user identity, the realm, the nonce, the URI and the algorithm.

26. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.9.3-26a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.9.3-26b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net          0 IN NAPTR 50   50 "s" "SIP+D2U"    ""
     _sip._udp.registrar.home1.net
                     0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                             0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""
     _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 6.9.3-26c: DNS: 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 RFC 2782 [4].

Table 6.9.3-26d: 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_p.home1.net
                                     0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

27. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.9.3-27**

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

Table 6.9.3-27: REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
               nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
               uri="sip:registrar.home1.net", response="0a1b04c89e54f09ab45e84d30e29f83a",
               integrity-protected="yes"
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.

28. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.9.3-28a provides the parameters in the REGISTER request (flow 5) which need to be sent to HSS.

Table 6.9.3-28a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	~~Roaming-Info~~P-Visited-Network-ID: ~~vnid~~	This information indicates the network identifier of the visited network

29. **REGISTER request (I-CSCF to S-CSCF) - see example in table 6.9.3-29**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 6.9.3-29: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
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.

30. **Authentication**

Upon receiving the REGISTER request carrying the authentication response, RES, the S-CSCF checks that the user's active, XRES matches the received RES. If the check is unsuccessful, and no more authentication challenges are to be made, then the authentication has failed and the public user identity is not registered in the S-CSCF.

31. **Cx: S-CSCF registration notification procedure**

Upon user authentication failure the S-CSCF informs the HSS that the user has not been registered at this instance. The HSS clears the S-CSCF name for that subscriber.

For detailed message flows see 3GPP TS 29.229.

Table 6.9.3-31 provides the parameters in the REGISTER request (flow 18) which need to be sent to HSS.

Table 6.9.3-31 Cx: S-CSCF registration notification procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	S-CSCF name	Request-URI:	This information indicates the serving CSCF's name of that user

32. **403 Forbidden response (S-CSCF to I-CSCF) - see example in table 6.9.3-32**

The S-CSCF sends an 403 Forbidden response to the I-CSCF indicating that authentication failed. No security parameters are included in this message.The S-CSCF will insert a warning header in the response, indicating to the UE the reason of refusing the Registration request. The Warning header will contain the name of the network inserting the warning header (warn-agent = home1.net) and in addition it may contain a warn-text.The warn-code inserted into the Warning header is 399.

Table 6.9.3-32: 403 Forbidden (S-CSCF to I-CSCF)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Authentication failed"
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID: apb03a0s09dkjdfglkj49111
CSeq: 3 REGISTER
Content-Length: 0
```

33. **403 Forbidden response (I-CSCF to P-CSCF) - see example in table 6.9.3-33**

The I-CSCF forwards the 403 Forbidden response from the S-CSCF to the P-CSCF indicating that authentication was unsuccessful.

Table 6.9.3-33: 403 Forbidden response (I-CSCF to P-CSCF)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Authentication failed"
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **403 Forbidden response (P-CSCF to UE) - see example in table 6.9.3-33**

The P-CSCF forwards the 403 Forbidden response to the UE.

Table 6.9.3-34: 403 Forbidden response (P-CSCF to UE)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Authentication failed"
From:
To:
Call-ID:
CSeq:
Content-Length:
```

35. **PDP Context Deactivate**

    On receiving the 403 Forbidden response the UE ceases registration and authentication attempts. In this case, if the PDP context on which the SIP signalling was being conducted is not being used for other purposes, the UE deactivates the signalling PDP context.

7 Signalling flows for session initiation (non hiding)

Next proposed change

16 Signalling flows for REGISTER (hiding)

16.1 Introduction

See subclause 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. This flow also shows the authentication of the private user identity. In this signalling flow, the home network has network configuration hiding active.

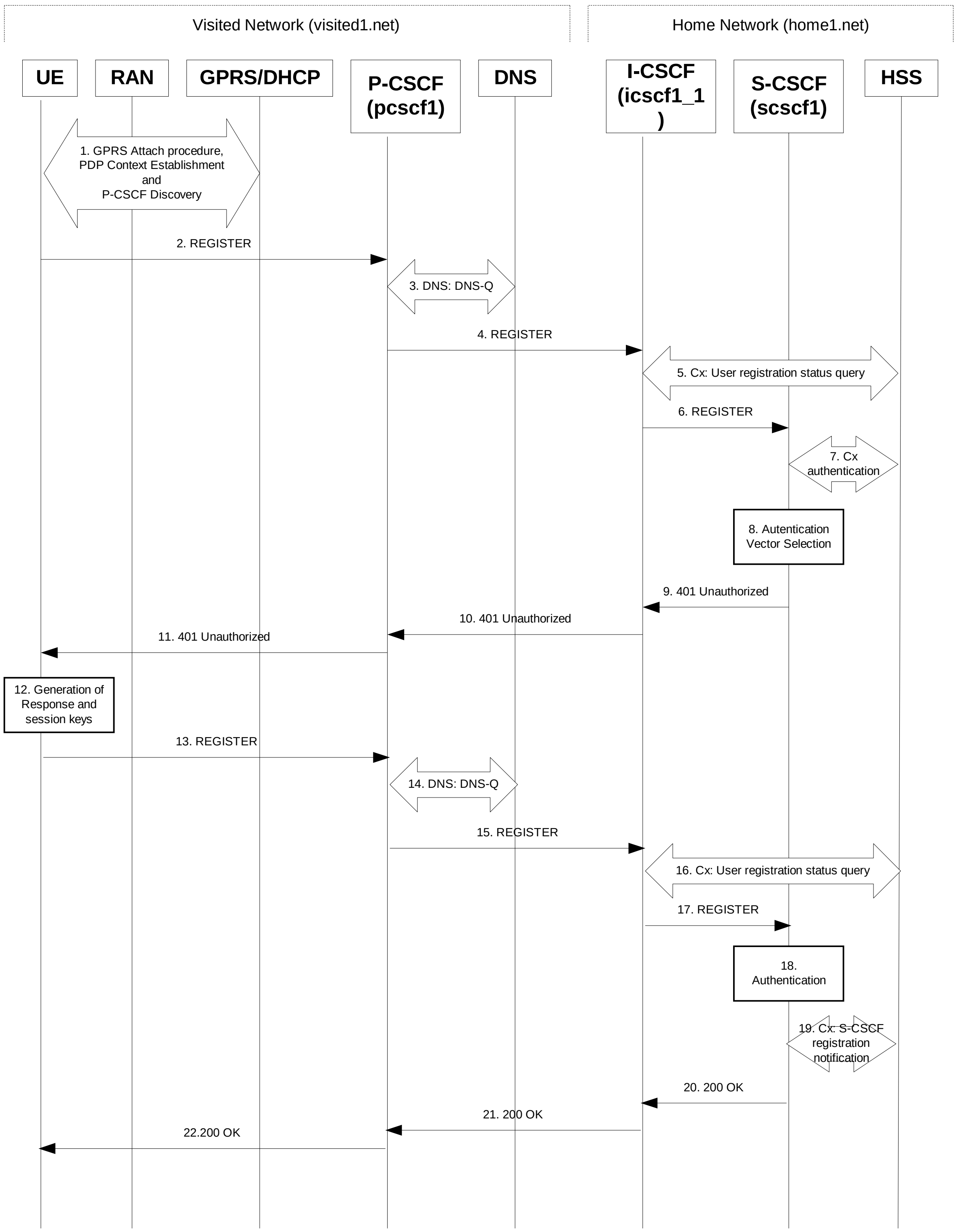


Figure 16.2-1: Registration when UE roaming

1. **GPRS Attach / PDP Context Establishment and P-CSCF Discovery (UE to GPRS)**

   This signalling flow is shown to indicate prerequisites for the registration signalling.

   See subclause 5.2 for details.

2. **REGISTER request (UE to P-CSCF) – see example in table 16.2-2**

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 16.2-2 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce="", uri="sip:registrar.home1.net", response=""
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789; Port_U_UDP=1357; Port_U_TCP=1358
Require: sec-agree
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 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.

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

Max-Forwards: Set to 70 by the UE and used to prevent loops.

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

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

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 and S-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 identity (user1_private@home1.net) is carried in the username field of the Digest AKA protocol. The uri parameter (directive) contains the same value as the Request-URI. The realm parameter (directive) contains the network name where the username is authenticated. The Request-URI and the realm parameter (directive) value are obtained from the same field in the USIM, and therefore, are identical. In this example, it is assumed that a new UICC card was just inserted into the terminal, and there is no other cached information to send. Therefore, nonce and response parameters (directives) are empty.

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

3. **DNS: DNS-Q**

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

   The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 16.2-3a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 16.2-3b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net          0 IN NAPTR 50   50 "s" "SIP+D2U"    ""
     _sip._udp.registrar.home1.net
                     0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                             0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""
     _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 16.2-3c DNS: 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 RFC 2782 [4].

Table 16.2-3d DNS: 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_p.home1.com
                                     0 IN SRV 1  0 5060 icscf7_p.home1.com

icscf1_p.home1.net                       0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

4. **REGISTER request (P-CSCF to I-CSCF) – see example in table 16.2-4**

The P-CSCF needs to be in the path for all mobile originated and mobile terminated requests for this user. To ensure this, the P-CSCF adds itself to the path for future requests.

The P-CSCF binds the public user identity under registration to the Contact header supplied by the user.

The P-CSCF adds also the ~~Roaming-Info~~P-Visited-Network-ID header~~ (if not present). The P-CSCF adds the *vnid* parameter~~ with the contents of the identifier of the P-CSCF network. This may be the visited network domain name or any other identifier that identifies the visited network at the home network.

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

Table 16.2-4 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce="", uri="sip:registrar.home1.net", response="", integrity-protected="no"
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.

~~Roaming-Info~~P-Visited-Network-ID: ~~The *vnid* parameter~~It contains the identifier of the P-CSCF network at the home network.

5. **Cx: User registration status query procedure**

The I-CSCF makes a request for information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-5a provides the parameters in the REGISTER request (flow 4) which need to been sent to HSS.

6. **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.2-6**

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

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

Table 16.2-6 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
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.

7. **Cx: S-CSCF authentication procedure**

As the REGISTER request arrived without integrity protection to the P-CSCF, the S-CSCF shall challenge it. For this, the S-CSCF requires at least one authentication vector to be used in the challenge to the user. If a valid AV is not available, then the S-CSCF requests at least one AV from the HSS.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-7a provides the parameters in the REGISTER request (flow 6) which need to be sent to HSS.

8. **Authentication vector selection**

The S-CSCF selects an authentication vector for use in the authentication challenge. For detailed description of the authentication vector, see 3GPP TS 33.203.

NOTE 1: The authentication vector may be of the form 3GPP TS 33.203 (if IMS AKA is the selected authentication scheme):

$AV = RAND_n||AUTN_n||XRES_n||CK_n||IK_n$ where:

- RAND: random number used to generate the XRES, CK, IK, and part of the AUTN. It is also used to generate the RES at the UE.
- AUTN: Authentication token (including MAC and SQN).
- XRES: Expected (correct) result from the UE.
- CK: Cipher key (optional).
- IK: Integrity key.

9. **401 Unauthorized response (S-CSCF to I-CSCF) – see example in table 16.2-9**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 16.2-9: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server
   specific data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
   ck="ffeeddccbbaa11223344556677889900"
CSeq:
Content-Length:
```

WWW-Authenticate: The S-CSCF challenges the user. The nonce includes the quoted string, base64 encoded value of the concatenation of the AKA RAND, AKA AUTN and server specific data. The S-CSCF appends also the Integrity Key (IK) and the Cyphering key (CK).

NOTE: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

10. **401 Unauthorized response (I-CSCF to P-CSCF) – see example in table 16.2-10**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 16.2-10: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
Content-Length:
```

11. **401 Unauthorized response (P-CSCF to UE) – see example in table 16.2-11**

The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 16.2-11: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server
   specific data), algorithm=AKAv1-MD5
Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
   Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

12. **Generation of response and session keys at UE**

Upon receiving the Unauthorized response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

13. **REGISTER request (UE to P-CSCF) – see example in table 16.2-13**

Table 16.2-13 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49112
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
   Port_P_TCP=8642
CSeq: 2 REGISTER
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 11 along with the private user identity , the realm, the nonce, the URI and the algorithm.

14. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 16.2-14a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 16.2-14b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net          0 IN NAPTR 50   50 "s" "SIP+D2U"    ""
     _sip._udp.registrar.home1.net
                     0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                             0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""
     _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 16.2-14c DNS: 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 RFC 2782 [4].

Table 16.2-14d 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_p.home1.net
                                     0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

15. **REGISTER request (P-CSCF to I-CSCF) – see example in table 16.2-15**

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

Table 16.2-15 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1", integrity-
   protected="yes"
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.

16. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-16a provides the parameters in the REGISTER request (flow 15) which need to been sent to HSS.

17. **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.2-17**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 16.2-17 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
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.

18. **Authentication**

Upon receiving an integrity protected REGISTER request, carrying the authentication response, RES, the S-CSCF checks that the user's active XRES matches the received RES. If the check is successful then the user has been authenticated and the public user identity is registered in the S-CSCF.

19. **Cx: S-CSCF registration notification procedure**

On registering a user the S-CSCF informs the HSS that the user has been registered at this instance. The HSS stores the S-CSCF name for that subscriber. For a positive response, the HSS will include the user profile in the response sent to the S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-19a provides the parameters in the SIP REGISTER request (flow 17) which need to been sent to HSS.

20. **200 OK response (S-CSCF to I-CSCF) – see example in table 16.2-20**

The S-CSCF sends acknowledgement 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 16.2-20 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 7200
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-
   1111
Content-Length:
```

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

21. **200 OK response (I-CSCF to P-CSCF) – see example in table 16.2-21**

The I-CSCF translates the S-CSCF name in the Path header. The I-CSCF forwards acknowledgement 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 16.2-21 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:token(scscf1.home1.net)>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

22. **200 OK response (P-CSCF to UE) – see example in table 16.2-22**

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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

Table 16.2-22 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

16.3 Registration signalling: reregistration – user currently registered

For the purpose of the reregistration signalling flow shown in figure 16.3-1, the subscriber is considered to be roaming. This flow also shows the authentication of the private user identity. 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 reregistration. 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.

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

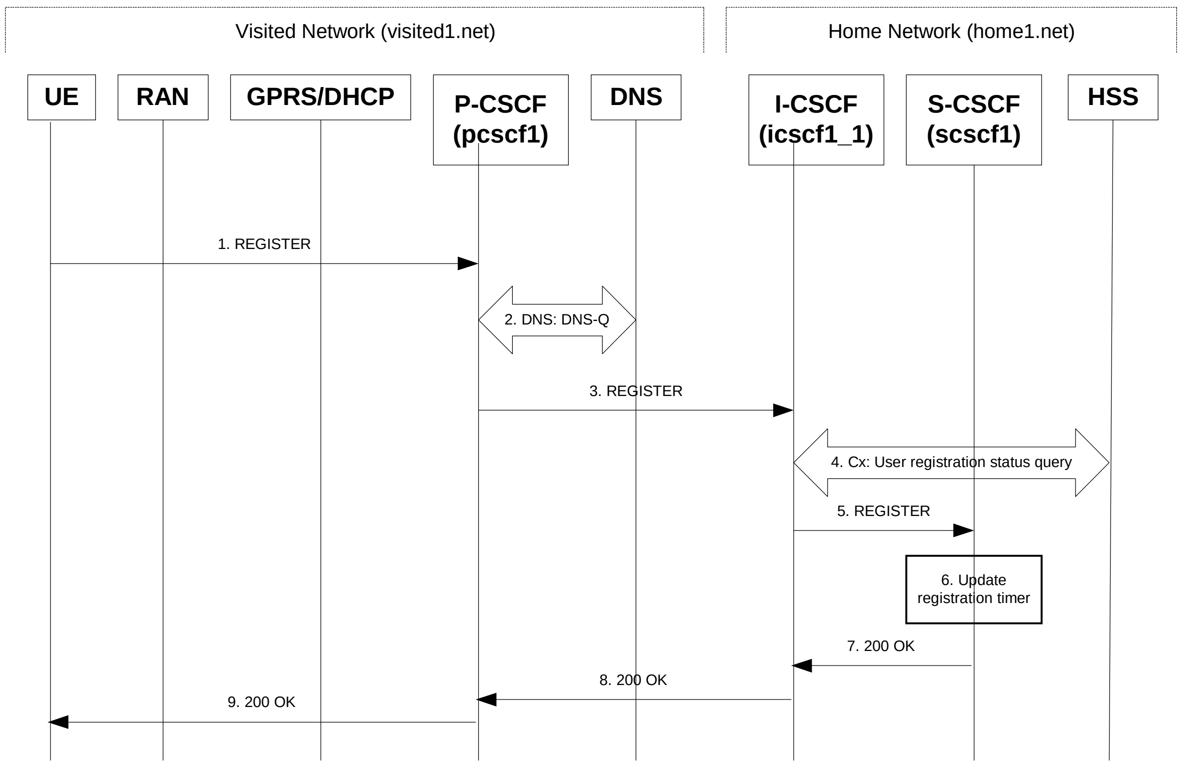


Figure 16.3-1: Reregistration when UE roaming

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

   The registration expires in the UE. The UE reregisters 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 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789; Port_U_UDP=1357; Port_U_TCP=1358
Required: sec-agree
CSeq: 3 REGISTER
Expires: 7200
Content-Length: 0
```

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

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

To: This indicates public user identity 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 identity (user1_private@home1.net) is carried in the username field of the Digest AKA protocol. As this is a re-registration process, the cached information (realm, nonce, algorithm, uri, response) is also sent.

Security-Client: The SPIs and port numbers both must be renewed for new SA usage.

NOTE 1: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

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.

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: DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs the DNS queries 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. **REGISTER request (P-CSCF to I-CSCF) – see example in table 16.3-3**

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

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

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1", integrity-
   protected="yes"
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.

~~Roaming-Info~~P-Visited-Network-ID: ~~The *vnid* parameter~~It contains the identifier of the P-CSCF network at the home network.

4. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. Because the user has registered, the HSS returns the I-CSCF with the S-CSCF address for the subscriber

For detailed message flows see 3GPP TS 29.228.

For the parameters in the REGISTER request (flow 3), which are sent to the HSS, see table 6.2-5a.

Table 6.3-4a provides the parameters in the SIP REGISTER request (flow 5), which are obtained from the information sent back from the HSS.

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

   This signalling flow forwards the 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 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
From:
To:
Contact:
Authorization:
Call-ID:
CSeq:
Expires:
Content-Length:
```

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

~~**Roaming-Info**~~**P-Visited-Network-ID:** ~~The *vnid* parameter~~It contains the identifier of the P-CSCF network at the home network.

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. **Update registration timer**

   As the REGISTER request arrived integrity protected, the S-CSCF does not need to challenge the user, but just update the registration timer to the value requested by the user (if the policy of the network allows it).

NOTE: The S-CSCF is allowed to challenge the user. If S-CSCF decides to challenge the user, the call flow will be similar to the one presented in section 16.2.

7. **200 OK response (S-CSCF to I-CSCF) – see example in Table 16.3-7**

   The S-CSCF sends acknowledgement 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 16.3-7 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-
   1111
Expires: 7200
Content-Length:
```

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

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

   The I-CSCF translates the S-CSCF name in the Path header. The I-CSCF forwards acknowledgement 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 16.3-8 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:token(scscf1.home1.net)>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

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

   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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

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

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

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.

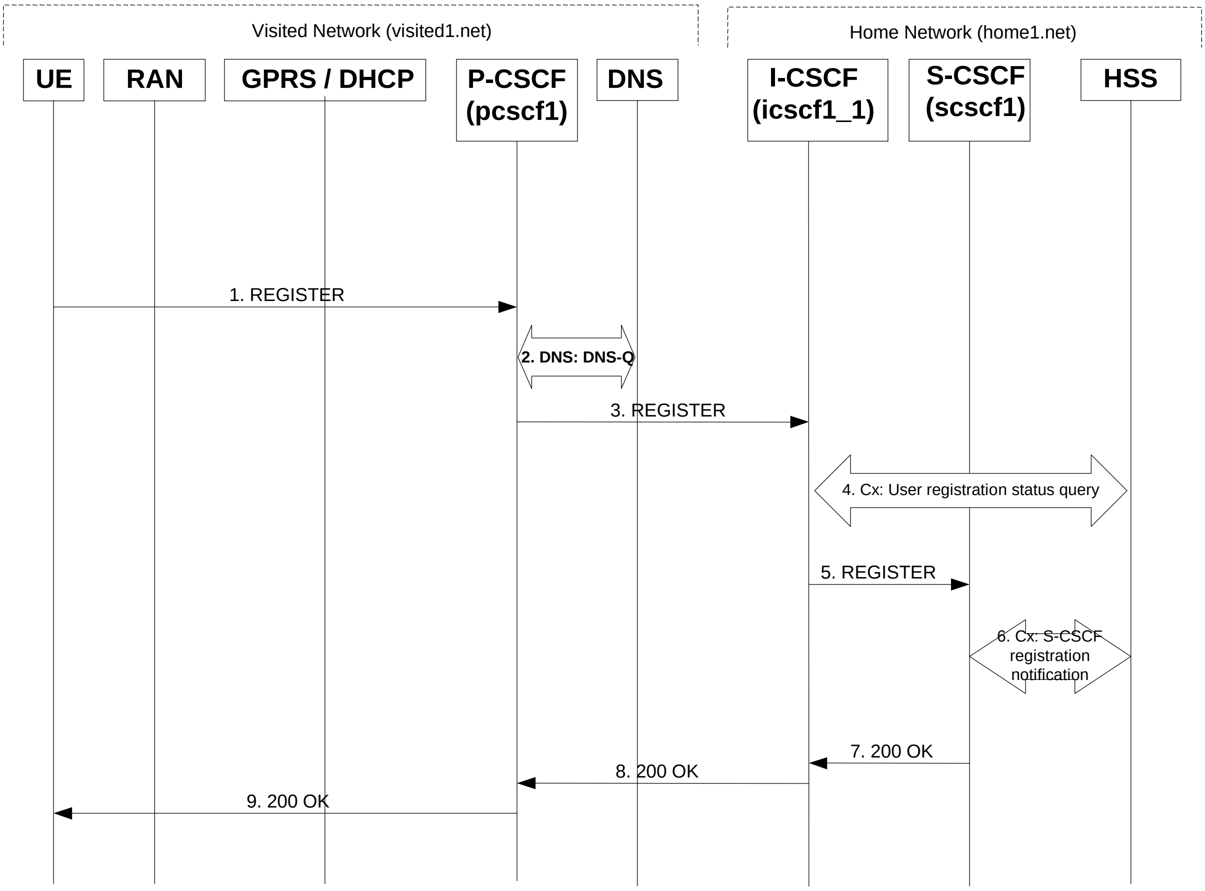


Figure 16.4-1: Registration signalling: mobile initiated deregistration

1. **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 reregister 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 REGISTER (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
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 public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

To: This indicates public user identity. 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 identity is carried in the usernamed field of the Digest AKA protocol. The deregistration process also includes the cached information (realm, nonce, algorithm, uri, response).

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

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

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

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-InfoP-Visited-Network-ID: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1", integrity-
   protected="yes"
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.

~~Roaming-Info~~P-Visited-Network-ID: ~~The *vnid* parameter~~It contains the identifier of the P-CSCF network at the home network.

4. **Cx: User registration status query procedure**

   The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. Because the user has registered, the HSS returns the I-CSCF with the S-CSCF address for the subscriber

   For detailed message flows see 3GPP TS 29.228.

   For the parameters in the SIP REGISTER request (flow 3) which are sent to the HSS, see table 6.2-5a.

   Table 6.3-4a provides the parameters in the SIP REGISTER request (flow 5) which are obtained from the information sent back from the HSS.

5. **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 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 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net> <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
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: S-CSCF registration notification procedure**

   The S-CSCF informs the HSS that the user is no longer registered and the S-CSCF either notifies the HSS to clear or requests to keep its location information for that subscriber. The HSS then either clears or keeps the S-CSCF name for that subscriber according to request. In both cases the state of the subscriber identity is stored as unregistered in the HSS and the S-CSCF. The HSS acknowledges the request.

   For detailed message flows see 3GPP TS 29.228.

   For the parameters in the SIP REGISTER request (flow 5), which are sent to the HSS, see table 6.2-7a.

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

   The S-CSCF sends acknowledgement 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 16.4-7 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To: <sip:user1_public1@home1.net>
Call-ID: apb03a0s09dkjdfglkj49111
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
CSeq: 3 REGISTER
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 0
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-
   1111
Content-Length: 0
```

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

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

   The I-CSCF forwards acknowledgement 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 16.4-8 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:token(scscf1.home1.net)>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

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

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

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

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

16.5 UE subscription for the registration state event package

This section describes the subscription procedure for the registration states event package, whereby the UE requests to be notified by the S-CSCF when the event has occurred. This is done using the information structure as indicated in 3GPP TS 24.229 [16].

It is assumed that the user has registered prior to initiating subscription of an event. Also, the subscriber is considered to be roaming and the home network has network configuration hiding active. For this example the trigger point at the UE for sending out the SUBSCRIBE request is the 200 OK response of the users registration.

Editor's Note: The interaction between the explicit subscription procedure for the `Event: registration-state event package` and the registration procedures needs further consideration. For example: What are the appropriate timer values of Expires header for these procedures considering the signalling is over the radio interface? What is the status of the ongoing explicit subscription procedure `(Event: registration-state event package)` when the registration timer has expired? etc.

Editor's Note: Further clarification with IETF on the setting of Request URI, Remote-Party-ID and To header has to be done. The values of these headers in the SUBSCRIBE and NOTIFY messages, as well as in their responses, as indicated in sections 16.5, 6.5, 16.6 and 6.6 of 24.228 has to be aligned to the outcome of this clarification.

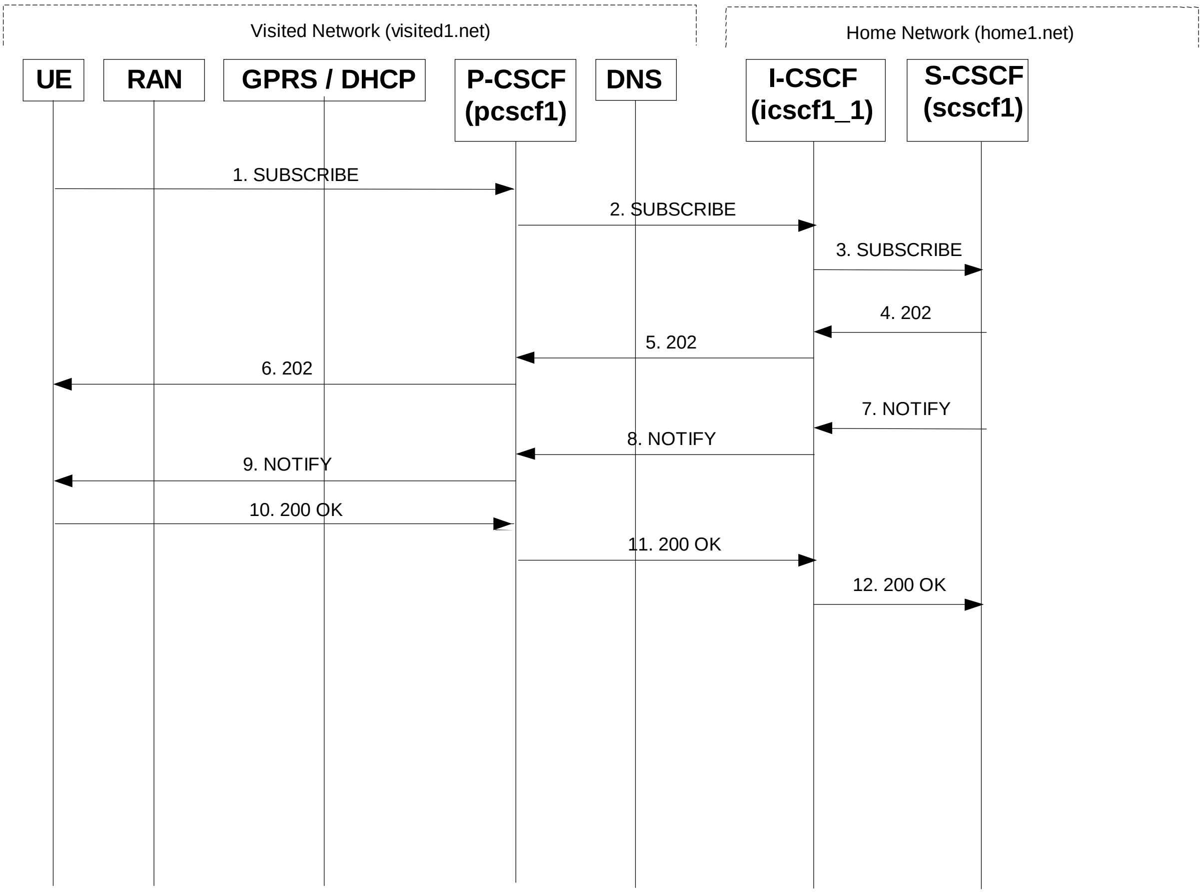


Figure 16.5-1: UE subscription for the registration state event package (with I-CSCF providing configuration independence)

1. **SUBSCRIBE request (UE to P-CSCF) – see example in table 16.5-1**

   The UE generates a SUBSCRIBE request in order to subscribe for the registration-state event package.

   The From and To fields both will contain the UE's public address.

Table 16.5-1 SUBSCRIBE request (UE to P-CSCF)

```
SUBSCRIBE sip:user1_public1@home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=31415
To: <sip: user1_public1@home1.net>
Call-ID: b89rjhnedlrfjflslj40a222
CSeq: 61 SUBSCRIBE
Event: registration-state
Expires: 7200
Accept: application/cpim-pidf+xml
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Content-Length: 0
```

Request URI: Public user identity whose events the subscriber subscribes to˝ . In this case the subscribing user and the monitored user are identical.

From: This field is populated with logical representation (FQDN) for the entity sending the SUBSCRIBE.

Event: This field is populated with the value 'registration-state' to specify the use of the presence package.

Accept: This field is populated with the value 'application/cpim-pidf+xml'.

To: Same as the Request-URI.

Contact: The contact information of the subscribing user.

2. **SUBSCRIBE request (P-CSCF to I-CSCF) – see example in table 16.5-2**

   P-CSCF looks up the serving network information for the public user identity that was stored during the registration procedure. The SUBSCRIBE request is forwarded to I-CSCF. A Route header is inserted into SUBSCRIBE request. The information for the Route header is taken from the path header as gathered during registration.

Table 16.5-2 SUBSCRIBE request (P-CSCF to I-CSCF)

```
SUBSCRIBE sip:icscf1_p.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip: token(scscf1.home1.net), sip:user1_public1@home1.net
Record-Route: sip:240f34.1@pcscf1.visited1.net
From:
To:
Call-ID:
CSeq:
Event:
Expires:
Accept:
Contact:
Content-Length:
```

Route: The Route: header is populated with the remaining elements from the Path header from Registration, with the initial Request-URI (received from the UE) appended as the final component.

3. **SUBSCRIBE (I-CSCF to S-CSCF) – see example in table 16.5-3**

   I-CSCF determines the S-CSCF name in the Route header field to retrieve the routing information. I-CSCF then forwards the SUBSCRIBE request to S-CSCF.

Table 16.5-3 SUBSCRIBE (I-CSCF to S-CSCF)

```
SUBSCRIBE sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:user1_public1@home1.net
Record-Route: sip:351g45.1@icscf1_p.home1.net, sip:240f34.1@pcscf1.visited1.net
From:
To:
Call-ID:
CSeq:
Event:
Expires:
Accept:
Contact:
Content-Length:
```

4. **202 Accepted response (S-CSCF to I-CSCF) – see example in table 16.5-4**

   The S-CSCF sends an acknowledgement towards the UE indicating that the subscription was successful. This response will traverse the path that the SUBSCRIBE request took as described in the Via list.

NOTE 1: If the S-CSCF can process the SUBSCRIBE request and send the NOTIFY request immediately, it can send a 200 OK response instead of a 202 Accepted response.

Table 16.5-4 202 Accepted response (S-CSCF to I-CSCF)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:332b23.1@scscf1.home1.net, sip:351g45.1@icscf1_p.home1.net,
   sip:240f34.1@pcscf1.visited1.net
From:
To: <sip:user1_public1@home1.net>;tag=151170
Call-ID:
CSeq:
Contact: sip:user1_public1@scscf1.home1.net
Event:
Expires:
Content-Length:
```

Expires: If value of the Expires header in SUBSCRIBE request is different from the one received in REGISTER method, then the value of Expires header in 202 Accepted is set to match the value of Expires header in REGISTER method.

Contact: This is populated with a identifier generated within the S-CSCF that will help it correlate refreshes for the SUBSCRIBE. It is assumed to be the public-id 'user1_public1' in this case.

5. **202 Accepted response (I-CSCF to P-CSCF) – see example in table 16.5-5**

   I-CSCF forwards 202 Accepted response to P-CSCF.

Table 16.5-5 202 Accepted response (I-CSCF to P-CSCF)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:token(scscf1.home1.net), sip:351g45.1@icscf1_p.home1.net,
   sip:240f34.1@pcscf1.visited1.net
From:
To:
Call-ID:
CSeq:
Event:
Contact: sip:token(user1_public1@scscf1.home1.net)Expires:
Content-Length:
```

6. **202 Accepted response (P-CSCF to UE) – see example in table 16.5-6**

   P-CSCF sends the response to UE.

Table 16.5-6 202 Accepted response (P-CSCF to UE)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Event:
Contact
Expires:
Content-Length:
```

7. **NOTIFY request (S-CSCF to I-CSCF) – see example in table 16.5-7**

   The S-CSCF sends a first NOTIFY request towards the UE in order to inform the UE about the registration status of the monitored user.

   In the example below, the NOTIFY specifies the following public user identities as registered (i.e. status=open): sip:user1_public1@home1.net, tel: +498972233114;

The following public user identity has been de-registered (i.e. status=closed) sip:user1_public2@home1.net. They are arranged in the preferred order of priority in this example.

The Route header is constructed from the information saved at registration.

Table 16.5-7 NOTIFY request (S-CSCF to I-CSCF)

```
NOTIFY sip:icscf1_p.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: sip:240f34.1@pcscf1.visited1.net, sip:[5555::aaa:bbb:ccc:ddd]
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID:
CSeq: 42 NOTIFY
Contact: sip:user1_public1@scscf1.home1.netExpires:
Event: registration-state
Content-Type: application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>open</basic></status>
        </tuple>

        <tuple name="sip:user1_public2@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

        <tuple name="tel:+498972233114">
          <status><basic>open</basic></status>
        </tuple>

      </presence>
```

From: The tag of this field matches that of the To; field in the received 200/202 for the SUBSCRIBE

Content-Type: Set to the value of the Accept: header received in the subscribe or 'application/cpim-pidf+xml' if Accept: was not present in the SUBSCRIBE:

The message body in the NOTIFY request that carries the subscriber's registration state is described as indicated in 3GPP TS 24.229 [16].

8. **NOTIFY request (I-CSCF to P-CSCF) – see example in table 16.5-8**

I-CSCF translates the S-CSCF address in the Via header and forwards NOTIFY to P-CSCF.

Table 16.5-8 NOTIFY request (I-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   token(scscf1.home1.net)
Max-Forwards: 69
Route: sip:[5555::aaa:bbb:ccc:ddd]
From:
To:
Call-ID:
Cseq:
Contact: sip:token(user1_public1@scscf1.home1.net)Expires:
Event:
Content-Type:
Content-Length:
```

9. **NOTIFY request (P-CSCF to UE) – see example in table 16.5-9**

P-CSCF sends NOTIFY to the user.

Table 16.5-9 NOTIFY request (P-CSCF to UE)

```
NOTIFY sip:[5555::aaa:bbb:ccc:ddd] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 68
From:
To:
Call-ID:
CSeq: Contact:
Expires:
Event:
Content-Type:
Content-Length:
```

10. **200 OK response (UE to P-CSCF) – see example in table 16.5-10**

    UE responds with 200 OK.

Table 16.5-10 200 OK response (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

11. **200 OK response (P-CSCF to I-CSCF) – see example in table 16.5-11**

    P-CSCF forwards the 200 OK to I-CSCF.

Table 16.5-11 200 OK response (P-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   token(scscf1.home1.net)
From:
To:
Call-ID:
CSeq:
Content-Length:
```

12. **200 OK response (I-CSCF to S-CSCF) – see example in table 16.5-12**

    I-CSCF determines the request and forwards response to S-CSCF. This confirms that notification is reached to the user.

Table 16.5-12 200 OK response (I-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

16.6 P-CSCF subscription for the registration state event package

This subclause describes the subscription procedure for the registration state event package, whereby the P-CSCF requests to be notified by the S-CSCF when the event has occurred. This is done using the 'registration-state' package.

It is assumed that the user has registered prior to initiating subscription of an event. Also, the subscriber is considered to be roaming and the home network has network configuration hiding active. For this example the trigger point at the P-CSCF for sending out the SUBSCRIBE request is the 200 OK response of the users registration.

Editor's Note: The interaction between the explicit subscription procedure for the `Event: registration-state event package` and the registration procedures needs further consideration. For example: What are the appropriate timer values of Expires header for these procedures considering the signalling is over the radio interface? What is the status of the ongoing explicit subscription procedure (`Event: registration-state event package`) when the registration timer has expired? etc.

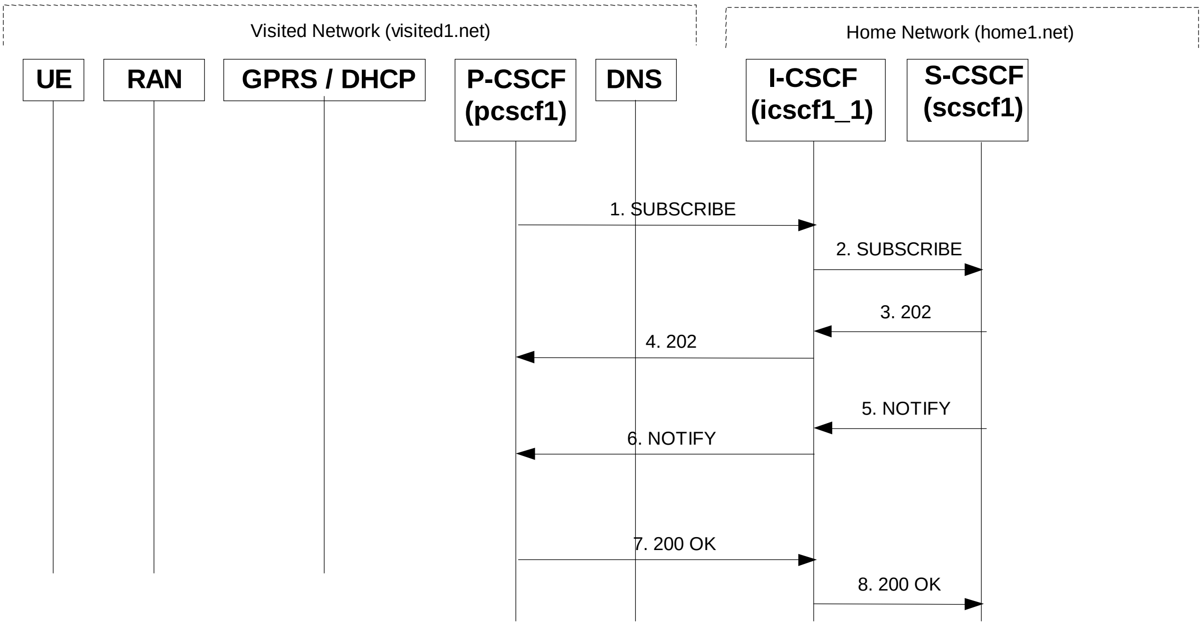


Figure 16.6-1: P-CSCF subscription for the registration state event package (with I-CSCF providing configuration independence)

1. **SUBSCRIBE request (P-CSCF to S-CSCF) – see example in table 16.6-1**

   The P-CSCF generates a SUBSCRIBE request in order to subscribe for the registration-state event package.

   The route is constructed from the monitored users path header as constructed during registration.

Table 16.6-1 SUBSCRIBE request (P-CSCF to I-CSCF)

```
SUBSCRIBE sip:icscf1_p.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 70
Route: sip:token(scscf1.home1.net)
From: <sip:pcscf1.visited1.net>;tag=31415
To: <sip:user1_public1@home1.net>
Call-ID: 223456789@pcscf1.visited1.net
CSeq: 61 SUBSCRIBE
Event: registration-state
Expires: 7200
Accept: application/cpim-pidf+xml
Contact: <sip:user1_public1%40home1.net@pcscf1.visited1.net>
Content-Length: 0
```

Request URI: The next hop on the route to the destination as recorded in the path information for the monitored user during registration.

Max-Forwards: Set to 70 by the P-CSCF and used to prevent loops.

Route: The token containing a representation of the S-CSCF allocated to this user, based on the registration information.

From: This header is populated with the SIP URI that identifies the P-CSCF.

To: The SIP-URI of the entity which provides information about the monitored users registration states. In this case this is the address of the registrar of user1_public1.

Contact: This is where the NOTIFY requests for this subscription will be sent. It consists of the SIP URL-escaped public user identity at the P-CSCF.

Event: This field shall be set to the value 'registration-state' to specify the use of the registration-state package

Accept: This field shall be set to the value 'application/cpim-pidf+xml'.

2. **SUBSCRIBE (I-CSCF to S-CSCF) – see example in table 16.6-2**

   I-CSCF determines the S-CSCF name in the Route header field to retrieve the routing information. I-CSCF then forwards the SUBSCRIBE request to S-CSCF.

Table 16.6-2 SUBSCRIBE (I-CSCF to S-CSCF)

```
SUBSCRIBE sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 69
Record-Route: sip:351g45.1@icscf1_p.home1.net
From:
To:
Call-ID:
CSeq:
Event:
Expires:
Accept:
Contact:
Content-Length:
```

Record-Route: The ICSCF adds a route header as it wants to stay on the routing path for network hiding purposes.

3. **202 Accepted response (S-CSCF to I-CSCF) – see example in table 16.6-3**

   The S-CSCF sends an acknowledgement towards the P-CSCF indicating that the subscription was successful. This response will traverse the path that the SUBSCRIBE request took as described in the Via list.

NOTE 1: If the S-CSCF can process the SUBSCRIBE request and send the NOTIFY request immediately, it can send a 200 OK response instead of a 202 Accepted response.

Table 16.6-3 202 Accepted response (S-CSCF to I-CSCF)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1
Record-Route: sip:332b23.1@scscf1.home1.net, sip:351g45.1@icscf1_p.home1.net,
   sip:240f34.1@pcscf1.visited1.net
From:
To: <sip:user1_public1@home1.net>;tag=151170
Call-ID:
CSeq:
Contact: sip:user1_public1@scscf1.home1.netEvent:
Expires:
Content-Length:
```

4. **202 Accepted response (I-CSCF to P-CSCF) – see example in table 16.6-4**

   I-CSCF forwards 202 Accepted response to P-CSCF.

Table 16.6-4 202 Accepted response (I-CSCF to P-CSCF)

```
SIP/2.0 202 Accepted
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Record-Route: sip:token(scscf1.home1.net), sip:351g45.1@icscf1_p.home1.net
From:
To:
Call-ID:
CSeq:
Contact: sip:token(user1_public1@scscf1.home1.net)Event:
Expires:
Content-Length:
```

5. **NOTIFY request (S-CSCF to I-CSCF) – see example in table 16.6-5**

The S-CSCF sends a first NOTIFY request towards the P-CSCF in order to inform the P-CSCF about the registration status of the monitored user.

The Route header is constructed from the Record-Route header as constructed during subscription.

Table 16.6-5 NOTIFY request (S-CSCF to I-CSCF)

```
NOTIFY sip:user1_public1%40home1.net@pcscf1.visited1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: sip:240f34.1@pcscf1.visited1.net
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:user1_public1@pcscf1.visited1.net>;tag=31415
Call-ID:
CSeq: 42 NOTIFY
Contact: sip:user1_public1@scscf1.home1.netExpires:
Event: registration-state
Content-Type: application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:">

        <tuple name="sip:user1_public1@home1.net">
          <status><basic>closed</basic></status>
        </tuple>

</presence>
```

Request-URI: The contents are the same as the Contact header in the SUBSCRIBE.

From: The tag of this field matches that of the To; field in the received 200/202 for the SUBSCRIBE

Content-Type: Set to the value of the Accept: header received in the subscribe or 'application/cpim-pidf+xml' if Accept: was not present in the SUBSCRIBE

The message body in the NOTIFY request that carries the subscriber's registration state is described as indicated in 3GPP TS 24.229 [16].

6. **NOTIFY request (I-CSCF to P-CSCF) – see example in table 16.6-6**

I-CSCF translates the S-CSCF address in the Via header and forwards NOTIFY to P-CSCF.

Table 16.6-6 NOTIFY request (I-CSCF to P-CSCF)

```
NOTIFY sip:user1_public1%40home1.net@pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   token(scscf1.home1.net)
Max-Forwards: 69
From:
To:
Call-ID:
Cseq:
Contact:
Expires:
Event:
Content-Type:
Content-Length:
```

7. **200 OK response (P-CSCF to I-CSCF) – see example in table 16.6-7**

   P-CSCF forwards the 200 OK to I-CSCF.

Table 16.6-7 200 OK response (P-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   token(scscf1.home1.net)
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **200 OK response (I-CSCF to S-CSCF) – see example in table 16.6-8**

   I-CSCF determines the request and forwards response to S-CSCF. This confirms that notification is reached to the user.

Table 16.6-8 200 OK response (I-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

16.7 Notifying of the network initiated deregistration event (not provided)

16.8 Network initiated re-authentication

This subclause describes the notification that occurs when the S-CSCF assigned to that user requests re-authentication in the case where the users home network provides network configuration hiding.

It is assumed that user has registered and also subscribed to the registration state event before. Also, the subscriber is considered to be roaming and the home network operator does not desire to keep its internal configuration hidden from the visited network.

After this procedure the users UE might automatically initiated re-registration procedures. If the user fails to re-register the public user id for which re-authentication was requested, the public user id may be de-registered by S-CSCF.

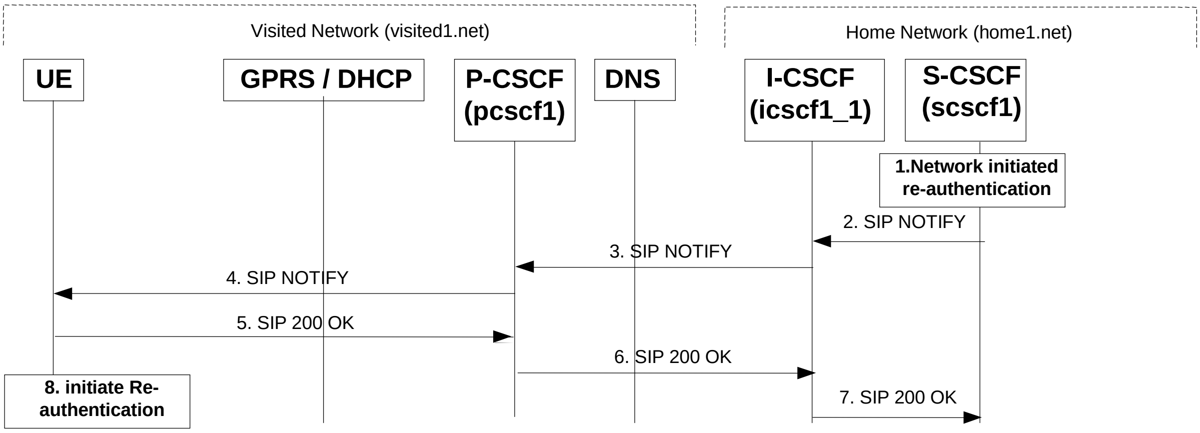


Figure 16.8-1: S-CSCF informs UE that network initiated re-authentication is needed (with I-CSCF providing configuration independence)

1. **Network initiated re-authentication (S-CSCF)**

   The network-initiated re-authentication event for the private user identity user occurs at the S-CSCF. As the user has subscribed to the registration state event package this is the trigger point for the S-CSCF to notify the user about the event occurrence.

2. **SIP NOTIFY request (S-CSCF to I-CSCF) – see example in table 16.8-2**

   The S-CSCF sends a NOTIFY request towards the UE in order to inform the UE about the occurrence of the network initiated re-authentication event.

   The Route header is constructed from the information saved at registration.

Table 16.8-2 SIP NOTIFY request (S-CSCF to I-CSCF)

```
NOTIFY sip:icscf1_p.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: sip:240f34.1@pcscf1.visited1.net, sip:[5555::aaa:bbb:ccc:ddd]
Remote-Party-ID:
From: <sip:user1_public1@home1.net>;tag=151170
To: <sip:user1_public1@home1.net>;tag=31415
Call-ID: 223456789@[5555::aaa:bbb:ccc:ddd]
CSeq: 43 NOTIFY
Expires: 7200
Event: registration-state
Content-Type:  application/cpim-pidf+xml
Content-Length: (...)

<presence xmlns="urn:ietf:params:xml:ns:cpim-pidf:"
     xmlns:registration="urn:ietf:params:xml:ns:cpim-pidf:registration">

        <tuple name="sip:user1_public1@home1.net">
          <status>
     <basic>open</basic>
     <registration>re-authenticate</registration>
     </status>
        </tuple>
      </presence>
```

From: The tag of this field matches that of the To; field in the received 200/202 for the SUBSCRIBE

Content-Type: Set to the value of the Accept: header received in the subscribe or 'application/cpim-pidf+xml' if Accept: was not present in the SUBSCRIBE

The message body in the NOTIFY request that carries the subscriber's registration state is described as indicated in 3GPP TS 24.229 [16].

3. **SIP NOTIFY request (I-CSCF to P-CSCF) – see example in table 16.8-3**

I-CSCF translates the S-CSCF address in the Via header and forwards NOTIFY to P-CSCF.

Table 16.8-3 SIP NOTIFY request (I-CSCF to P-CSCF)

```
NOTIFY sip:pcscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP token(SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1)
Max-Forwards: 69
Route: sip:[5555::aaa:bbb:ccc:ddd]
Remote-Party-ID:
From:
To:
Call-ID:
Cseq:
Expires:
Event:
Content-Type:
Content-Length:
```

4. **SIP NOTIFY request (P-CSCF to UE) – see example in table 16.8-4**

   P-CSCF sends NOTIFY to the user.

Table 16.8-4 SIP NOTIFY request (P-CSCF to UE)

```
NOTIFY sip:[5555::aaa:bbb:ccc:ddd] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Max-Forwards: 68
From:
To:
Call-ID:
CSeq: Expires:
Event:
Content-Type:
Content-Length:
```

5. **SIP 200 OK response (UE to P-CSCF) – see example in table 16.8-5**

   UE responds with 200 OK.

Table 16.8-5 SIP 200 OK response (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **SIP 200 OK response (P-CSCF to I-CSCF) – see example in table 16.8-6**

   P-CSCF forwards the 200 OK to I-CSCF.

Table 16.8-6 SIP 200 OK response (P-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP token(SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

7. **SIP 200 OK response (I-CSCF to S-CSCF) – see example in table 16.8-7**

I-CSCF determines the request and forwards response to S-CSCF. This confirms that notification is reached to the user.

Table 16.8-7 SIP 200 OK response (I-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length:
```

8. **Re-authentication (UE)**

The UE shall now initiate the re-authentication procedures.

16.9 Registration error conditions

16.9.1 Reregistration – failure of reregistration

This signalling flow (see figure 16.9.1-1) is a continuation of the signalling flow in subclause 16.3 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.

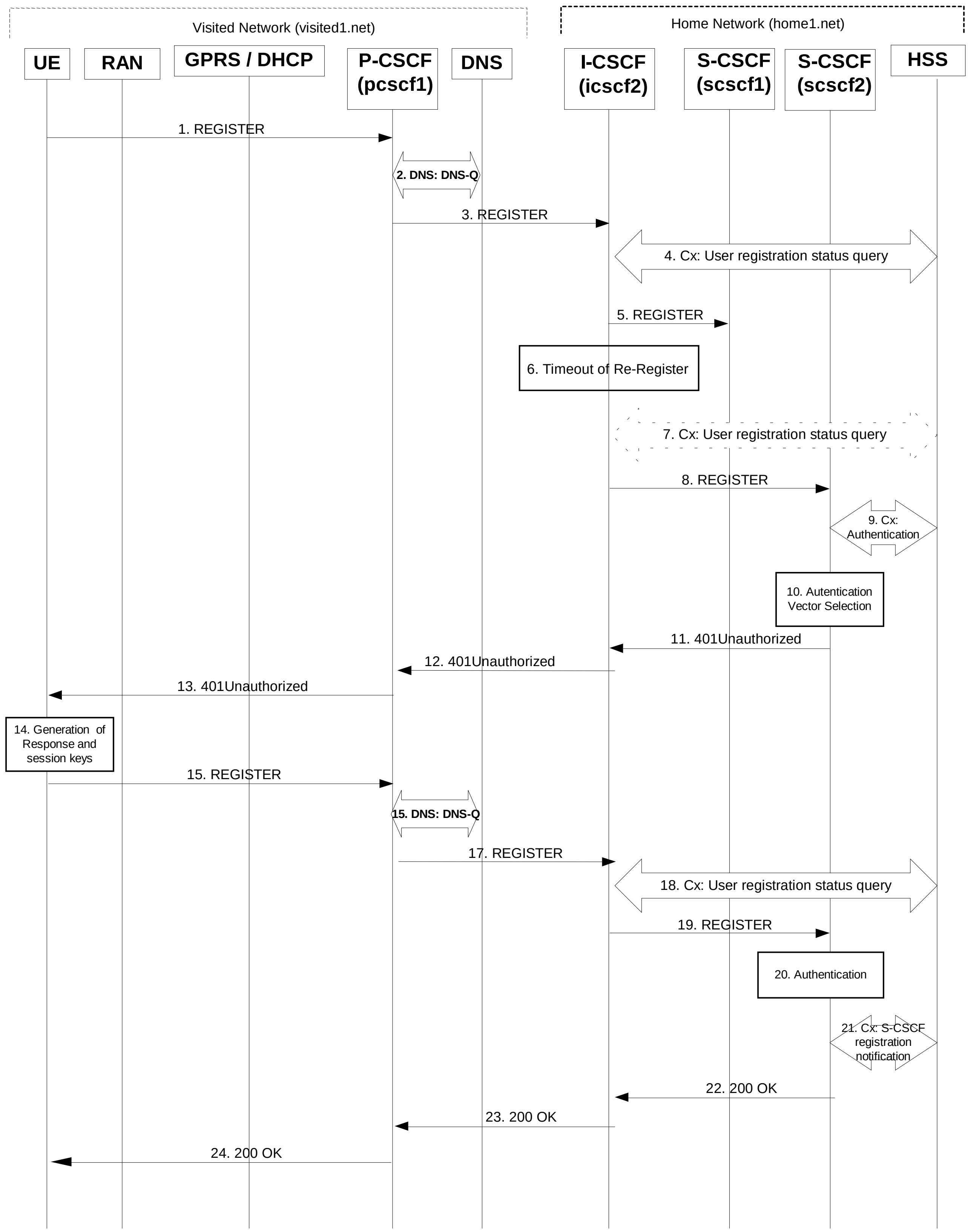


Figure 16.9.1-1: Failure of previous S-CSCF during reregistration

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

5 **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.9.1-5**

This signalling flow forwards the 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 16.9.1-5 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
~~Roaming-Info~~P-Visited-Network-ID: ~~vnid=~~"Visited Network Number 1"
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
   nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
   uri="sip:registar.home1.net", response="0a1b04c89e54f09ab45e84d30e29f83a", integrity-
   protected="yes"
CSeq: 10 REGISTER
Expires: 7200
Content-Length: 0
```

6 **Timeout of reregister**

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: User registration status 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 **REGISTER (I-CSCF to S-CSCF) – see example in table 16.9.1-8**

This signalling flow forwards the 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 16.9.1-8 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf2.home1.net SIP/2.0
Via:
Via:
Via:
Max-Forwards: 67
Path:
Path:
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
From:
To:
Contact:
Call-ID:
Authorization:
CSeq:
Expires:
Content-Length:
```

The next ten steps (9 to18) are the same as in the normal reregistration case (steps 6 to 12 in subclause 16.3).

19. **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.9.1-9**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 16.9.1-9 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf2.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-InfoP-Visited-Network-ID:
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.

The remaining steps (20-25) are the same as in the normal reregistration case (steps 17-22 in subclause 16.3)

17 Signalling flows for session initiation (hiding)

3GPP TSG-CN1 Meeting #25 | ***Tdoc*** ⌘ N1-021712
Helsinki, Finland, 29 July to 2 Aug 2002

CR-Form-v7

CHANGE REQUEST

⌘ **24.228 CR 070** ⌘ **rev** **-** ⌘ Current version: **5.1.0** ⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [ ]

Title: ⌘	CallID of REGISTER requests		
Source: ⌘	Nokia		
Work item code: ⌘	IMS-CCR	***Date:*** ⌘	2002-07-22
Category: ⌘	**F**	***Release:*** ⌘	5
	Use one of the following categories: ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)*

Reason for change: ⌘	The CallID has to be the same in the initial and protected REGISTER
Summary of change: ⌘	The CallID of the second REGISTER is changed to be the same as the one used by the first REGISTER
Consequences if not approved: ⌘	AKA mechanism would be broken

Clauses affected: ⌘				
	Y	**N**		
Other specs affected: ⌘		**X**	Other core specifications ⌘	
		X	Test specifications	
		X	O&M Specifications	
Other comments: ⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

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. This flow also shows the authentication of the private user identity. In this signalling flow, the home network does not have network configuration hiding active.

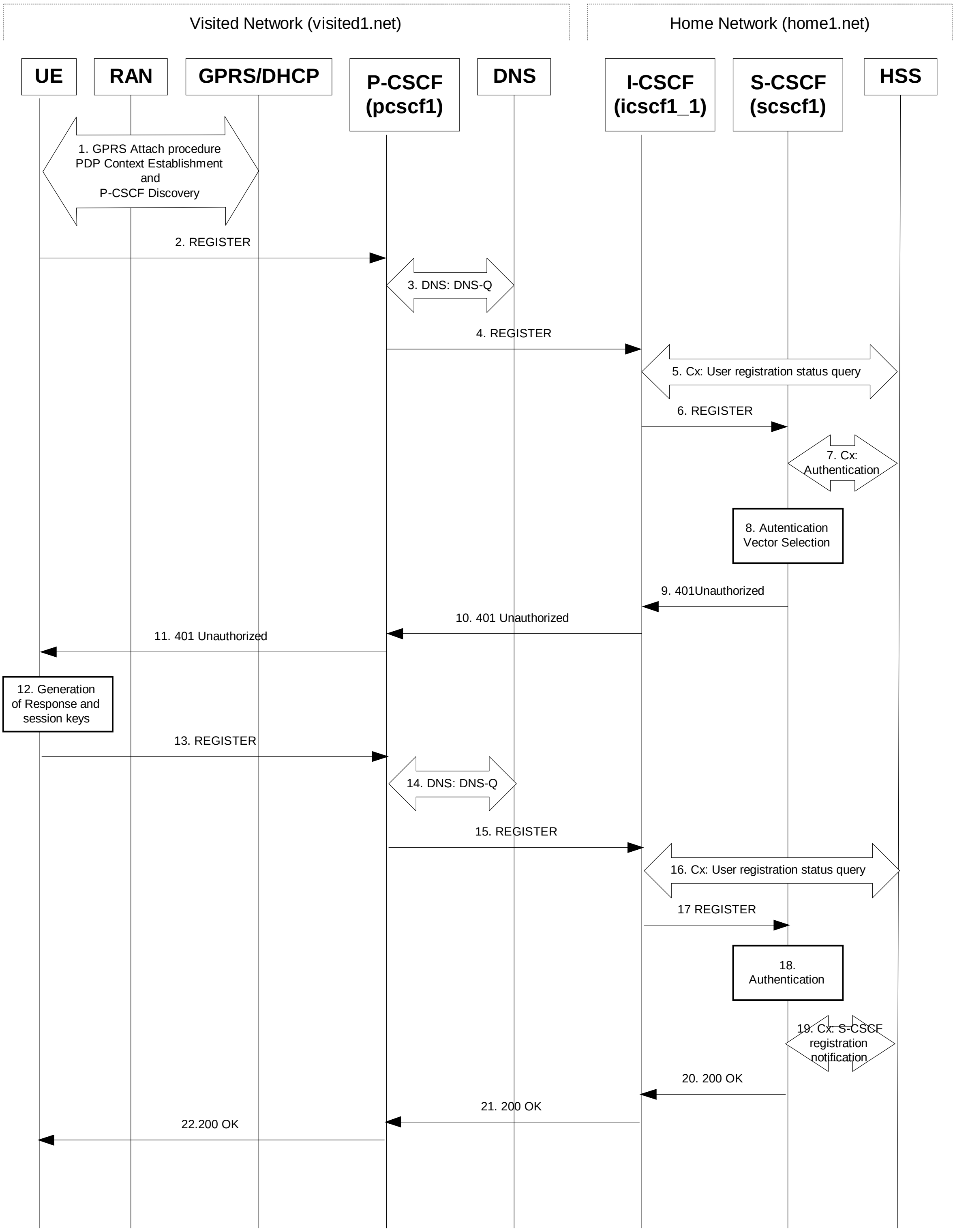


Figure 6.2-1: Registration signalling: user not registered

1. **GPRS Attach / PDP Context Establishment and P-CSCF Discovery (UE to GPRS)**

This signalling flow is shown to indicate prerequisites for the registration signalling.

See subclause 5.2 for details.

2. **REGISTER request (UE to P-CSCF) – see example in table 6.2-2**

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 6.2-2: REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response=""
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789; Port_U_UDP=1357;
Port_U_TCP=1358
Require: sec-agree
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 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.

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

Max-Forwards: Set to 70 by the UE and used to prevent loops.

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

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

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 and S-CSCF.

Authorization: It carries authentication information. The private user identity (user1_private@home1.net) is carried in theusername field of the Digest AKA protocol. The uri parameter (directive) contains the same value as the Request-URI. The realm parameter (directive) contains the network name where the username is authenticated. The Request-URI and the realm parameter (directive) value are obtained from the same field in the USIM and therefore, are identical. In this example, it is assumed that a new UICC card was just inserted into the terminal, and there is no other cached information to send. Therefore, nonce and response parameters (directives) are empty.

Security-Client: lists the supported algorithm(s) by the UE. It encapsulates the detail of each mechanism to be negotiated.

SPI value is the UE's SA_ID. Two SA_IDs are inserted, one for the SA using transport UDP, the other for TCP. The UE needs to choose the SA_IDs in such a way that those uniquely identify the inbound SAs at the UE.

Port_U_UDP and Port_U_TCP contain the port number the UE would like receive the SA protected messages.

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

3. **DNS: DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs the DNS queries 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 REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port number are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.2-3a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.2-3b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 6.2-3c: DNS: 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 RFC 2782 [4].

Table 6.2-3d: 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_p.home1.net
                                        0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

4. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.2-4**

The P-CSCF needs to be in the path for all mobile originated and mobile terminated requests for this user. To ensure this, the P-CSCF adds itself to the Path header value for future requests.

The P-CSCF binds the public user identity under registration to the Contact header supplied by the user.

The P-CSCF adds also the Roaming-Info header (if not present). The P-CSCF adds the *vnid* parameter with the contents of the identifier of the P-CSCF network. This may be the visited network domain name or any other identifier that identifies the visited network at the home network.

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

P-CSCF removes the Security-Client and Require: sec-agree headers prior to forwarding the message.

Table 6.2-4: REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response="", integrity-protected="no"
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.

Roaming-Info: The *vnid* parameter contains the identifier of the P-CSCF network at the home network.

5. **Cx: User registration status query procedure**

The I-CSCF makes a request for information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-5a provides the parameters in the REGISTER request (flow 4) which are sent to the HSS.

Table 6.2-5a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description

I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	Roaming Info: vnid	This information indicates the network identifier of the visited network

6. **REGISTER request (I-CSCF to S-CSCF) – see example in table 6.2-6**

I-CSCF does not modify the Path header.

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 6.2-6: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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 may set its SIP registration timer for this UE to the Expires time in this request or the S-CSCF may assign another registration timer for this registration

7. **Cx: Authentication procedure**

As the REGISTER request arrived without integrity protection to the P-CSCF, the S-CSCF shall challenge it. For this, the S-CSCF requires at least one authentication vector to be used in the challenge to the user. If a valid AV is not available, then the S-CSCF requests at least one AV from the HSS.

The S-CSCF indicates to the HSS that it has been assigned to serve this user.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-7a provides the parameters in the REGISTER request (flow 6) which are sent to the HSS.

Table 6.2-7a Cx: S-CSCF authentication information procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.

	S-CSCF Name	Request-URI:	This information element contains the name of the S-CSCF. The presence of this IE indicates that the user has not been authenticated yet by the S-CSCF

8. **Authentication vector selection**

The S-CSCF selects an authentication vector for use in the authentication challenge. For detailed description of the authentication vector, see 3GPP TS 33.203.

NOTE 1: The authentication vector may be of the form as in 3GPP TS 33.203 (if IMS AKA is the selected authentication scheme):

- AV = $RAND_n||AUTN_n||XRES_n||CK_n||IK_n$ where:
  - RAND: random number used to generate the XRES, CK, IK, and part of the AUTN. It is also used to generate the RES at the UE.
  - AUTN: Authentication token (including MAC and SQN).
  - XRES: Expected (correct) result from the UE.
  - CK: Cipher key (optional).
  - IK: Integrity key.

9. **401 Unauthorized response (S-CSCF to I-CSCF) - see example in table 6.2-9**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.2-9: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID: apb03a0s09dkjdfglkj49111
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
                 data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
                 ck="ffeeddccbbaa11223344556677889900"
CSeq: 1 REGISTER
Content-Length: 0
```

WWW-Authenticate: The S-CSCF challenges the user. The nonce includes the quoted string, base64 encoded value of the concatenation of the AKA RAND, AKA AUTN and server specific data. The S-CSCF appends also the Integrity Key (IK) and the Cyphering key (CK).

NOTE 2: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

10. **401 Unauthorized response (I-CSCF to P-CSCF) - see example in table 6.2-10**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.2-10: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
```

```
Content-Length:
```

11. **401 Unauthorized response (P-CSCF to UE) - see example in table 6.2-11**

The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 6.2-11: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
                data), algorithm=AKAv1-MD5
Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

Security-Server: q is the preference value, 0.1 means IPsec is the first preferred choice. The q value represents only relative degradation of all mechanisms listed here. The lower value, the higher prority.

12. **Generation of response and session keys at UE**

Upon receiving the Unauthorised response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

13. **REGISTER request (UE to P-CSCF) - see example in table 6.2-13**

Table 6.2-13 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111~~apb03a0s09dkjdfglkj49112~~
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
             nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
             uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
CSeq: 2 REGISTER
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 11 along with the private user identity, the realm, the nonce, the URI and the algorithm.

This message is protected by the IPsec SA negotiated.

14. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port number are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.2-14a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.2-14b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by an DNS SRV lookup according to RFC 2782 [4].

Table 6.2-14c DNS: 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 RFC 2782 [4].

Table 6.2-14d 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_p.home1.net
                                        0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

15. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.2-15**

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

Table 6.2-15 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
```

```
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
             nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
             uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1", integrity-
             protected="yes"
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.

16. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF name which was previously selected in step 5 (Cx: User registration status query procedure).

For detailed message flows see 3GPP TS 29.228.

Table 6.2-16a provides the parameters in the REGISTER request (flow 15), which are sent to the HSS.

Table 6.2-16a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	Roaming-Info: vnid	This information indicates the network identifier of the visited network

17. **REGISTER request (I-CSCF to S-CSCF) - see example in table 6.2-17**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF.

Table 6.2-17: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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.

18. **Authentication**

Upon receiving an integrity protected REGISTER request carrying the authentication response, RES, the S-CSCF checks that the user's active, XRES matches the received RES. If the check is successful then the user has been authenticated and the public user identity is registered in the S-CSCF.

19. **Cx: S-CSCF registration notification procedure**

On registering a user the S-CSCF informs the HSS that the user has been registered at this instance. Upon being requested by the S-CSCF , the HSS will also include the user profile in the response sent to the S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-19a provides the parameters in the REGISTER request (flow 17), which are sent to the HSS.

Table 6.2-19a Cx: S-CSCF registration notification procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	S-CSCF name	Request-URI:	This information indicates the serving CSCF's name of that user

20. **200 OK response (S-CSCF to I-CSCF) - see example in table 6.2-20**

The S-CSCF sends acknowledgement to the I-CSCF indicating that Registration was successful.

Table 6.2-20: 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 7200
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-1111
Content-Length:
```

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

21. **200 OK response (I-CSCF to P-CSCF) - see example in table 6.2-21**

The I-CSCF forwards acknowledgement from the S-CSCF to the P-CSCF indicating that Registration was successful.

Table 6.2-21: 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
```

```
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

22. **200 OK response (P-CSCF to UE) - see example in table 6.2-22**

    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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

Table 6.2-22: 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

6.9.3 Registration failure – user authentication failure

This clause (see figure 6.9.3-1) shows the signalling flow with user authentication failure at step 19 of subclause 6.2 "Signalling flows for REGISTER" and a final failure of the authentication at step 30.

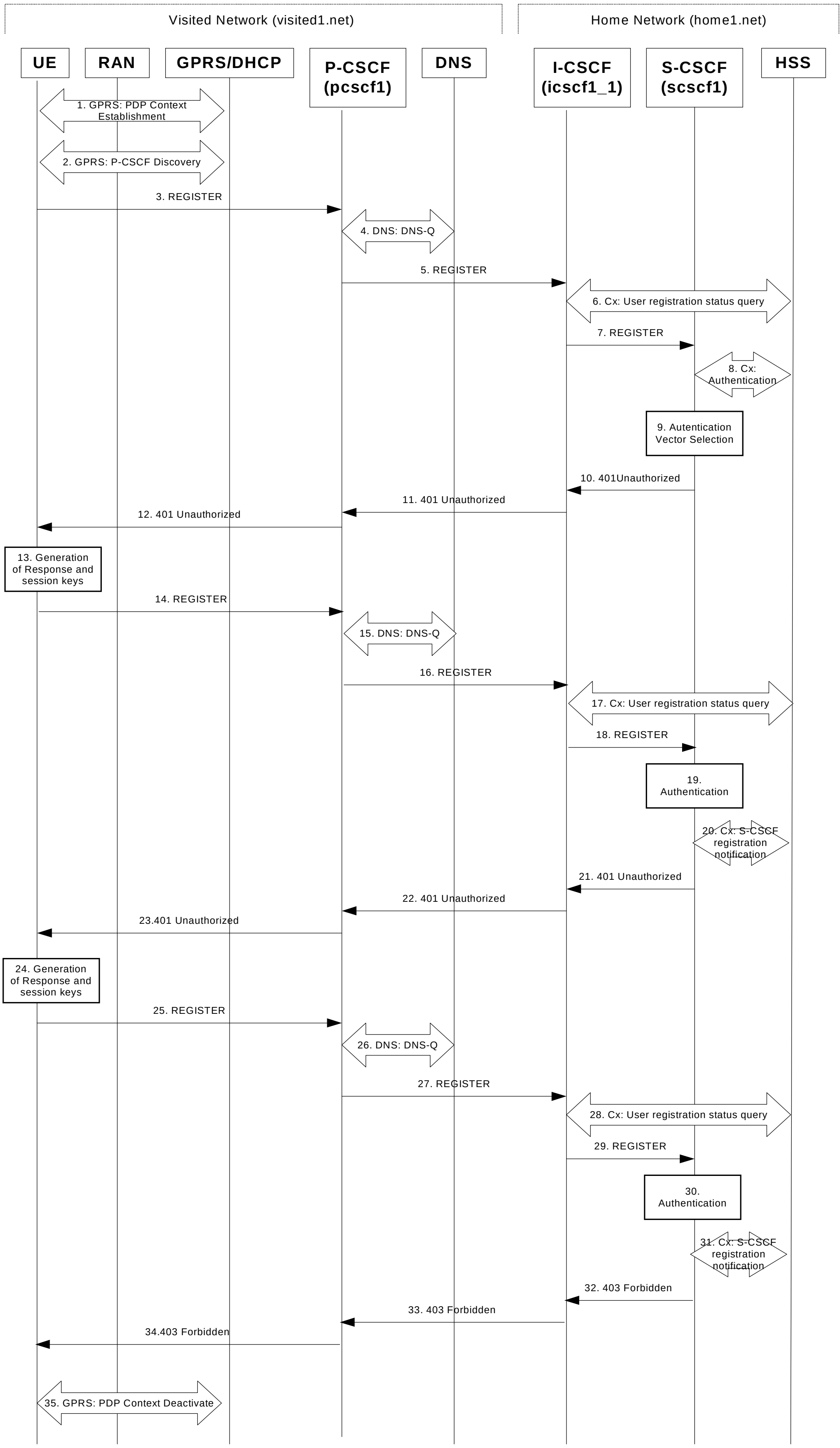


Figure 6.9.3-1: User Authentication Failure

Steps 1 through 18 are the same as the signalling flow in subclause 6.2.

19. **Authentication: User authentication fails**

Upon receiving the REGISTER request carrying the authentication response, RES, the S-CSCF checks that the user's active, XRES matches the received RES. If the check is unsuccessful then this authentication challenge fails and the public user identity is not yet registered in the S-CSCF.

At this point the S-CSCF has the option of repeating a number of authentication challenges as given in step 19 through 29. For the purposes of this flow, only one repetition is shown.

20. **Cx. SCGF registration notification**

The S-CSCF selects new authentication vectors as specified in step 9, either from the list already within the S-CSCF, or by requesting new vectors from the HSS.

21. **401 Unauthorized response (S-CSCF to I-CSCF) - see example in table 6.9.3-21**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.9.3-21: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID: apb03a0s09dkjdfglkj49111
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
                data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
                ck="ffeeddccbbaa11223344556677889900"
CSeq: 2 REGISTER
Content-Length: 0
```

NOTE: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="AY+3fUYo021Qi1Mnv3C6qAzEp4502"

22. **401 Unauthorized response(I-CSCF to P-CSCF) - see example in table 6.9.3-22**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.9.3-22: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
Content-Length:
```

23. **401 Unauthorized response (P-CSCF to UE) - see example in table 6.9.3-23**

The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 6.9.3-23: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
                data), algorithm=AKAv1-MD5
```

```
Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

24. **Generation of response and session keys at UE**

Upon receiving the Unauthorised response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

25. **REGISTER request (UE to P-CSCF) - see example in table 6.9.3-25**

Table 6.9.3-25: REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111~~apb03a0s09dkjdfglkj49112~~
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
             nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
             uri="sip:registrar.home1.net", response="0a1b04c89e54f09ab45e84d30e29f83a"
Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
CSeq: 3 REGISTER
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 12 along with the private user identity, the realm, the nonce, the URI and the algorithm.

26. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.9.3-26a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.9.3-26b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 6.9.3-26c: DNS: 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 RFC 2782 [4].

Table 6.9.3-26d: 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_p.home1.net
                                        0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

27. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.9.3-27**

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

Table 6.9.3-27: REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
               nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
               uri="sip:registrar.home1.net", response="0a1b04c89e54f09ab45e84d30e29f83a",
               integrity-protected="yes"
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.

28. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.9.3-28a provides the parameters in the REGISTER request (flow 5) which need to be sent to HSS.

Table 6.9.3-28a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	Roaming-Info: vnid	This information indicates the network identifier of the visited network

29. **REGISTER request (I-CSCF to S-CSCF) - see example in table 6.9.3-29**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 6.9.3-29: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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.

30. **Authentication**

Upon receiving the REGISTER request carrying the authentication response, RES, the S-CSCF checks that the user's active, XRES matches the received RES. If the check is unsuccessful, and no more authentication challenges are to be made, then the authentication has failed and the public user identity is not registered in the S-CSCF.

31. **Cx: S-CSCF registration notification procedure**

Upon user authentication failure the S-CSCF informs the HSS that the user has not been registered at this instance. The HSS clears the S-CSCF name for that subscriber.

For detailed message flows see 3GPP TS 29.229.

Table 6.9.3-31 provides the parameters in the REGISTER request (flow 18) which need to be sent to HSS.

Table 6.9.3-31 Cx: S-CSCF registration notification procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description

S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	S-CSCF name	Request-URI:	This information indicates the serving CSCF's name of that user

32. **403 Forbidden response (S-CSCF to I-CSCF) - see example in table 6.9.3-32**

The S-CSCF sends an 403 Forbidden response to the I-CSCF indicating that authentication failed. No security parameters are included in this message.The S-CSCF will insert a warning header in the response, indicating to the UE the reason of refusing the Registration request. The Warning header will contain the name of the network inserting the warning header (warn-agent = home1.net) and in addition it may contain a warn-text.The warn-code inserted into the Warning header is 399.

Table 6.9.3-32: 403 Forbidden (S-CSCF to I-CSCF)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Authentication failed"
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID: apb03a0s09dkjdfglkj49111
CSeq: 3 REGISTER
Content-Length: 0
```

33. **403 Forbidden response (I-CSCF to P-CSCF) - see example in table 6.9.3-33**

The I-CSCF forwards the 403 Forbidden response from the S-CSCF to the P-CSCF indicating that authentication was unsuccessful.

Table 6.9.3-33: 403 Forbidden response (I-CSCF to P-CSCF)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Authentication failed"
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **403 Forbidden response (P-CSCF to UE) - see example in table 6.9.3-33**

The P-CSCF forwards the 403 Forbidden response to the UE.

Table 6.9.3-34: 403 Forbidden response (P-CSCF to UE)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Warning: 399 home1.net "Authentication failed"
From:
To:
Call-ID:
CSeq:
Content-Length:
```

35. **PDP Context Deactivate**

On receiving the 403 Forbidden response the UE ceases registration and authentication attempts. In this case, if the PDP context on which the SIP signalling was being conducted is not being used for other purposes, the UE deactivates the signalling PDP context.

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. This flow also shows the authentication of the private user identity. In this signalling flow, the home network has network configuration hiding active.

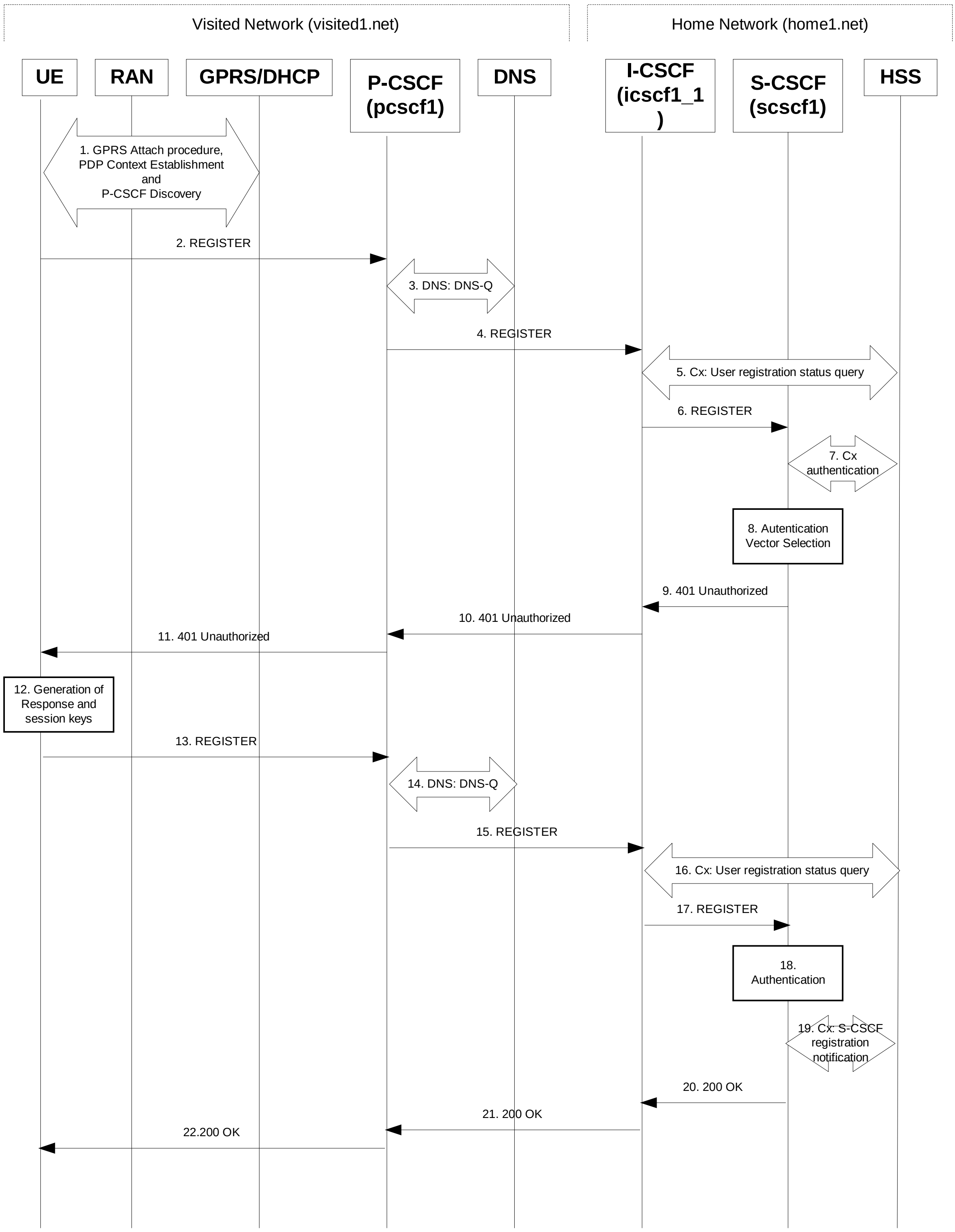


Figure 16.2-1: Registration when UE roaming

1. **GPRS Attach / PDP Context Establishment and P-CSCF Discovery (UE to GPRS)**

This signalling flow is shown to indicate prerequisites for the registration signalling.

See subclause 5.2 for details.

2. **REGISTER request (UE to P-CSCF) – see example in table 16.2-2**

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 16.2-2 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response=""
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789; Port_U_UDP=1357; Port_U_TCP=1358
Require: sec-agree
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 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.

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

Max-Forwards: Set to 70 by the UE and used to prevent loops.

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

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

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 and S-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 identity (user1_private@home1.net) is carried in the username field of the Digest AKA protocol. The uri parameter (directive) contains the same value as the Request-URI. The realm parameter (directive) contains the network name where the username is authenticated. The Request-URI and the realm parameter (directive) value are obtained from the same field in the USIM, and therefore, are identical. In this example, it is assumed that a new UICC card was just inserted into the terminal, and there is no other cached information to send. Therefore, nonce and response parameters (directives) are empty.

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

3. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 16.2-3a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 16.2-3b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 16.2-3c DNS: 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 RFC 2782 [4].

Table 16.2-3d DNS: 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_p.home1.com
                                        0 IN SRV 1  0 5060 icscf7_p.home1.com

icscf1_p.home1.net                      0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

4. **REGISTER request (P-CSCF to I-CSCF) – see example in table 16.2-4**

The P-CSCF needs to be in the path for all mobile originated and mobile terminated requests for this user. To ensure this, the P-CSCF adds itself to the path for future requests.

The P-CSCF binds the public user identity under registration to the Contact header supplied by the user.

The P-CSCF adds also the Roaming-Info header (if not present). The P-CSCF adds the *vnid* parameter with the contents of the identifier of the P-CSCF network. This may be the visited network domain name or any other identifier that identifies the visited network at the home network.

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

Table 16.2-4 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response="", integrity-protected="no"
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.

Roaming-Info: The *vnid* parameter contains the identifier of the P-CSCF network at the home network.

5. **Cx: User registration status query procedure**

The I-CSCF makes a request for information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-5a provides the parameters in the REGISTER request (flow 4) which need to been sent to HSS.

6. **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.2-6**

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

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

Table 16.2-6 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
```

```
Proxy-require:
Require:
Roaming-Info:
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.

7. **Cx: S-CSCF authentication procedure**

As the REGISTER request arrived without integrity protection to the P-CSCF, the S-CSCF shall challenge it. For this, the S-CSCF requires at least one authentication vector to be used in the challenge to the user. If a valid AV is not available, then the S-CSCF requests at least one AV from the HSS.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-7a provides the parameters in the REGISTER request (flow 6) which need to be sent to HSS.

8. **Authentication vector selection**

The S-CSCF selects an authentication vector for use in the authentication challenge. For detailed description of the authentication vector, see 3GPP TS 33.203.

NOTE 1: The authentication vector may be of the form 3GPP TS 33.203 (if IMS AKA is the selected authentication scheme):

$AV = RAND_n||AUTN_n||XRES_n||CK_n||IK_n$ where:

- RAND: random number used to generate the XRES, CK, IK, and part of the AUTN. It is also used to generate the RES at the UE.
- AUTN: Authentication token (including MAC and SQN).
- XRES: Expected (correct) result from the UE.
- CK: Cipher key (optional).
- IK: Integrity key.

9. **401 Unauthorized response (S-CSCF to I-CSCF) – see example in table 16.2-9**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 16.2-9: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
ck="ffeeddccbbaa11223344556677889900"
CSeq:
Content-Length:
```

WWW-Authenticate: The S-CSCF challenges the user. The nonce includes the quoted string, base64 encoded value of the concatenation of the AKA RAND, AKA AUTN and server specific data. The S-CSCF appends also the Integrity Key (IK) and the Cyphering key (CK).

NOTE: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

10. **401 Unauthorized response (I-CSCF to P-CSCF) – see example in table 16.2-10**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 16.2-10: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
Content-Length:
```

11. **401 Unauthorized response (P-CSCF to UE) – see example in table 16.2-11**

The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 16.2-11: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
data), algorithm=AKAv1-MD5
Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

12. **Generation of response and session keys at UE**

Upon receiving the Unauthorized response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

13. **REGISTER request (UE to P-CSCF) – see example in table 16.2-13**

Table 16.2-13 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111apb03a0s09dkjdfglkj49112
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
```

```
CSeq: 2 REGISTER
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 11 along with the private user identity , the realm, the nonce, the URI and the algorithm.

14. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 16.2-14a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 16.2-14b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Since the UDP is prefered, the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 16.2-14c DNS: 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 RFC 2782 [4].

Table 16.2-14d 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_p.home1.net
                                        0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

15. **REGISTER request (P-CSCF to I-CSCF) – see example in table 16.2-15**

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

Table 16.2-15 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1", integrity-
protected="yes"
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.

16. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-16a provides the parameters in the REGISTER request (flow 15) which need to been sent to HSS.

17. **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.2-17**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 16.2-17 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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.

18. **Authentication**

    Upon receiving an integrity protected REGISTER request, carrying the authentication response, RES, the S-CSCF checks that the user's active XRES matches the received RES. If the check is successful then the user has been authenticated and the public user identity is registered in the S-CSCF.

19. **Cx: S-CSCF registration notification procedure**

    On registering a user the S-CSCF informs the HSS that the user has been registered at this instance. The HSS stores the S-CSCF name for that subscriber. For a positive response, the HSS will include the user profile in the response sent to the S-CSCF.

    For detailed message flows see 3GPP TS 29.228.

    Table 6.2-19a provides the parameters in the SIP REGISTER request (flow 17) which need to been sent to HSS.

20. **200 OK response (S-CSCF to I-CSCF) – see example in table 16.2-20**

    The S-CSCF sends acknowledgement 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 16.2-20 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 7200
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-1111
Content-Length:
```

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

21. **200 OK response (I-CSCF to P-CSCF) – see example in table 16.2-21**

    The I-CSCF translates the S-CSCF name in the Path header. The I-CSCF forwards acknowledgement 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 16.2-21 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:token(scscf1.home1.net)>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

22. **200 OK response (P-CSCF to UE) – see example in table 16.2-22**

    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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

Table 16.2-22 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

7 Signalling flows for session initiation (non hiding)

Editors Note: The purpose of this "duplicate" Editors Note is to capture the fact that the following changes have only been partially implemented, Note that a more comprehensive explanation is given in Annex B-2.
- The initial INVITE and any network initiated requests is routed from Terminating S-CSCF to Terminating P-CSCF using a Route header constructed from the information saved from the Path header during registration of called subscriber.
- The content of Record Route headers from the initial INVITE and its 183 SDP messages are stored in P-CSCFs before P-CSCFs removes it from the request (response) which is delivered to the UE. This is then used for routing subsequent requests.
- The route (the entries found in the Record Route header) between Originating P-CSCF and Terminating S-CSCF will be stored by Terminating S-CSCF from the initial INVITE request and used for routing subsequent requests originated by Terminating S-CSCF.
- Originating S-CSCF will store the route (the entries found in the Record Route header) between itself and Terminating P-CSCF from the 183 SDP provisional response and used for routing subsequent requests originated by Originating S-CSCF
- PRACK and UPDATE~~COMET~~ will be routed with Route header constructed from Record Route headers saved in P-CSCFs from initial INVITE and 183 SDP
- NO S-CSCFs neither I-CSCFs remove entries from any of the headers
- The Contact header is not modified during session setup.

7.1 Introduction

Editor's note: The following issues, contributed in N1-001094 issue 3, needs to be reflected in flows for INVITE, and for subsequent flows after INVITE.

The requirement of caller-id-blocking (aka calling-line-identification-blocking, CLIB), in an IP environment requires that the IP address of the caller be blocked as well. If it was not, a mere 'traceroute' would provide the called party essentially all the information of caller-id.

Editor's Note: Need to show ENUM interactions at the S-CSCF.

This subclause breaks down the signalling flows for establishing sessions into a number of individual procedures, following the same principles as 3GPP TS 23.228 [2] subclause 5.4.9.

For the purposes of this document, a further breakdown has been necessary, and therefore a number of signalling flows have been given an (a) or (b) suffix, so that the signalling flows for establishing sessions where configuration independence is applied may be distinguished from those where it is not, e.g.:

- (MO#1a) Mobile origination, roaming, without I-CSCF providing configuration independence.
- (MO#1b) Mobile origination, roaming, with I-CSCF in home network providing configuration independence.

7.2 Origination procedures

7.2.1 Introduction

This subclause presents the detailed signalling flows to define the procedures for session originations.

The session origination procedures specify the signalling path between the UE initiating a session attempt and the S-CSCF that is assigned to perform the session origination service. This signalling path is determined at the time of UE registration, and remains fixed for the life of the registration.

A UE always has a proxy (P-CSCF) associated with it. This P-CSCF is located in the same network as the UE, performs resource authorization, and may have additional functions in handling of emergency sessions. The P-CSCF is determined by the CSCF discovery process.

As a result of the registration procedure, the P-CSCF determines the next hop toward the S-CSCF. This next hop may be directly to the S-CSCF (MO#1a for the roaming case, MO#2 for the home case), or to an I-CSCF who forwards the request to the S-CSCF (MO#1b). These next-hop addresses could be IPv6 addresses, or could be names that are translated via DNS to an IPv6 address.

Sessions originated in the PSTN to a mobile destination are a special case of the Origination procedures and three possibilities to route such sessions are detailed. In the first one, all sessions originated in the PSTN are routed towards the IM CN subsystem. The MGCF uses H.248/MEGACO to control a Media Gateway, and communicates with the SS7 network. In case of interworking between IP based and SS7 based signalling network is required, a SGW would be used [2]. The MGCF initiates the SIP request, and subsequent nodes consider the signalling as if it came from a S-CSCF. In the second one, all sessions originated in the PSTN are routed towards the CS domain. The entry point of the network is then a G-MSC. In the third one, the operator can choose to handle simultaneously the first two routing possibilities and a way to handle this flexibility is detailed.

7.2.2 MO#1a

7.2.2.1 (MO#1a) Mobile origination, roaming (S-S#1a, MT#1a assumed)

Figure 7.2.2.1-1 shows an origination procedure which applies to roaming subscribers when the home network operator does not desire to keep its internal configuration hidden from the visited network. The UE is located in a visited network, and determines the P-CSCF via the CSCF discovery procedure. During registration, the home network allocates a S-CSCF. The home network provides the S-CSCF name/address as the entry point from the visited network.

When registration is complete, P-CSCF knows the name/address of the S-CSCF.

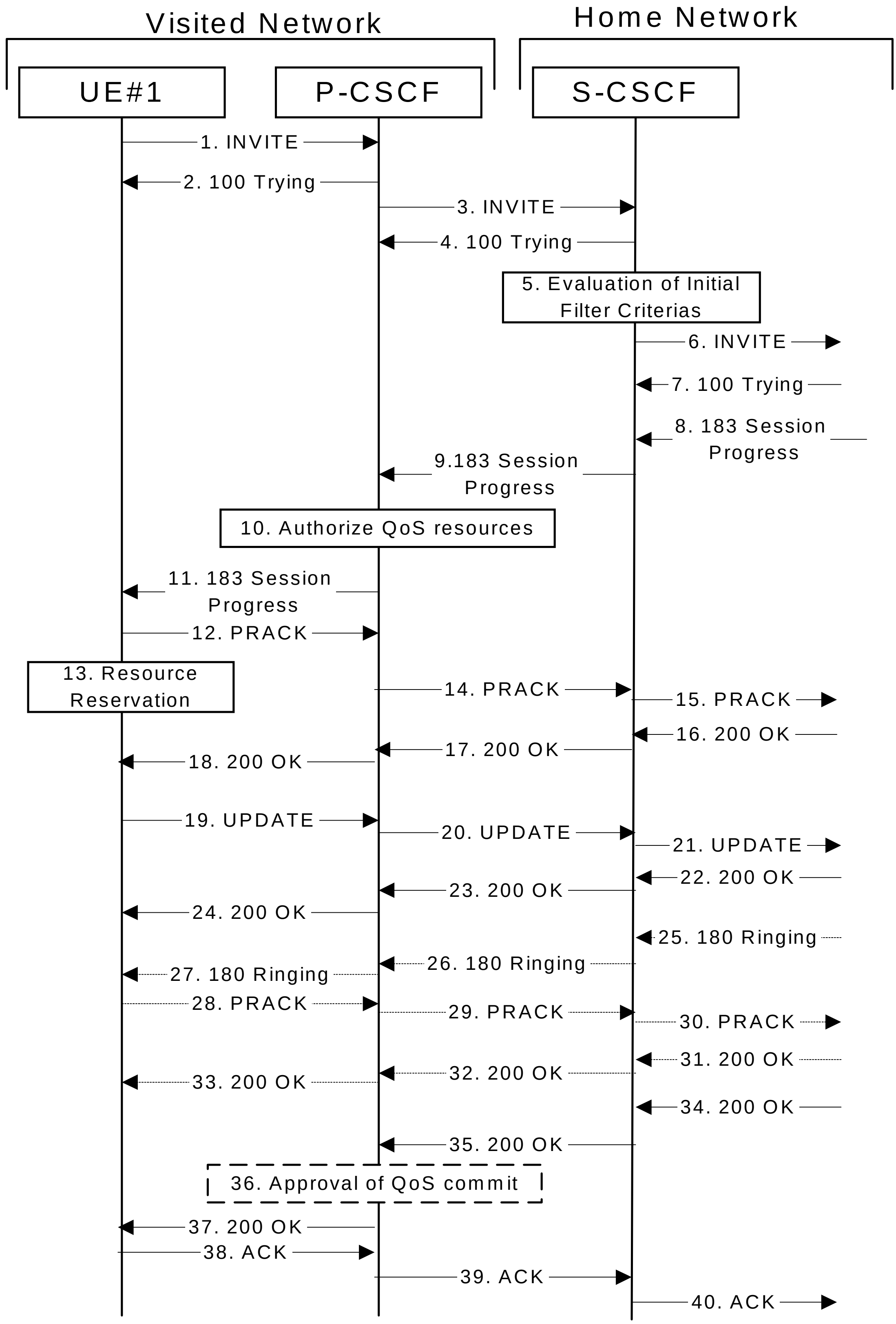


Figure 7.2.2.1-1: MO#1a

Procedure MO#1a is as follows:

1. **INVITE (UE to P-CSCF) - see example in table 7.2.2.1-1**

UE#1 determines the complete set of codecs that it is capable of supporting for this session. It builds a SDP containing bandwidth requirements and characteristics of each, and assigns local port numbers for each possible media flow. Multiple media flows may be offered, and for each media flow (m= line in SDP), there may be multiple codec choices offered.

For this example, assume UE#1 is capable of sending two simultaneous video streams, either H261 or MPV format, and two simultaneous audio streams, either AMR, G726-32, PCMU, or G728.

UE sends the INVITE request, containing an initial SDP, to the P-CSCF determined via the CSCF discovery mechanism. The initial SDP may represent one or more media for a multimedia session.

Editor's Note: Need to insure the codec negotiation procedures are compatible with the procedures brought into release 4 for CS domain services (BICC).

Table 7.2.2.1-1: INVITE (UE to P-CSCF)

```
INVITE tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>
Privacy: none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 98 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:98 H261
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 98 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:98 H261
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Request-URI: contains the keyed number from the user.

Via: contains the IP address or FQDN of the originating UE.

Privacy: the user does not require privacy, therefore the Privacy header is set to the value “none” as specified in draft-ietf-sip-asserted-identity [17] and draft-ietf-sip-privacy-general [13].

P-Asserted-Identity: the user provides a hint about the identity to be used for this session.

From: the user does not require privacy, the From header contains the value requested by the user.

Cseq: is a random starting number.

Contact: is a SIP URL that contains the IP address or FQDN of the originating UE.

SDP The SDP contains a set of codecs supported by UE#1 and desired by the user at UE#1 for this session.

Upon receiving the INVITE, the P-CSCF stores the following information about this session, for use in possible error recovery actions - see example in table 7.2.2.1-1b.

Table 7.2.2.1-1b: Storage of information at P-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
Cseq(2orig): none
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

2. **100 Trying (P-CSCF to UE) - see example in table 7.2.2.1-2**

P-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.2.2.1-2: 100 Trying (P-CSCF to UE)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **INVITE (P-CSCF to S-CSCF) - see example in table 7.2.2.1-3**

P-CSCF remembers (from the registration procedure) the request routing for this UE. This becomes a Route header in the request. This next hop is the S-CSCF within the home network of UE#1.

P-CSCF adds itself to the Record-Route header and Via header.

P-CSCF examines the media parameters, and removes any choices that the network operator decides based on local policy, not to allow on the network.

For this example, assume the network operator disallows H261 video encoding.

The INVITE request is forwarded to the S-CSCF.

Table 7.2.2.1-3: INVITE (P-CSCF to S-CSCF)

```
INVITE sip:tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Record-Route: sip:pcscf1.visited1.net;lr
Route: sip:scscf1.home1.net;lr
Record-Route: sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Route: contains the elements from the Path header from registration.

P-Asserted-Identity: The P-CSCF inserts this header based on the user's hint present in the incoming P-Asserted-Identity header.

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the video media streams no longer list code 98 (H261).

Upon receiving the INVITE, the S-CSCF stores the following information about this session, for use in possible error recovery actions - see example in table 7.2.2.1-3b.

Table 7.2.2.1-3b: Storage of information at S-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
Cseq(2orig): none
Route(2orig): sip:pcscf1.visited1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

4. **100 Trying (S-CSCF to P-CSCF) - see example in table 7.2.2.1-4**

   S-CSCF responds to the INVITE request (3) with a 100 Trying provisional response.

Table 7.2.2.1-4: 100 Trying (S-CSCF to P-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

5. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber and evaluates the initial filter criterias.

6. **INVITE (MO#1 to S-S) - see example in table 7.2.2.1-6**

   S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

   S-CSCF forwards the INVITE request, as specified by the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-6: INVITE request (MO#1a to S-S)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip: scscf2.home2.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>, <tel:+1-212-555-1111>
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (...)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the video media streams show a port number zero, which removes them from the negotiation.

P-Asserted-Identity: The S-CSCF the corresponding TEL URL to the P-Asserted-Identity header in order that the TEL URL is known to the destination network in case the INVITE is forwarded to a MGCF.

Request-URI: In the case where the Request-URI of the incoming INVITE request to S-CSCF contains a TEL-URL [5], it has to be translated to a globally routable SIP-URL before applying it as Request-URI of the outgoing INVITE request. For this address translation the S-CSCF shall use the services of an ENUM-DNS protocol according to RFC 2916 [6], or any other suitable translation database. Database aspects of ENUM are outside the scope of this specification.

7. **100 Trying (S-S to MO#1a) - see example in table 7.2.2.1-7 (related to table 7.2.2.1-6)**

S-CSCF receives a 100 Trying provisional response, as specified by the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-7: 100 Trying (S-S to MO#1a)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **183 Session Progress (S-S to MO#1a) - see example in table 7.2.2.1-8 (related to table 7.2.2.1-6)**

The media stream capabilities of the destination are returned along the signalling path, in a 183 Session Progress provisional response (to 6), per the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-8: 183 Session Progress (S-S to MO#1a)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Smith" <sip:user2_public1@home2.net>,
P-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>
Privacy: none
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

Upon receiving the 183 Session Progress, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.2.2.1-8b.

Table 7.2.2.1-8b: Storage of information at S-CSCF

```
Request-URI: sip:user2_public1@home2.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:scscf2.home2.net,sip:pcscf2.visited2.net
Route(2orig): sip:pcscf1.visited1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

9. **183 Session Progress (S-CSCF to P-CSCF) - see example in table 7.2.2.1-9**

S-CSCF forwards the 183 Session Progress response to P-CSCF.

Table 7.2.2.1-9: 183 Session Progress (S-CSCF to P-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:

Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

Upon receiving the 183 Session Progress, the P-CSCF removes the Record-Route headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE. The saved value of the information for this session is - see example in table 7.2.2.1-9b.

Table 7.2.2.1-9b: Storage of information at P-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:scscf1.home1.net, sip:scscf2.home2.net, pcscf2.visited2.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

10. **Authorize QoS Resources**

P-CSCF authorizes the resources necessary for this session. The approval of QoS commitment either happens at this stage or after 200 OK of INVITE (35) based on operator local policy.

11. **183 Session Progress (P-CSCF to UE) – see example in table 7.2.2.1-11**

P-CSCF forwards the 183 Session Progress response to the originating endpoint.

Table 7.2.2.1-11: 183 Session Progress (P-CSCF to UE)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
P-Asserted-Identity:
~~P-Asserted-Identity:~~
Privacy:
P-Media-Authorization:0020000100100101706366312e78797a2e6e6574000c02013942563330373200
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

P-Media-Authorization: a P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf1.xyz.net" with credentials "9BV3072". "00" at the end of the authorization token is required to pad to a multiple of 4 bytes.

12. **PRACK (UE to P-CSCF) - see example in table 7.2.2.1-12**

UE#1 determines which media flows should be used for this session, and which codecs should be used for each of those media flows. If there was any change in media flows, or if there was more than one choice of codec for a media flow, then UE#1 includes a new SDP offer in the PRACK message sent to UE#2.

For this example, assume UE#1 chooses AMR as the codec to use for the single audio stream.

UE includes this information in the PRACK request to P-CSCF.

Table 7.2.2.1-12: PRACK (UE to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

Request-URI: takes the value of the Contact header of the received 183 Session Progress response.

Via: takes the value of either the IP address or FQDN of the originating UE.

From:/To:/Call-ID: copied from the 183 Session Progress response so that they include any tag parameter.

Cseq: takes a higher value than that in the previous request.

13. **Resource Reservation**

After determining the final media streams in step #11, UE initiates the reservation procedures for the resources needed for this session.

14. **PRACK (P-CSCF to S-CSCF) – see example in table 7.2.2.1-14**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the PRACK request to S-CSCF.

Table 7.2.2.1-14: PRACK (P-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Route: saved from the Record-Route header of the 183 Session Progress response.

15. **PRACK (MO#1a to S-S) – see example in table 7.2.2.1-15**

S-CSCF forwards the PRACK request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-15: PRACK (MO#1a to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

16. **200 OK (S-S to MO#1a) – see example in table 7.2.2.1-16 (related to table 7.2.2.1-15)**

The destination endpoint responds to the PRACK request (14) with a 200 OK response, per the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-16: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

17. **200 OK (S-CSCF to P-CSCF) - see example in table 7.2.2.1-17**

S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.2.1-17: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

18. **200 OK (P-CSCF to UE) - see example in table 7.2.2.1-18**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.2.1-18: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

19. **UPDATE (UE to P-CSCF) – see example in table 7.2.2.1-19**

    When the resource reservation is completed, UE sends the UPDATE request to the terminating endpoint, via the signalling path established by the INVITE request.

Table 7.2.2.1-19: UPDATE (UE to P-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

Request-URI: takes the value of the Contact header of the received 183 Session Progress response.

Via: takes the value of either the IP address or FQDN of the originating UE.

From:/To:/Call-ID: copied from the 183 Session Progress response so that they include any tag parameters.

Cseq: takes a higher value than that in the previous request.

The SDP indicates that the resource reservation was successful in the local segment.

20. **UPDATE (P-CSCF to S-CSCF) – see example in table 7.2.2.1-20**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the UPDATE request to S-CSCF.

Table 7.2.2.1-20: UPDATE (P-CSCF to S-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Route: saved from the Record-Route header of the 183 Session Progress response.

21. **UPDATE (MO#1a to S-S) - see example in table 7.2.2.1-21**

S-CSCF forwards the UPDATE request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-21: UPDATE (MO#1a to S-S)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

22. **200 OK (S-S to MO#1a) – see example in table 7.2.2.1-22 (related to table 7.2.2.1-21)**

The destination endpoint responds to the UPDATE request (21) with a 200 OK, per the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-22: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

The SDP indicates that the resource reservation was successful both in the local and the remote segment.

23. **200 OK (S-CSCF to P-CSCF) - see example in table 7.2.2.1-23**

S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.2.1-23: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

24. **200 OK (P-CSCF to UE) – see example in table 7.2.2.1-24**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.2.1-24: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

25. **180 Ringing (S-S to MO#1a) – see example in table 7.2.2.1-25 (related to table 7.2.2.1-6)**

The called UE may optionally perform alerting. If so, it signals this to the calling party by a 180 Ringing provisional response to (6). This response is sent to S-CSCF per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-25: 180 Ringing (S-S to MO#1a)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

26. **180 Ringing (S-CSCF to P-CSCF) – see example in table 7.2.2.1-26**

S-CSCF forwards the 180 Ringing response to P-CSCF.

Table 7.2.2.1-26: 180 Ringing (S-CSCF to P-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

27. **180 Ringing (P-CSCF to UE) - see example in table 7.1.1-27**

P-CSCF removes the Record-Route headers.

P-CSCF forwards the 180 Ringing response to UE.

Table 7.2.2.1-27: 180 Ringing (P-CSCF to UE)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

28. **PRACK (UE to P-CSCF) – see example in table 7.2.2.1-28**

UE indicates to the originating subscriber that the destination is ringing. It responds to the 180 Ringing provisional response (28) with a PRACK request.

Table 7.2.2.1-28: PRACK (UE to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

Request-URI: takes the value of the Contact header of the received 180 Ringing response.

Via: takes the value of either the IP address or FQDN of the originating UE.

From:/To:/Call-ID: copied from the 180 Ringing response so that they include any revised tag parameters.

Cseq: takes a higher value than in the previous request.

29. **PRACK (P-CSCF to S-CSCF) – see example in table 7.2.2.1-29**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the PRACK request to S-CSCF.

Table 7.2.2.1-29: PRACK (P-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

30. **PRACK (MO#1a to S-S) - see example in table 7.2.2.1-30**

S-CSCF forwards the PRACK request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-30: PRACK (MO#1a to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

31. **200 OK (S-S to MO#1a) - see example in table 7.2.2.1-31 (related to table 7.2.2.1-30)**

The destination endpoint responds to the PRACK request (30) with a 200 OK response.

Table 7.2.2.1-31: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

32. **200 OK (S-CSCF to P-CSCF) - see example in table 7.2.2.1-32**

S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.2.1-32: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

33. **200 OK (P-CSCF to UE) – see example in table 7.2.2.1-33**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.2.1-33: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **200 OK (S-S to MO#1a) – see example in table 7.2.2.1-34 (related to table 7.2.2.1-6)**

When the called party answers, the terminating endpoint sends a 200 OK final response to the INVITE request (6), as specified by the termination procedures and the S-CSCF to S-CSCF procedures, to S-CSCF.

Table 7.2.2.1-34: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length:0
```

35. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.2.1-35**

S-CSCF sends a 200 OK final response along the signalling path back to P-CSCF.

Table 7.2.2.1-35: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

36. **Approval of QoS Commit**

The P-CSCF approves the commitment of the QoS resources if it was not approved already in step (10).

37. **200 OK (P-CSCF to UE) – see example in table 7.2.2.1-37**

P-CSCF forwards the 200 OK final response to the session originator. UE can start the media flow(s) for this session.

Table 7.2.2.1-37: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

38. **ACK (UE to P-CSCF) – see example in table 7.2.2.1-38**

UE starts the media flow for this session, and responds to the 200 OK (37) with an ACK request sent to P-CSCF.

Table 7.2.2.1-38: ACK (UE to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 ACK
Content-Length: 0
```

Cseq: is required to be the same value as Cseq contained in original INVITE request [3].

39. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.2.1-39**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the ACK request to S-CSCF.

Table 7.2.2.1-38: ACK (P-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

Route: saved from the Record-Route header of the 183 Session Progress response.

40. **ACK (MO#1a to S-S) - see example in table 7.2.2.1-40**

S-CSCF forwards the ACK request to the terminating endpoint, per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-40: ACK (MO#1a to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

7.2.2.2 Failure in termination procedure

The roaming subscriber that initiated a session with procedure MO#1a had the attempt fail due to an error detected in the Termination procedure or in the S-CSCF-to-S-CSCF procedure. This could be due to, for example, destination busy (error code 486), destination service denied (error code 403), destination currently out of coverage (error code 480), or some other error.

Depending on the exact error that causes the session initiation failure, and when the error situation was detected, UE#1 could be at many different stages in the session establishment procedure. This is shown in figure 7.2.2.2-1, as optional messages 7-33 that may appear in this error procedure.

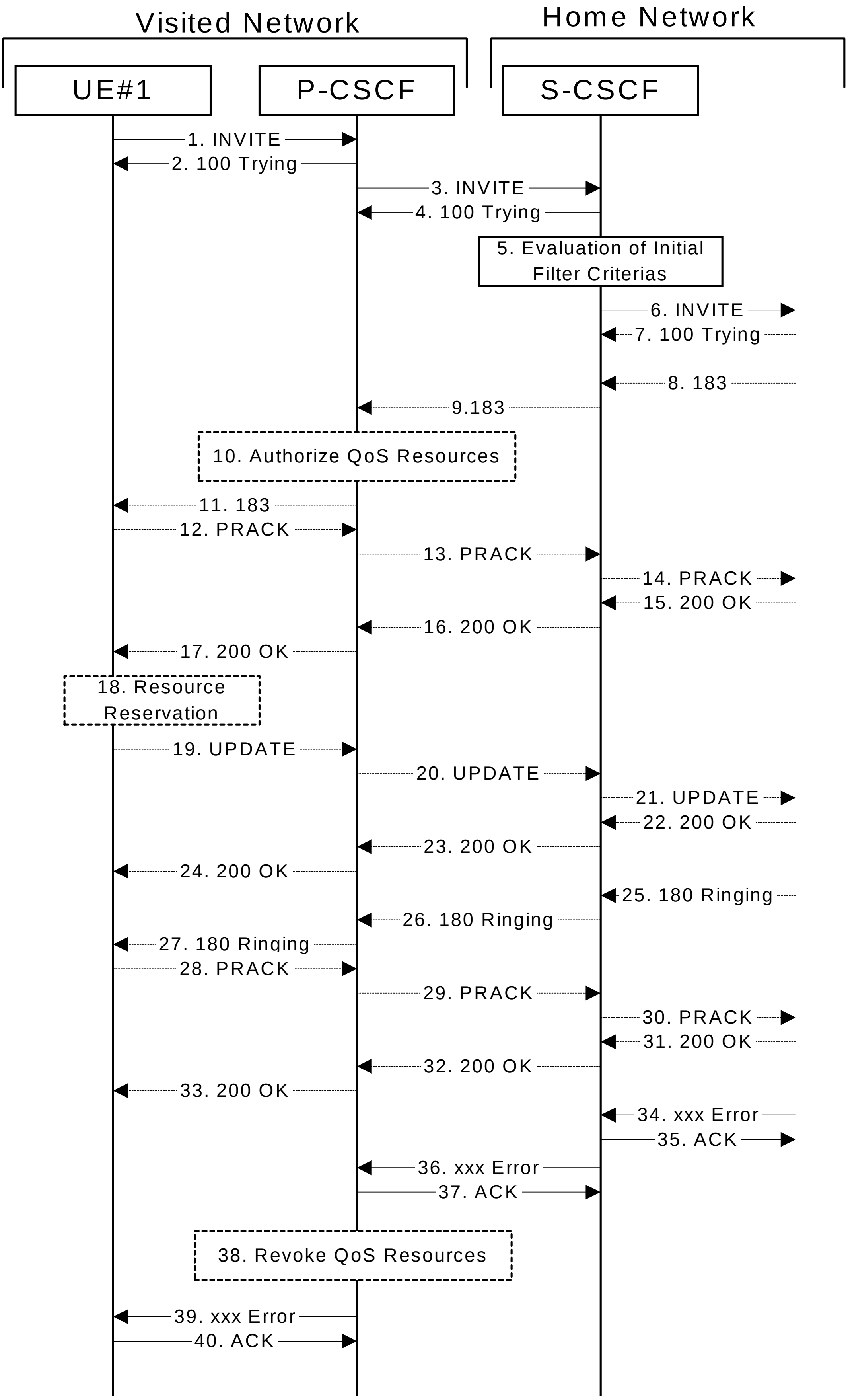


Figure 7.2.2.2-1: Failure in termination procedure

1-6. **INVITE (UE to P-CSCF) et seq**

UE#1 initiated a session, as described in subclause 7.2.2.1.

7-33. **100 Trying (S-S to MO#1a) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.2.2.1.

34. **xxx Error (S-S to MO#1a) – see example in table 7.2.2.2-34**

The termination procedure detected some error situation, and returned a SIP error response.

NOTE 1: The error response may be, for example, "486 (Busy Here)", "403 (Forbidden)", "480 (Temporarily Unavailable)", or others. For this example, "486 (Busy Here)" is shown.

Table 7.2.2.2-34: 486 Busy Here (S-S to MO#1a)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq: 127 INVITE
Retry-After: 3600
Content-Length: 0
```

35. **ACK (MO#1a to S-S) - see example in table 7.2.2.2-35**

Upon receive the 486 response from the S-S procedure, S-CSCF sends ACK.

Table 7.2.2.2-35: ACK (MO#1a to S-S)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

36. **xxx Error (S-CSCF to P-CSCF) – see example in table 7.2.2.2-36 (related to table 7.2.2.2-34)**

The S-CSCF returned a SIP error response to P-CSCF.

NOTE 2: The error response may be, for example, "486 (Busy Here)", "403 (Forbidden)", "480 (Temporarily Unavailable)", or others. For this example, "486 (Busy Here)" is shown.

Table 7.2.2.2-36: 486 Busy Here (S-CSCF to P-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

37. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.2.2-37**

Upon receive the 486 response from the S-CSCF procedure, P-CSCF sends ACK.

Table 7.2.2.2-37: ACK (P-CSCF to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Route: sip:scscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

38. **Revoke QoS authorization**

P-CSCF removes the QoS authorization, if any, for this session.

39. **xxx Error (P-CSCF to UE) – see example in table 7.2.2.2-39 (related to table 7.2.2.2-36)**

The P-CSCF returned a SIP error response to UE.

NOTE 3: The error response may be, for example, "486 (Busy Here)", "403 (Forbidden)", "480 (Temporarily Unavailable)", or others. For this example, "486 (Busy Here)" is shown.

Table 7.2.2.2-39: 486 Busy Here (P-CSCF to UE)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

40. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.2.2-40**

Upon receive the 486 response from the P-CSCF, UE sends ACK.

Table 7.2.2.2-40: ACK (UE to P-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.2.2.3 Session abandoned, or resource failure

The roaming subscriber that initiated a session with procedure MO#1a either abandoned the attempt, or was unable to obtain the resources necessary for the session. The signalling flow for this error handling is shown in figure 7.2.2.3-1.

If the session is aborted due to failure to obtain resources, it will occur at step #18 in the signalling flow; steps 19-33 (marked as optional) will not be present. If the session is abandoned due to user command, it can happen at any point between steps 8-33.

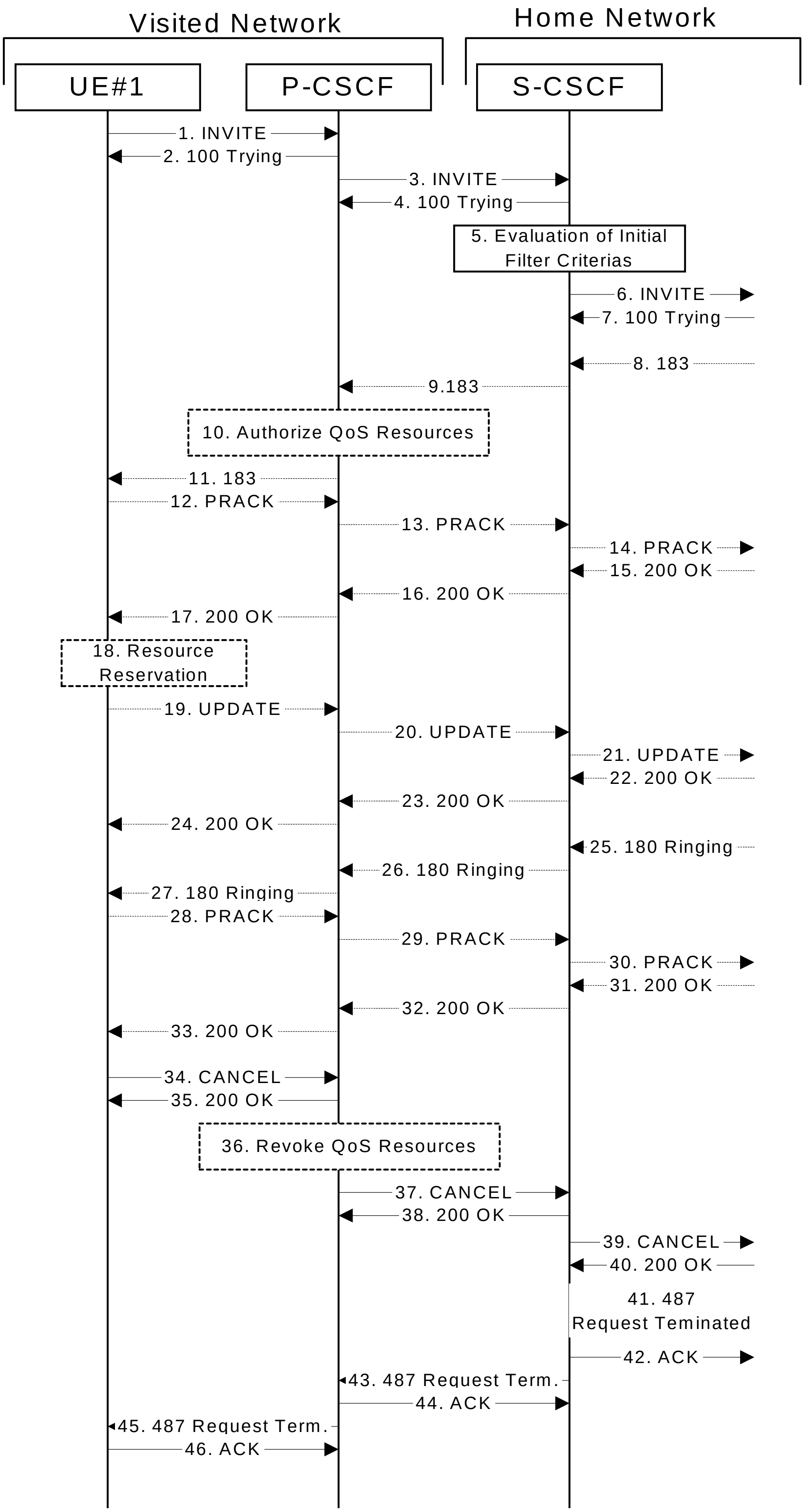


Figure 7.2.2.3-1: Session abandoned or resource failure

1-7. **INVITE (UE to P-CSCF) et seq**

UE#1 initiated a session, as described in subclause 7.2.2.1.

8-33. **183 Session Progress (S-S to MO#1a) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.2.2.1.

34. **CANCEL (UE to P-CSCF) – see example in table 7.2.2.3-34**

The UE cancelled the original INVITE request.

Table 7.2.2.3-34: CANCEL (UE to P-CSCF)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 CANCEL
Content-Length: 0
```

35. **200 OK (P-CSCF to UE) – see example in table 7.2.2.3-35**

Upon receive the CANCEL request from the UE, P-CSCF sends 200 OK.

Table 7.2.2.3-35: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

36. **Revoke QoS authorization**

P-CSCF removes the QoS authorization, if any, for this session.

37. **CANCEL (P-CSCF to S-CSCF) – see example in table 7.2.2.3-37**

The P-CSCF forwards the CANCEL request to S-CSCF.

Table 7.2.2.3-37: CANCEL (P-CSCF to S-CSCF) (related to table 7.2.2.3-34)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:scscf1.home1.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

38. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.2.3-38**

Upon receiving the CANCEL request from the P-CSCF, S-CSCF sends 200 OK.

Table 7.2.2.3-38: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

39. **CANCEL (S-CSCF to S-S) – see example in table 7.2.2.3-39 (related to table 7.2.2.3-37)**

    The S-CSCF forwards the CANCEL request to the appropriate S-CSCF-to-S-CSCF procedure.

Table 7.2.2.3-39: CANCEL (S-CSCF to S-S)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Cseq:
Content-Length:
```

40. **200 OK (S-S to S-CSCF) – see example in table 7.2.2.3-40**

    Upon receive the CANCEL request from the S-CSCF, the next hop (whatever it is) sends 200 OK.

Table 7.2.2.3-40: 200 OK (S-S to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

41. **487 Request Terminated (S-S to MO#1a) – see example in table 7.2.2.3-41**

    The termination procedure cancelled the request, and returned a SIP error response to the original INVITE request.

Table 7.2.2.3-41: 487 Request Terminated (S-S to MO#1a)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq: 127 INVITE
Content-Length: 0
```

42. **ACK (MO#1a to S-S) - see example in table 7.2.2.3-42**

    Upon receive the 487 response from the S-S procedure, S-CSCF sends ACK.

Table 7.2.2.3-42: ACK (MO#1a to S-S)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

43. **487 Request Terminated (S-CSCF to P-CSCF) - see example in table 7.2.2.3-43 (related to table 7.2.2.3-41)**

The S-CSCF returned the SIP error response to P-CSCF.

Table 7.2.2.3-43: 487 Request Terminated (S-CSCF to P-CSCF)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

44. **ACK (P-CSCF to S-CSCF) - see example in table 7.2.2.3-44**

Upon receive the 487 response from the S-CSCF, P-CSCF sends ACK.

Table 7.2.2.3-44: ACK (P-CSCF to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Route: sip:scscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

45. **487 Request Terminated (P-CSCF to UE) - see example in table 7.2.2.3-45 (related to table 7.2.2.3-43)**

The P-CSCF returned a SIP error response to UE.

Table 7.2.2.3-45: 487 Request Terminated (P-CSCF to UE)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

46. **ACK (UE to P-CSCF) – see example in table 7.2.2.3-46**

Upon receive the 487 response from the P-CSCF, UE sends ACK.

Table 7.2.2.3-46: ACK (UE to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.2.3 MO#2

7.2.3.1 (MO#2) Mobile origination, located in home network (S-S#2, MT#2 assumed)

Figure 7.2.3.1-1 shows an origination procedure which applies to subscribers located in their home service area.

The UE is located in the home network, and determines the P-CSCF via the CSCF discovery procedure. During registration, the home network allocates an S-CSCF in the home network.

When registration is complete, the P-CSCF knows the name/address of S-CSCF.

NOTE: Although S-S#2 flow is assumed, home2.net is used in the Record-Route and Route headers in order to be more generic and clearly identify the originating and terminating nodes. In the S-S#2 scenario home2.net = home1.net.

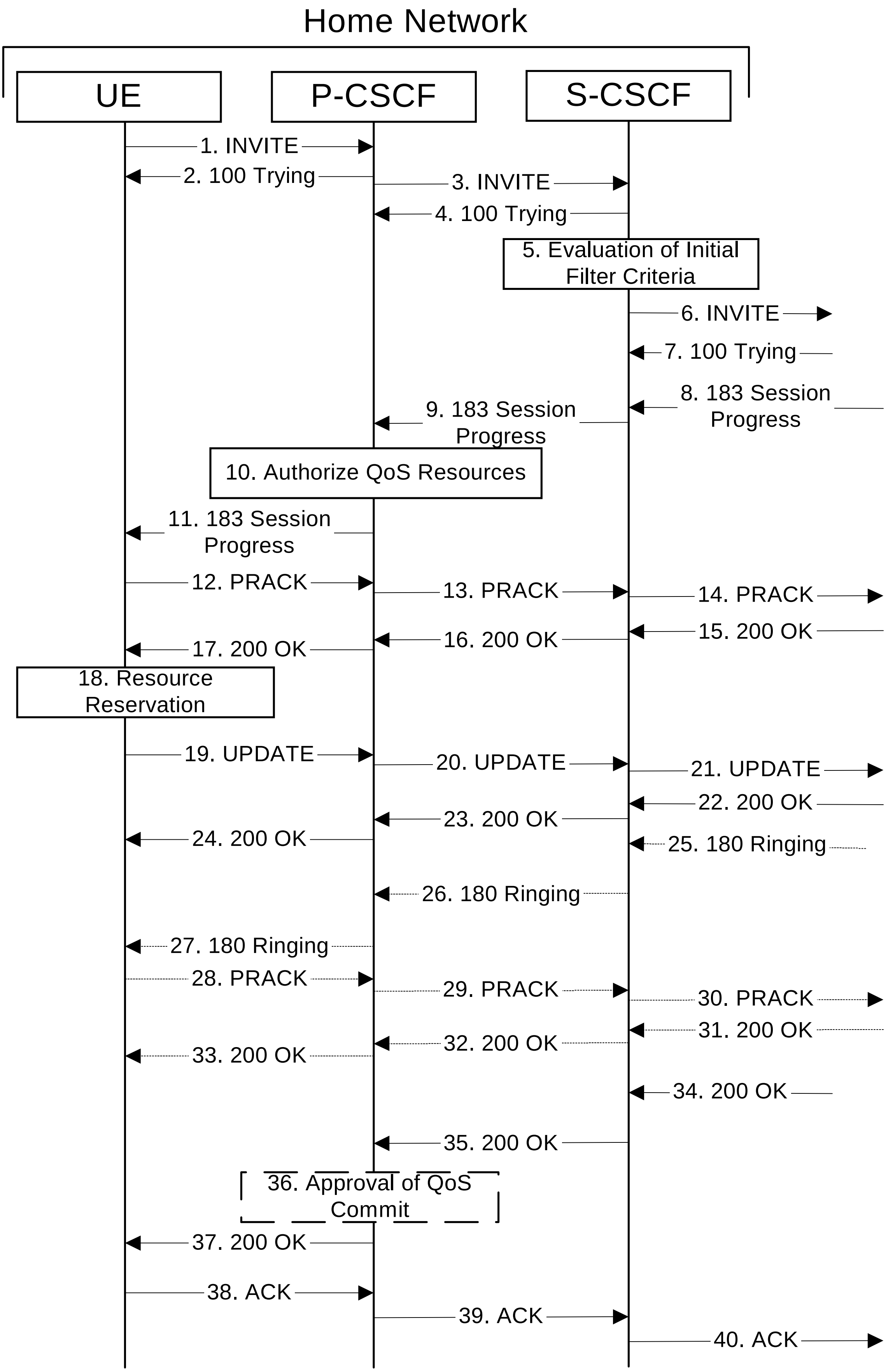


Figure 7.2.3.1-1: MO#2

Procedure MO#2 is as follows:

1. **INVITE (UE to P-CSCF) - see example in table 7.2.3.1-1**

   UE#1 determines the complete set of codecs that it is capable of supporting for this session. It builds a SDP containing bandwidth requirements and characteristics of each, and assigns local port numbers for each possible media flow. Multiple media flows may be offered, and for each media flow (m= line in SDP), there may be multiple codec choices offered.

   For this example, assume UE#1 is capable of sending two simultaneous video streams, either H261 or MPV format, and two simultaneous audio streams, either AMR, G726-32, PCMU, or G728.

   UE sends the INVITE request, containing an initial SDP, to the P-CSCF determined via the CSCF discovery mechanism.

Table 7.2.3.1-1: INVITE (UE to P-CSCF)

```
INVITE tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>
~~RPID-Privacy~~Privacy: ~~privacy=off; party=calling~~none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 98 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:98 H261
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 98 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:98 H261
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Request-URI: contains the keyed number from the user. This is specified by the UE as tel:<keyed number>. This is in accordance to standard IETF procedures for specifying dialled digits.

Via: contains the IP address or FQDN of the originating UE.

~~**Remote-Party-ID**~~**P-Asserted-Identity:** the user provides a hint about the identity to be used for this session.

~~**:** contains the originator's public user identity. The Display name is optional.~~

From:/To:/Call-ID: follow the recommendations of draft-ietf-sip-privacy[13], even though anonymity is not being requested for this session.

Cseq: A random starting number.

Contact: is a SIP URL that contains the IP address or FQDN of the originating UE.

SDP The SDP contains a set of codecs supported by UE#1 and desired by the user at UE#1 for this session.

Upon receiving the INVITE, the P-CSCF stores the following information about this session, for use in possible error recovery actions – see example in table 7.2.3.1-1b:

Table 7.2.3.1-1b: Storage of information at P-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
Cseq(2orig): none
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

2. **100 Trying (P-CSCF to UE) – see example in table 7.2.3.1-2**

P-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.2.3.1-2: 100 Trying (P-CSCF to UE)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **INVITE (P-CSCF to S-CSCF) – see example in table 7.2.3.1-3**

P-CSCF remembers (from the registration procedure) the request routing for this UE. This becomes a Route header in the request. This next hop is the S-CSCF within the home network of UE#1.

P-CSCF adds itself to the Record-Route header and Via header.

P-CSCF examines the media parameters, and removes any choices that the network operator decides based on local policy, not to allow on the network.

For this example, assume the network operator disallows H261 video encoding.

The INVITE request is forwarded to the S-CSCF.

Table 7.2.3.1-3: INVITE (P-CSCF to S-CSCF)

```
INVITE tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Record-Route: sip:pcscf1.home1.net;lr
Route: sip:scscf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Route: Contains the elements from the Path header from registration.

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the video media streams no longer list code 98 (H261).

Upon receiving the INVITE, the S-CSCF stores the following information about this session, for use in possible error recovery actions – see example in table 7.2.3.1-3b:

Table 7.2.3.1-3b: Storage of information at S-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
Cseq(2orig): none
Route(2orig): sip:pcscf1.home1.net
Contact (orig): sip:[5555::aaa:bbb:ccc:ddd]
```

4. **100 Trying (S-CSCF to P-CSCF) - see example in table 7.2.3.1-4**

   S-CSCF responds to the INVITE request (3) with a 100 Trying provisional response.

Table 7.2.3.1-4: 100 Trying (S-CSCF to P-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

5. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber, and evaluates the initial filter criterias.

6. **INVITE (MO#2 to S-S) – see example in table 7.2.3.1-6**

   S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

   S-CSCF forwards the INVITE request, as specified by the S-CSCF to S-CSCF procedures.

Table 7.2.3.1-6: INVITE (MO#2 to S-S)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
~~Remote-Party-ID~~P-Asserted-Identity:~~ "John Doe" <tel:+1-212-555-1111>;screen=yes~~
~~RPID-Privacy~~Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (...)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the video media streams show a port number zero, which removes them from the negotiation.

Request-URI: In the case where the Request-URI of the incoming INVITE request to S-CSCF contains a TEL-URL [5], it has to be translated to a globally routable SIP-URL before applying it as Request-URI of the outgoing INVITE request. For this address translation the S-CSCF shall use the services of an ENUM-DNS protocol according to RFC 2916 [6], or any other suitable translation database. Database aspects of ENUM are outside the scope of this specification.

7. **100 Trying (S-S to MO#2) – see example in table 7.2.3.1-7**

S-CSCF receives a 100 Trying provisional response, as specified by the S-CSCF to S-CSCF procedures.

Table 7.2.3.1-7: 100 Trying (S-S to MO#2)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **183 Session Progress (S-S to MO#2) – see example in table 7.2.3.1-8**

The media stream capabilities of the destination are returned along the signalling path, in a 183 Session Progress provisional response (to (6)), per the S-CSCF to S-CSCF procedures.

Table 7.2.3.1-8: 183 Session Progress (S-S to MO#2)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home2.net;lr, sip:scscf2.home2.net;lr, sip:332b23.1@scscf1.home1.net,
   sip:431h23.1@pcscf1.home1.net
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>;screen=yes
RPID-PrivacyPrivacy: privacy=off;party=callednone
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

Upon receiving the 183 Session Progress, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.2.3.1-8b.

Table 7.2.3.1-8b: Storage of information at S-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:scscf2.home2.net,sip:pcscf2.home2.net
Route(2orig): sip:pcscf1.home1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

9. **183 Session Progress (S-CSCF to P-CSCF) – see example in table 7.2.3.1-9**

S-CSCF forwards the 183 Session Progress response to P-CSCF.

Table 7.2.3.1-9: 183 Session Progress (S-CSCF to P-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
~~Remote-Party-ID~~P-Asserted-Identity:
~~RPID-Privacy~~Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

Upon receiving the 183 Session Progress, the P-CSCF removes the Record-Route headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE. The saved value of the information for this session is – see example in table 7.2.3.1-9b:

Table 7.2.3.1-9b: Storage of information at P-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:scscf1.home1.net, sip:scscf2.home2.net, sip:pcscf2.home2.net
Contact (dest): sip:[5555::eee:fff:aaa:bbb]
Contact (orig): sip:[5555::aaa:bbb:ccc:ddd]
```

10. **Authorize QoS Resources**

P-CSCF authorizes the resources necessary for this session. The approval of QoS commitment either happens at this stage or after 200 OK of INVITE (35) based on operator local policy.

11. **183 Session Progress (P-CSCF to UE) – see example in table 7.2.3.1-11**

P-CSCF forwards the 183 Session Progress response to the originating endpoint.

Table 7.2.3.1-11: 183 Session Progress (P-CSCF to UE)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
P-Media-Authorization: 0020000100100101706366312e78797a2e6e6574000c02013942563330373200
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

P-Media-Authorization: a P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf1.xyz.net" with credentials "9BV3072". "00" at the end of the authorization token is required to pad to a multiple of 4 bytes.

12. **PRACK (UE to P-CSCF) – see example in table 7.2.3.1-12**

UE#1 determines which media flows should be used for this session, and which codecs should be used for each of those media flows. If there was any change in media flows, or if there was more than one choice of codec for a media flow, then UE#1 include a new SDP offer in the PRACK request sent to UE#2).

For this example, assume UE#1 chooses AMR as the codec to use for the single audio stream.

UE includes this information in the PRACK request to P-CSCF.

Table 7.2.3.1-12: PRACK (UE to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

Request-URI: Takes the value of the Contact header of the received 183 Session Progress response.

Via: Takes the value of either the IP address or FQDN of the originating UE.

From:/To:/Call-ID: Copied from the 183 Session Progress response so that they include any tag parameter.

Cseq: Takes a higher value than that in the previous request.

13. **Resource Reservation**

After determining the final media streams in step #11, UE initiates the reservation procedures for the resources needed for this session.

14. **PRACK (P-CSCF to S-CSCF) – see example in table 7.2.3.1-14**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the PRACK request to S-CSCF.

Table 7.2.3.1-14: PRACK (P-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

Request-URI: The first component of the saved Route header.

Route: saved from the 183 Session Progress response (with first element moved to Request-URI) with the initial Request-URI (received from the UE) appended as the final component.

15. **PRACK (MO#2 to S-S) – see example in table 7.2.3.1-15**

S-CSCF forwards the PRACK request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.3.1-15: PRACK (MO#2 to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr, sip:[5555::eee:fff:aaa:bbb]
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

16. **200 OK (S-S to MO#2) – see example in table 7.2.3.1-16**

The destination endpoint responds to the PRACK request (14) with a 200 OK response, per the S-CSCF to S-CSCF procedures.

Table 7.2.3.1-16: 200 OK (S-S to MO#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

17. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.3.1-17**

S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.3.1-17: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

18. **200 OK (P-CSCF to UE) – see example in table 7.2.3.1-18**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.3.1-18: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

19. **UPDATE (UE to P-CSCF) – see example in table 7.2.3.1-19**

When the resource reservation is completed, UE sends the UPDATE request to the terminating endpoint, via the signalling path established by the INVITE request. The request is sent first to P-CSCF.

Table 7.2.3.1-19: UPDATE (UE to P-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

Request-URI: Takes the value of the Contact header of the received 183 Session Progress response.

Via: Takes the value of either the IP address or FQDN of the originating UE.

From:/To:/Call-ID: Copied from the 183 Session Progress response so that they include any tag parameters.

CSeq: Takes a higher value than that in the previous request.

The SDP indicates that the resource reservation was successful in the local segment.

20. **UPDATE (P-CSCF to S-CSCF) – see example in table 7.2.3.1-20**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the UPDATE request to S-CSCF.

Table 7.2.3.1-20: UPDATE (P-CSCF to S-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Route: saved from the Record-Route header of the 183 Session Progress response.

21. **UPDATE (MO#2 to S-S) – see example in table 7.2.3.1-21**

S-CSCF forwards the UPDATE request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.3.1-21: UPDATE (MO#2 to S-S)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

22. **200 OK (S-S to MO#2) – see example in table 7.2.3.1-22**

The destination endpoint responds to the UPDATE request (21) with a 200 OK, per the S-CSCF to S-CSCF procedures.

Table 7.2.3.1-22: 200 OK (S-S to MO#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

The SDP indicates that the resource reservation was successful both in the local and the remote segment.

23. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.3.1-23**

S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.3.1-23: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

24. **200 OK (P-CSCF to UE) – see example in table 7.2.3.1-24**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.3.1-24: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

25. **180 Ringing (S-S to MO#2) - see example in table 7.2.3.1-25**

    The called UE may optionally perform alerting. If so, it signals this to the calling party by a 180 Ringing provisional response to (6). This response is sent to S-CSCF per the S-CSCF to S-CSCF procedure.

Table 7.2.3.1-25: 180 Ringing (S-S to MO#2)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

26. **180 Ringing (S-CSCF to P-CSCF) – see example in table 7.2.3.1-26**

    S-CSCF forwards the 180 Ringing response to P-CSCF.

Table 7.2.3.1-26: 180 Ringing (S-CSCF to P-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

27. **180 Ringing (P-CSCF to UE) – see example in table 7.2.3.1-27**

P-CSCF removes the Record-Route headers.

P-CSCF forwards the 180 Ringing response to UE.

Table 7.2.3.1-27: 180 Ringing (P-CSCF to UE)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

28. **PRACK (UE to P-CSCF) – see example in table 7.2.3.1-28**

UE indicates to the originating subscriber that the destination is ringing. It acknowledges the 180 Ringing provisional response (27) with a PRACK request.

Table 7.2.3.1-28: PRACK (UE to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

Request-URI: Takes the value of the Contact header of the received 180 Ringing response.

Via: Takes the value of either the IP address or FQDN of the originating UE.

From:/To:/Call-ID: Copied from the 180 Ringing response so that they include any revised tag parameters.

Cseq: Takes a higher value than in the previous request.

29. **PRACK (P-CSCF to S-CSCF) – see example in table 7.2.3.1-29**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the PRACK request to S-CSCF.

Table 7.2.3.1-29: PRACK (P-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip: scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

30. **PRACK (MO#2 to S-S) – see example in table 7.2.3.1-30**

S-CSCF forwards the PRACK request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.3.1-30: PRACK (MO#2 to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

31. **200 OK (S-S to MO#2) – see example in table 7.2.3.1-31**

    The destination endpoint responds to the PRACK request (30) with a 200 OK response.

Table 7.2.3.1-31: 200 OK (S-S to MO#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

32. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.3.1-32**

    S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.3.1-32: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

33. **200 OK (P-CSCF to UE) – see example in table 7.2.3.1-33**

    P-CSCF forwards the 200 OK response to UE.

Table 7.2.3.1-33: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **200 OK (S-S to MO#2) – see example in table 7.2.3.1-34**

    When the called party answers, the terminating endpoint sends a 200 OK final response to the INVITE request (6), as specified by the termination procedures and the S-CSCF to S-CSCF procedures, to S-CSCF.

Table 7.2.3.1-34: 200 OK (S-S to MO#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length: 0
```

35. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.3.1-35**

S-CSCF sends a 200 OK final response along the signalling path back to P-CSCF.

Table 7.2.3.1-35: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

36. **Approval of QoS Commit**

The P-CSCF approves the commitment of the QoS resources if it was not approved already in step (10).

37. **200 OK (P-CSCF to UE) – see example in table 7.2.3.1-37**

P-CSCF indicates the resources reserved for this session should now be committed, and forwards the 200 OK final response to the session originator. UE can start media flow(s) for this session.

Table 7.2.3.1-37: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

38. **ACK (UE to P-CSCF) – see example in table 7.2.3.1-38**

UE starts the media flow for this session, and responds to the 200 OK (39) with an ACK request sent to P-CSCF.

Table 7.2.3.1-38: ACK (UE to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 ACK
Content-Length: 0
```

Cseq: Is required to be the same value as Cseq is original INVITE request [3].

39. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.3.1-39**

    P-CSCF adds the Route header corresponding to the session.

    P-CSCF forwards the ACK request to S-CSCF.

Table 7.2.3.1-39: ACK (P-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr,sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

Route: Saved from the Record-Route header of the 183 Session Progress response.

40. **ACK (MO#2 to S-S) – see example in table 7.2.3.1-40**

    S-CSCF forwards the ACK request to the terminating endpoint, per the S-CSCF to S-CSCF procedure.

Table 7.2.3.1-40: ACK (MO#2 to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

7.2.3.2 Failure in termination procedure

The roaming subscriber that initiated a session with procedure MO#2 had the attempt fail due to an error detected in the Termination procedure or in the S-CSCF-to-S-CSCF procedure. This could be due to, for example, destination busy (error code 486), destination service denied (error code 403), destination currently out of coverage (error code 480), or some other error.

Depending on the exact error that causes the session initiation failure, and when the error situation was detected, UE#1 could be at many different stages in the session establishment procedure. This is shown in figure 7.2.3.2-1, as optional messages 7-33 that may appear in this error procedure.

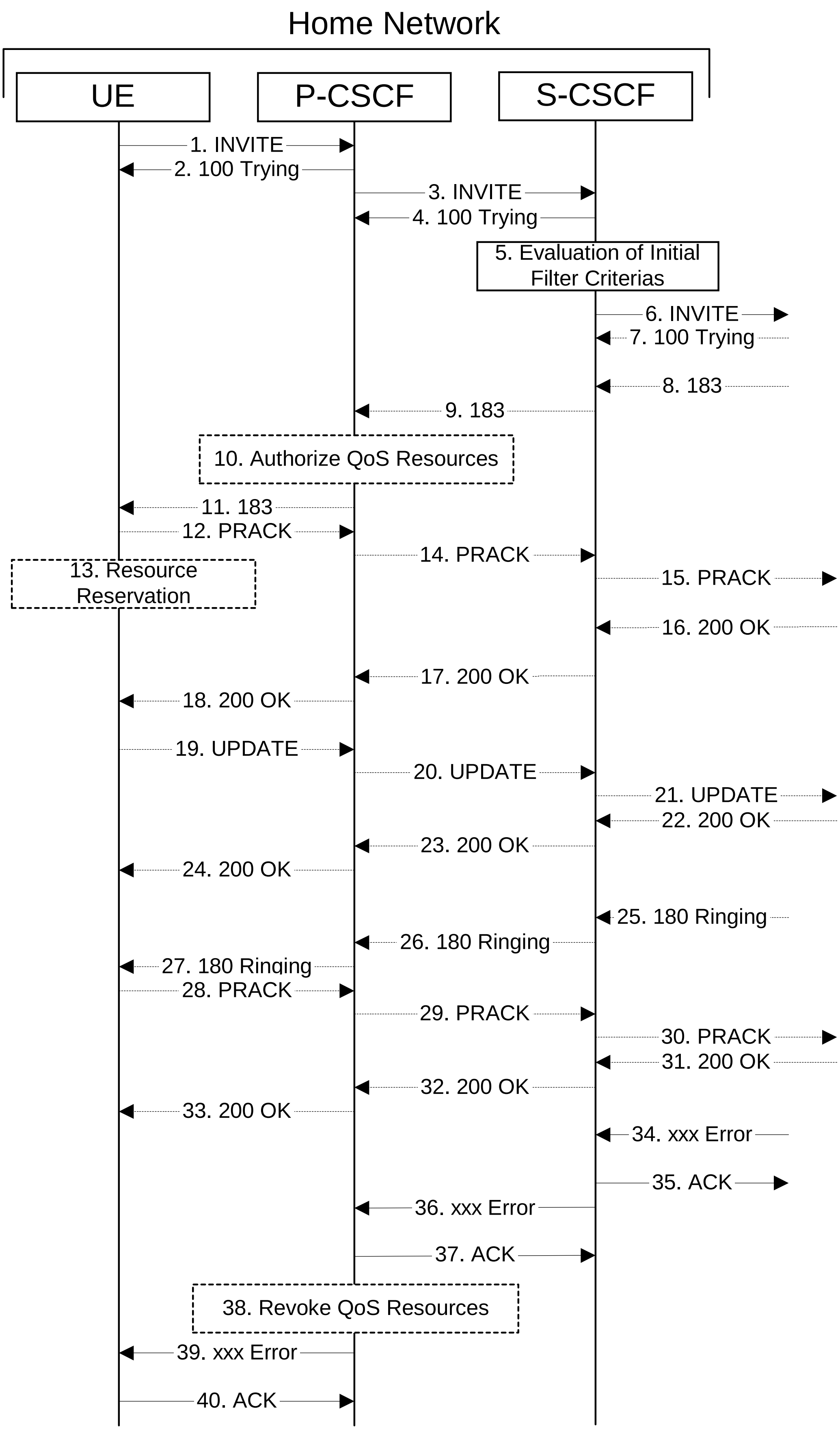


Figure 7.2.3.2-1: Failure in termination procedure

1-6. **INVITE (UE to P-CSCF) et seq**

UE#1 initiated a session, as described in subclause 7.2.3.1.

7-33. **100 Trying (S-S to MO#2) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.2.3.1.

34. **xxx Error (S-S to MO#2) – see example in table 7.2.3.2-34**

The termination procedure detected some error situation, and returned a SIP error response.

NOTE 1: The error response may be, for example, "486 Busy", "403 Service Denied", "480 Temporarily Unavailable", or others. For this example, "486 Busy" is shown.

Table 7.2.3.2-34: 486 Busy Here (S-S to MO#2)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Contact: sip:[5555::eee:fff:aaa:bbb]
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Retry-After:3600
Content-Length: 0
```

35. **ACK (MO#2 to S-S) – see example in table 7.2.3.2-35**

Upon receive the 486 response from the S-S procedure, S-CSCF sends ACK.

Table 7.2.3.2-35: ACK (MO#2 to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

36. **xxx Error (S-CSCF to P-CSCF) – see example in table 7.2.3.2-36 (related to table 7.2.3.2-34)**

The S-CSCF returned a SIP error response to P-CSCF.

NOTE 2: The error response may be, for example, "486 Busy", "403 Service Denied", "480 Temporarily Unavailable", or others. For this example, "486 Busy" is shown.

Table 7.2.3.2-36: 486 Busy Here (S-CSCF to P-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Contact:
Call-ID:
CSeq:
Retry-After:3600
Content-Length: 0
```

37. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.3.2-37**

Upon receive the 486 response from the S-CSCF procedure, P-CSCF sends ACK.

Table 7.2.3.2-37: ACK (P-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1
Max-Forwards: 70
Route: sip:scscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

38. **Revoke QoS authorization**

P-CSCF removes the QoS authorization, if any, for this session.

39. **xxx Error (P-CSCF to UE) – see example in table 7.2.3.2-39 (related to table 7.2.3.2-36)**

The P-CSCF returned a SIP error response to UE.

NOTE 3: The error response may be, for example, "486 Busy", "403 Service Denied", "480 Temporarily Unavailable", or others. For this example, "486 Busy" is shown.

Table 7.2.3.2-39: 486 Busy Here (P-CSCF to UE)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Contact:
Call-ID:
CSeq:
Retry-After:3600
Content-Length: 0
```

40. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.3.2-40**

Upon receive the 486 response from the P-CSCF, UE sends ACK.

Table 7.2.3.2-40: ACK (UE to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.2.3.3 Session abandoned, or resource failure

The roaming subscriber that initiated a session with procedure MO#2 either abandoned the attempt, or was unable to obtain the resources necessary for the session. The signalling flow for this error handling is shown in figure 7.2.3.3-1.

If the session is aborted due to failure to obtain resources, it will occur at step #18 in the signalling flow; steps 19-33 (marked as optional) will not be present. If the session is abandoned due to user command, it can happen at any point between steps 8-33.

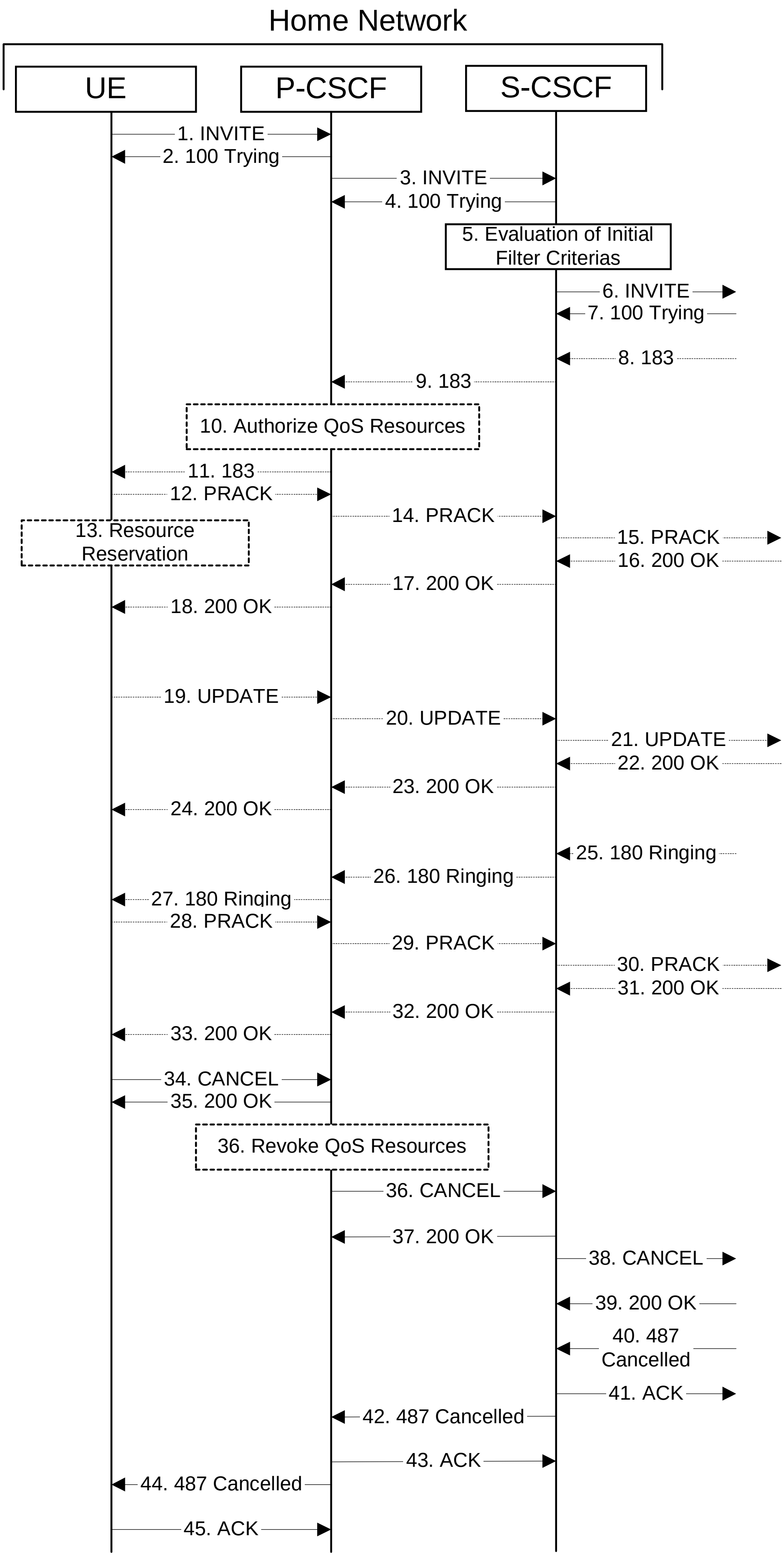


Figure 7.2.3.3-1: Session abandoned or resource failure

1-7. **INVITE (UE to P-CSCF) et seq**

UE#1 initiated a session, as described in subclause 7.2.3.1.

8-33. **183 Session Progress (S-S to MO#2) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.2.3.1.

34. **CANCEL (UE to P-CSCF) – see example in table 7.2.3.3-34**

The UE cancelled the original INVITE request.

Table 7.2.3.3-34: CANCEL (UE to P-CSCF)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 CANCEL
Content-Length: 0
```

35. **200 OK (P-CSCF to UE) – see example in table 7.2.3.3-35**

Upon receive the CANCEL request from the UE, P-CSCF sends 200 OK.

Table 7.2.3.3-35: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

36. **Revoke QoS authorization**

P-CSCF removes the QoS authorization, if any, for this session.

37. **CANCEL (P-CSCF to S-CSCF) – see example in table 7.2.3.3-37 (related to table 7.2.3.3-34)**

The P-CSCF forwards the CANCEL request to S-CSCF.

Table 7.2.3.3-37: CANCEL (P-CSCF to S-CSCF)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scfcf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

38. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.3.3-38**

Upon receiving the CANCEL request from the P-CSCF, S-CSCF sends 200 OK.

Table 7.2.3.3-38: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

39. **CANCEL (S-CSCF to S-S) – see example in table 7.2.3.3-39 (related to table 7.2.3.3-37)**

    The S-CSCF forwards the CANCEL request to the appropriate S-CSCF-to-S-CSCF procedure.

Table 7.2.3.3-39: CANCEL (S-CSCF to S-S)

```
CANCEL sip:[555:eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net
From:
To:
Call-ID:
Cseq:
Contact:
Content-Length:
```

40. **200 OK (S-S to S-CSCF) – see example in table 7.2.3.3-40**

    Upon receive the CANCEL request from the S-CSCF, the next hop (whatever it is) sends 200 OK.

Table 7.2.3.3-40: 200 OK (S-S to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

41. **487 Cancelled (S-S to MO#2) – see example in table 7.2.3.3-41**

    The termination procedure cancelled the request, and returned a SIP error response to the original INVITE request.

Table 7.2.3.3-41: 487 Cancelled (S-S to MO#2)

```
SIP/2.0 487 Cancelled
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Contact: sip:[5555::eee:fff:aaa:bbb]
Call-ID:
CSeq: 127 INVITE
Content-Length: 0
```

42. **ACK (MO#2 to S-S) – see example in table 7.2.3.3-42**

    Upon receive the 487 response from the S-S procedure, S-CSCF sends ACK.

Table 7.2.3.3-42: ACK (MO#2 to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards 70
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

43. **487 Cancelled (S-CSCF to P-CSCF) – see example in table 7.2.3.3-43 (related to table 7.2.3.3-41)**

The S-CSCF returned the SIP error response to P-CSCF.

Table 7.2.3.3-43: 487 Cancelled (S-CSCF to P-CSCF)

```
SIP/2.0 487 Cancelled
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Contact:
Call-ID:
CSeq:
Content-Length: 0
```

44. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.3.3-44**

Upon receive the 487 response from the S-CSCF, P-CSCF sends ACK.

Table 7.2.3.3-44: ACK (P-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1
Max-Forwards: 70
Route: sip:scscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

45. **487 Cancelled (P-CSCF to UE) – see example in table 7.2.3.3-45 (related to table 7.2.3.3-43)**

The P-CSCF returned a SIP error response to UE.

Table 7.2.3.3-45: 487 Cancelled (P-CSCF to UE)

```
SIP/2.0 487 Cancelled
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Contact:
Call-ID:
CSeq:
Retry-After:3600
Content-Length: 0
```

46. **ACK (UE to P-CSCF) – see example in table 7.2.3.3-46**

Upon receive the 487 response from the P-CSCF, UE sends ACK.

Table 7.2.3.3-46: ACK (UE to P-CSCF)

```
ACK sip:+1-212-555-2222@home1.net;user=phone SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.2.4 (CS-O) CS Networks origination

The MGCF in the IM subsystem is a SIP endpoint that initiates requests on behalf of the CS Networks origination and Media Gateway. The subsequent nodes consider the signalling as if it came from a S-CSCF. The MGCF incorporates the network security functionality of the S-CSCF. This MGCF does not invoke Service Control, as this may be carried out in the CS Networks or at the terminating S-CSCF. This origination procedure can be used for any of the MT procedures.

Due to routing of sessions within the CS Networks, this origination procedure will only occur in the home network of the destination subscriber. However, the destination subscriber may be roaming in a different operator's network. Further, due to cases of session forwarding and electronic surveillance, the destination of the session through the IM subsystem may actually be another CS Networks termination.

7.2.4.1 CS Networks originated sessions routed towards IM CN subsystem (through MGCF) (S-S#2, MT#2 assumed)

This clause and figure 7.2.4.1-1 presents only the case of CS Networks originated sessions routed towards the IM CN subsystem reaching first a MGCF.

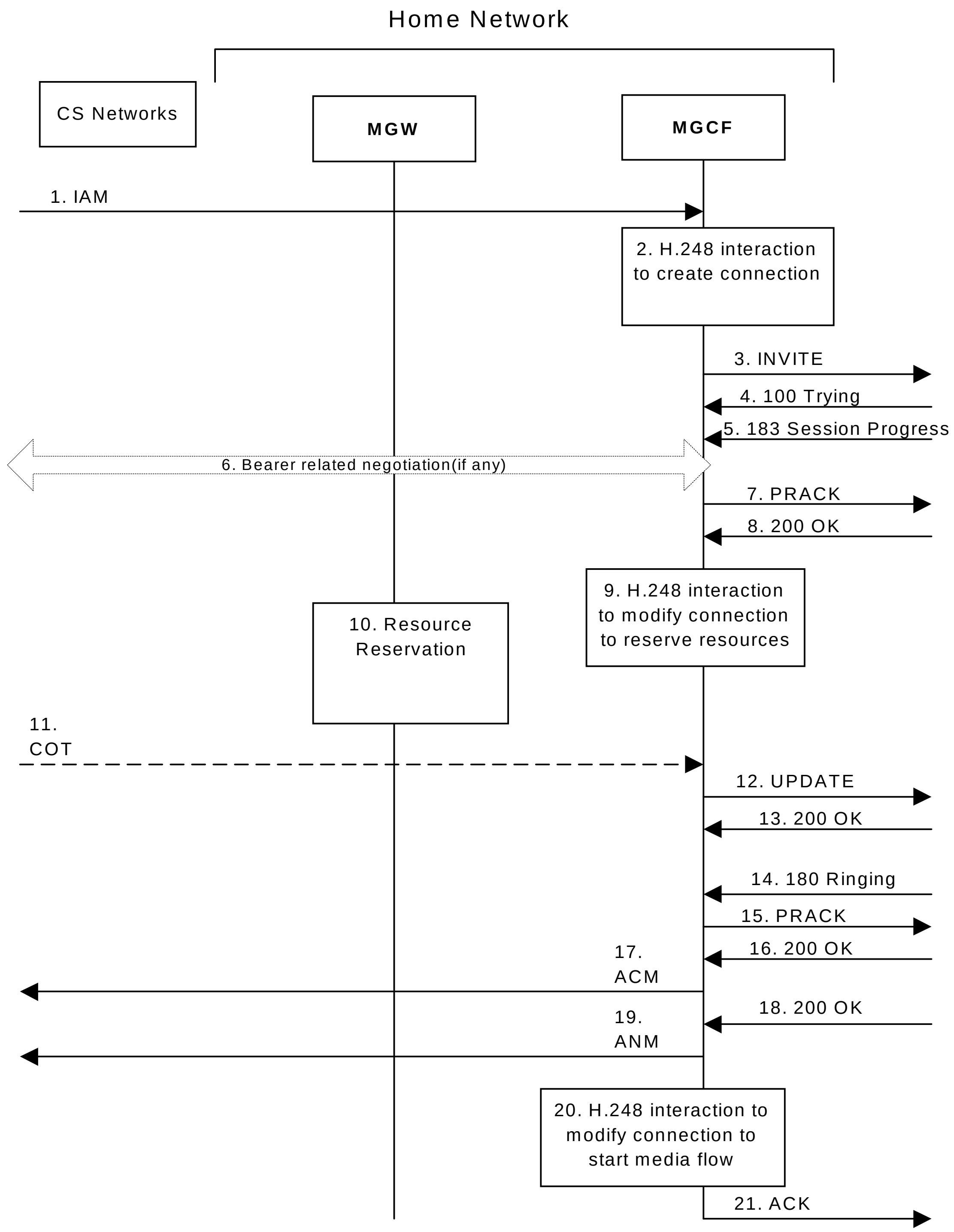


Figure 7.2.4.1-1: CS Networks origination

The CS Networks Origination procedure is as follows:

1. **SS7: IAM**

   The CS Network establishes a bearer path to the MGW, and signals to the MGCF with a IAM message, giving the trunk identity, destination information and optionally the continuity indication.

2. **H.248 Interaction**

   The MGCF initiates a H.248 command, to seize the trunk and an IP port.

3. **INVITE (CS-O to S-S) – see example in table 7.2.4.1-3**

The MGCF initiates an INVITE request, containing an initial SDP, as per the proper S-CSCF to S-CSCF procedure.

Table 7.2.4.1-3: INVITE (CS-O to S-S)

```
INVITE sip:+1-212-555-2222@home1.net;user=phone SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
Remote-Party-IDP-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>; screen=yes
RPID-PrivacyPrivacy: noneprivacy=off;party=calling
From: sip:user1_public1@home1.nettel:+1-212-555-1111; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip: mgcf1.home1.net
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97 3 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Request-URI: Contains the keyed number from the user, as obtained from CS Networks signalling.

Via: Contains the IP address or FQDN of the originating MGCF.

~~Remote-Party-ID~~P-Asserted-Identity~~:~~ : the user provides a hint about the identity to be used for this session.

~~Contains the identity of the originator. The Display name is optional~~.

From:/To:/Call-ID: Follow the recommendations of draft-ietf-sip-privacy [13], even though anonymity is not being requested for this session.

Cseq: A random starting number.

Contact: Is the SIP URL that contains the IP address or FQDN of the originating UE.

SDP The SDP contains a preconfigured set of codecs supported by the MGW.

4. **100 Trying (S-S to CS-O) – see example in table 7.2.4.1-4**

MGCF receives a 100 Trying provisional response, as specified by the S-CSCF to S-CSCF procedures.

Table 7.2.4.1-4: 100 Trying (S-S to CS-O)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

5. **183 Session Progress (S-S to CS-O) – see example in table 7.2.4.1-5**

   The media stream capabilities of the destination are returned along the signalling path, in a 183 Session Progress provisional response, per the S-CSCF to S-CSCF procedures.

Table 7.2.4.1-5: 183 Session Progress (S-S to CS-O)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Record-Route: sip:pcscf2.home1.net;lr, sip:scscf2.home1.net;lr
~~Remote-Party-ID~~P-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>
~~RPID-Privacy~~Privacy: ~~privacy=off; party=called~~none
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=audio 6544 RTP/AVP 97
b=AS:25.4 3
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
```

   Upon receiving the 183 Session Progress, the MGCF stores the following information about this session – see example in table 7.2.4.1-6b.

Table 7.2.4.1-6b: Storage of information at MGCF

```
Request-URI: sip:+1-212-555-2222@home1.net;user=phone
From: tel:+1-212-555-1111~~sip:user1_public1@home1.net~~; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Route: sip:scscf2.home1.net, sip:pcscf2.home1.net
```

6. **Possible bearer related negotiation takes place**

   Steps 6 and 7 can be done in an arbitrary order.

7. **PRACK (CS-O to S-S) – see example in table 7.2.4.1-7**

   MGCF decides the final set of media streams for this session, and includes this information in the PRACK request, send to the destination per the S-CSCF to S-CSCF procedures.

Table 7.2.4.1-7: PRACK (CS-O to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
Route: sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From: tel:+1-212-555-1111sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require:
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=
```

Request-URI: Takes the first component of the saved Route header.

Via: Takes the value of either the IP address or FQDN of the originating MGCF.

Route: Takes the saved Route header without the first component.

From:/To:/Call-ID: Copied from the 183 Session Progress response so that they include any tag parameter.

Cseq: Takes a higher value than that in the previous request.

8. **200 OK (S-S to CS-O) – see example in table 7.2.4.1-8**

The destination responds to the PRACK request (7) with a 200 OK response.

Table 7.2.4.1-8: 200 OK (S-S to CS-O)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
```

9. **H.248 Interaction**

MGCF initiates a H.248 command to modify the connection parameters and instruct the MGW to reserve the resources needed for the session.

10. **Reserve Resources**

    MGW reserves the resources needed for the session.

11. **COT**

    In case the IAM had contained a continuity indication, the COT message arrives to the MGCF.

12. **UPDATE (CS-O to S-S) – see example in table 7.2.4.1-12**

    When the resource reservation is completed and the possible COT message is received, MGCF sends the UPDATE request to the terminating endpoint, per the S-S procedures.

Table 7.2.4.1-12: UPDATE (CS-O to S-S)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
Route: sip:scsf2.home1.net;lr, sip:pcscf2.home1.net;lr
From: tel:+1-212-555-1111sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
```

Request-URI: The first component of saved the Route header.

Via: Contains the IP address or FQDN of the originating MGCF.

Route: Takes the saved Route header without the first component.

From:/To:/Call-ID: Copied from the 183 Session Progress response so that they include any tag parameters.

Cseq: Takes a higher value than that in the previous request.

The SDP indicates that the resource reservation was successful in the local segment.

13. **200 OK (S-S to CS-O) – see example in table 7.2.4.1-13**

    The destination endpoint responds to the UPDATE request (12) with a 200 OK response.

Table 7.2.4.1-13: 200 OK (S-S to CS-O)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
```

The SDP indicates that the resource reservation was successful both in the local and the remote segment.

14. **180 Ringing (S-S to CS-O) – see example in table 7.2.4.1-14**

The destination endpoint may optionally perform alerting. If so, it signals this to the calling party by a 180 Ringing provisional response. This response is sent to MGCF per the S-CSCF to S-CSCF procedure.

Table 7.2.4.1-14: 180 Ringing (S-S to CS-O)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Record-Route: sip:pcscf2.home1.net;lr, sip:scscf2.home1.net;lr
Require: 100rel
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

15. **PRACK (CS-O to S-S) – see example in table 7.2.4.1-15**

MGCF acknowledges the 180 Ringing provisional response (14) with a PRACK request. MGCF adds the Route header corresponding to the session.

Table 7.2.4.1-15: PRACK (CS-O to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
Route: sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From: tel:+1-212-555-1111sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID:
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

16. **200 OK (S-S to CS-O) – see example in table 7.2.4.1-16**

The destination endpoint responds to the PRACK request (15) with a 200 OK response.

Table 7.2.4.1-16: 200 OK (S-S to CS-O)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

17. **SS7: ACM**

    If alerting is being performed, the MGCF forwards an ACM message.

18. **200 OK (S-S to CS-O) – see example in table 7.2.4.1-18**

    When the called party answers, the terminating and S-S procedures result in a 200 OK final response being sent to MGCF.

Table 7.2.4.1-18: 200 OK (S-S to CS-O)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Record-Route: sip:pcscf2.home1.net;lr, sip:scscf2.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length: 0
```

19. **SS7: ANM**

    MGCF forwards an ANM message to the CS Networks.

20. **H.248: Interaction**

    MGCF initiates a H.248 command to alter the connection at MGW to make it bidirectional.

21. **ACK (CS-O to S-S) – see example in table 7.2.4.1-21**

    MGCF acknowledges the 200 OK final response (18) with an ACK request.

Table 7.2.4.1-21: ACK (CS-O to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
Route: sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq: 127 ACK
Content-Length: 0
```

Request-URI: the first component of the saved Route header.

Route: takes the saved Route header without the first component.

Cseq: is required to be the same value as Cseq is original INVITE request [3]

7.2.4.2 CS Networks originated sessions routed towards CS domain (through G-MSC) (not provided)

An example of this flow is not shown in the present document.

7.2.4.3 CS Networks originated sessions routed either towards IM CN subsystem or towards CS domain (not provided)

An example of this flow is not shown in the present document.

7.2.4.4 Failure in termination procedure

The PSTN subscriber that initiated a session with procedure CS-O had the attempt fail due to an error detected in the Termination procedure or in the S-CSCF-to-S-CSCF procedure. This could be due to, for example, destination busy (error code 486), destination service denied (error code 403), destination currently out of coverage (error code 480), or some other error.

Depending on the exact error that causes the session initiation failure, and when the error situation was detected, the originator could be at many different stages in the session establishment procedure. This is shown in figure 7.2.4.4-1, as optional messages 5-17 that may appear in this error procedure.

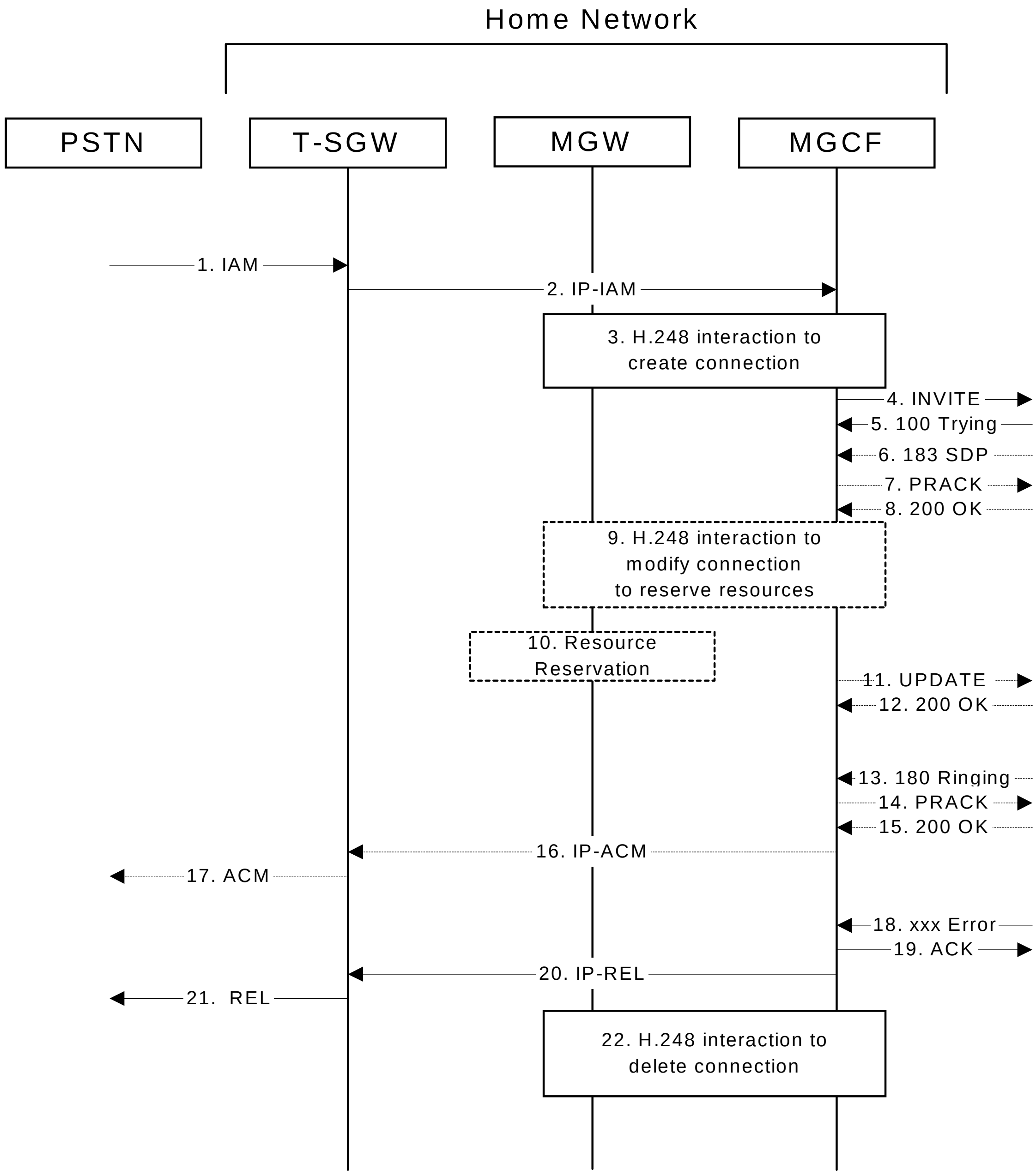


Figure 7.2.4.4-1: Failure in termination procedure

4. **INVITE (MGCF to S-S) et seq**

The PSTN originator initiated a session, as described in subclause 7.2.4.1.

5-17. **100 Trying (S-S to CS-O) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.2.4.1.

18. **xxx Error (S-S to CS-O) – see example in table 7.2.4.4-18**

The termination procedure detected some error situation, and returned a SIP error response.

NOTE 1: The error response may be, for example, "486 Busy", "403 Service Denied", "480 Temporarily Unavailable", or others. For this example, "486 Busy" is shown.

Table 7.2.4.4-18: 486 Busy Here (S-S to CS-O)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
From: tel:+1-212-555-1111~~sip:user1_public1@home1.net~~; tag=171828
To: tel:+1-212-555-2222; tag=314159
Contact: sip:[5555::eee:fff:aaa:bbb]
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Retry-After:3600
Content-Length: 0
```

19. **ACK (CS-O to S-S) – see example in table 7.2.4.4-19**

Upon receive the 486 response from the S-S procedure, S-CSCF sends ACK.

Table 7.2.4.4-19: ACK (CS-O to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

20. **H.248 Interaction**

MGCF initiates a H.248 interaction with MGW to delete the connection.

7.2.4.5 Session abandoned, or resource failure

The PSTN subscriber that initiated a session with procedure CS-O either abandoned the attempt, or was unable to obtain the resources necessary for the session. The signalling flow for this error handling is shown in figure 7.2.4.5-1.

If the session is aborted due to failure to obtain resources, it will occur at step #10 in the signalling flow; steps 11-17 (marked as optional) will not be present. If the session is abandoned due to user command, it can happen at any point between steps 5-17.

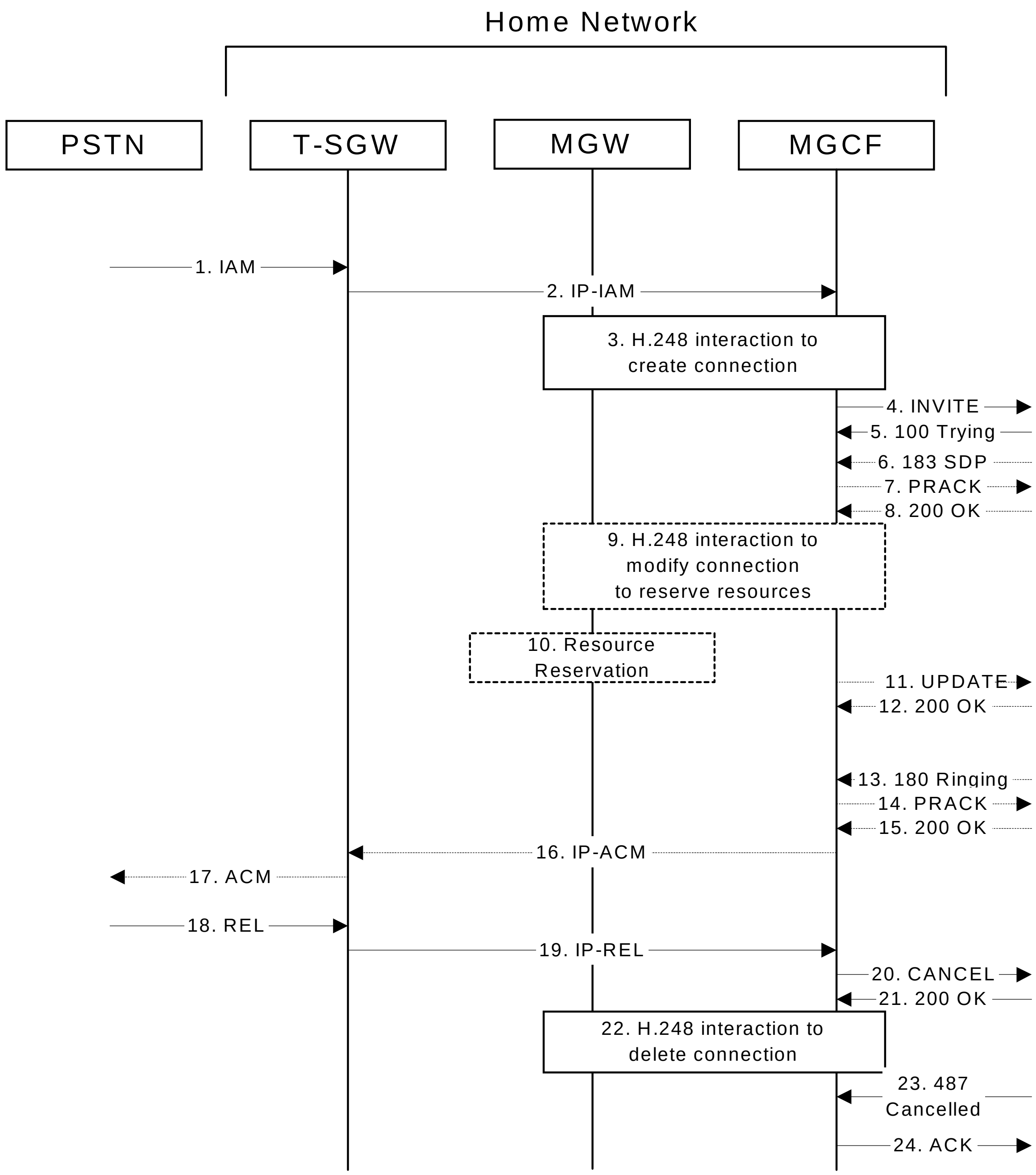


Figure 7.2.4.5-1: Session abandoned or resource failure

4. **INVITE (CS-O to S-S) et seq**

   CS-O initiated a session, as described in subclause 7.2.4.1.

5-15. **183 SDP (S-S to CS-O) et seq**

   Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.2.4.1.

20. **CANCEL (CS-O to S-S) – see example in table 7.2.4.5-20**

   The PSTN cancelled the original INVITE request.

Table 7.2.4.5-20: CANCEL (CS-O to S-S)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
Route: sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From: tel:+1-212-555-1111sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 CANCEL
Content-Length: 0
```

21. **200 OK (S-S to CS-O) – see example in table 7.2.4.5-21**

Upon receive the CANCEL request from CS-O, the S-S procedure sends 200 OK.

Table 7.2.4.5-21: 200 OK (S-S to CS-O)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

22. **H.248 Interaction**

MGCF initiates a H.248 interaction with MGW to delete the connection

23. **487 Cancelled (S-S to CS-O) – see example in table 7.2.4.5-23**

The termination procedure processed the CANCEL request, and returned a SIP error response.

Table 7.2.4.5-23: 487 Cancelled (S-S to CS-O)

```
SIP/2.0 487 Cancelled
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
From:
To:
Contact:
Call-ID:
Cseq: 127 INVITE
Retry-After:3600
Content-Length: 0
```

24. **ACK (CS-O to S-S) – see example in table 7.2.4.5-24**

Upon receive the 487 response from the S-S procedure, MGCF sends ACK.

Table 7.2.4.5-24: ACK (CS-O to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP mgcf1.home1.net;branch=z9hG4bK779s24.0
Max-Forwards: 70
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.2.5 Error handling: origination procedures (not provided)

An example of this flow is not shown in the present document.

7.3 S-CSCF (MGCF) to S-CSCF (MGCF) procedures

7.3.1 Introduction

This subclause presents the detailed signalling flows to define the procedures for S-CSCF to S-CSCF.

This subclause contains four signalling flow procedures, showing variations on the signalling path between the S-CSCF (or MGCF) that handles session origination, and the S-CSCF (or MGCF) that handles session termination. This signalling path depends on:

- whether the originator and destination are served by the same network operator;
- agreements between operators for optimum PSTN gateway location.

Between separate operators, there are additional sub-cases covering the optional network configuration hiding – hiding required by both operators, neither operator, or just one operator.

The S-CSCF handling session origination performs an analysis of the destination address, and determines whether it is a PSTN destination, a subscriber of the same network operator or a subscriber of a different operator.

If the analysis of the destination address determined that it belongs to a subscriber of a different operator, the request is forwarded (optionally through an I-CSCF within the originating operator's network) to a well-known entry point in the destination operator's network, the I-CSCF. The I-CSCF queries the HSS for current location information. The I-CSCF then forwards the request to the S-CSCF. This is signalling flow procedure S-S#1.

If the analysis of the destination address determines that it belongs to a subscriber of the same operator, the S-CSCF forwards the request to a local I-CSCF, who queries the HSS for current location information. The I-CSCF then forwards the request to the S-CSCF. This is signalling flow procedure S-S#2.

If the analysis of the destination address determines that it is a PSTN destination, the S-CSCF forwards the request to a local BGCF. Based on further analysis of the destination address, and on agreements between operators for PSTN termination, the BGCF will either select a local MGCF to perform the termination (procedure S-S#3) or will forward the request to a BGCF in another operator's network who will select the MGCF to perform the termination (procedures S-S#4).

7.3.2 S-S#1a

7.3.2.1 (S-S#1a) Different network operators performing origination and termination (MO#1a, MT#1a assumed)

Figure 7.3.2.1-1 shows a S-CSCF handling session origination (S-CSCF#1), which performs an analysis of the destination address, and determines that it belongs to a subscriber of a different operator. The originating network operator does not desire to keep their configuration hidden, so it forwards the request to a well-known entry point in the destination operator's network, I-CSCF. I-CSCF queries the HSS for current location information, and finds the S-CSCF assigned to the subscriber (S-CSCF#2), and forwards the request to S-CSCF#2. The terminating network operator does not desire to keep their configuration hidden, so the I-CSCF does not insert itself into the signalling path for future exchanges. This example flow does not show Application Server involvement.

Origination sequences that share this common S-CSCF to S-CSCF procedure are:

MO#1a Mobile origination, roaming, without a THIG. The "Originating Network" of S-S#1a is therefore a visited network.

MO#1b Mobile origination, roaming, with a THIG in home network. The "Originating Network" of S-S#1a is therefore a visited network.

MO#2 Mobile origination, located in home service area. The "Originating Network" of S-S#1a is therefore the home network.

CS-O CS Networks origination. The "Originating Network" of S-S#1a is the home network. The element labelled S-CSCF#1 is the MGCF of the CS-O procedure.

Termination sequences that share this common S-CSCF to S-CSCF procedure are:

MT#1a Mobile termination, roaming, without a THIG. The "Terminating Network" of S-S#1a is a visited network.

MT#1b Mobile termination, roaming, with a THIG in home network. The "Terminating Network" of S-S#1a is a visited network.

MT#2 Mobile termination, located in home service area. The "Terminating Network" of S-S#1a is the home network.

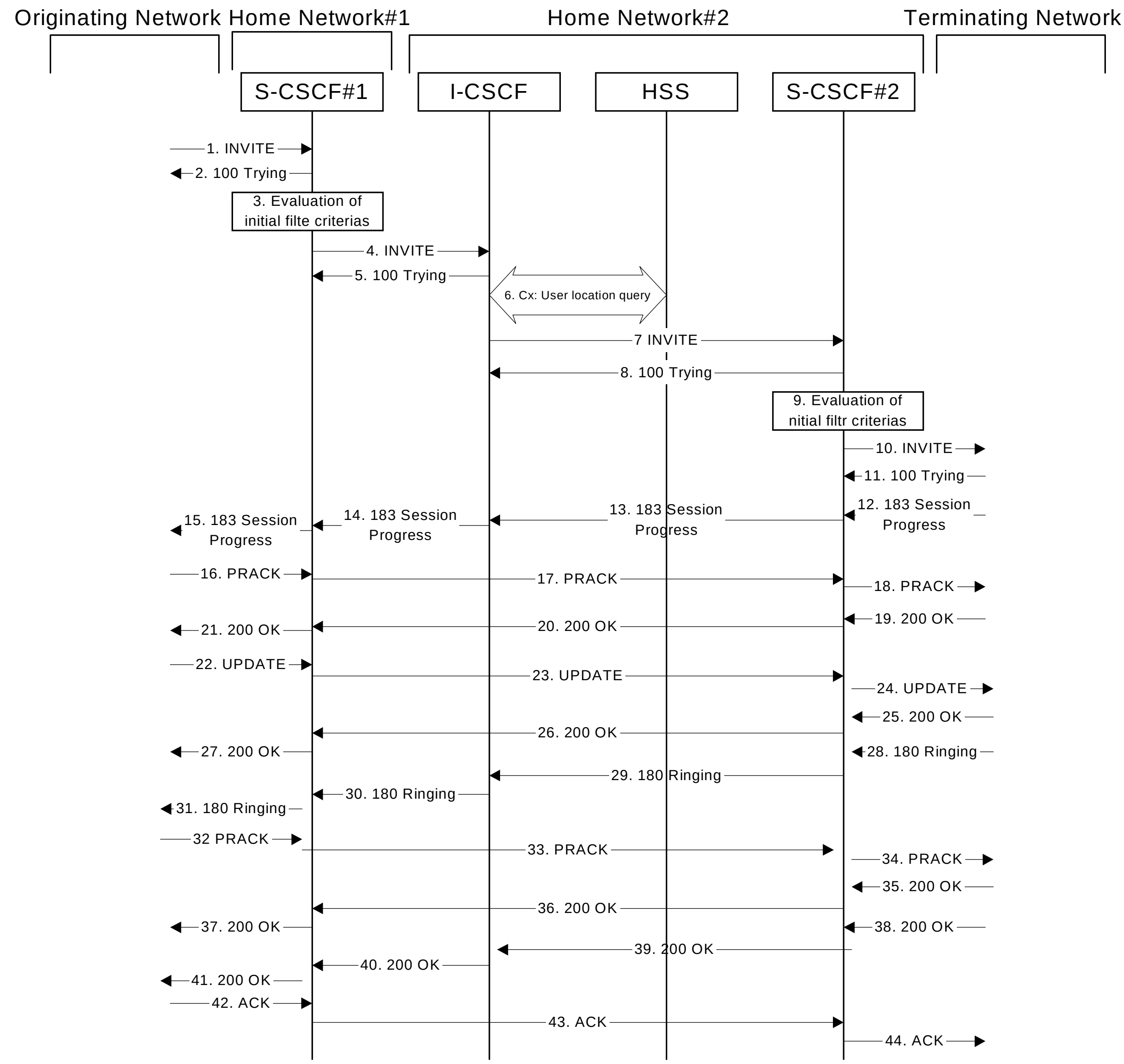


Figure 7.3.2.1-1: S-S#1a

Procedure S-S#1a is as follows:

1. **INVITE (MO to S-S#1a) – see example in table 7.3.2.1-1**

   The INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating signalling flow.

Table 7.3.2.1-1: INVITE (MO to S-S#1a)

```
INVITE tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Record-Route: sip:pcscf1.visited1.net;lr
Route: sip:scscf1.home1.net;lr
Record-Route: sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>
Privacy: none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

2. **100 Trying (S-S#1a to MO) – see example in table 7.3.2.1-2**

   S-CSCF#1 responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.3.2.1-2: 100 Trying (S-S#1a to MO)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

S-CSCF#1 validates the service profile of this subscriber and evaluates the initial filter criterias. For this example, assume no Application Server involvement.

4. **INVITE (S-CSCF to I-CSCF) – see example in table 7.3.2.1-4**

S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the destination subscriber belongs. Since the originating operator does not desire to keep their internal configuration hidden, S-CSCF#1 forwards the INVITE request directly to to I-CSCF in the destination network.

S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

Table 7.3.2.1-4: INVITE (S-CSCF to I-CSCF)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
P-Asserted-Identity:
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>, <tel:+1-212-555-1111>
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Request-URI: In the case where the Request-URI of the incoming INVITE request to S-CSCF contains a TEL-URL [5], it has to be translated to a globally routable SIP-URL before applying it as Request-URI of the outgoing INVITE request. For this address translation the S-CSCF shall use the services of an ENUM-DNS protocol according to RFC 2916 [6], or any other suitable translation database. Database aspects of ENUM are outside the scope of this specification.

P-Asserted-Identity: ~~S-CSCF inserts the TEL-URL of the user.~~The S-CSCF adds the corresponding TEL URL to the P-Asserted-Identity header in order that the TEL URL is known to the destination network in case the INVITE is forwarded to a MGCF.

5. **100 Trying (I-CSCF to S-CSCF) – see example in table 7.3.2.1-5**

I-CSCF responds to the INVITE request (4) by sending a 100 Trying provisional response to S-CSCF#1.

Table 7.3.2.1-5: 100 Trying (I-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
    pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **Cx: User Location Query procedure**

The I-CSCF sends a query to the HSS to find out the S-CSCF of the called user. The HSS responds with the address of the current S-CSCF for the terminating subscriber.

For detailed message flows see 3GPP TS 29.228 [11].

Table 6.3.2-6a provides the parameters in the SIP INVITE request (flow 4), which are sent to the HSS.

Table 7.3.2.1-6a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx: Information element name	Information source in SIP INVITE	Description
I-CSCF to HSS	User Public Identity	Request-URI:	This information element indicates the public user identity

Table 7.3.2.1-6b provides the parameters sent from the HSS that need to be mapped to SIP INVITE (flow 7) and sent to S-CSCF.

Table 7.3.2.1-6b Cx: User registration status query procedure (HSS to I-CSCF)

Message source & destination	Cx: Information element name	Mapping to SIP header in SIP INVITE	Description
HSS to I-CSCF	S-CSCF name	Route header field	This information indicates the serving CSCF's name of that user

7. **INVITE (I-CSCF to S-CSCF) – see example in table 7.3.2.1-7**

I-CSCF forwards the INVITE request to the S-CSCF (S-CSCF#2) that will handle the session termination.

Table 7.3.2.1-7: INVITE (I-CSCF to S-CSCF)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
Route: sip:scscf2.home2.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
```

NOTE: The I-CSCF does not add itself to the Record-Route header, as it has no need to remain in the signalling path once the session is established.

8. **100 Trying (S-CSCF to I-CSCF) – see example in table 7.3.2.1-8**

S-CSCF#2 responds to the INVITE request (7) with a 100 Trying provisional response.

Table 7.3.2.1-8: 100 Trying (S-CSCF to I-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
    scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
    pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

9. **Evaluation of initial filter criterias**

   S-CSCF#2 validates the service profile of this subscriber and evaluates the initial filter criterias.

10. **INVITE (S-S#1a to MT) – see example in table 7.3.2.1-10**

    S-CSCF#2 forwards the INVITE request, as determined by the termination procedure. S-CSCF#2 remembers (from the registration procedure) the UE Contact address and the next hop CSCF for this UE.

    S-CSCF#2 examines the media parameters, and removes any choices that the destination subscriber does not have authority to request. For this example, assume the destination subscriber is not allowed stereo, so only a single audio stream is permitted.

Table 7.3.2.1-10: INVITE (S-S#1a to MT)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 66
Record-Route: sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr
sip:pcscf1.visited1.net;lr
Route: sip:pcscf2.visited2.net;lr
Record-Route: sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID: sip:user2_public1@home2.net
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

11. **100 Trying (MT to S-S#1a) – see example in table 7.3.2.1-11 (related to table 7.3.2.1-10)**

S-CSCF#2 receives a 100 Trying provisional response to the INVITE request (10), as specified by the termination procedures.

Table 7.3.2.1-11: 100 Trying (MT to S-S#1a)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

12. **183 Session Progress (MT to S-S#1a) – see example in table 7.3.2.1-12 (related to table 7.3.2.1-10)**

The media stream capabilities of the destination are returned along the signalling path, in a 183 Session Progress provisional response to the INVITE request (10), as per the termination procedure.

Table 7.3.2.1-12: 183 Session Progress (MT to S-S#1a)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Smith" <sip:user2_public1@home2.net>
Privacy: none
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

13. **183 Session Progress (S-CSCF to I-CSCF) – see example in table 7.3.2.1-13**

S-CSCF#2 forwards the 183 Session Progress provisional response to I-CSCF.

Table 7.3.2.1-13: 183 Session Progress (S-CSCF to I-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
P-Asserted-Identity:
P-Asserted-Identity: "John Smith" <sip:user2_public1@home2.net>, <tel:+1-212-555-2222>
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

P-Asserted-Identity: The S-CSCF adds the corresponding TEL URL to the P-Asserted-Identity header in order that the TEL URL is known to the destination network in case the INVITE is forwarded to a MGCF.

~~S-CSCF inserts the TEL URL of the user~~.

14. **183 Session Progress (I-CSCF to S-CSCF) – see example in table 7.3.2.1-14**

I-CSCF forwards the 183 Session Progress provisional response to S-CSCF#1.

Table 7.3.2.1-14: 183 Session Progress (I-CSCF to S-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

15. **183 Session Progress (S-S#1a to MO) – see example in table 7.3.2.1-15**

S-CSCF#1 forwards the 183 Session Progress to the originator, as per the originating procedure.

Table 7.3.2.1-15: 183 Session Progress (S-S#1a to MO)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
~~P-Asserted-Identity:~~
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

16. **PRACK (MO to S-S#1a) – see example in table 7.3.2.1-16**

The originator decides the final set of media streams, and includes this information in the PRACK request sent to S-CSCF#1 by the origination procedures.

Table 7.3.2.1-16: PRACK (MO to S-S#1a)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:cscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

17. **PRACK (S-CSCF to S-CSCF) – see example in table 7.3.2.1-17**

S-CSCF#1 forwards the PRACK request to S-CSCF#2.

Table 7.3.2.1-17: PRACK (S-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

18. **PRACK (S-S#1a to MT) – see example in table 7.3.2.1-18**

S-CSCF#2 forwards the PRACK request to the terminating endpoint, as per the termination procedure.

Table 7.3.2.1-18: PRACK (S-S#1a to MT)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

19. **200 OK (MT to S-S#1a) – see example in table 7.3.2.1-19 (related to table 7.3.2.1-18)**

The terminating endpoint responds to the PRACK request (18) with a 200 OK response.

Table 7.3.2.1-19: 200 OK (MT to S-S#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

20. **200 OK (S-CSCF to S-CSCF) – see example in table 7.3.2.1-20**

S-CSCF#2 forwards the 200 OK response to S-CSCF#1.

Table 7.3.2.1-20: 200 OK (S-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

21. **200 OK (S-S#1a to MO) – see example in table 7.3.2.1-21**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.2.1-21: 200 OK (S-S#1a to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

22. **UPDATE (MO to S-S#1a) – see example in table 7.3.2.1-22**

When the originating endpoint has completed the resource reservation procedures, it sends the UPDATE request to S-CSCF#1 by the origination procedures.

Table 7.3.2.1-22: UPDATE (MO to S-S#1a)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

23. **UPDATE (S-CSCF to S-CSCF) – see example in table 7.3.2.1-23**

S-CSCF#1 forwards the UPDATE request to S-CSCF#2.

Table 7.3.2.1-23: UPDATE (S-CSCF to S-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

24. **UPDATE (S-S#1a to MT) – see example in table 7.3.2.1-24**

S-CSCF#2 forwards the UPDATE request to the terminating endpoint, as per the termination procedure.

Table 7.3.2.1-24: UPDATE (S-S#1a to MT)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

25. **200 OK (MT to S-S#1a) – see example in table 7.3.2.1-25 (related to table 7.3.2.1-24)**

The terminating endpoint responds to the UPDATE request (24) with a 200 OK response.

Table 7.3.2.1-25: 200 OK (MT to S-S#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

26. **200 OK (S-CSCF to S-CSCF) – see example in table 7.3.2.1-26**

S-CSCF#2 forwards the 200 OK response to S-CSCF#1.

Table 7.3.2.1-26: 200 OK (S-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

27. **200 OK (S-S#1a to MO) – see example in table 7.3.2.1-27**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.2.1-27: 200 OK (S-S#1a to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

28. **180 Ringing (MT to S-S#1a) – see example in table 7.3.2.1-28 (related to table 7.3.2.1-10)**

The terminating endpoint may optionally send a 180 Ringing provisional response indicating alerting is in progress. This response is sent by the termination procedure to S-CSCF#2.

Table 7.3.2.1-28: 180 Ringing (MT to S-S#1a)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
     sip:pcscf1.visited1.net;lr
From:
To:
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

29. **180 Ringing (S-CSCF to I-CSCF) – see example in table 7.3.2.1-29**

S-CSCF#2 forwards the 180 Ringing response to I-CSCF.

Table 7.3.2.1-29: 180 Ringing (S-CSCF to I-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

30. **180 Ringing (I-CSCF to S-CSCF) – see example in table 7.3.2.1-30**

I-CSCF forwards the 180 Ringing response to S-CSCF#1.

Table 7.3.2.1-30: 180 Ringing (I-CSCF to S-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

31. **180 Ringing (S-S#1a to MO) – see example in table 7.3.2.1-31**

S-CSCF#1 forwards the 180 Ringing response to the originator, per the origination procedure.

Table 7.3.2.1-31: 180 Ringing (S-S#1a to MO)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

32. **PRACK (MO to S-S#1a) – see example in table 7.3.2.1-32**

The originator acknowledges the 180 Ringing provisional response (31) with a PRACK request.

Table 7.3.2.1-32: PRACK (MO to S-S#1a)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

33. **PRACK (S-CSCF to S-CSCF) – see example in table 7.3.2.1-33**

S-CSCF#1 forwards the PRACK request to S-CSCF#2.

Table 7.3.2.1-33: PRACK (S-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

34. **PRACK (S-S#1a to MT) – see example in table 7.3.2.1-34**

S-CSCF#2 forwards the PRACK request to the terminating endpoint.

Table 7.3.2.1-34: PRACK (S-S#1a to MT)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

35. **200 OK (MT to S-S#1a) – see example in table 7.3.2.1-35 (related to table 7.3.2.1-34)**

The terminating endpoint responds to the PRACK request (34) with a 200 OK response.

Table 7.3.2.1-35: 200 OK (MT to S-S#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

36. **200 OK (S-CSCF to S-CSCF) – see example in table 7.3.2.1-36**

S-CSCF#2 forwards the 200 OK response to S-CSCF#1.

Table 7.3.2.1-36: 200 OK (S-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

37. **200 OK (S-S#1a to MO) – see example in table 7.3.2.1-37**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.2.1-37: 200 OK (S-S#1a to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

38. **200 OK (MT to S-S#1a) – see example in table 7.3.2.1-38 (related to table 7.3.2.1-10)**

The final response to the INVITE request (10), 200 OK, is sent by the terminating endpoint over the signalling path. This is typically generated when the subscriber has accepted the incoming session attempt. The response is sent to S-CSCF#2 per the termination procedure.

Table 7.3.2.1-38: 200 OK (MT to S-S#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length:0
```

39. **200 OK (S-CSCF to I-CSCF) – see example in table 7.3.2.1-39**

The 200 OK response is forwarded to the I-CSCF.

Table 7.3.2.1-39: 200 OK (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

40. **200 OK (I-CSCF to S-CSCF) – see example in table 7.3.2.1-40**

The 200 OK response is forwarded to S-CSCF#1.

Table 7.3.2.1-40: 200 OK (I-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

41. **200 OK (S-S#1a to MO) – see example in table 7.3.2.1-41**

The 200 OK response is returned to the originating endpoint, by the origination procedure.

Table 7.3.2.1-41: 200 OK (S-S#1a to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

42. **ACK (MO to S-S#1a) – see example in table 7.3.2.1-42**

The originating endpoint sends the final acknowledgement to S-CSCF#1 by the origination procedures.

Table 7.3.2.1-42: ACK (MO to S-S#1a)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 ACK
Content-Length: 0
```

43. **ACK (S-CSCF to S-CSCF) – see example in table 7.3.2.1-43**

S-CSCF#1 forwards the ACK request to S-CSCF#2.

Table 7.3.2.1-43: ACK (S-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

44. **ACK (S-S#1a to MT) – see example in table 7.3.2.1-44**

S-CSCF#2 forwards the ACK request to the terminating endpoint, as per the termination procedure.

Table 7.3.2.1-44: ACK (S-S#1a to MT)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

7.3.2.2 Termination failure

The subscriber that originated a session with one of the MO procedures had the attempt fail due to an error detected in the termination procedure. This could be due to, for example, destination busy (error code 486), resource failure (error code 580), or some other error.

Depending on the exact error that causes the session initiation failure, and when the error situation was detected, the S-CSCF-to-S-CSCF procedure could be at many different stages in the session establishment procedure. This is shown in figure 7.3.2.2-1, as optional messages 12-38 that may appear in this error procedure.

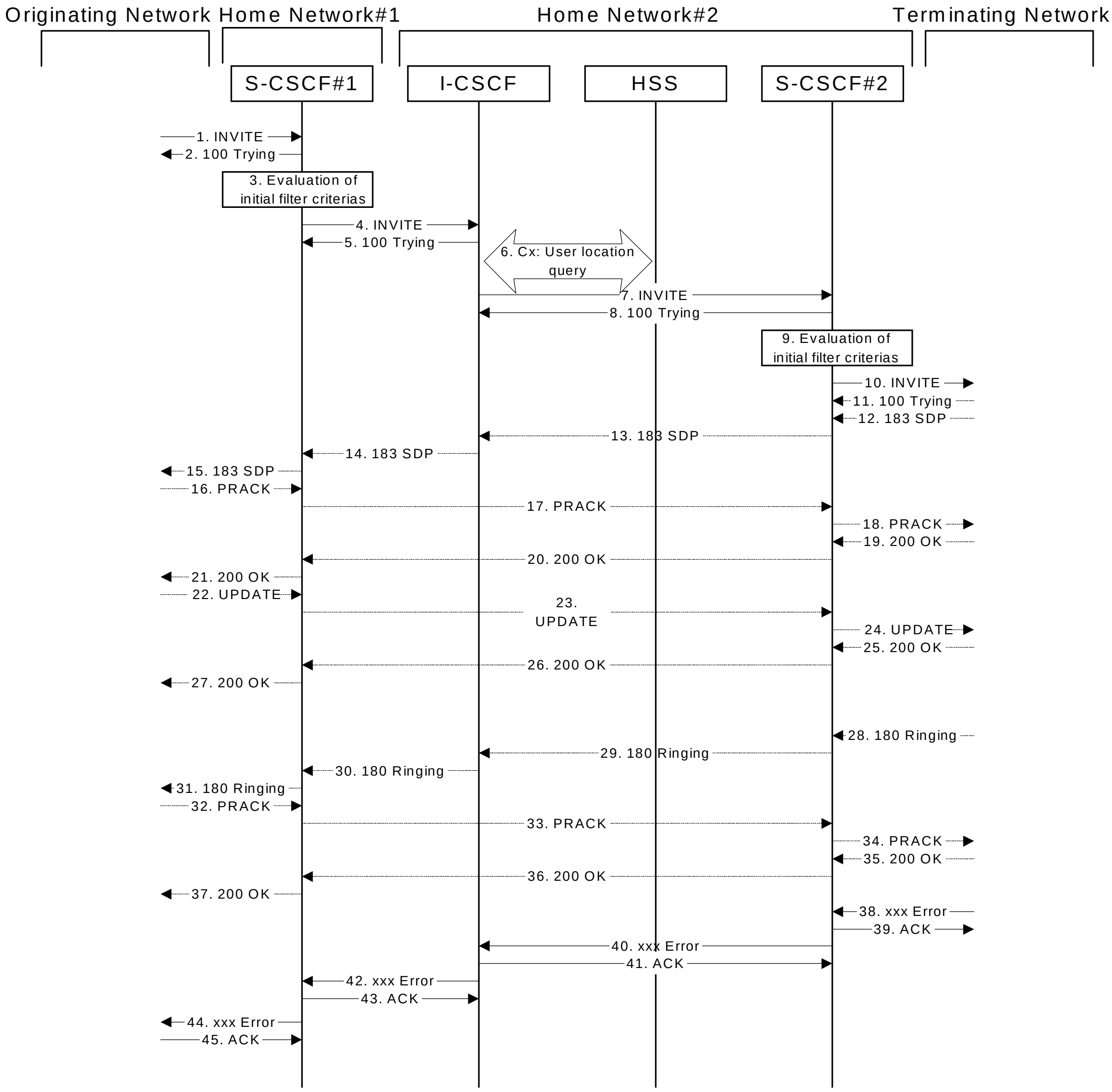


Figure 7.3.2.2-1: Failure in termination procedure

1-10. **INVITE (MO to S-CSCF) et seq**

A subscriber of the originating network initiated a session, as described in subclause 7.3.2.1.

11-37. **100 Trying (MT to S-CSCF) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.3.2.1.

38. **xxx Error (MT to S-CSCF) – see example in table 7.3.2.2-38**

The termination procedure detected some error situation, and returned a SIP error response.

NOTE 1: The error response may be, for example, “486 (Busy Here)”, “403 (Forbidden)”, “480 (Temporarily Unavailable)”, “580 (Precondition Failure)”, or others. For this example, “486 (Busy Here)” is shown.

Table 7.3.2.2-38: 486 Busy Here (MT to S-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Retry-After: 3600
Content-Length: 0
```

39. **ACK (S-CSCF to MT) – see example in table 7.3.2.2-39**

Upon receive the 486 response from the MT procedure, S-CSCF sends ACK.

Table 7.3.2.2-39: ACK (S-CSCF to MT)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

40. **xxx Error (S-CSCF to I-CSCF) – see example in table 7.3.2.2-40 (related to table 7.3.2.2-38)**

The S-CSCF returned a SIP error response to I-CSCF.

NOTE 2: The error response may be, for example, “486 (Busy Here)”, “403 (Forbidden)”, “480 (Temporarily Unavailable)”, or others. For this example, “486 (Busy Here)” is shown.

Table 7.3.2.2-40: 486 Busy Here (S-CSCF to I-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

41. **ACK (I-CSCF to S-CSCF) – see example in table 7.3.2.2-41**

Upon receive the 486 response from the S-CSCF procedure, I-CSCF sends ACK.

Table 7.3.2.2-41: ACK (I-CSCF to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK332b23.1
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

42. **xxx Error (I-CSCF to S-CSCF) – see example in table 7.3.2.2-42 (related to table 7.3.2.2-40)**

The I-CSCF returned a SIP error response to S-CSCF.

NOTE 3: The error response may be, for example, “486 (Busy Here)”, “403 (Forbidden)”, “480 (Temporarily Unavailable)”, or others. For this example, “486 (Busy Here)” is shown.

Table 7.3.2.2-42: 486 Busy Here (I-CSCF to S-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

43. **ACK (S-CSCF to I-CSCF) – see example in table 7.3.2.2-43**

Upon receive the 486 response from the S-CSCF procedure, I-CSCF sends ACK.

Table 7.3.2.2-43: ACK (S-CSCF to I-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

44. **xxx Error (S-CSCF to MO) – see example in table 7.3.2.2-44 (related to table 7.3.2.2-42)**

The S-CSCF returned a SIP error response to the appropriate MO procedure.

NOTE 4: The error response may be, for example, “486 (Busy Here)”, “403 (Forbidden)”, “480 (Temporarily Unavailable)”, or others. For this example, “486 (Busy Here)” is shown.

Table 7.3.2.2-44: 486 Busy Here (S-CSCF to MO)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

45. **ACK (MO to S-CSCF) – see example in table 7.3.2.2-45**

Upon receiving the 486 response from the S-CSCF, the MO procedure sends ACK.

Table 7.3.2.2-45: ACK (MO to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Route: sip:scscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.3.2.3 Origination failure

The subscriber that initiated a session with one of the MO procedures either abandoned the attempt, or was unable to obtain the resources necessary for the session. The signalling flow for this error handling is shown in figure 7.3.2.3-1.

If the session is aborted due to failure to obtain resources, it will occur at step #23 in the signalling flow; steps 23-38 (marked as optional) will not be present. If the session is abandoned due to user command, it can happen at any point between steps 13-38.

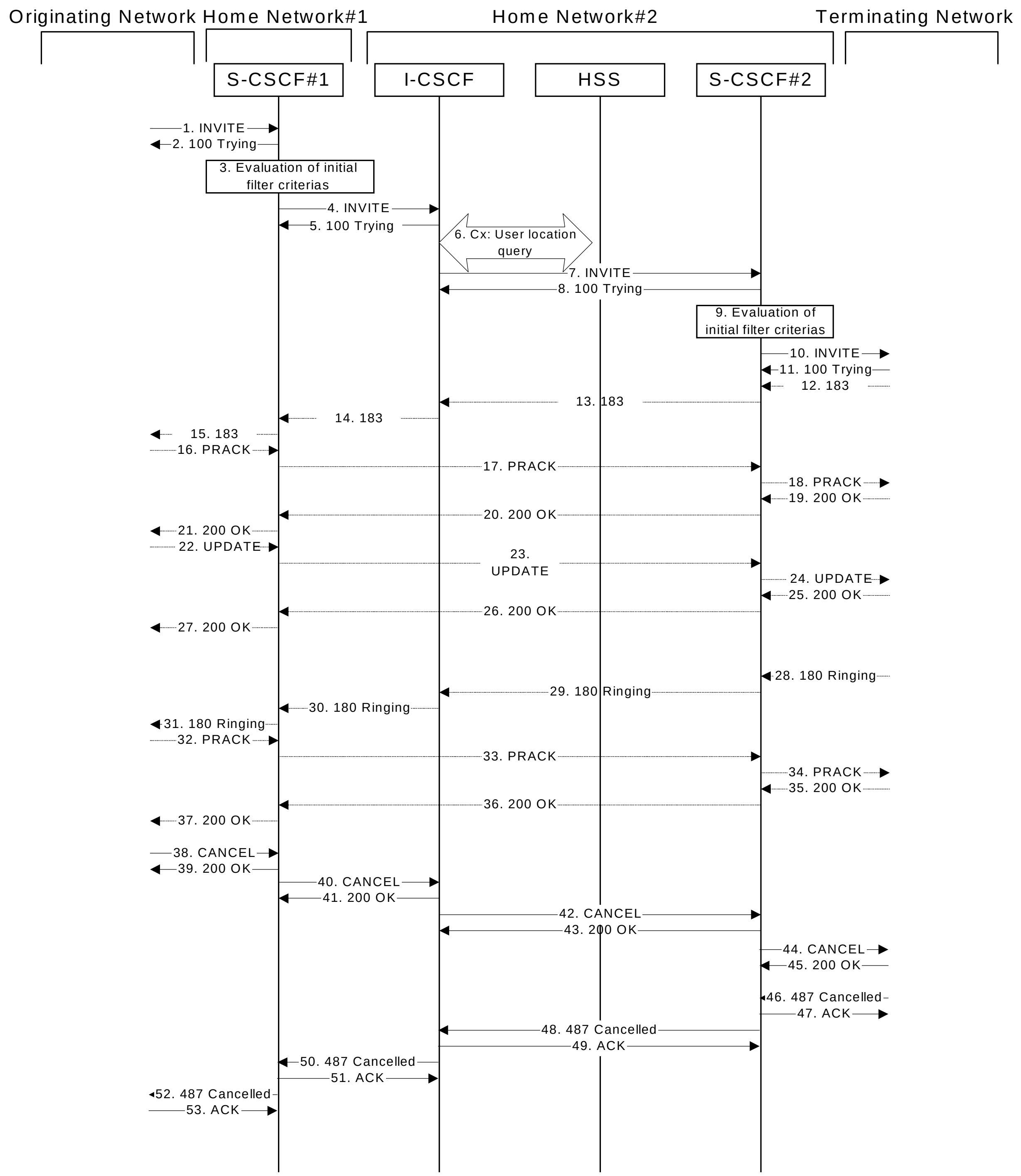


Figure 7.3.2.3-1: Failure in origination procedure

1-11.**INVITE (MO to S-CSCF) et seq**

UE#1 initiated a session, as described in subclause 7.3.2.1.

12-37. **183 Session Progress (MT to S-CSCF) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.3.2.1.

38. **CANCEL (MO to S-CSCF) – see example in table 7.3.2.3-38**

The originator, through the MO procedure, cancelled the original INVITE request.

Table 7.3.2.3-38: CANCEL (MO to S-CSCF)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:scscf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 CANCEL
Content-Length: 0
```

39. **200 OK (S-CSCF to S-S) – see example in table 7.3.2.3-39**

Upon receive the CANCEL request from the MO procedure, S-CSCF sends 200 OK.

Table 7.3.2.3-39: 200 OK (S-CSCF to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq: 127 CANCEL
Content-Length: 0
```

40. **CANCEL (S-CSCF to I-CSCF) – see example in table 7.3.2.3-40 (related to table 7.3.2.3-38)**

The S-CSCF forwards the CANCEL request to I-CSCF.

Table 7.3.2.3-40: CANCEL (S-CSCF to I-CSCF)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Cseq:
Content-Length:
```

41. **200 OK (I-CSCF to S-CSCF) – see example in table 7.3.2.3-41**

Upon receiving the CANCEL request from the S-CSCF, P-CSCF sends 200 OK.

Table 7.3.2.3-41: 200 OK (I-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq: 127 CANCEL
Content-Length: 0
```

42. **CANCEL (I-CSCF to S-CSCF) – see example in table 7.3.2.3-42 (related to table 7.3.2.3-40)**

The I-CSCF forwards the CANCEL request to S-CSCF.

Table 7.3.2.3-42: CANCEL (I-CSCF to S-CSCF)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

43. **200 OK (S-CSCF to I-CSCF) – see example in table 7.3.2.3-43**

Upon receiving the CANCEL request from the I-CSCF, S-CSCF sends 200 OK.

Table 7.3.2.3-43: 200 OK (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq: 127 CANCEL
Content-Length: 0
```

44. **CANCEL (S-CSCF to MT) – see example in table 7.3.2.3-44 (related to table 7.3.2.3-42)**

The P-CSCF forwards the CANCEL request to the appropriate MT procedure.

Table 7.3.2.3-44: CANCEL (S-CSCF to MT)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

45. **200 OK (MT to S-CSCF) – see example in table 7.3.2.3-45**

Upon receive the CANCEL request from the S-CSCF, the MT procedure sends 200 OK.

Table 7.3.2.3-45: 200 OK (MT to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq: 127 CANCEL
Content-Length: 0
```

46. **487 Request Terminated (MT to S-CSCF) – see example in table 7.3.2.3-46**

The termination procedure detected some error situation, and returned a SIP error response.

Table 7.3.2.3-46: 487 Request Terminated (MT to S-CSCF)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Retry-After: 3600
Content-Length: 0
```

47. **ACK (S-CSCF to MT) – see example in table 7.3.2.3-47**

Upon receive the 487 response from the MT procedure, S-CSCF sends ACK.

Table 7.3.2.3-47: ACK (S-CSCF to MT)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

48. **487 Request Terminated (S-CSCF to I-CSCF) – see example in table 7.3.2.3-48 (related to table 7.3.2.3-46)**

The S-CSCF returned a SIP error response to I-CSCF.

Table 7.3.2.3-48: 487 Request Terminated (S-CSCF to I-CSCF)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

49. **ACK (I-CSCF to S-CSCF) – see example in table 7.3.2.3-49**

Upon receive the 487 response from the S-CSCF procedure, I-CSCF sends ACK.

Table 7.3.2.3-49: ACK (I-CSCF to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

50. **487 Request Terminated (I-CSCF to S-CSCF) – see example in table 7.3.2.3-50 (related to table 7.3.2.3-48)**

The I-CSCF returns the SIP error response to S-CSCF.

Table 7.3.2.3-50: 487 Request Terminated (I-CSCF to S-CSCF)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

51. **ACK (S-CSCF to I-CSCF) – see example in table 7.3.2.3-51**

Upon receive the 487 response from the S-CSCF procedure, I-CSCF sends ACK.

Table 7.3.2.3-51: ACK (S-CSCF to I-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

52. **487 Request Terminated (S-CSCF to MO) – see example in table 7.3.2.3-52 (related to table 7.3.2.3-50)**

The S-CSCF returns the SIP error response to the appropriate MO procedure.

Table 7.3.2.3-52: 487 Request Terminated (S-CSCF to MO)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

53. **ACK (MO to S-CSCF) – see example in table 7.3.2.3-53**

Upon receive the 487 response from the S-CSCF, the MO procedure sends ACK.

Table 7.3.2.3-53: ACK (MO to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
Route: sip:scscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.3.3 Not applicable

7.3.4 Not applicable

7.3.5 S-S#2

7.3.5.1 (S-S#2) Single network operator performing origination and termination (MO#2, MT#2 assumed)

Figure 7.3.5.1-1 shows a S-CSCF handling session origination, which performs an analysis of the destination address, and determines that it belongs to a subscriber of the same operator. The request is therefore forwarded to a local I-CSCF. The I-CSCF queries the HSS for current location information, and finds the S-CSCF assigned to the subscriber (S-CSCF#2), and forwards the request to S-CSCF#2.

Origination sequences that share this common S-CSCF to S-CSCF procedure are:

MO#1a Mobile origination, roaming, without a THIG. The "Originating Network" of S-S#2 is therefore a visited network.

MO#1b Mobile origination, roaming, with a THIG in home network. The "Originating Network" of S-S#2 is therefore a visited network.

MO#2 Mobile origination, located in home service area. The "Originating Network" of S-S#2 is therefore the home network.

CS-O CS Networks origination. The "Originating Network" of S-S#2 is the home network. The element labeled S-CSCF#1 is the MGCF of the CS-O procedure.

Termination sequences that share this common S-CSCF to S-CSCF procedure are:

MT#1a Mobile termination, roaming, without a THIG. The "Terminating Network" of S-S#2 is a visited network.

MT#1b Mobile termination, roaming, with a THIG in home network. The "Terminating Network" of S-S#2 is a visited network.

MT#2 Mobile termination, located in home service area. The "Terminating Network" of S-S#2 is the home network.

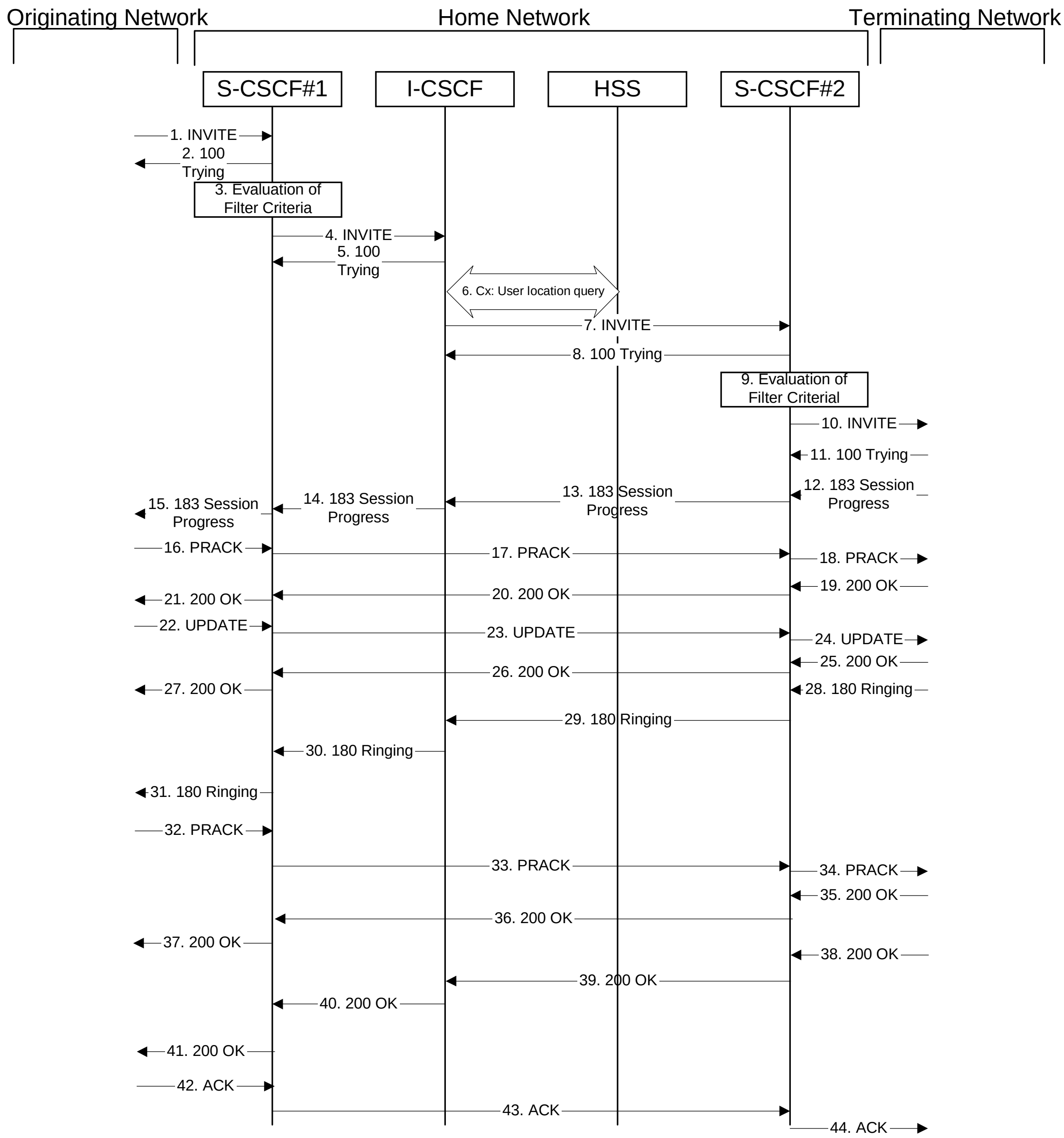


Figure 7.3.5.1-1: S-S#2

Procedure S-S#2 is as follows:

1. **INVITE (MO to S-S#2) – see example in table 7.3.5.1-1**

   The INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating signalling flow.

Table 7.3.5.1-1: INVITE (MO to S-S#2)

```
INVITE tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
~~Record-Route: sip:pcscf1.home1.net~~
Route: sip:scscf1.home1.net;lr
Record-Route: sip:pcscf1.home1.net
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>
~~RPID-Privacy~~Privacy: ~~privacy=off; party=calling~~none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

2. **100 Trying (S-S#2 to MO) – see example in table 7.3.5.1-2**

S-CSCF#1 responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.3.5.1-2: 100 Trying (S-S#2 to MO)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

S-CSCF#1 validates the service profile of this subscriber and evaluates the initial filter criterias. For this example, assume no Application Server involvement.

4. **INVITE (S-CSCF to I-CSCF) – see example in table 7.3.5.1-4**

S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the destination subscriber belongs. Since the originating operator does not desire to keep their internal configuration hidden, S-CSCF#1 forwards the INVITE request directly to to I-CSCF in the destination network.

S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

Table 7.3.5.1-4: INVITE (S-CSCF to I-CSCF)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip: icscf2_s.home1.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>;screen=yes
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Request-URI: In the case where the Request-URI of the incoming INVITE request to S-CSCF contains a TEL-URL [5], it has to be translated to a globally routable SIP-URL before applying it as Request-URI of the outgoing INVITE request. For this address translation the S-CSCF shall use the services of an ENUM-DNS protocol according to RFC 2916 [6], or any other suitable translation database. Database aspects of ENUM are outside the scope of this specification.

5. **100 Trying (I-CSCF to S-CSCF) – see example in table 7.3.5.1-5**

   I-CSCF responds to the INVITE request (4) by sending a 100 Trying provisional response to S-CSCF#1.

Table 7.3.5.1-5: 100 Trying (I-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **Cx: User Location Query procedure**

   The I-CSCF sends a query to the HSS to find out the S-CSCF of the called user. The HSS responds with the address of the current S-CSCF for the terminating subscriber.

   For detailed message flows see 3GPP TS 29.228[11].

   Table 7.3.2.1-6a provides the parameters in the SIP INVITE request (flow 4), which are sent to the HSS.

   Table 7.3.2.1-6b provides the parameters sent from the HSS that need to be mapped to SIP INVITE request (flow 7) and sent to S-CSCF.

7. **INVITE (I-CSCF to S-CSCF) – see example in table 7.3.5.1-7**

   I-CSCF forwards the INVITE request to the S-CSCF (S-CSCF#2) that will handle the session termination.

Table 7.3.5.1-7: INVITE (I-CSCF to S-CSCF)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:scscf2.home1.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
~~Route: sip:scscf2.home1.net;lr~~
Supported:
~~Remote-Party-ID~~P-Asserted-Identity:
~~RPID-Privacy~~Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
```

NOTE: The I-CSCF does not add itself to the Record-Route header, as it has no need to remain in the signalling path once the session is established.

8. **100 Trying (S-CSCF to I-CSCF) – see example in table 7.3.5.1-8**

S-CSCF#2 responds to the INVITE request (8) with a 100 Trying provisional response.

Table 7.3.5.1-8: 100 Trying (S-CSCF to I-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

9. **Evaluation of initial filter criterias**

   S-CSCF#2 validates the service profile of this subscriber and evaluates the initial filter criterias.

10. **INVITE (S-S#2 to MT) – see example in table 7.3.5.1-10**

    S-CSCF#2 forwards the INVITE request, as determined by the termination procedure. S-CSCF#2 remembers (from the registration procedure) the UE Contact address and the next hop CSCF for this UE.

    S-CSCF#2 examines the media parameters, and removes any choices that the destination subscriber does not have authority to request. For this example, assume the destination subscriber is not allowed stereo, so only a single audio stream is permitted.

Table 7.3.5.1-10: INVITE (S-S#2 to MT)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 66
Route: sip:pcscf2.home1.net;lr
Record-Route: sip:scscf2.home1.net;lr, sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Route: sip:pcscf2.home1.net;lr
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID: <tel:+1-212-555-2222>
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

11. **100 Trying (MT to S-S#2) – see example in table 7.3.5.1-11 (related to table 7.3.5.1-10)**

S-CSCF#2 receives a 100 Trying provisional response to the INVITE request (11), as specified by the termination procedures.

Table 7.3.5.1-11: 100 Trying (MT to S-S#2)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

12. **183 Session Progress (MT to S-S#2) – see example in table 7.3.5.1-12 (related to table 7.3.5.1-10)**

The media stream capabilities of the destination are returned along the signalling path, in a 183 Session Progress provisional response, as per the termination procedure.

Table 7.3.5.1-12: 183 Session Progress (MT to S-S#2)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP icscf2.home1.net,
     SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home1.net;lr, sip:scscf2.home1.net;lr, sip:scscf1.home1.net;lr,
     sip:pcscf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>
RPID-PrivacyPrivacy: privacy=off;party=callednone
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

13. **183 Session Progress (S-CSCF to I-CSCF) – see example in table 7.3.5.1-13**

S-CSCF#2 forwards the 183 Session Progress provisional response to I-CSCF.

Table 7.3.5.1-13: 183 Session Progress (S-CSCF to I-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>; screen=yes
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

14. **183 Session Progress (I-CSCF to S-CSCF) – see example in table 7.3.5.1-14**

I-CSCF forwards the 183 Session Progress provisional response to S-CSCF#1.

Table 7.3.5.1-14: 183 Session Progress (I-CSCF to S-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

15. **183 Session Progress (S-S#2 to MO) – see example in table 7.3.5.1-15**

S-CSCF#1 forwards the 183 Session Progress to the originator, as per the originating procedure.

Table 7.3.5.1-15: 183 Session Progress (S-S#2 to MO)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

16. **PRACK (MO to S-S#2) – see example in table 7.3.5.1-16**

The originator decides the final set of media streams, and includes this information in the PRACK request sent to S-CSCF#1 by the origination procedures.

Table 7.3.5.1-16: PRACK (MO to S-S#2)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

17. **PRACK (S-CSCF to S-CSCF) – see example in table 7.3.5.1-17**

S-CSCF#1 forwards the PRACK request to S-CSCF#2.

Table 7.3.5.1-17: PRACK (S-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

18. **PRACK (S-S#2 to MT) – see example in table 7.3.5.1-18**

S-CSCF#2 forwards the PRACK request to the terminating endpoint, as per the termination procedure.

Table 7.3.5.1-18: PRACK (S-S#2 to MT)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

19. **200 OK (MT to S-S#2) – see example in table 7.3.5.1-19 (related to table 7.3.5.1-18)**

The terminating endpoint responds to the PRACK request (19) with a 200 OK response.

Table 7.3.5.1-19: 200 OK (MT to S-S#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

20. **200 OK (S-CSCF to S-CSCF) – see example in table 7.3.5.1-20**

S-CSCF#2 forwards the 200 OK response to S-CSCF#1.

Table 7.3.5.1-20: 200 OK (S-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

21. **200 OK (S-S#2 to MO) – see example in table 7.3.5.1-21**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.5.1-21: 200 OK (S-S#2 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

22. **UPDATE (MO to S-S#2) – see example in table 7.3.5.1-22**

When the originating endpoint has completed the resource reservation procedures, it sends the UPDATE request to S-CSCF#1 by the origination procedures.

Table 7.3.5.1-22: UPDATE (MO to S-S#2)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

23. **UPDATE (S-CSCF to S-CSCF) – see example in table 7.3.5.1-23**

S-CSCF#1 forwards the UPDATE request to S-CSCF#2.

Table 7.3.5.1-23: UPDATE (S-CSCF to S-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

24. **UPDATE (S-S#2 to MT) – see example in table 7.3.5.1-24**

S-CSCF#2 forwards the UPDATE request to the terminating endpoint, as per the termination procedure.

Table 7.3.5.1-24: UPDATE (S-S#2 to MT)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

25. **200 OK (MT to S-S#2) – see example in table 7.3.5.1-25 (related to table 7.3.5.1-24)**

The terminating endpoint responds to the UPDATE request (24) with a 200 OK response.

Table 7.3.5.1-25: 200 OK (MT to S-S#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

26. **200 OK (S-CSCF to S-CSCF) – see example in table 7.3.5.1-26**

S-CSCF#2 forwards the 200 OK response to S-CSCF#1.

Table 7.3.5.1-26: 200 OK (S-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

27. **200 OK (S-S#2 to MO) – see example in table 7.3.5.1-27**

    S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.5.1-27: 200 OK (S-S#2 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

28. **180 Ringing (MT to S-S#2) – see example in table 7.3.5.1-28 (related to table 7.3.5.1-10)**

    The terminating endpoint may optionally send a 180 Ringing provisional response indicating alerting is in progress. This response is sent by the termination procedure to S-CSCF#2.

Table 7.3.5.1-28: 180 Ringing (MT to S-S#2)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home1.net;lr, sip:scscf2.home1.net;lr, sip:scscf1.home1.net;lr,
     sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

29. **180 Ringing (S-CSCF to I-CSCF) – see example in table 7.3.5.1-29**

S-CSCF#2 forwards the 180 Ringing response to I-CSCF.

Table 7.3.5.1-29: 180 Ringing (S-CSCF to I-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

30. **180 Ringing (I-CSCF to S-CSCF) – see example in table 7.3.5.1-30**

I-CSCF forwards the 180 Ringing response to S-CSCF#1.

Table 7.3.5.1-30: 180 Ringing (I-CSCF to S-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

31. **180 Ringing (S-S#2 to MO) – see example in table 7.3.5.1-31**

S-CSCF#1 forwards the 180 Ringing response to the originator, per the origination procedure.

Table 7.3.5.1-31: 180 Ringing (S-S#2 to MO)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

32. **PRACK (MO to S-S#2) – see example in table 7.3.5.1-32**

The originator acknowledges the 180 Ringing provisional response (34) with a PRACK request.

Table 7.3.5.1-32: PRACK (MO to S-S#2)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr,
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

33. **PRACK (S-CSCF to S-CSCF) – see example in table 7.3.5.1-33**

S-CSCF#1 forwards the PRACK request to S-CSCF#2.

Table 7.3.5.1-33: PRACK (S-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

34. **PRACK (S-S#2 to MT) – see example in table 7.3.5.1-34**

S-CSCF#2 forwards the PRACK request to the terminating endpoint.

Table 7.3.5.1-34: PRACK (S-S#2 to MT)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home1.net
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

35. **200 OK (MT to S-S#2) – see example in table 7.3.5.1-35 (related to table 7.3.5.1-34)**

The terminating endpoint responds to the PRACK request (34) with a 200 OK response.

Table 7.3.5.1-35: 200 OK (MT to S-S#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

36. **200 OK (S-CSCF to S-CSCF) – see example in table 7.3.5.1-36**

S-CSCF#2 forwards the 200 OK response to S-CSCF#1.

Table 7.3.5.1-36: 200 OK (S-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

37. **200 OK (S-S#2 to MO) – see example in table 7.3.5.1-37**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.5.1-37: 200 OK (S-S#2 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

38. **200 OK (MT to S-S#2) – see example in table 7.3.5.1-38 (related to table 7.3.5.1-10)**

The final response, 200 OK, is sent by the terminating endpoint over the signalling path. This is typically generated when the subscriber has accepted the incoming session attempt. The response is sent to S-CSCF#2 per the termination procedure.

Table 7.3.5.1-38: 200 OK (MT to S-S#2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home1.net;lr, sip:scscf2.home1.net;lr, sip:scscf1.home1.net;lr,
     sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length: 0
```

39. **200 OK (S-CSCF to I-CSCF) – see example in table 7.3.5.1-39**

The 200 OK response is forwarded to the I-CSCF.

Table 7.3.5.1-39: 200 OK (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

40. **200 OK (I-CSCF to S-CSCF) – see example in table 7.3.5.1-40**

The 200 OK response is forwarded to S-CSCF#1.

Table 7.3.5.1-40: 200 OK (I-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

41. **200 OK (S-S#2 to MO) – see example in table 7.3.5.1-41**

The 200 OK response is returned to the originating endpoint, by the origination procedure.

Table 7.3.5.1-41: 200 OK (S-S#2 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

42. **ACK (MO to S-S#2) – see example in table 7.3.5.1-42**

The originating endpoint sends the final acknowledgement to S-CSCF#1 by the origination procedures.

Table 7.3.5.1-42: ACK (MO to S-S#2)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:scscf2.home1.net;lr, sip:pcscf2.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 ACK
Content-Length: 0
```

43. **ACK (S-CSCF to S-CSCF) – see example in table 7.3.5.1-43**

S-CSCF#1 forwards the ACK request to S-CSCF#2.

Table 7.3.5.1-43: ACK (S-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scsf2.home1.net;lr, sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

44. **ACK (S-S#2 to MT) – see example in table 7.3.5.1-44**

S-CSCF#2 forwards the ACK request to the terminating endpoint, as per the termination procedure.

Table 7.3.5.1-44: ACK (S-S#2 to MT)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

7.3.5.2 (S-S#2) Single network operator performing origination and termination, terminating UE is busy, and not able or not willing to answer the call (MO#2, MT#2 assumed)

Figure 7.3.5.2-1 shows the subscriber that originated a session with one of the MO procedures had the attempt fail due to an error detected in the termination procedure. In this flow, 486 error response is shown as the example.

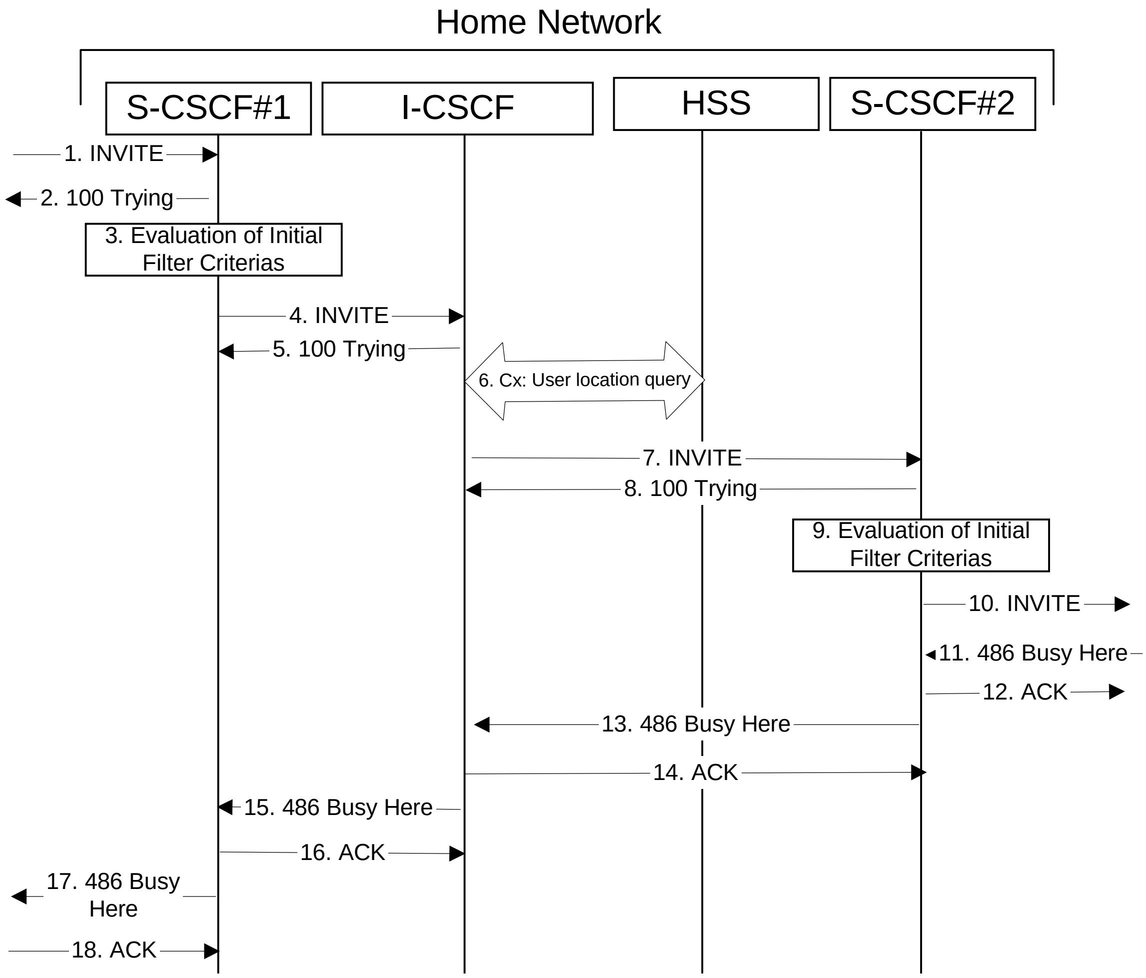


Figure 7.3.5.2: (S-S#2) Single network operator performing origination and termination, terminating UE is busy, and not able or not willing to answer the call (MO#2, MT#2 assumed)

1-10. The same as described in flow 1-8 in subclause 7.3.5

11. **486 Busy Here (MT to S-CSCF) – see example in table 7.3.5.2-11**

The termination procedure detected some error situation, and returned a SIP 486 Busy Here response.

NOTE: The error response may be other error responses like "403 Service Denied", "480 Temporarily Unavailable", "580 Precondition Failure", or others. For this example, "486 Busy" is shown.

Table 7.3.5.2-11: 486 Busy Here (MT to S-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1,  SIP/2.0/UDP
     icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Contact: sip:[5555::eee:fff:aaa:bbb]
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Retry-After:3600
Content-Length: 0
```

12. **ACK (S-CSCF to MT) – see example in table 7.3.5.2-12**

Upon receive the 486 response from the MT procedure, S-CSCF sends ACK.

Table 7.3.5.2-12: ACK (S-CSCF to MT)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP sip:scscf2.home1.net;branch=z9hG4bK764z87.1
Max-Forwards: 70
Route: sip:pcscf2.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

13. **486 Busy Here (S-CSCF to I-CSCF) – see example in table 7.3.5.2-13**

The S-CSCF returned a SIP error response to I-CSCF.

Table 7.3.5.2-13: 486 Busy Here (S-CSCF to I-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
     scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To:
Call-ID:
CSeq:
Contact: sip:[5555::eee:fff:aaa:bbb]
Retry-After:3600
Content-Length: 0
```

14. **ACK (I-CSCF to S-CSCF) – see example in table 7.3.5.2-14**

Upon receive the 486 response from the S-CSCF procedure, I-CSCF sends ACK.

Table 7.3.5.2-14: ACK (I-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via:  SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1
Max-Forwards: 70
Route: sip:scscf2.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

15. **486 Busy Here (I-CSCF to S-CSCF) – see example in table 7.3.5.2-15 (related to table 7.3.5.2-42)**

The I-CSCF returned a SIP error response to S-CSCF.

Table 7.3.5.2-15: 486 Busy Here (I-CSCF to S-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To:
Call-ID:
CSeq:
Contact:
Retry-After:3600
Content-Length: 0
```

16. **ACK (S-CSCF to I-CSCF) – see example in table 7.3.5.2-16**

Upon receive the 486 response from the S-CSCF procedure, I-CSCF sends ACK.

Table 7.3.5.2-16: ACK (S-CSCF to I-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: sip:icscf2_s.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

17. **486 Busy Here (S-CSCF to MO) – see example in table 7.3.5.2-17**

    The S-CSCF returned a SIP error response to the appropriate MO procedure.

Table 7.3.5.2-17: 486 Busy Here (S-CSCF to MO)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To:
Contact:
Call-ID:
CSeq:
Retry-After:3600
Content-Length: 0
```

18. **ACK (MO to S-CSCF) – see example in table 7.3.5.2-18**

    Upon receiving the 486 response from the S-CSCF, the MO procedure sends ACK.

Table 7.3.5.2-18: ACK (MO to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Max-Forwards: 70
Route: scscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.3.5.3 Origination failure (not provided)

An example of this flow is not shown in the present document.

7.3.6 S-S#3

7.3.6.1 (S-S#3) PSTN Termination performed by home network of originator (MO#2 assumed)

Figure 7.3.6.1-1 shows a S-CSCF handling session origination, which performs an analysis of the destination address, and determines that it will result in a PSTN termination. The request is therefore forwarded to a local BGCF. The BGCF performs further analysis of the destination address, combined with information of agreements between operators for optimum Gateway selection, and decides to do the PSTN termination locally. The BGCF therefore allocates a MGCF within the home network, and sends the request to it. This example flow does not show Application Server involvement.

Origination sequences that share this common S-CSCF to S-CSCF procedure are:

MO#1a Mobile origination, roaming, without a THIG. The "Originating Network" of S-S#3 is therefore a visited network.

MO#1b Mobile origination, roaming, with a THIG in home network. The "Originating Network" of S-S#3 is therefore a visited network.

MO#2 Mobile origination, located in home service area. The "Originating Network" of S-S#3 is therefore the home network.

CS-O CS Networks origination. The "Originating Network" of S-S#3 is the home network. The element labelled S-CSCF#1 is the MGCF of the CS-O procedure.

Termination sequences that share this common S-CSCF to S-CSCF procedure are:

CS-T CS Networks termination.

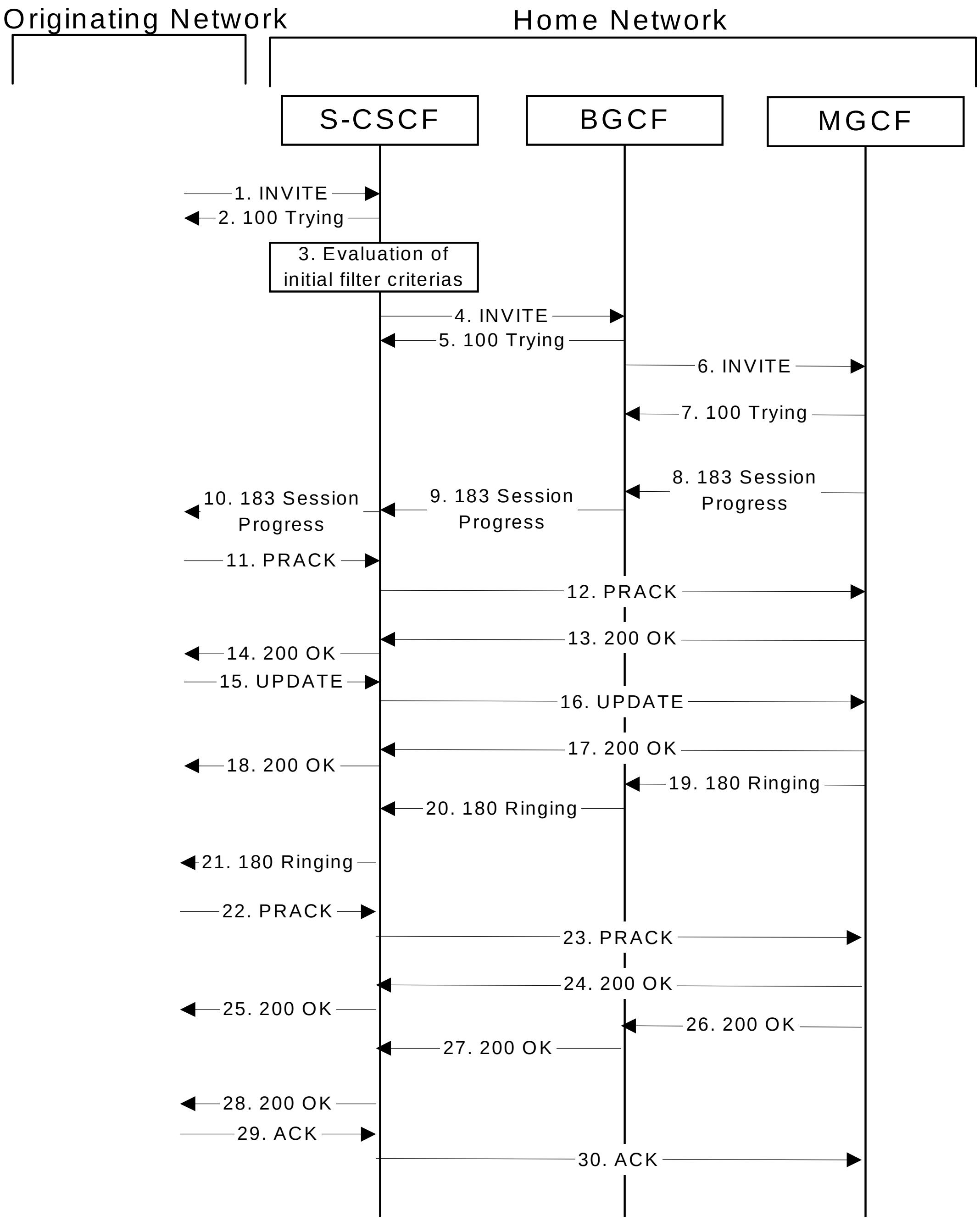


Figure 7.3.6.1-1: S-S#3

Procedure S-S#3 is as follows:

1. **INVITE (MO to S-S#3) – see example in table 7.3.6.1-1**

   The INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating signalling flow.

Table 7.3.6.1-1: INVITE (MO to S-S#3)

```
INVITE sip: +1-212-555-2222@home1.net;user=phone SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
Record-Route: sip:pcscf1.home1.net;lr
~~Route: sip:scscf1.home1.net;lr~~
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>
~~RPID-Privacy~~Privacy: ~~privacy=off;party=calling~~none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

2. **100 Trying (S-S#3 to MO) – see example in table 7.3.6.1-2**

   S-CSCF#1 responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.3.6.1-2: 100 Trying (S-S#3 to MO)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

S-CSCF#1 validates the service profile of this subscriber and evaluates the initial filter criterias. For this example, assume no Application Server involvement.

4. **INVITE (S-CSCF to BGCF) – see example in table 7.3.6.1-4**

S-CSCF#1 performs an analysis of the destination address, and determines the destination is on the PSTN. S-CSCF forwards the INVITE request to the BGCF in the local network.

S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

Table 7.3.6.1-4: INVITE (S-CSCF to BGCF)

```
INVITE sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:bgcf1.home1.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Route: sip:bgcf1.home1.net
Remote-Party-IDP-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>; screen=yes
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Request-URI: In the case where the Request-URI of the incoming INVITE request to S-CSCF contains a TEL-URL [5], it has to be translated to a globally routable SIP-URL before applying it as Request-URI of the outgoing INVITE request. For this address translation the S-CSCF shall use the services of an ENUM-DNS protocol according to RFC 2916 [6], or any other suitable translation database. Database aspects of ENUM are outside the scope of this specification.

5. **100 Trying (BGCF to S-CSCF) – see example in table 7.3.6.1-5**

BGCF sends a 100 Trying provisional response to S-CSCF.

Table 7.3.6.1-5: 100 Trying (BGCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **INVITE (BGCF to MGCF) – see example in table 7.3.6.1-6**

BGCF analyzes the destination address, and allocates a MGCF to handle the termination. BGCF forwards the INVITE request to the MGCF.

Table 7.3.6.1-6: INVITE (BGCF to MGCF)

```
INVITE sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:mgcf1.home1.net;lr
Record-Route:
Route: sip:mgcf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
```

NOTE: The BGCF does not add itself to the Record-Route header, as it has no need to remain in the signalling path once the session is established.

7. **100 Trying (MGCF to BGCF) – see example in table 7.3.6.1-7**

   MGCF responds to the INVITE request (6) with a 100 Trying provisional response.

Table 7.3.6.1-7: 100 Trying (MGCF to BGCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **183 Session Progress (MGCF to BGCF) – see example in table 7.3.6.1-8**

   The MGCF returns the media stream capabilities of the destination along the signalling path in a 183 Session Progress provisional response.

Table 7.3.6.1-8: 183 Session Progress (MGCF to BGCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>; screen=yes
RPID-PrivacyPrivacy: privacy=off; party=callednone
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:mgcf1.home1.net
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

9. **183 Session Progress (BGCF to S-CSCF) – see example in table 7.3.6.1-9**

   BGCF forwards the 183 Session Progress provisional response to S-CSCF.

Table 7.3.6.1-9: 183 Session Progress (BGCF to S-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

10. **183 Session Progress (S-S#3 to MO) – see example in table 7.3.6.1-10**

S-CSCF#1 forwards the 183 Session Progress to the originator, as per the originating procedure.

Table 7.3.6.1-10: 183 Session Progress (S-S#3 to MO)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

11. **PRACK (MO to S-S#3) – see example in table 7.3.6.1-11**

The originator decides the final set of media streams, and includes this information in the PRACK request sent to S-CSCF#1 by the origination procedures.

Table 7.3.6.1-11: PRACK (MO to S-S#3)

```
PRACK sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

12. **PRACK (S-CSCF to MGCF) – see example in table 7.3.6.1-12**

S-CSCF forwards the PRACK request to MGCF.

Table 7.3.6.1-12: PRACK (S-CSCF to MGCF)

```
PRACK sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

13. **200 OK (MGCF to S-CSCF) – see example in table 7.3.6.1-13**

The MGCF responds to the PRACK request (12) with a 200 OK response.

Table 7.3.6.1-13: 200 OK (MGCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

14. **200 OK (S-S#3 to MO) – see example in table 7.3.6.1-14**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.6.1-14: 200 OK (S-S#3 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

15. **UPDATE (MO to S-S#3) – see example in table 7.3.6.1-15**

When the originating endpoint has completed the resource reservation procedures, it sends the UPDATE request to S-CSCF#1 by the origination procedures.

Table 7.3.6.1-15: UPDATE (MO to S-S#3)

```
UPDATE sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

16. **UPDATE (S-CSCF to MGCF) – see example in table 7.3.6.1-16**

S-CSCF forwards the UPDATE request to MGCF.

Table 7.3.6.1-16: UPDATE (S-CSCF to MGCF)

```
UPDATE sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

17. **200 OK (MGCF to S-CSCF) – see example in table 7.3.6.1-17**

The MGCF responds to the UPDATE request (16) with a 200 OK response.

Table 7.3.6.1-17: 200 OK (MGCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

18. **200 OK (S-S#3 to MO) – see example in table 7.3.6.1-18**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.6.1-18: 200 OK (S-S#3 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

19. **180 Ringing (MGCF to BGCF) – see example in table 7.3.6.1-19**

The MGCF may optionally send a 180 Ringing provisional response indicating alerting is in progress. This response is sent by the termination procedure to BGCF.

Table 7.3.6.1-19: 180 Ringing (MGCF to BGCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Require: 100rel
Contact: sip:mgcf1.home1.net
RSeq: 9022
Content-Length: 0
```

20. **180 Ringing (BGCF to S-CSCF) – see example in table 7.3.6.1-20**

BGCF forwards the 180 Ringing response to S-CSCF.

Table 7.3.6.1-20: 180 Ringing (BGCF to S-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

21. **180 Ringing (S-S#3 to MO) – see example in table 7.3.6.1-21**

S-CSCF forwards the 180 Ringing response to the originator, per the origination procedure.

Table 7.3.6.1-21: 180 Ringing (S-S#3 to MO)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

22. **PRACK (MO to S-S#3) – see example in table 7.3.6.1-22**

The originator acknowledges the 180 Ringing provisional response (21) with a PRACK request.

Table 7.3.6.1-22: PRACK (MO to S-S#3)

```
PRACK sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

23. **PRACK (S-CSCF to MGCF) – see example in table 7.3.6.1-23**

S-CSCF forwards the PRACK request to MGCF.

Table 7.3.6.1-23: PRACK (S-CSCF to MGCF)

```
PRACK sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

24. **200 OK (MGCF to S-CSCF) – see example in table 7.3.6.1-24**

The MGCF responds to the PRACK request (23) with a 200 OK response.

Table 7.3.6.1-24: 200 OK (MGCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

25. **200 OK (S-S#3 to MO) – see example in table 7.3.6.1-25**

S-CSCF forwards the 200 OK response to the originating endpoint.

Table 7.3.6.1-25: 200 OK (S-S#3 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

26. **200 OK (MGCF to BGCF) – see example in table 7.3.6.1-26**

The final response, 200 OK, is sent by the MGCF over the signalling path when the subscriber has accepted the incoming session attempt.

Table 7.3.6.1-26: 200 OK (MGCF to BGCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:mgcf1.home1.net
Content-Length: 0
```

27. **200 OK (BGCF to S-CSCF) – see example in table 7.3.6.1-27**

The 200 OK response is forwarded to the S-CSCF.

Table 7.3.6.1-27: 200 OK (BGCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

28. **200 OK (S-S#3 to MO) – see example in table 7.3.6.1-28**

The 200 OK is returned to the originating endpoint, by the origination procedure.

Table 7.3.6.1-28: 200 OK (S-S#3 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

29. **ACK (MO to S-S#3) – see example in table 7.3.6.1-29**

The originating endpoint sends the final acknowledgement to S-CSCF#1 by the origination procedures.

Table 7.3.6.1-29: ACK (MO to S-S#3)

```
ACK sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scsf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 ACK
Content-Length: 0
```

30. **ACK (S-CSCF to MGCF) – see example in table 7.3.6.1-30**

S-CSCF#1 forwards the ACK request to MGCF.

Table 7.3.6.1-30: ACK (S-CSCF to MGCF)

```
ACK sip:mgcf1.home1.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Content-Length:
```

7.3.7 S-S#4

7.3.7.1 (S-S#4) PSTN Termination performed by different operator than origination (MO#2 assumed)

Figure 7.3.7.1-1 shows a S-CSCF handling session origination, which performs an analysis of the destination address, and determines that it will result in a PSTN termination. The request is therefore forwarded to a local BGCF (BGCF#1). BGCF#1 performs further analysis of the destination address, combined with information of agreements between operators for optimum Gateway selection, and decides to do the PSTN termination in a different operator's network. BGCF#1 therefore forwards the request to a BGCF in the terminating operator's network, BGCF#2. BGCF#2 allocates a MGCF within the its network, and sends the request to it. This example flow does not show Application Server involvement.

Origination sequences that share this common S-CSCF to S-CSCF procedure are:

MO#1a Mobile origination, roaming, without a THIG. The "Originating Network" of S-S#4 is therefore a visited network.

MO#1b Mobile origination, roaming, with a THIG in home network. The "Originating Network" of S-S#4 is therefore a visited network.

MO#2 Mobile origination, located in home service area. The "Originating Network" of S-S#4 is therefore the home network.

CS-O CS Networks origination. The "Originating Network" of S-S#4 is the home network. The element labeled S-CSCF#1 is the MGCF of the CS-O procedure.

Termination sequences that share this common S-CSCF to S-CSCF procedure are:

CS-T CS Networks termination.

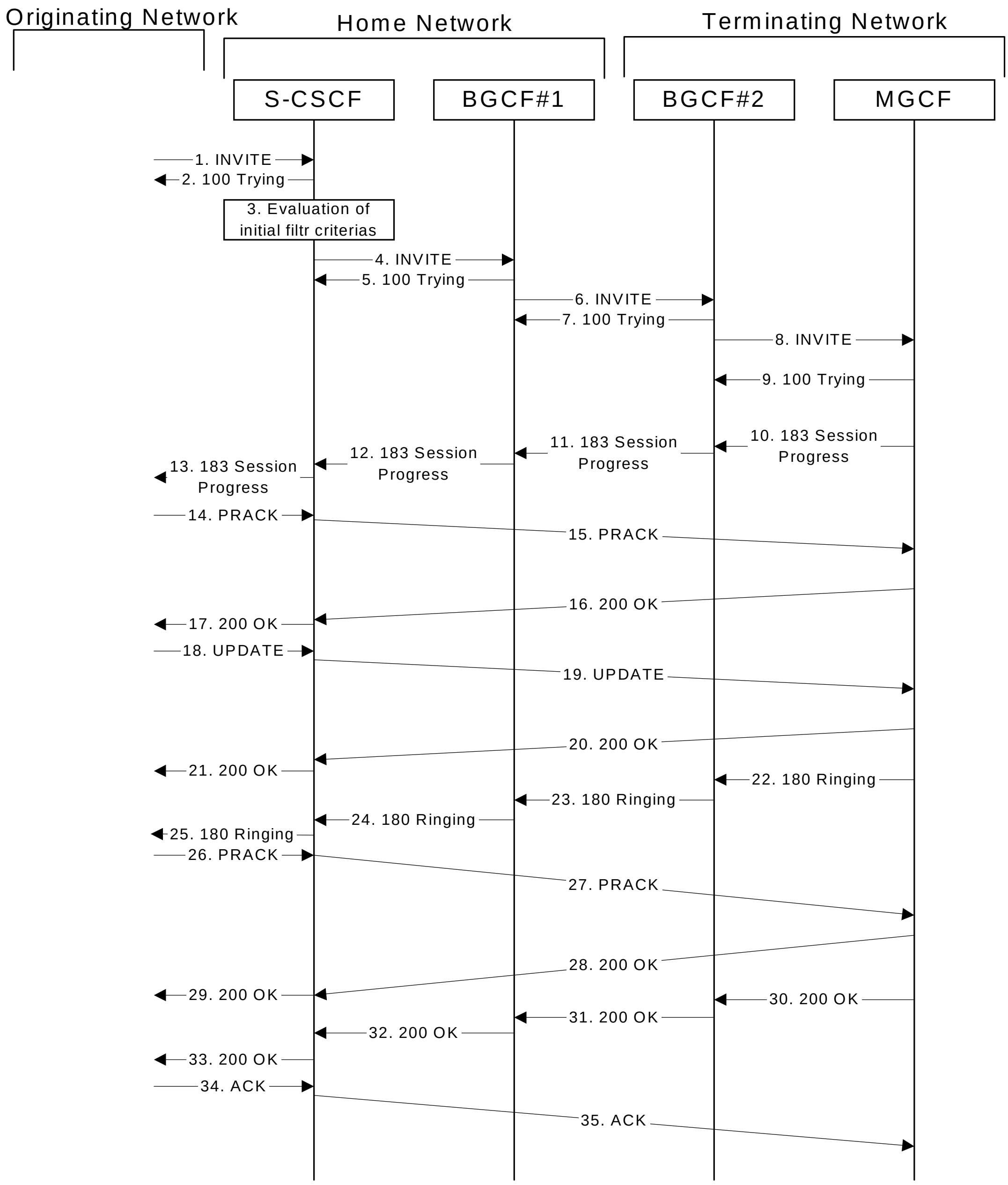


Figure 7.3.7.1-1: S-S#4

Procedure S-S#4 is as follows:

1. **INVITE (MO to S-S#4) – see example in table 7.3.7.1-1**

   The INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating signalling flow.

Table 7.3.7.1-1: INVITE (MO to S-S#4)

```
INVITE sip:+1-212-555-2222@home1.net; user=phone SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
Record-Route: sip:pcscf1.home1.net;lr
~~Route:scscf1.home1.net;lr~~
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>
~~RPID-Privacy~~Privacy: ~~privacy=off; party=calling~~none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

2. **100 Trying (S-S#4 to MO) – see example in table 7.3.7.1-2**

S-CSCF#1 responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.3.7.1-2: 100 Trying (S-S#4 to MO)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

   S-CSCF#1 validates the service profile of this subscriber and evaluates the initial filter criterias. For this example, assume no Application Server involvement.

4. **INVITE (S-CSCF to BGCF) – see example in table 7.3.7.1-4**

   S-CSCF#1 performs an analysis of the destination address, and determines the destination is on the PSTN. S-CSCF#1 forwards the INVITE request to the BGCF in the local network.

   S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

Table 7.3.7.1-4: INVITE (S-CSCF to BGCF)

```
INVITE sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:bgcf1.home1.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Route: sip:bgcf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>; screen=yes
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

5. **100 Trying (BGCF to S-CSCF) – see example in table 7.3.7.1-5**

BGCF#1 sends a 100 Trying provisional response to S-CSCF#1.

Table 7.3.7.1-5: 100 Trying (BGCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **INVITE (BGCF to BGCF) – see example in table 7.3.7.1-6**

   BGCF#1 analyses the destination address, and the inter-operator agreements for optimal PSTN termination, and selects the network operator that can best terminate this session. BGCF#1 forwards the INVITE request to the BGCF (BGCF#2) in the network that will handle the session termination.

Table 7.3.7.1-6: INVITE (BGCF to BGCF)

```
INVITE sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:bgcf2.home2.net;lr
Record-Route:
Route: sip:bgcf2.home2.net;lr
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
```

7. **100 Trying (BGCF to BGCF) – see example in table 7.3.7.1-7**

BGCF#2 responds to the INVITE request (6) with a 100 Trying provisional response.

Table 7.3.7.1-7: 100 Trying (BGCF to BGCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **INVITE (BGCF to MGCF) – see example in table 7.3.7.1-8**

BGCF#2 allocates a Media Gateway Controller, and forwards the INVITE request to that MGCF.

Table 7.3.7.1-8: INVITE (BGCF to MGCF)

```
INVITE sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP bgcf2.home2.net;branch=z9hG4bK456u71.1, SIP/2.0/UDP
   bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 66
Route: sip:mgcf2.home2.net;lr
Record-Route:
Route: sip:mgcf2.home2.net
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
```

9. **100 Trying (MGCF to BGCF) – see example in table 7.3.7.1-9**

MGCF sends a 100 Trying provisional response.

Table 7.3.7.1-9: 100 Trying (MGCF to BGCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP bgcf2.home2.net;branch=z9hG4bK456u71.1, SIP/2.0/UDP
   bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

10. **183 Session Progress (MGCF to BGCF) – see example in table 7.3.7.1-10**

MGCF returns the media stream capabilities of the destination in a 183 Session Progress provisional response.

Table 7.3.7.1-10: 183 Session Progress (MGCF to BGCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP bgcf2.home2.net;branch=z9hG4bK456u71.1, SIP/2.0/UDP
   bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip: scscf1.home1.net,  sip:pcscf1.home1.net
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>; screen=yes
RPID-PrivacyPrivacy: privacy=off; party=callednone
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:mgcf2.home2.net
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

11. **183 Session Progress (BGCF to BGCF) – see example in table 7.3.7.1-11**

BGCF#2 forwards the 183 Session Progress provisional response to BGCF#1.

Table 7.3.7.1-11: 183 Session Progress (BGCF to BGCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

12. **183 Session Progress (BGCF to S-CSCF) – see example in table 7.3.7.1-12**

BGCF#1 forwards the 183 Session Progress provisional response to S-CSCF.

Table 7.3.7.1-12: 183 Session Progress (BGCF to S-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

13. **183 Session Progress (S-S#4 to MO) – see example in table 7.3.7.1-13**

S-CSCF#1 forwards the 183 Session Progress response to the originator, as per the originating procedure.

Table 7.3.7.1-13: 183 Session Progress (S-S#4 to MO)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

14. **PRACK (MO to S-S#4) – see example in table 7.3.7.1-14**

The originator decides the final set of media streams, and includes this information in the PRACK request sent to S-CSCF by the origination procedures.

Table 7.3.7.1-14: PRACK (MO to S-S#4)

```
PRACK sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

15. **PRACK (S-CSCF to MGCF) – see example in table 7.3.7.1-15**

S-CSCF forwards the PRACK request to the MGCF.

Table 7.3.7.1-15: PRACK (BGCF to MGCF)

```
PRACK sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

16. **200 OK (MGCF to S-CSCF) – see example in table 7.3.7.1-16**

The MGCF responds to the PRACK request (15) with a 200 OK response.

Table 7.3.7.1-16: 200 OK (MGCF to BGCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

17. **200 OK (S-S#4 to MO) – see example in table 7.3.7.1-17**

S-CSCF forwards the 200 OK response to the originating endpoint.

Table 7.3.7.1-17: 200 OK (S-S#4 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

18. **UPDATE (MO to S-S#4) – see example in table 7.3.7.1-18**

    When the originating endpoint has completed the resource reservation procedures, it sends the UPDATE request to S-CSCF#1 by the origination procedures.

Table 7.3.7.1-18: UPDATE (MO to S-S#4)

```
UPDATE sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

19. **UPDATE (BGCF to MGCF) – see example in table 7.3.7.1-19**

    S-CSCF forwards the UPDATE request to the MGCF.

Table 7.3.7.1-19: UPDATE (BGCF to MGCF)

```
UPDATE sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
m=
```

20. **200 OK (MGCF to BGCF) – see example in table 7.3.7.1-20**

The MGCF responds to the UPDATE request (19) with a 200 OK response.

Table 7.3.7.1-20: 200 OK (MGCF to BGCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

21. **200 OK (S-S#4 to MO) – see example in table 7.3.7.1-21**

S-CSCF#1 forwards the 200 OK response to the originating endpoint.

Table 7.3.7.1-21: 200 OK (S-S#4 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

22. **180 Ringing (MGCF to BGCF) – see example in table 7.3.7.1-22**

The MGCF may optionally send a 180 Ringing provisional response indicating alerting is in progress.

Table 7.3.7.1-22: 180 Ringing (MGCF to BGCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP bgcf2.home2.net;branch=z9hG4bK456u71.1, SIP/2.0/UDP
   bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Require: 100rel
Contact: sip:mgcf2.home2.net
RSeq: 9022
Content-Length: 0
```

23. **180 Ringing (BGCF to BGCF) – see example in table 7.3.7.1-23**

BGCF#2 forwards the 180 Ringing response to BGCF#1.

Table 7.3.7.1-23: 180 Ringing (BGCF to BGCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

24. **180 Ringing (BGCF to S-CSCF) – see example in table 7.3.7.1-24**

    BGCF#1 forwards the 180 Ringing response to S-CSCF.

Table 7.3.7.1-24: 180 Ringing (BGCF to S-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

25. **180 Ringing (S-S#4 to MO) – see example in table 7.3.7.1-25**

    S-CSCF#1 forwards the 180 Ringing response to the originator, per the origination procedure.

Table 7.3.7.1-25: 180 Ringing (S-S#4 to MO)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

26. **PRACK (MO to S-S#4) – see example in table 7.3.7.1-26**

    The originator acknowledges the 180 Ringing provisional response (25) with a PRACK request.

Table 7.3.7.1-26: PRACK (MO to S-S#4)

```
PRACK sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

27. **PRACK (BGCF to MGCF) – see example in table 7.3.7.1-27**

    S-CSCF forwards the PRACK request to the MGCF.

Table 7.3.7.1-27: PRACK (S-CSCF to MGCF)

```
PRACK sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

28. **200 OK (MGCF to S-CSCF) – see example in table 7.3.7.1-28**

The MGCF responds to the PRACK request (27) with a 200 OK response.

Table 7.3.7.1-28: 200 OK (MGCF to S-SCSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP pcscf1.home2.net,
   SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

29. **200 OK (S-S#4 to MO) – see example in table 7.3.7.1-29**

S-CSCF forwards the 200 OK to the originating endpoint.

Table 7.3.7.1-29: 200 OK (S-S#4 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

30. **200 OK (MGCF to BGCF) – see example in table 7.3.7.1-30**

The final response, 200 OK, is sent by the MGCF when the subscriber has accepted the incoming session attempt.

Table 7.3.7.1-30: 200 OK (MGCF to BGCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:mgcf2.home2.net
Content-Length: 0
```

31. **200 OK (BGCF to BGCF) – see example in table 7.3.7.1-31**

BGCF#2 forwards the 200 OK final response to BGCF#1.

Table 7.3.7.1-31: 200 OK (BGCF to BGCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP bgcf1.home.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

32. **200 OK (BGCF to S-CSCF) – see example in table 7.3.7.1-32**

    BGCF#1 forwards the 200 OK final response to S-CSCF.

Table 7.3.7.1-32: 200 OK (BGCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

33. **200 OK (S-S#4 to MO) – see example in table 7.3.7.1-33**

    The 200 OK response is returned to the originating endpoint, by the origination procedure.

Table 7.3.7.1-33: 200 OK (S-S#4 to MO)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

34. **ACK (MO to S-S#4) – see example in table 7.3.7.1-34**

    The originating endpoint sends the final acknowledgement to S-CSCF by the origination procedures.

Table 7.3.7.1-34: ACK (MO to S-S#4)

```
ACK sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 ACK
Content-Length: 0
```

35. **ACK (S-CSCF to MGCF) – see example in table 7.3.7.1-35**

S-CSCF forwards the ACK request to the MGCF.

Table 7.3.7.1-35: ACK (S-CSCF to MGCF)

```
ACK sip:mgcf2.home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq:
Content-Length:
```

7.4 Termination procedures

7.4.1 Introduction

This subclause presents the detailed signalling flows to define the procedures for session terminations.

The session termination procedures specify the signalling path between the S-CSCF assigned to perform the session termination service and the UE. This signalling path is determined at the time of UE registration, and remains fixed for the life of the registration. This signalling path is the reverse of the session initiation signalling path of subclause 7.2. Therefore there is a one-to-one correspondence between the origination procedures of subclause 7.2 and the termination procedures of this subclause.

A UE always has a proxy (P-CSCF) associated with it. This P-CSCF is located in the same network as the UE, and performs resource authorization for the sessions to the UE. The P-CSCF is determined by the CSCF discovery process, described in subclause 5.2.1.

As a result of the registration procedure, the P-CSCF knows the address of the UE. The assigned S-CSCF, in the home network, knows the name/address of the P-CSCF. If the network operator owning the S-CSCF wants to keep their configuration private, the S-CSCF will have chosen an Interrogating-CSCF, I-CSCF, who will perform the THIG functions and pass messages to the P-CSCF (procedure MT#1b).

Sessions destined to the PSTN are a special case of the Termination procedures. Two of the S-CSCF to S-CSCF procedures deal specifically with PSTN termination, and route the session signalling through a BGCF that allocates a MGCF. The MGCF uses H.248/MEGACO to control a Media Gateway, and communicates with SS7 network. In case of interworking between IP based and SS7 based signalling network is required, a SGW would be used [2]. The MGCF receives and processes SIP requests, and subsequent nodes consider the signalling as if it came from a S-CSCF.

7.4.2 MT#1a

7.4.2.1 (MT#1a) Mobile termination, roaming (MO#1a, S-S#1a assumed)

Figure 7.4.2.1 shows a termination procedure which applies to roaming subscribers when the home network operator does not desire to keep its internal configuration hidden from the visited network. The UE is located in a visited network, and determines the P-CSCF via the P-CSCF discovery procedure. During registration, the home network allocates the S-CSCF.

When registration is complete, S-CSCF knows the name/address of P-CSCF and the UE Contact address, and P-CSCF obtains the name/address of the UE.

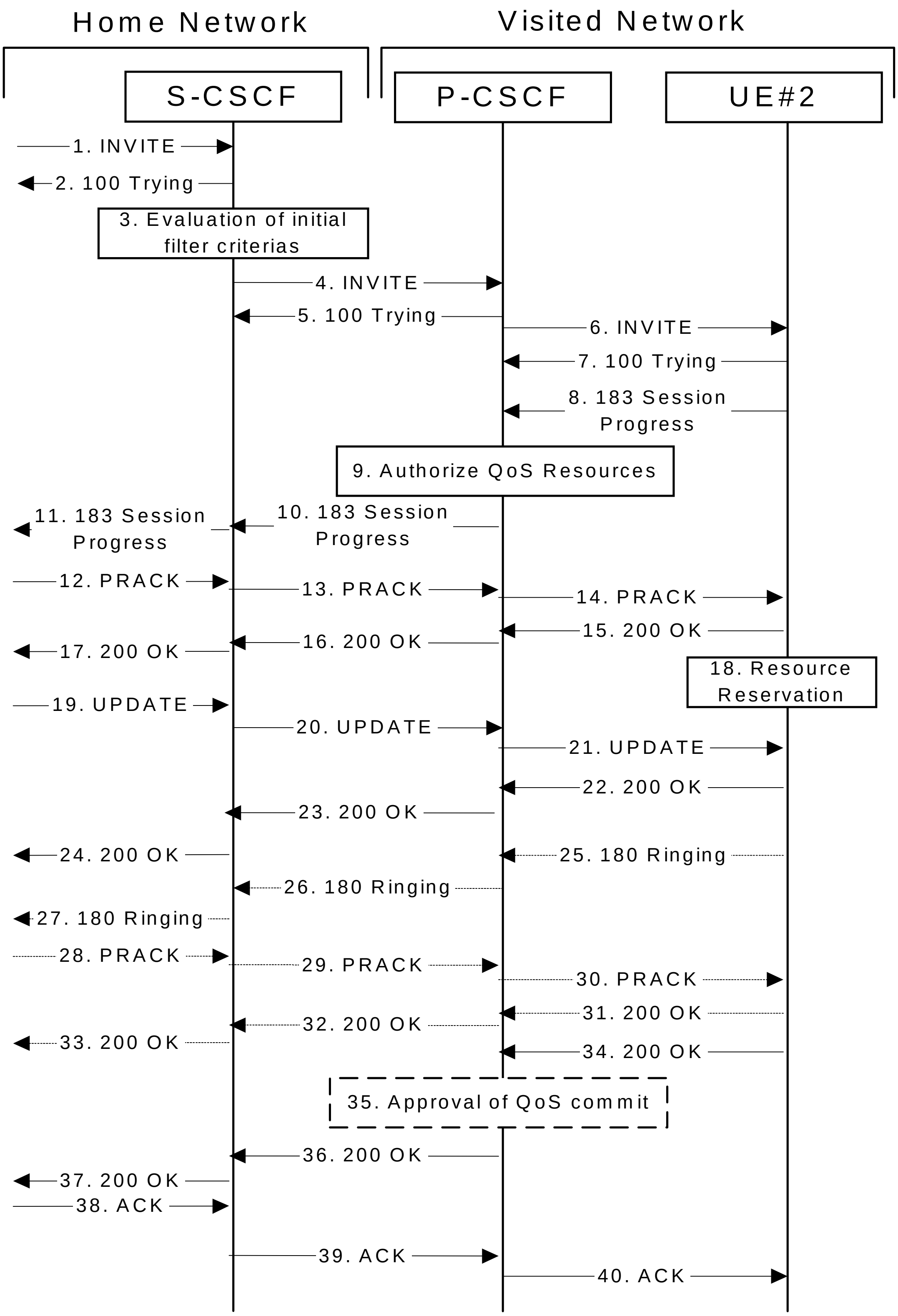


Figure 7.4.2.1-1: MT#1a

Procedure MT#1a is as follows:

1. **INVITE (S-S to MT#1a) – see example in table 7.4.2.1-1**

   The calling party sends the INVITE request, via one of the origination procedures and via one of the S-CSCF to S-CSCF procedures, to the S-CSCF for the terminating subscriber.

Table 7.4.2.1-1: INVITE (S-S to MT#1a)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:scscf2.home2.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
Route: sip:scscf2.home2.net;lr
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>,;screen=yes
P-Asserted-Identity: <tel:+1-212-555-1111>
Privacy: none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

SDP The SDP contains the complete set of supported codecs from the session originator, as restricted by the originating network operator. The "m=" lines for the video media streams show a port number zero, which removes them from the negotiation.

Upon receipt of the INVITE, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.2.1-1b.

Table 7.4.2.1-1b: Storage of information at S-CSCF

```
Request-URI: sip:user2_public1@home2.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

2. **100 Trying (MT#1a to S-S) – see example in table 7.4.2.1-2**

   S-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.4.2.1-2: 100 Trying (MT#1a to S-S)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber, and evaluates the initial filter criterias.

4. **INVITE (S-CSCF to P-CSCF) – see example in table 83.2-4**

   S-CSCF remembers (from the registration procedure) the UE Contact address and the next hop CSCF for this UE. It forwards the INVITE to the P-CSCF.

   S-CSCF examines the media parameters, and removes any choices that the destination subscriber does not have authority to request. For this example, assume the destination subscriber is not allowed stereo, so only a single audio stream is permitted.

Table 7.4.2.1-4: INVITE (S-CSCF to P-CSCF)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 66
Route: sip:pcscf2.visited2.net;lr
Record-Route: sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID: sip:user2_public1@home2.net
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Route: Built from the Path header stored at registration.

P-Called-Party-ID: Includes the dialled URL with its parameters.

Via:/Record-Route: S-CSCF adds itself.

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the second audio stream shows a port number zero, which removes it from the negotiation.

P-CSCF saves information from the received INVITE request. The saved value of the information for this session is – see example in table 7.4.2.1-4b.

Table 7.4.2.1-4b: Storage of information at P-CSCF

```
Request-URI: sip:+1-212-555-2222@home2.net;user=phone
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf2.home2.net, sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

5. **100 Trying (P-CSCF to S-CSCF) – see example in table 7.4.2.1-5**

   P-CSCF responds to the INVITE request (4) with a 100 Trying provisional response.

Table 7.4.2.1-5: 100 Trying (P-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **INVITE (P-CSCF to UE) – see example in table 7.4.2.1-6**

   P-CSCF examines the media parameters, and removes any that the network operator decides, based on local policy, not to allow on the network.

   For this example, assume the network operator does not allow 64 kb/s audio, so the PCMU codec is removed.

   P-CSCF removes the Record-Route and Via headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE.

Table 7.4.2.1-6: INVITE (P-CSCF to UE)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 65
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
P-Media-Authorization: 0020000100100101706366322e78797a2e6e6574000c02013331533134363231
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID:
Content-Type:
Content-Length: (...)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saves values. It inserts this as a branch value on its Via header.

P-Media-Authorization: A P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf2.xyz.net" with credentials "31S14621".

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the first audio stream no longer contains codec "0" (PCMU), which removes it from the negotiation.

7. **100 Trying (UE to P-CSCF) – see example in table 7.4.2.1-7**

UE may optionally send a 100 Trying provisional response to P-CSCF.

Table 7.4.2.1-7: 100 Trying (UE to P-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **183 Session Progress (UE to P-CSCF) – see example in table 7.4.2.1-8**

UE#2 determines the complete set of codecs that it is capable of supporting for this session. It determines the intersection with those appearing in the SDP in the INVITE request. For each media flow that is not supported, UE#2 inserts a SDP entry for media (m= line) with port=0. For each media flow that is supported, UE#2 inserts a SDP entry with an assigned port and with the codecs in common with those in the SDP from UE#1.

For this example, assume UE#2 supports both AMR and G726, but not G728 (code 15).

UE responds with a 183 Session Progress response containing SDP back to the originator. This SDP may represent one or more media for a multimedia session. This response is sent to P-CSCF.

Table 7.4.2.1-8: 183 Session Progress (UE to P-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Privacy: none
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

To: A tag is added to the To header.

Contact: Contains a SIP URL with the IP address or FQDN of the UE.

SDP The SDP contains the subset of codecs supported by UE. It requests a confirmation of the QoS preconditions for establishing the session

Upon receipt of the 183 Session Progress, the P-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.2.1-8b.

Table 7.4.2.1-8b: Storage of information at P-CSCF

```
Request-URI: sip:[5555::eee:fff:aaa:bbb]
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf2.home2.net, sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

9. **Authorize QoS Resources**

   P-CSCF authorizes the resources necessary for this session. The approval of QoS commitment either happens at this stage or after 200 OK of INVITE (34) based on operator local policy.

10. **183 Session Progress (P-CSCF to S-CSCF) – see example in table 7.4.2.1-10**

   P-CSCF forwards the 183 Session Progress response to S-CSCF.

Table 7.4.2.1-10: 183 Session Progress (P-CSCF to S-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Smith" <sip:user2_public1@home2.net>
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

Via:/Record-Route: P-CSCF restores the Via headers and Record-Route headers from the branch value in its Via.

P-Asserted-Identity: The P-CSCF inserts this header based on the user's hint present in the incoming P-Asserted-Identity header.

Upon receipt of the 183 Session Progress, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.2.1-10b.

Table 7.4.2.1-10b: Storage of information at S-CSCF

```
Request-URI: sip:user2_public1@home2.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:pcscf2.visited2.net
Route(2orig): sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

11. **183 Session Progress (MT#1a to S-S) – see example in table 7.4.2.1-11**

S-CSCF forwards the 183 Session Progress response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-11: 183 Session Progress (MT#1a to S-S)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
P-Asserted-Identity:
P-Asserted-Identity: "John Smith" <sip:user2_public1@home2.net>,<tel:+1-212-555-2222>
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

12. **PRACK (S-S to MT#1a) – see example in table 7.4.2.1-12**

The originating endpoint sends a PRACK request containing the final SDP to be used in this session, via the S-CSCF to S-CSCF procedure, to S-CSCF.

Table 7.4.2.1-12: PRACK (S-S to MT#1a)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

13. **PRACK (S-CSCF to P-CSCF) – see example in table 7.4.2.1-13**

    S-CSCF forwards the PRACK request to P-CSCF.

Table 7.4.2.1-13: PRACK (S-CSCF to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

14. **PRACK (P-CSCF to UE) – see example in table 7.4.2.1-14**

    P-CSCF forwards the PRACK request to UE.

Table 7.4.2.1-14: PRACK (P-CSCF to UE)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

15. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-15**

UE acknowledges the PRACK request (14) with a 200 OK response.

Table 7.4.2.1-15: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

16. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-16**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.2.1-16: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

17. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-17**

    S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-17: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

18. **Resource Reservation**

    UE initiates the reservation procedures for the resources needed for this session.

19. **UPDATE (S-S to MT#1a) – see example in table 7.4.2.1-19**

    When the originating endpoint has completed its resource reservation, it sends the UPDATE request to S-CSCF, via the S-CSCF to S-CSCF procedures.

Table 7.4.2.1-19: UPDATE (S-S to MT#1a)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

20. **UPDATE (S-CSCF to P-CSCF) – see example in table 7.4.2.1-20**

S-CSCF forwards the UPDATE request to P-CSCF.

Table 7.4.2.1-20: UPDATE (S-CSCF to P-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

21. **UPDATE (P-CSCF to UE) – see example in table 7.4.2.1-21**

P-CSCF forwards the UPDATE request to UE.

Table 7.4.2.1-21: UPDATE (P-CSCF to UE)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

22. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-22**

UE acknowledges the UPDATE request (21) with a 200 OK response.

Table 7.4.2.1-22: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

23. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-23**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.2.1-23: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

24. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-24**

S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-24: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

25. **180 Ringing (UE to P-CSCF) – see example in table 7.4.2.1-25**

Before proceeding with session establishment, the UE waits for two events. First, the resource reservation initiated in step #17 must complete successfully. Second, the resource reservation initiated by the originating endpoint must complete successfully (which is indicated by message #20 received by UE). The UE may now immediately accept the session (and proceed with step #34), or alert the destination subscriber of an incoming session attempt; if the latter it indicates this to the calling party by a 180 Ringing provisional response sent to P-CSCF.

Table 7.4.2.1-25: 180 Ringing (UE to P-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

26. **180 Ringing (P-CSCF to S-CSCF) – see example in table 7.4.2.1-26**

P-CSCF forwards the 180 Ringing response to S-CSCF.

Table 7.4.2.1-26: 180 Ringing (P-CSCF to S-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr,sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

27. **180 Ringing (MT#1a to S-S) – see example in table 7.4.2.1-27**

S-CSCF forwards the 180 Ringing response to the originating endpoint, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-27: 180 Ringing (MT#1a to S-S)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

28. **PRACK (S-S to MT#1a) – see example in table 7.4.2.1-28**

The originator acknowledges the 180 Ringing response (27) with a PRACK request.

Table 7.4.2.1-28: PRACK (S-S to MT#1a)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

29. **PRACK (S-CSCF to P-CSCF) – see example in table 7.4.2.1-29**

S-CSCF forwards the PRACK request to P-CSCF.

Table 7.4.2.1-29: PRACK (S-CSCF to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

30. **PRACK (P-CSCF to UE) – see example in table 7.4.2.1-30**

P-CSCF forwards the PRACK request to UE.

Table 7.4.2.1-30: PRACK (P-CSCF to UE)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

31. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-31**

UE acknowledges the PRACK request (31) with a 200 OK response.

Table 7.4.2.1-31: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

32. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-32**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.2.1-32: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

33. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-33**

S-CSCF forwards the 200 OK response to the session originator, per the S-CSCF to S-CSCF procedures.

Table 7.4.2.1-33: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-34**

When the called party answers the UE sends a 200 OK final response to the INVITE request (6) to P-CSCF, and starts the media flow(s) for this session.

Table 7.4.2.1-34: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length:0
```

35. **Approval of QoS Commit**

The P-CSCF approves the commitment of the QoS resources if it was not approved already in step (9).

36. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-36**

P-CSCF sends the 200 OK final response to S-CSCF.

Table 7.4.2.1-36: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

37. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-37**

S-CSCF forwards the 200 OK final response along the signalling path back to the session originator, as per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-37: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

38. **ACK (S-S to MT#1a) – see example in table 7.4.2.1-38**

The calling party responds to the 200 OK final response (37) with an ACK request which is sent to S-CSCF via the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-38: ACK (S-S to MT#1a)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq: 127 ACK
Content-Length: 0
```

39. **ACK (S-CSCF to P-CSCF) – see example in table 7.4.2.1-39**

S-CSCF forwards the ACK request to P-CSCF.

Table 7.4.2.1-39: ACK (S-CSCF to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

40. **ACK (P-CSCF to UE) – see example in table 7.4.2.1-40**

P-CSCF forwards the ACK request to UE.

Table 7.4.2.1-40: ACK (P-CSCF to UE)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Length:
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

7.4.2.2 UE-detected failure/resource failure

The subscriber that initiated a session with one of the MO procedures had the attempt fail due to an error detected in the Termination procedure. This could be due to, for example, destination busy (error code 486), or some other error.

Depending on the exact error that causes the session initiation failure, and when the error situation was detected, MT#1a could be at many different stages in the session establishment procedure. This is shown in figure 7.4.2.2-1, as optional messages 7-33 that may appear in this error procedure.

This subclause also includes the procedures for the terminating UE to indicate a failure to allocate required resources for the session. This is detected in step #18 and reported with a 580-Precondition-Failure error response.

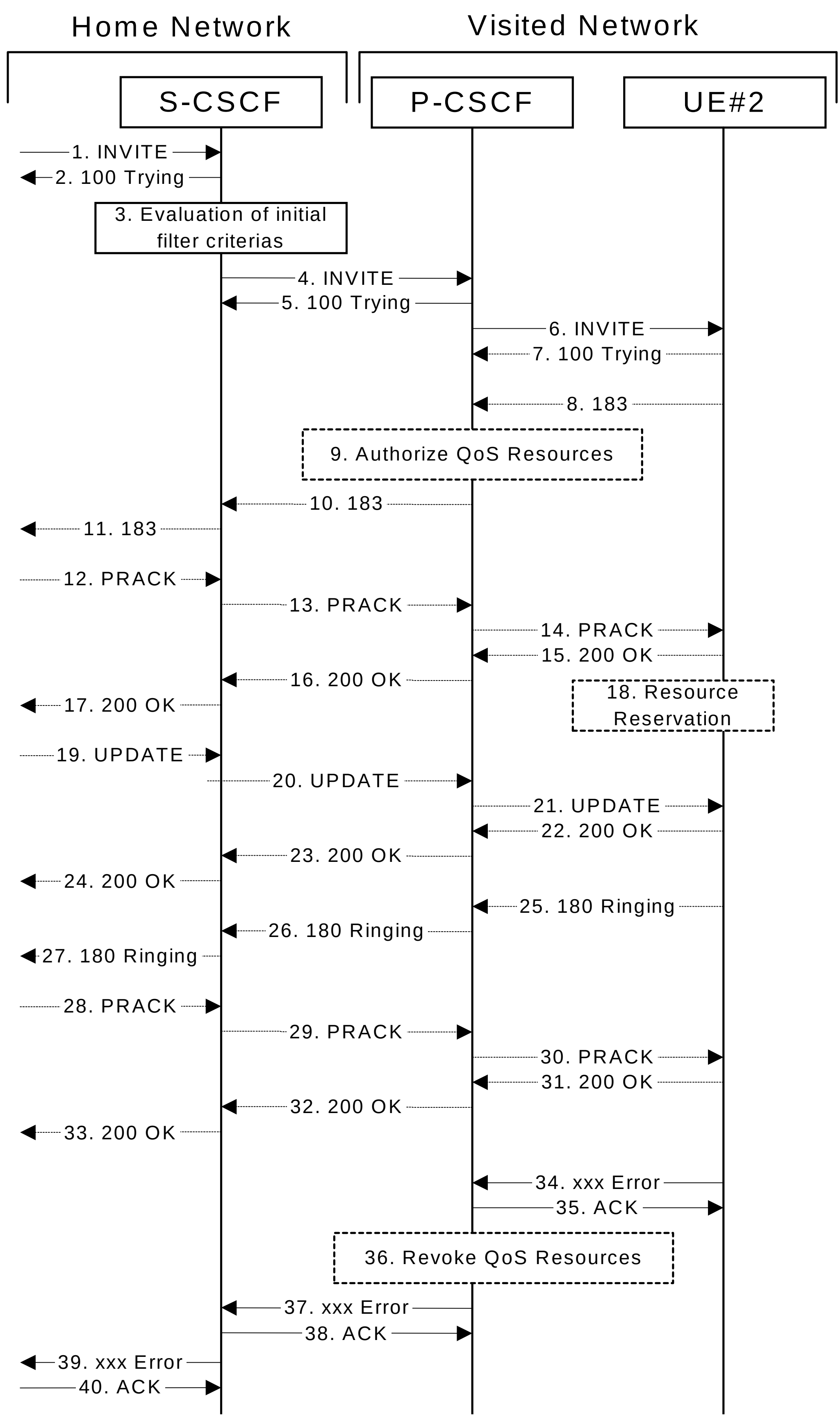


Figure 7.4.2.2-1: Failure in termination procedure

1-6. **INVITE (S-S to S-CSCF) et seq**

UE#1 initiated a session, as described in subclause 7.4.2.1.

7-33. **100 Trying (S-CSCF to S-S) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.4.2.1.

34. **xxx Error (UE to P-CSCF) – see example in table 7.4.2.2-34**

The termination procedure detected some error situation, and returned a SIP error response.

NOTE 1: The error response may be, for example, "486 Busy", "403 Service Denied", "480 Temporarily Unavailable", "580 Precondition Failure", or others. For this example, "486 Busy" is shown.

Table 7.4.2.2-34: 486 Busy Here (UE to P-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Retry-After: 3600
Content-Length: 0
```

35. **ACK (P-CSCF to UE) – see example in table 7.4.2.2-35**

Upon receive the 486 response from the UE, P-CSCF sends ACK.

Table 7.4.2.2-35: ACK (P-CSCF to UE)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

36. **Revoke QoS authorization**

P-CSCF removes the QoS authorization, if any, for this session.

37. **xxx Error (P-CSCF to S-CSCF) – see example in table 7.4.2.2-37 (related to table 7.4.2.2-34)**

The P-CSCF returned a SIP error response to S-CSCF.

NOTE 2: The error response may be, for example, “486 (Busy Here)”, “403 (Forbidden)”, “480 (Temporarily Unavailable)”, or others. For this example, “486 (Busy Here)” is shown.

Table 7.4.2.2-37: 486 Busy Here (P-CSCF to S-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

38. **ACK (S-CSCF to P-CSCF) – see example in table 7.4.2.2-38**

Upon receive the 486 response from the P-CSCF procedure, S-CSCF sends ACK.

Table 7.4.2.2-38: ACK (S-CSCF to P-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

39. **xxx Error (S-CSCF to S-S) – see example in table 7.4.2.2-39 (related to table 7.4.2.2-37)**

The S-CSCF returned a SIP error response to the appropriate S-S procedure.

NOTE 3: The error response may be, for example, “486 (Busy Here)”, “403 (Forbidden)”, “480 (Temporarily Unavailable)”, or others. For this example, “486 (Busy Here)” is shown.

Table 7.4.2.2-39: 486 Busy Here (S-CSCF to S-S)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

40. **ACK (S-S to S-CSCF) – see example in table 7.4.2.2-40**

Upon receive the 486 response from the S-CSCF, the S-S procedure sends ACK.

Table 7.4.2.2-40: ACK (S-S to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.4.2.3 Origination failure

After sending the initial INVITE for a multimedia session, the originating endpoint either abandoned the attempt or was unable to obtain the resources necessary for the session. The termination procedure is informed of this by a CANCEL request from the originator, which is shown in figure 7.4.2.3-1.

If the session is aborted due to failure to obtain resources by the originator, it will occur prior to step #19; steps 19-33 (marked as optional) will not be present. If the session is abandoned due to user command, it can happen at any point between steps 8-33.

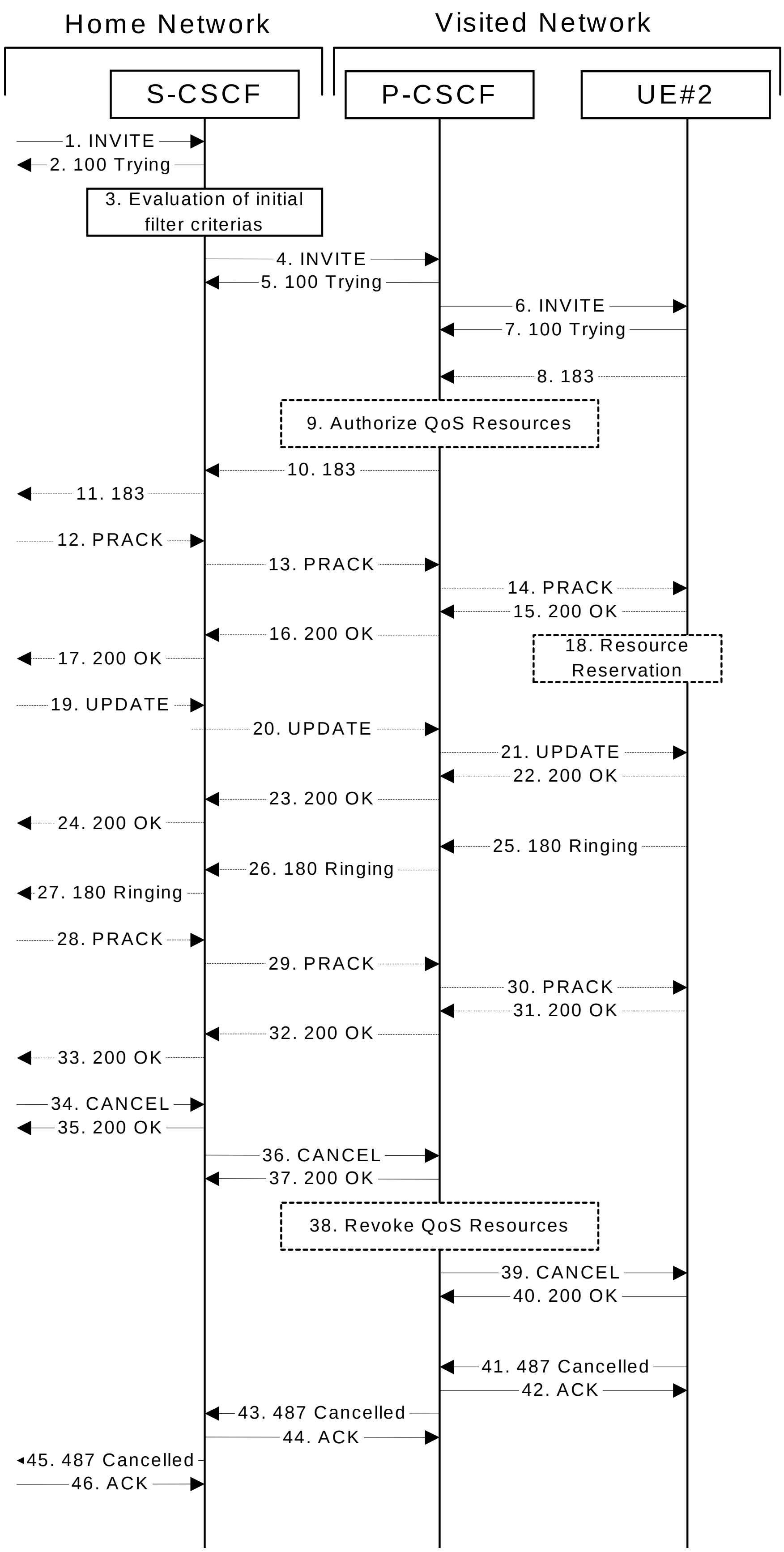


Figure 7.4.2.3-1: Failure in origination procedure

1-7. **INVITE (S-S to S-CSCF) et seq**

UE#1 initiated a session, as described in subclause 7.4.2.1.

8-33. **183 Session Progress (UE to S-CSCF) et seq**

Session initiation possibly continued, prior to detection of a failure condition, as described in subclause 7.4.2.1.

34. **CANCEL (S-S to S-CSCF) – see example in table 7.4.2.3-34**

The originator, through the S-S procedure, cancelled the original INVITE request.

Table 7.4.2.3-34: CANCEL (S-S to S-CSCF)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Route: sip:scscf2.home2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 CANCEL
Content-Length: 0
```

35. **200 OK (S-CSCF to S-S) – see example in table 7.4.2.3-35**

Upon receive the CANCEL request from the S-S procedure, S-CSCF sends 200 OK.

Table 7.4.2.3-35: 200 OK (S-CSCF to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

36. **CANCEL (S-CSCF to P-CSCF) – see example in table 7.4.2.3-36**

The S-CSCF forwards the CANCEL request to P-CSCF.

Table 7.4.2.3-36: CANCEL (S-CSCF to P-CSCF) (related to 7.4.2.3-34)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

37. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.3-37**

Upon receiving the CANCEL request from the S-CSCF, P-CSCF sends 200 OK.

Table 7.4.2.3-37: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

38. **Revoke QoS authorization**

P-CSCF removes the QoS authorization, if any, for this session.

39. **CANCEL (P-CSCF to UE) – see example in table 7.4.2.3-39 (related to table 7.4.2.3-36)**

The P-CSCF forwards the CANCEL request to the UE.

Table 7.4.2.3-39: CANCEL (P-CSCF to UE)

```
CANCEL sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
Cseq:
Content-Length:
```

40. **200 OK (UE to P-CSCF) – see example in table 7.4.2.3-40**

Upon receive the CANCEL request from the P-CSCF, the UE sends 200 OK.

Table 7.4.2.3-40: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

41. **487 Request Terminated (UE to P-CSCF) – see example in table 7.4.2.3-41**

The termination procedure performed the cancel operation, and returned a SIP error response to the initial INVITE request.

Table 7.4.2.3-41: 487 Request Terminated (UE to P-CSCF)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Retry-After: 3600
Content-Length: 0
```

42. **ACK (P-CSCF to UE) – see example in table 7.4.2.3-42**

Upon receive the 487 response from the UE, P-CSCF sends ACK.

Table 7.4.2.3-42: ACK (P-CSCF to UE)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

43. **487 Request Terminated (P-CSCF to S-CSCF) – see example in table 7.4.2.3-43 (related to table 7.4.2.3-41)**

The P-CSCF returns the SIP error response to S-CSCF.

Table 7.4.2.3-43: 487 Request Terminated (P-CSCF to S-CSCF)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

44. **ACK (S-CSCF to P-CSCF) – see example in table 7.4.2.3-44**

Upon receive the 487 response from the P-CSCF procedure, S-CSCF sends ACK.

Table 7.4.2.3-44: ACK (S-CSCF to P-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

45. **487 Request Terminated (S-CSCF to S-S) – see example in table 7.4.2.3-45 (related to table 7.4.2.3-43)**

The S-CSCF returns the SIP error response to the appropriate S-S procedure.

Table 7.4.2.3-45: 487 Request Terminated (S-CSCF to S-S)

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

46. **ACK (S-S to S-CSCF) – see example in table 7.4.2.3-46**

Upon receive the 487 response from the S-CSCF, the S-S procedure sends ACK.

Table 7.4.2.3-46: ACK (S-S to S-CSCF)

```
ACK sip:+1-212-555-2222@home2.net;user=phone  SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq: 127 ACK
Content-Length: 0
```

7.4.2.4 Mobile termination, roaming, terminal is out of radio coverage (MO#2, S-S#2 assumed)

An example of this flow is not shown in the present document.

7.4.3 MT#2

7.4.3.1 (MT#2) Mobile termination, located in home network (MO#2, S-S#2 assumed)

Figure 7.4.3.1-1 shows a termination procedure which applies to subscribers located in their home service area.

The UE is located in the home network, and determines the P-CSCF via the CSCF discovery procedure. During registration, the home network allocates a S-CSCF in the home network, S-CSCF.

When registration is complete, S-CSCF knows the name/address of P-CSCF, and P-CSCF knows the name/address of the UE.

NOTE: Although S-S#2 flow is assumed, home2.net is used in the Via, Record-Route and Route headers in order to be more generic and clearly identify the originating and terminating nodes. In the S-S#2 scenario home2.net = home1.net.

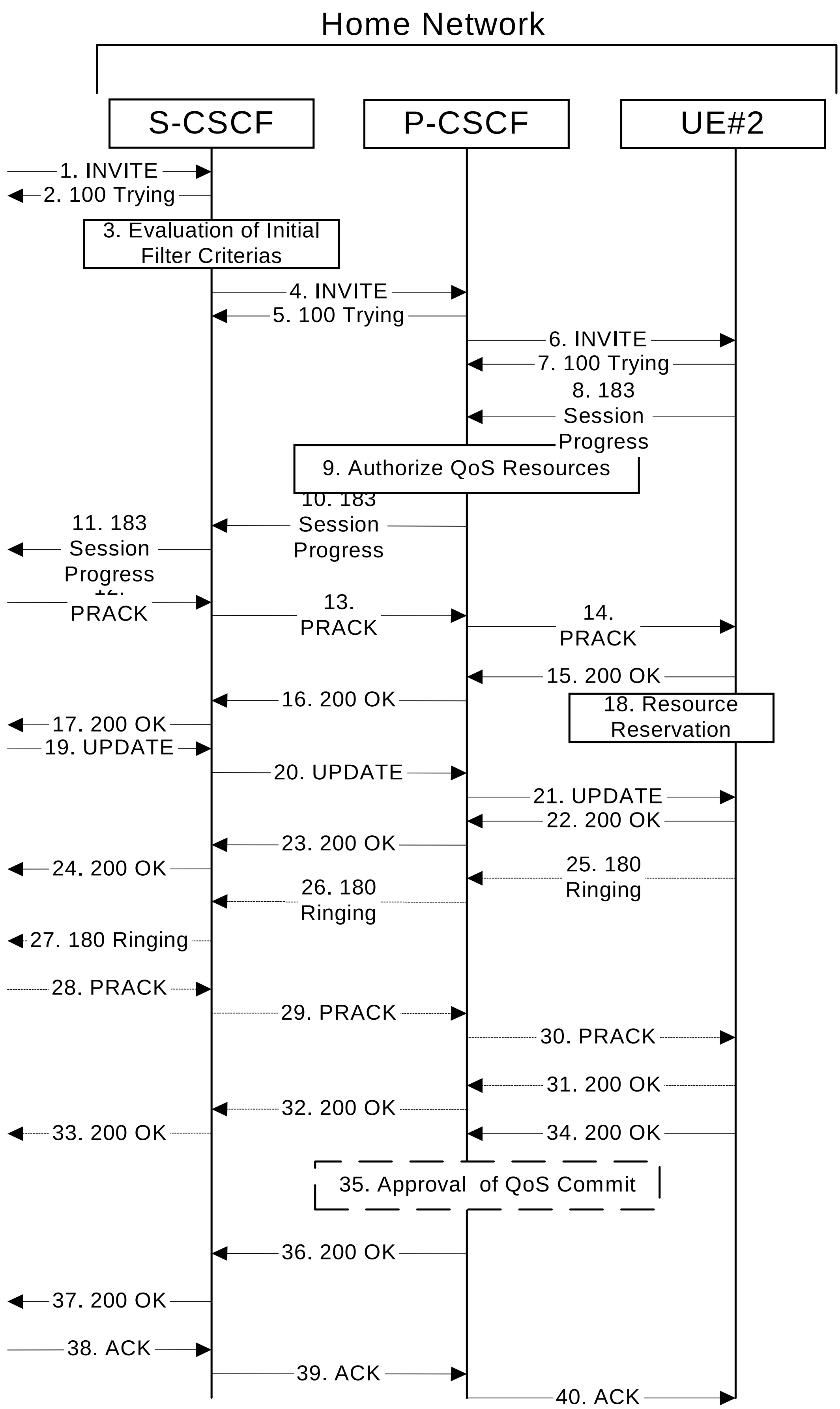


Figure 7.4.3.1-1: MT#2

Procedure MT#2 is as follows:

1. **INVITE (S-S to MT#2) – see example in table 7.4.3.1-1**

   The calling party sends the INVITE request, via one of the origination procedures and via one of the S-CSCF to S-CSCF procedures, to the S-CSCF for the terminating subscriber.

Table 7.4.3.1-1: INVITE (S-S to MT#2)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:sip:scscf2.home1.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Route: sip:sip:scscf2.home1.net;lr
Remote-Party-IDP-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>; screen=yes
RPID-PrivacyPrivacy: privacy=off; party=callingnone
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

SDP The SDP contains the complete set of supported codecs from the session originator, as restricted by the originating network operator. The "m=" lines for the video media streams show a port number zero, which removes them from the negotiation.

Upon receipt of the INVITE, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.3.1-1b.

Table 7.4.3.1-1b: Storage of information at S-CSCF

```
Request-URI: sip: user2_public1@home2.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf1.home1.net, sip:pcscf1.home1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

2. **100 Trying (MT#2 to S-S) – see example in table 7.4.3.1-2**

   S-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.4.3.1-2: 100 Trying (MT#2 to S-S)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber, and evaluates the initial filter criterias.

4. **INVITE (S-CSCF to P-CSCF) – see example in table 7.4.3.1-4**

   S-CSCF remembers (from the registration procedure) the next hop CSCF for this UE. It forwards the INVITE request to the P-CSCF.

   S-CSCF examines the media parameters, and removes any choices that the destination subscriber does not have authority to request. For this example, assume the destination subscriber is not allowed stereo, so only a single audio stream is permitted.

Table 7.4.3.1-4: INVITE (S-CSCF to P-CSCF)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1 SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 66
Route: sip:pcscf2.home2.net;lr
Record-Route: sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID: <tel:+1-212-555-2222>
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Route: Built from the Path header stored at registration.

P-Called-Party-ID: Includes the dialled URL with its parameters.

Via:, Record-Route: S-CSCF adds itself in the Record-Route and Via headers.

SDP: The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the second audio stream shows a port number zero, which removes it from the negotiation.

P-CSCF saves information from the received INVITE request. The saved value of the information for this session is – see example in table 7.4.3.1-4b.

Table 7.4.3.1-4b: Storage of information at P-CSCF

```
Request-URI: sip:[5555::eee:fff:aaa:bbb]
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf2.home2.net, sip:scscf1.home1.net, sip:pcscf1.home1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

5. **100 Trying (P-CSCF to S-CSCF) – see example in table 7.4.3.1-5**

   P-CSCF responds to the INVITE request (4) with a 100 Trying provisional response.

Table 7.4.3.1-5: 100 Trying (P-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **INVITE (P-CSCF to UE) – see example in table 7.4.3.1-6**

   P-CSCF examines the media parameters, and removes any that the network operator decides, based on local policy, not to allow on the network.

   For this example, assume the network operator does not allow 64 kb/s audio, so the PCMU codec is removed.

   P-CSCF removes the Record-Route and Via headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE.

Table 7.4.3.1-6: INVITE (P-CSCF to UE)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
Max-Forwards: 65
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID:
P-Media-Authorization: 0020000100100101706366322e78797a2e6e6574000c02013331533134363231
Content-Type:
Content-Length:

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saves values. It inserts this as a branch value on its Via header.

P-Media-Authorization: A P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf2.xyz.net" with credentials "31S14621".

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the first audio stream no longer contains codec "0" (PCMU), which removes it from the negotiation.

7. **100 Trying (UE to P-CSCF) – see example in table 7.4.3.1-7**

UE may optionally send a 100 Trying provisional response to P-CSCF.

Table 7.4.3.1-7: 100 Trying (UE to P-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **183 Session Progress (UE to P-CSCF) – see example in table 7.4.3.1-8**

UE#2 determines the complete set of codecs that it is capable of supporting for this session. It determines the intersection with those appearing in the SDP in the INVITE request. For each media flow that is not supported, UE#2 inserts a SDP entry for media (m= line) with port=0. For each media flow that is supported, UE#2 inserts a SDP entry with an assigned port and with the codecs in common with those in the SDP from UE#1.

For this example, assume UE#2 supports both AMR and G726, but not G728 (code 15).

UE responds with a 183 Session Progress response containing SDP back to the originator. This SDP may represent one or more media for a multimedia session. This response is sent to P-CSCF.

Table 7.4.3.1-8: 183 Session Progress (UE to P-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
P-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>
~~Remote-Party-ID: "John Smith" <tel:+1-212-555-2222>~~
~~RPID-Privacy~~Privacy: none~~privacy=off; party=called~~
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

~~**Remote-Party- ID:**~~ ~~Identifies the answering subscriber. It contains the public user identity, and the name of the answering party.~~

To: A tag is added to the To header.

Contact: Contains a SIP URL with the IP address or FQDN of the terminating UE.

SDP The SDP contains the subset of codecs supported by UE. It requests a confirmation of the QoS preconditions for establishing the session.

Upon receipt of the 183 Session Progress, the P-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.3.1-8b.

Table 7.4.3.1-8b: Storage of information at P-CSCF

```
Request-URI: sip:[5555::eee:fff:aaa:bbb]
From: "Alien Blaster" <sip:B36(SHA-1(user1_public1@home1.net; time=36123E5B;
   seq=72))@localhost>; tag=171828
To: tel:sip:B36(SHA-1(+1-212-555-2222; time=36123E5B; seq=73))@localhost; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf2.home2.net, sip:scscf1.home1.net, sip:pcscf1.home1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

9. **Authorize QoS Resources**

P-CSCF authorizes the resources necessary for this session. The approval of QoS commitment either happens at this stage or after 200 OK of INVITE (34) based on operator local policy.

10. **183 Session Progress (P-CSCF to S-CSCF) – see example in table 7.4.3.1-10**

P-CSCF forwards the 183 Session Progress response to S-CSCF.

Table 7.4.3.1-10: 183 Session Progress (P-CSCF to S-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
Record-Route: sip:pcscf2.home2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.home1.net;lr
Remote-Party-IDP-Asserted-Identity:
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

P-CSCF restores the Via headers and Record-Route headers from the branch value in its Via.

P-Asserted-Identity: The P-CSCF inserts this header based on the user's hint present in the incoming P-Asserted-Identity header.

Upon receipt of the 183 Session Progress, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.3.1-10b.

Table 7.4.3.1-10b: Storage of information at S-CSCF

```
Request-URI: sip:user2_public1@home2.net
From: "Alien Blaster" <sip:B36(SHA-1(user1_public1@home1.net; time=36123E5B;
   seq=72))@localhost>; tag=171828
To: siptel: B36(SHA-1(+1-212-555-2222; time=36123E5B; seq=73))@localhost tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:pcscf2.home2.net
Route(2orig): sip:scscf1.home1.net, sip:pcscf1.home1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

11. **183 Session Progress (MT#2 to S-S) – see example in table 7.4.3.1-11**

S-CSCF forwards the 183 Session Progress response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.3.1-11: 183 Session Progress (MT#2 to S-S)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>; screen=yes
RPID-PrivacyPrivacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

12. **PRACK (S-S to MT#2) – see example in table 7.4.3.1-12**

The originating endpoint sends a PRACK request containing the final SDP to be used in this session, via the S-CSCF to S-CSCF procedure, to S-CSCF.

Table 7.4.3.1-12: PRACK (S-S to MT#2)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

13. **PRACK (S-CSCF to P-CSCF) – see example in table 7.4.3.1-13**

S-CSCF forwards the PRACK request to P-CSCF.

Table 7.4.3.1-13: PRACK (S-CSCF to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

14. **PRACK (P-CSCF to UE) – see example in table 7.4.3.1-14**

P-CSCF forwards the PRACK request to UE.

Table 7.4.3.1-14: PRACK (P-CSCF to UE)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

15. **200 OK (UE to P-CSCF) – see example in table 7.4.3.1-15**

UE acknowledges the PRACK request (14) with a 200 OK response.

Table 7.4.3.1-15: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

16. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.3.1-16**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.3.1-16: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

17. **200 OK (MT#2 to S-S) – see example in table 7.4.3.1-17**

    S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.3.1-17: 200 OK (MT#2 to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

18. **Resource Reservation**

    UE initiates the reservation procedures for the resources needed for this session.

19. **UPDATE (S-S to MT#2) – see example in table 7.4.3.1-19**

    When the originating endpoint has completed its resource reservation, it sends the UPDATE request to S-CSCF, via the S-CSCF to S-CSCF procedures.

Table 7.4.3.1-19: UPDATE (S-S to MT#2)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m-video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

20. **UPDATE (S-CSCF to P-CSCF) – see example in table 7.4.3.1-20**

S-CSCF forwards the UPDATE request to P-CSCF.

Table 7.4.3.1-20: UPDATE (S-CSCF to P-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

21. **UPDATE (P-CSCF to UE) – see example in table 7.4.3.1-21**

P-CSCF forwards the UPDATE request to UE.

Table 7.4.3.1-21: UPDATE (P-CSCF to UE)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

22. **200 OK (UE to P-CSCF) – see example in table 7.4.3.1-22**

UE acknowledges the UPDATE request (21) with a 200 OK response.

Table 7.4.3.1-22: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

23. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.3.1-23**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.3.1-23: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

24. **200 OK (MT#2 to S-S) – see example in table 7.4.3.1-24**

S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.3.1-24: 200 OK (MT#2 to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

25. **180 Ringing (UE to P-CSCF) – see example in table 7.4.3.1-25**

Before proceeding with session establishment, the UE waits for two events. First, the resource reservation initiated in step #17 must complete successfully. Second, the resource reservation initiated by the originating endpoint must complete successfully (which is indicated by message #20 received by UE). The UE may now immediately accept the session (and proceed with step #34), or alert the destination subscriber of an incoming session attempt; if the latter it indicates this to the calling party by a 180 Ringing provisional response sent to P-CSCF.

Table 7.4.3.1-25: 180 Ringing (UE to P-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
From:
To:
Call-ID:
CSeq:
Require:
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

26. **180 Ringing (P-CSCF to S-CSCF) – see example in table 7.4.3.1-26**

    P-CSCF forwards the 180 Ringing response to S-CSCF.

Table 7.4.3.1-26: 180 Ringing (P-CSCF to S-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

27. **180 Ringing (MT#2 to S-S) – see example in table 7.4.3.1-27**

    S-CSCF forwards the 180 Ringing response to the originating endpoint, per the S-CSCF to S-CSCF procedure.

Table 7.4.3.1-27: 180 Ringing (MT#2 to S-S)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

28. **PRACK (S-S to MT#2) – see example in table 7.4.3.1-28**

    The originator acknowledges the 180 Ringing response (27) with a PRACK request.

Table 7.4.3.1-28: PRACK (S-S to MT#2)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip: scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

29. **PRACK (S-CSCF to P-CSCF) – see example in table 7.4.3.1-29**

S-CSCF forwards the PRACK request to P-CSCF.

Table 7.4.3.1-29: PRACK (S-CSCF to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home2.net ;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

30. **PRACK (P-CSCF to UE) – see example in table 7.4.3.1-30**

P-CSCF forwards the PRACK request to UE.

Table 7.4.3.1-30: PRACK (P-CSCF to UE)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

31. **200 OK (UE to P-CSCF) – see example in table 7.4.3.1-31**

UE acknowledges the PRACK request (31) with a 200 OK response.

Table 7.4.3.1-31: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

32. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.3.1-32**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.3.1-32: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

33. **200 OK (MT#2 to S-S) – see example in table 7.4.3.1-33**

S-CSCF forwards the 200 OK response to the session originator, per the S-CSCF to S-CSCF procedures.

Table 7.4.3.1-33: 200 OK (MT#2 to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **200 OK (UE to P-CSCF) – see example in table 7.4.3.1-34**

When the called party answers, the UE sends a 200 OK final response to the INVITE request (6) to P-CSCF, and starts the media flow(s) for this session.

Table 7.4.3.1-34: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length: 0
```

35. **Approval of QoS Commit**

The P-CSCF approves the commitment of the QoS resources if it was not approved already in step (9).

36. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.3.1-36**

P-CSCF indicates the resources reserved for this session should now be committed, and sends the 200 OK final response to S-CSCF.

Table 7.4.3.1-36: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP icscf2.home2.net,
   SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.home2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

37. **200 OK (MT#2 to S-S) – see example in table 7.4.3.1-37**

S-CSCF forwards the 200 OK final response along the signalling path back to the session originator, as per the S-CSCF to S-CSCF procedure.

Table 7.4.3.1-37: 200 OK (MT#2 to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1,SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

38. **ACK (S-S to MT#2) – see example in table 7.4.3.1-38**

The calling party responds to the 200 OK final response (37) with an ACK request which is sent to S-CSCF via the S-CSCF to S-CSCF procedure.

Table 7.4.3.1-38: ACK (S-S to MT#2)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq: 127 ACK
Content-Length: 0
```

39. **ACK (S-CSCF to P-CSCF) – see example in table 7.4.3.1-39**

S-CSCF forwards the ACK request to P-CSCF.

Table 7.4.3.1-39: ACK (S-CSCF to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.home2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

40. **ACK (P-CSCF to UE) – see example in table 7.4.3.1-40**

P-CSCF forwards the ACK request to UE.

Table 7.4.3.1-40: ACK (P-CSCF to UE)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.home2.net;branch=z9hG4bK876t12.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Length:
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

7.4.3.2 UE-detected failure/resource failure (not provided)

An example of this flow is not shown in the present document.

7.4.3.3 Origination failure (not provided)

An example of this flow is not shown in the present document.

7.4.4 CS-T

7.4.4.1 (CS-T) CS Networks termination (MO#2, S-S#3 assumed)

Figure 7.4.4.1-1 shows the MGCF in the IM CN subsystem, which is a SIP endpoint that initiates and receives requests on behalf of the CS Networks and Media Gateway (MGW). Other nodes consider the signalling as if it came from a S-CSCF. The MGCF incorporates the network security functionality of the S-CSCF.

Agreements between network operators may allow CS Networks termination in a network other than the originator's home network. This may be done, for example, to avoid long distance or international tariffs.

This termination procedure can be used in either S-S#3 or S-S#4.

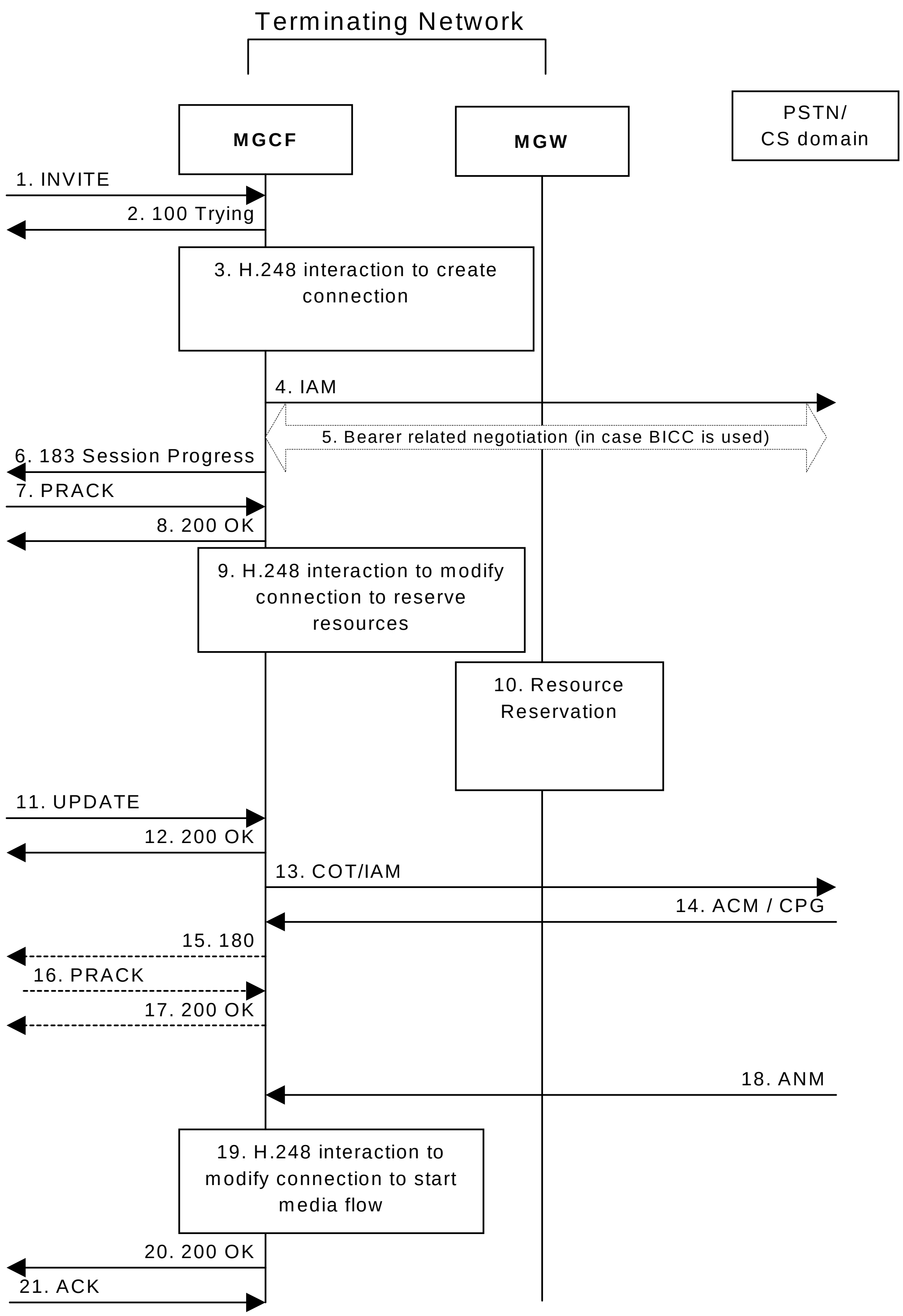


Figure 7.4.4.1-1: CS Networks termination

The CS Networks termination procedure is as follows:

1. **INVITE (S-S to CS-T) – see example in table 7.4.4.1-1**

   MGCF receives an INVITE request, through one of the origination procedures and via one of the S-CSCF to S-CSCF procedures.

Table 7.4.4.1-1: INVITE (S-S to CS-T)

```
INVITE sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>~~; screen=yes~~
~~RPID-Privacy~~Privacy: ~~privacy=off; party=calling~~none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
m=video 0 RTP/AVP 99
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Upon receiving the INVITE, the MGCF stores the following information about this session – see example in table 7.4.4.1-1b.

Table 7.4.4.1-1b: Storage of information at MGCF

```
Request-URI: sip:+1-212-555-2222@home1.net;user=phone
From: sip:user1_public1@home1.net~~"Alien Blaster" <sip:B36(SHA-1(+1-212-555-1111;
   time=36123E5B; seq=72))@localhost>~~;tag=171828
To: tel:+1-212-555-2222; tag=314159~~<sip:B36(SHA-1(+1-212-555-2222; time=36123E5B;
   seq=73))@localhost>~~
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Route: sip:scscf1.home1.net, sip:pcscf1.home1.net
```

SDP: The SDP contains the desired set of supported codecs from the session originator, as restricted by the originating network operator. The "m=" lines for the video media streams show a port number zero, which removes them from the negotiation.

2. **100 Trying (CS-T to S-S) – see example in table 7.4.4.1-2**

   MGCF may respond to the INVITE request with a 100 Trying provisional response.

Table 7.4.4.1-2: 100 Trying (CS-T to S-S)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **H.248 Interaction to Create Connection**

   MGCF initiates a H.248 interaction to pick an outgoing channel and determine media capabilities of the MGW.

4. **SS7: IAM**

   Based on the continuity support of the outgoing channel selected, MGCF may decide to send an IAM message out to the CS Networks at this point. In case the outgoing channel does not support continuity indication, MGCF sends out an IAM message only in step 14.

5. **Possible bearer related negotiation takes place (in case BICC is used)**

6. **183 Session Progress (CS-T to S-S) – see example in table 7.4.4.1-6**

   MGCF determines the subset of the media flows proposed by the originating endpoint that it supports, and responds with a 183 Session Progress response back to the originator. This response is sent via the S-CSCF to S-CSCF procedure.

NOTE: in order to be able to send the IAM message at step 4, the MGCF has to select one media from the SDP received in INVITE.

Table 7.4.4.1-6: 183 Session Progress (CS-T to S-S)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
~~Remote-Party-ID~~P-Asserted-Identity: <tel:+1-212-555-2222>~~; screen=yes~~
~~RPID-Privacy~~Privacy: ~~privacy=off; party=called~~none
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:mgcf1.home1.net
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m-video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4 3
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

7. **PRACK (S-S to CS-T) – see example in table 7.4.4.1-7**

The originating endpoint sends a PRACK request containing the final SDP to be used in this session, via the S-CSCF to S-CSCF procedure, to MGCF.

Table 7.4.4.1-7: PRACK (S-S to CS-T)

```
PRACK sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m-video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

8. **200 OK (CS-T to S-S) – see example in table 7.4.4.1-8**

MGCF acknowledges the PRACK request (8) with a 200 OK response.

Table 7.4.4.1-8: 200 OK (CS-T to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m-video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4 3
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

9. **H.248 Interaction to Modify Connection**

   MGCF initiates a H.248 interaction to modify the connection established in step #3 and instruct MGW to reserve the resources necessary for the media streams.

10. **Resource Reservation**

   MGW reserved the resources necessary for the media streams.

11. **UPDATE (S-S to CS-T) – see example in table 7.4.4.1-11**

   When the originating endpoint has completed its resource reservation, it sends the UPDATE request to MGCF, via the S-CSCF to S-CSCF procedures.

Table 7.4.4.1-11: UPDATE (S-S to CS-T)

```
UPDATE sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97 3 96
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

12. **200 OK (CS-T to S-S) – see example in table 7.4.4.1-12**

MGCF acknowledges the UPDATE request (11) with a 200 OK response.

Table 7.4.4.1-12: 200 OK (CS-T to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97 3 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

13. **SS7: COT/IAM**

Based on the continuity support of the outgoing channel selected MGCF sends a IAM or COT message to the CS Networks. In case the outgoing channel supports continuity indication, MGCF has already sent out the IAM message in step 4, and at this point sends out a COT message.

14. **SS7: ACM/CPG**

    The CS Networks establishes the path to the destination. In the present case the CS Networks responds with an ACM message containing a "subscriber free" indication, implying that the called party is being alerted.

15. **180 (CS-T to S-S) – see example in table 7.4.4.1-15**

    If the CS Network is alerting the destination user, MGCF indicates this to the calling party by a 180 Ringing provisional response. This response is sent via the S-CSCF to S-CSCF procedures.

    As the indication of called party being alerted ("subscriber free" indication) may not be available in ACM, the 180 Ringing is only sent when the indication is available. An ACM without the "subscriber free" indication will not trigger any SIP message.

Table 7.4.4.1-15: 180 Ringing (CS-T to S-S)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Require: 100rel
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:mgcf1.home1.net
RSeq: 9022
Content-Length: 0
```

The 180 Ringing is used when the ACM has indicated that the called party is being alerted.

16. **PRACK (S-S to CS-T) – see example in table 7.4.4.1-16**

    The originator acknowledges the 180 Ringing provisional response (15) with a PRACK request.

Table 7.4.4.1-16: PRACK (S-S to CS-T)

```
PRACK sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

17. **200 OK (CS-T to S-S) – see example in table 7.4.4.1-17**

    MGCF acknowledges the PRACK request (16) with a 200 OK response.

Table 7.4.4.1-17: 200 OK (CS-T to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

18. **SS7: ANM**

When the called party answers, the CS Network sends an ANM message to the MGCF.

19. **H.248:Interaction to Modify Connection**

MGCF initiates a H.248 interaction to make the connection in the MGW bi-directional.

20. **200 OK (CS-T to S-S) – see example in table 7.4.4.1-20**

MGCF sends a 200 OK final response along the signalling path back to the session originator.

Table 7.4.4.1-20: 200 OK (CS-T to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP bgcf1.home1.net;branch=z9hG4bK6546q2.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:mgcf1.home1.net
Content-Length: 0
```

21. **ACK (S-S to CS-T) – see example in table 7.4.4.1-21**

The Calling party acknowledges the final response (20) with an ACK request.

Table 7.4.4.1-21: ACK (S-S to CS-T)

```
ACK sip:+1-212-555-2222@home2.net; user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
From:
To:
Call-ID:
Cseq: 127 ACK
Content-Length: 0
```

7.4.4.2 MGCF-detected failure/resource failure (not provided)

An example of this flow is not shown in the present document.

7.4.4.3 Origination failure (not provided)

An example of this flow is not shown in the present document.

7.4.5 MT#1c

7.4.5.1 (MT#1c) Mobile termination, roaming, without I-CSCF in home network providing configuration independence, terminating UE is busy, and not able or not willing to answer the call (MO#2, S-S#2 assumed)

Figure 7.4.5.1 shows a termination procedure which applies to roaming subscribers when the home network operator does not desire to keep its internal configuration hidden from the visited network. The UE is located in a visited network, and determines the P-CSCF via the CSCF discovery procedure. During registration, the home network allocates the S-CSCF.

When registration is complete, S-CSCF knows the name/address of P-CSCF, and P-CSCF knows the name/address of the UE.

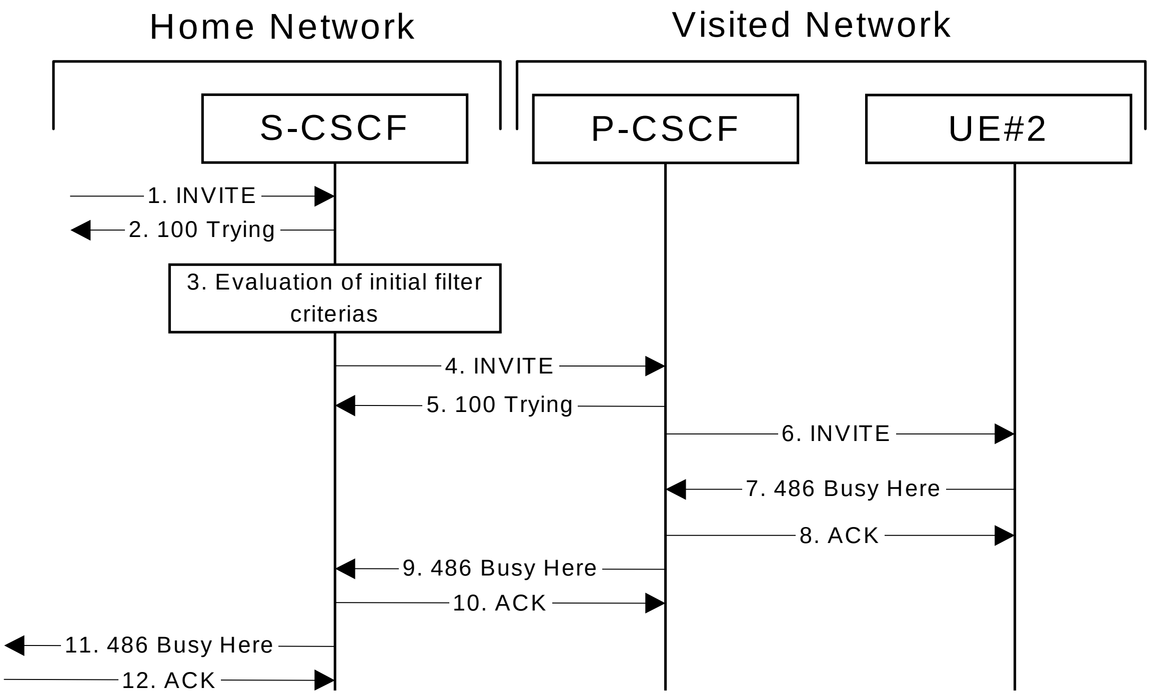


Figure 7.4.5.1-1: MT#1c

Procedure MT#1c is as follows:

1. **INVITE (S-S to MT#1a) – see example in table 7.4.5.1-1**

   The calling party sends the INVITE request, via one of the origination procedures and via one of the S-CSCF to S-CSCF procedures, to the S-CSCF for the terminating subscriber.

Table 7.4.5.1-1: INVITE (S-S to MT#1c)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:scscf2.home2.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Route: sip:scscf2.home2.net;lr
Asserted-Identity: "John Doe" <tel:+1-212-555-1111>
Privacy: none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97 3 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

2. **100 Trying (MT#1c to S-S) – see example in table 7.4.5.1-2**

   S-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.4.5.1-2: 100 Trying (MT#1c to S-S)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber, and evaluates the initial filter criterias.

4. **INVITE (S-CSCF to P-CSCF) – see example in table 7.4.5.1-4**

   S-CSCF remembers (from the registration procedure) the next hop CSCF for this UE. It forwards the INVITE to the P-CSCF.

   S-CSCF examines the media parameters, and removes any choices that the destination subscriber does not have authority to request. For this example, assume the destination subscriber is not allowed stereo, so only a single audio stream is permitted.

Table 7.4.5.1-4: INVITE (S-CSCF to P-CSCF)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 66
Route: sip:pcscf2.visited2.net;lr
Record-Route: sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
sip:pcscf1.home1.net;lr
Asserted-Identity:
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID: sip:user2_public1@home2.net
Content-Type:
Content-Length: (…)

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
a=
```

P-Called-Party-ID: Includes the dialled URL with its parameters

Route: Built from the Path header.

Via:, Record-Route: S-CSCF adds itself

5. **100 Trying (P-CSCF to S-CSCF) – see example in table 7.4.5.1-5**

   P-CSCF responds to the INVITE request (4) with a 100 Trying provisional response.

Table 7.4.5.1-5: 100 Trying (P-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **INVITE (P-CSCF to UE) – see example in table 7.4.5.1-6**

   P-CSCF removes the Record-Route and Via headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE. P-CSCF forwards the INVITE request to the UE.

Table 7.4.5.1-6: INVITE (P-CSCF to UE)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 65
Asserted-Identity:
Privacy: P-Media-Authorization:
   0020000100100101706366322e78797a2e6e6574000c02013331533134363231
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
a=
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saves values. It inserts this as a branch value on its Via header.

P-Media-Authorization: A P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf2.xyz.net" with credentials "31S14621".

7. **486 Busy Here (UE to P-CSCF) – see example in table 7.4.5.1-7**

   UE is contacted successfully but it is currently not willing or able to take additional sessions. The response MAY indicate a better time later to call in the Retry-After header.

Table 7.4.5.1-7: 486 Busy Here (UE to P-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To: tel:+1-212-555-2222;tag=314159
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

8. **ACK (P-CSCF to UE) – see example in table 7.4.5.1-8**

   Upon receive the 486 response from the UE, P-CSCF sends ACK back to the UE.

Table 7.4.5.1-8: ACK (P-CSCF to UE)

```
ACK sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

9. **486 Busy Here (P-CSCF to S-CSCF) – see example in table 7.4.5.1-9**

P-CSCF forwards the 486 response to the S-CSCF.

Table 7.4.5.1-9: 486 Busy Here (P-CSCF to S-CSCF)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To: tel:+1-212-555-2222;tag=314159
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

10. **ACK (S-CSCF to P-CSCF) – see example in table 7.4.5.1-10**

S-CSCF sends ACK to the P-CSCF.

Table 7.4.5.1-10: ACK (S-CSCF to P-CSCF)

```
ACK sip:user2_public1@home2.net  SIP/2.0
Via: SIP/2.0/UDP scscf2.home1.net;branch=z9hG4bK764z87.1From:
Route: sip:pcscf2.visited2.net;lr
To:
Call-ID:
CSeq:
Content-Length: 0
```

11. **486 Busy Here (MT#1c to S-S) – see example in table 7.4.5.1-11**

S-CSCF forwards the 486 Busy Here response to the originator, per the S-CSCF to S-CSCF procedure. Also indicates the voice mail address of the callee.

Table 7.4.5.1-11: 486 Busy Here (MT#1c to S-S)

```
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP icscf2_s.home1.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Retry-After: 3600
Content-Length: 0
```

12. **ACK (S-S to MT#1c) – see example in table 7.4.5.1-12**

The S-CSCF of calling party responds to the 486 Busy Here response with an ACK request that is sent to S-CSCF via the S-CSCF to S-CSCF procedure.

Table 7.4.5.1-12: ACK (S-S to MT#1c)

```
ACK sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

7.4.6 MT#2a

7.4.6.1 (MT#2a) Mobile termination, located in home network, terminating UE is busy, and not able or not willing to answer the call (MO#2, S-S#2 assumed)

MT#2a flow is the same scenario as MT#1c with the difference that in MT#2a S-CSCF and P-CSCF are in the same network. For simplicity the detailed flow is not provided.

7.4.7 MT#1e

7.4.7.1 (MT#1e) Mobile termination, roaming, without I-CSCF in home network providing configuration independence, service is refused by S-CSCF when receiving INVITE request (MO#2, S-S#2 assumed)

Figure 7.4.7.1-1 shows a termination procedure, which applies to roaming subscribers when the home network operator does not desire to keep its internal configuration hidden from the visited network. The UE is located in a visited network, and determines the P-CSCF via the CSCF discovery procedure. During registration, the home network allocates the S-CSCF.

When registration is complete, S-CSCF knows the name/address of P-CSCF, and P-CSCF knows the name/address of the UE.

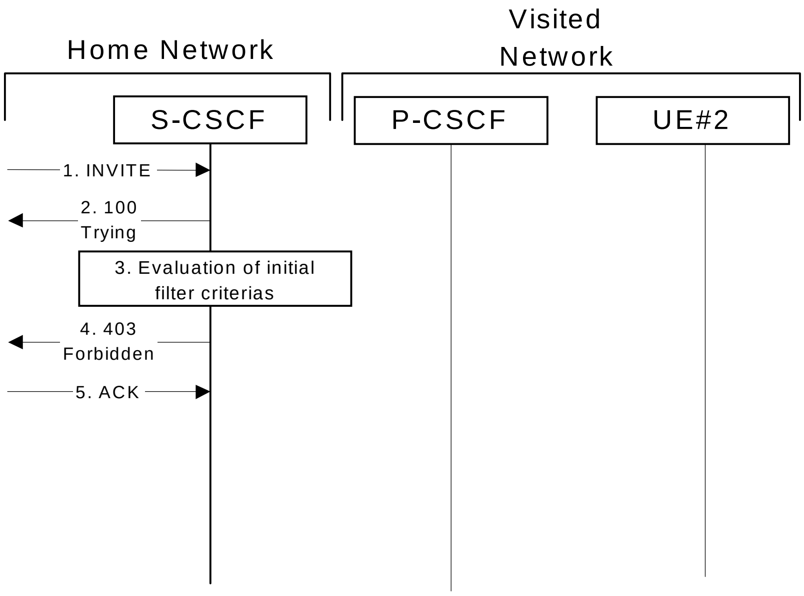


Figure 7.4.7.1-1: Mobile termination, roaming, without I-CSCF in home network providing configuration independence, service is refused by S-CSCF when receiving INVITE request

1. **INVITE (S-S to MT#1e) - see example in table 7.4.7.1-1**

   The calling party sends the INVITE request, via one of the origination procedures and via one of the S-CSCF to S-CSCF procedures, to the S-CSCF for the terminating subscriber.

Table 7.4.7.1-1: INVITE (S-S to MT#1e)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
    scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1,
    SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:scscf2.home2.net;lr
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.home1.net;lr
Route: sip:scscf2.home2.net;lr
Asserted-Identity: "John Doe" <tel:+1-212-555-1111>
Privacy: none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555:aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97 3 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

2. **100 Trying (MT#1e to S-S) - see example in table 7.4.7.1-2**

   S-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.4.7.1-2: 100 Trying (MT#1e to S-S)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber, and evaluates the initial filter criterias.

4. **403 Forbidden (MT#1e to S-S) - see example in table 7.4.7.1-4**

   S-CSCF forwards the 403 Forbidden response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.7.1-4: 403 Forbidden (MT#1e to S-S)

```
SIP/2.0 403 Forbidden
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To: tel:+1-212-555-2222;tag=314159
Call-ID:
CSeq:
Content-Length: 0
```

5. **ACK (S-S to MT#1e) - see example in table 7.4.7.1-5**

   The S-CSCF of calling party responds to the 403 Forbidden response with an ACK request that is sent to S-CSCF via the S-CSCF to S-CSCF procedure.

Table 7.4.7.1-5: ACK (S-S to MT#1e)

```
ACK sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1
Route: sip:scscf2.home2.net;lr
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

7.4.8 Mobile termination, roaming, terminal is out of radio coverage (MO#2, S-S#2 assumed)

Void.

7.4.9 Mobile termination, unregistered subscriber

7.4.9.1 Introduction

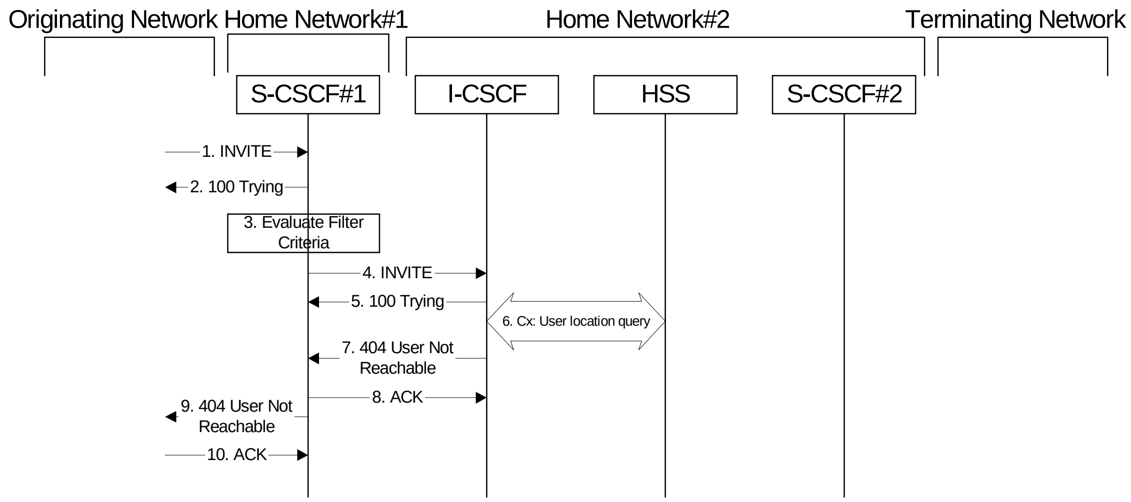
In the example information flows in the following sections, the subscriber receiving a terminating call is unregistered. Therefore, when the I-CSCF in the home network of the called subscriber queries the HSS for the location of the called subscriber, the HSS indicates that the subscriber is unregistered.

In subclause 7.4.9.2, call setup does not proceed, as the subscriber does not have services related to unregistered state.

In subclause 7.4.9.3, call setup proceeds and a temporary call instance is created at the callee's S-CSCF for the life of the call. This is to support services related to the unregistered state of the callee.

7.4.9.2 Mobile termination, unregistered subscriber, no services related to unregistered state

In the example information flow the subscriber is unregistered and the subscriber has no services related to unregistered state. This is shown in the following information flow (figure 7.4.9.2-1).



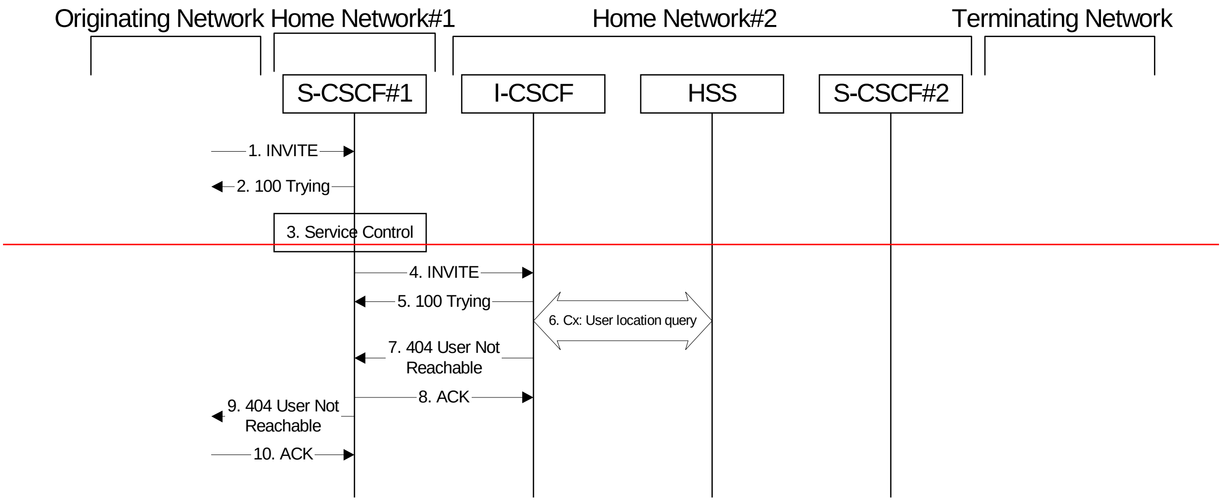


Figure 7.4.9.2-1: Mobile termination, unregistered subscriber

1. **INVITE (MO to S-S#1a) – see example in table 7.4.9.2-1**

   The INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating signalling flow.

Table 7.4.9.2-1: INVITE (MO to S-S#1a)

```
INVITE tel:+1-212-555-2222 ~~sip:scscf1.home1.net~~ SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr
Record-Route: sip:~~240f34.1@~~pcscf1.visited1.net;lr
~~Route: sip:+1-212-555-2222@home2.net;user=phone~~
~~Supported: 100rel~~
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>
~~<tel:+1-212-555-1111>;privacy=off~~
~~Anonymity~~Privacy: none~~off~~
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:99:MPV~~
~~m=video 3402 RTP/AVP 99~~
~~b=AS:54.6~~
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:99:MPV~~
~~m=audio 3456 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=rtpmap:96 G726-32/8000~~
~~a=qos:mandatory sendrecv~~
~~m=audio 3458 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=rtpmap:96 G726-32/8000~~
~~a=qos:mandatory sendrecv~~
```

2. **100 Trying (S-S#1a to MO) – see example in table 7.4.9.2-2**

   S-CSCF#1 responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.4.9.2-2: 100 Trying (S-S#1a to MO)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

   S-CSCF#1 validates the service profile of this subscriber and evaluates the initial filter criterias. For this example, assume no Application Server involvement.

~~**Service Control**~~

~~S-CSCF#1 performs whatever service control logic is appropriate for this session attempt.~~

~~S-CSCF#1 examines the media parameters, and removes any choices that the subscriber does not have authority to request.~~

~~For this example, assume the subscriber is not allowed video.~~

4. **INVITE (S-CSCF to I-CSCF) – see example in table 7.4.9.2-4**

   S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the destination subscriber belongs. Since the originating operator does not desire to keep their internal configuration hidden, S-CSCF#1 forwards the INVITE request directly to I-CSCF in the destination network

   S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

.

Table 7.4.9.2-4: INVITE (S-CSCF to I-CSCF)

```
INVITE sip:user2_public1@home2.net~~:+1-212-555-2222@home2.net;user=phone~~ SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:iscsf1_s.home1.net;lr
Record-Route: sip:~~332b23.1@~~scscf1.home1.net;lr, sip:~~240f34.1@~~pcscf1.visited1.net;lr
~~Supported:~~
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>, <tel:+1-212-555-
   1111>;~~privacy=off;screen=yes~~
~~Anonymity~~Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
~~m=video 0 RTP/AVP 99~~
~~m=video 0 RTP/AVP 99~~
~~m=audio 3456 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=rtpmap:96 G726-32/8000~~
~~m=audio 3458 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=rtpmap:96 G726-32/8000~~
```

5. **100 Trying (I-CSCF to S-CSCF) – see example in table 7.4.9.2-5**

I-CSCF responds to the INVITE request (4) by sending a 100 Trying provisional response to S-CSCF#1.

Table 7.4.9.2-5: 100 Trying (I-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **Cx: User Location Query procedure**

   The I-CSCF sends a query to the HSS to find out the S-CSCF of the called user. The HSS responds with the information that the subscriber is not currently registered and it does not have any service when the user is unregistered.

   For detailed message flows see 3GPP TS 29.228.

   Table 7.3.2.1-6a provides the parameters in the SIP INVITE request (flow 4), which are sent to the HSS.

7. **404 User Not Reachable (I-CSCF to S-CSCF) – see example in table 7.4.9.2-7**

   I-CSCF initiates a 404 User Not Reachable response to S-CSCF#1.

Editor's Note: It is FFS to decide whether 404 User Not Reachable is the best response code to send.

Table 7.4.9.2-7: 404 User Not Reachable (I-CSCF to S-CSCF)

```
SIP/2.0 404 User Not Reachable
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **ACK (S-CSCF to I-CSCF) – see example in table 7.4.9.2-8**

   S-CSCF#1 responds to the I-CSCF with ACK.

Table 7.4.9.2-8: ACK (S-CSCF to I-CSCF)

```
ACK sip: user2_public1@home2.net:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1
From:
To:
Call-ID:
Cseq:
Content-Length:
```

9. **404 User Not Reachable (S-S#1a to MO) – see example in table 7.4.9.2-9**

   S-CSCF#1 forwards the 404 User Not Reachable to the originator, as per the originating procedure.

Table 7.4.9.2-9: 404 User Not Reachable (S-S#1a to MO)

```
SIP/2.0 404 User Not Reachable
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

10. **ACK (MO to S-S#1a) – see example in table 7.4.9.2-10**

The originating endpoint sends the final acknowledgement to S-CSCF#1 by the origination procedures.

Table 7.4.9.2-10: ACK (MO to S-S#1a)

```
ACK tel:+1-212-555-2222sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1
From:
To:
Call-ID:
Cseq: 127 ACK
Content-Length: 0
```

7.4.9.3 Mobile termination, unregistered subscriber, services related to unregistered state

In the example information flow the subscriber is unregistered and the subscriber has services related to unregistered state. This is shown in the following information flow (figure 7.4.9.3-1).

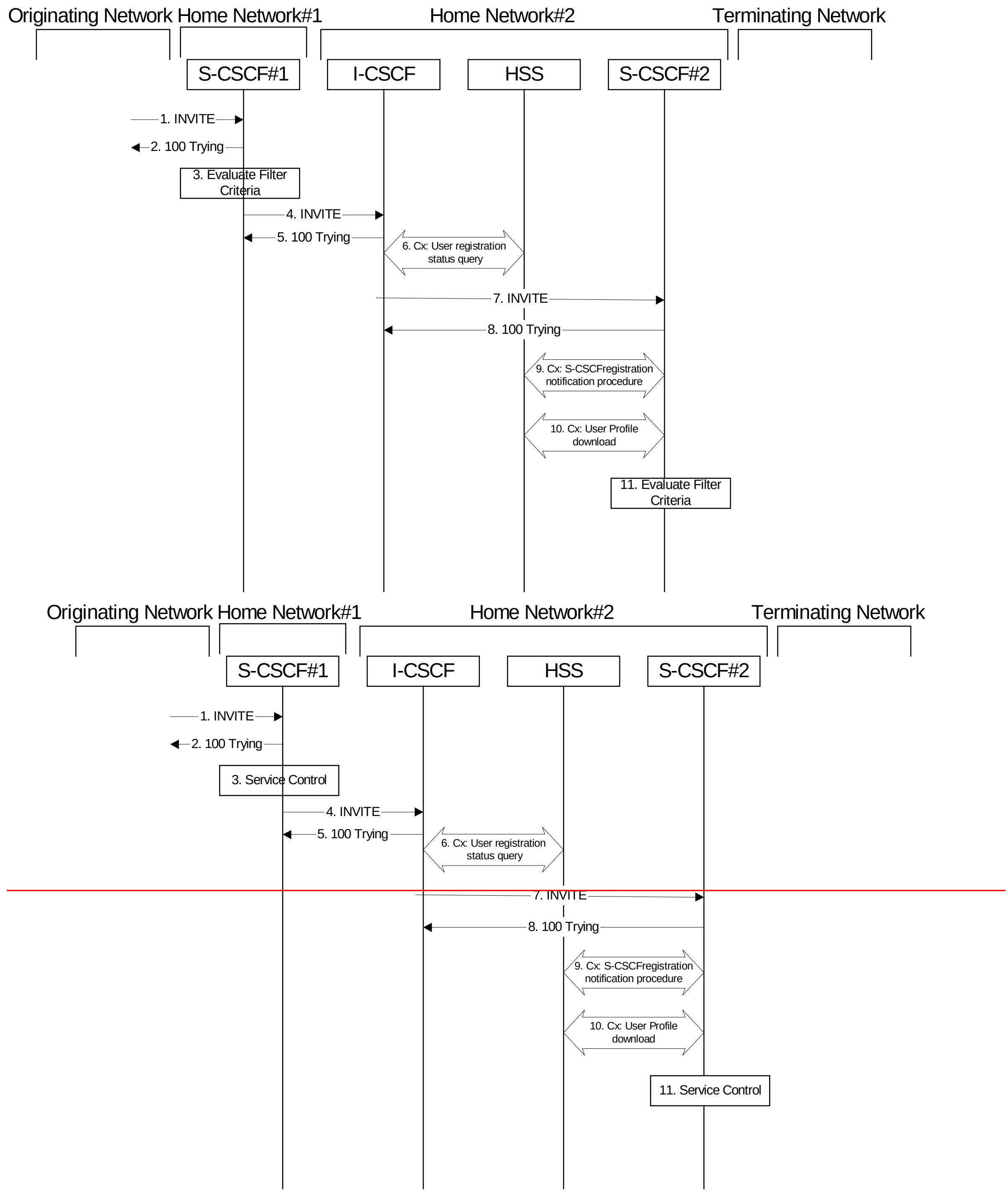


Figure 7.4.9.3-1: Mobile termination, unregistered subscriber with services

1. **INVITE (MO to S-S#1a) – see example in table 7.4.9.3-1**

   The INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating signalling flow.

Table 7.4.9.3-1: INVITE (MO to S-S#1a)

INVITE tel:+1-212-555-2222 ~~sip:scscf1.home1.net~~ SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net; lr
Record-Route: sip:~~240f34.1@~~pcscf1.visited1.net;lr
~~Route: sip:+1-212-555-2222@home2.net;user=phone~~
~~Supported: 100rel~~
~~Remote-Party-ID~~P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>~~<tel:+1-212-555-1111>;privacy=off~~
Privacy~~Anonymity~~: none~~Off~~
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
~~m=video 3400 RTP/AVP 99~~
~~b=AS:54.6~~
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:99:MPV~~
~~m=video 3402 RTP/AVP 99~~
~~b=AS:54.6~~
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:99:MPV~~
~~m=audio 3456 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=rtpmap:96 G726-32/8000~~
~~a=qos:mandatory sendrecv~~
~~m=audio 3458 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~

```
~~a=rtpmap:96 G726-32/8000~~
~~a=qos:mandatory sendrecv~~
```

2. **100 Trying (S-S#1a to MO) – see example in table 7.4.9.3-2**

S-CSCF#1 responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.4.9.3-2: 100 Trying (S-S#1a to MO)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

S-CSCF#1 validates the service profile of this subscriber and evaluates the initial filter criterias. For this example, assume no Application Server involvement.~~**Service Control**~~

~~S-CSCF#1 performs whatever service control logic is appropriate for this session attempt.~~

~~S-CSCF#1 examines the media parameters, and removes any choices that the subscriber does not have authority to request~~.

4. **INVITE (S-CSCF to I-CSCF) – see example in table 7.4.9.3-4**

S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the destination subscriber belongs. Since the originating operator does not desire to keep their internal configuration hidden, S-CSCF#1 forwards the INVITE request directly to to I-CSCF in the destination network.

S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

Table 7.4.9.3-4: INVITE (S-CSCF to I-CSCF)

```
INVITE sip:user2_public1@home2.net~~sip:+1-212-555-2222@home2.net;user=phone~~ SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:iscscf1_s.home1.net;lr
Record-Route: sip:~~332b23.1@~~scscf1.home1.net;lr, sip:~~240f34.1@~~pcscf1.visited1.net;lr
P-Asserted-Identity:
~~Supported: Remote-Party-ID~~P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net,
   <tel:+1-212-555-1111>~~;privacy=off;screen=yes~~
~~Anonymity~~Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
~~m=video 0 RTP/AVP 99~~
~~m=video 0 RTP/AVP 99~~
~~m=audio 3456 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=rtpmap:96 G726-32/8000~~
~~m=audio 3458 RTP/AVP 97 96 0 15~~
~~b=AS:25.4~~
~~a=qos:mandatory sendrecv~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=rtpmap:96 G726-32/8000~~
```

5. **100 Trying (I-CSCF to S-CSCF) – see example in table 7.4.9.3-5**

I-CSCF responds to the INVITE request (4) by sending a 100 Trying provisional response to S-CSCF#1.

Table 7.4.9.3-5: 100 Trying (I-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **Cx: User Registration Status Query procedure**

   The I-CSCF sends a query to the HSS to find out the S-CSCF of the called user. The HSS responds with the information that the user is not currently registered, but the user has services when the user is not registered.

   For detailed message flows see 3GPP TS 29.228.

   Table 7.3.2.1-6a provides the parameters in the SIP INVITE request (flow 4), which are sent to the HSS.

   Based on the CX response the I-CSCF selects an appropriate S-CSCF.

7. **INVITE (I-CSCF to S-CSCF) – see example in table 7.4.9.3-7**

Table 7.4.9.3-7: INVITE (I-CSCF to S-CSCF)

```
INVITE ~~sip:scscf2.home2.net ~~sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
Max-Forwards: 67
Route: sip:scscf2.home2.net;lr
~~sip:+1-212-555-2222@home2.net;user=phone~~
Record-Route: sip:~~332b23.1@~~scscf1.home1.net;lr, sip:~~240f34.1@~~pcscf1.visited1.net;lr
~~Supported: Remote-Party-ID~~P-Asserted-Identity:
P-Asserted-Identity:
~~Anonymity~~Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
a=
~~v=~~
~~o=~~
~~s=~~
~~c=~~
~~t=~~
~~m=~~
~~m=~~
~~m=~~
~~b=~~
~~a=~~
~~a=~~
~~a=~~
~~a=~~
~~m=~~
~~b=~~
~~a=~~
~~a=~~
```

```
~~a=~~
~~a=~~
```

8. **100 Trying (I-CSCF to S-CSCF) – see example in table 7.4.9.3-8**

   I-CSCF responds to the INVITE request (4) by sending a 100 Trying provisional response to S-CSCF#1.

Table 7.4.9.3-8: 100 Trying (S-CSCF to I-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

9. **Cx: S-CSCF registration notification procedure**

   The S-CSCF sends a query to the HSS to record the S-CSCF of the called user.

   For detailed message flows see 3GPP TS 29.228.

   Table 6.2-7a provides the parameters in the INVITE request (flow 7) which are sent to the HSS

Editor's Note: It needs to be checked whether all the input information in table 6.2-8 is available in the INVITE. For instance, the private user identity may not be available in the INVITE.

10. **Cx: User Profile Download procedure**

    The S-CSCF sends a query to the HSS to determine the subscriber profile of the callee. The HSS responds with the profile.

    For detailed message flows see 3GPP TS 29.228.

    Table 6.2-9a provides the parameters in the SIP INVITE request (flow 7), which are sent to the HSS.

11. **Evaluation of initial filter criterias**

    S-CSCF#2 validates the service profile of this subscriber and evaluates the initial filter criterias.

~~**Service Control**~~

~~S-CSCF#2 performs whatever service control logic is appropriate for this session attempt.~~

12. **Successful session setup continues (not shown in the flow)**

    The rest of the terminating session is setup as described in subclause 7.4.2 with the INVITE being transmitted from the S-CSCF#2 to the appropriate network entity (e.g. the INVITE may be forwarded to an application server).

7.5 Sample multimedia signalling flows: addition of further media streams

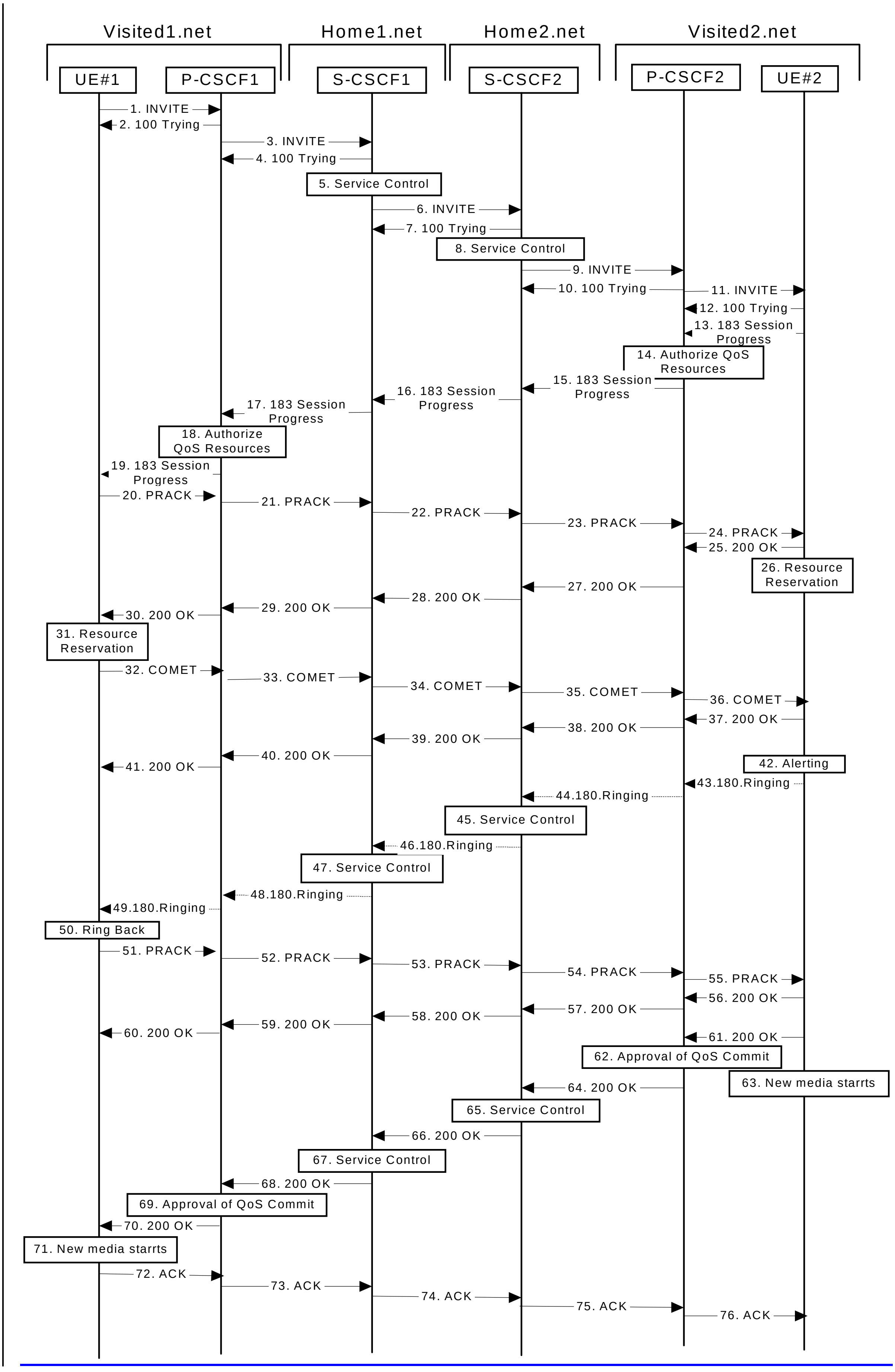
7.5.1 Introduction

None.

7.5.2 Sample multimedia signalling flow - addition of further media - originator and terminator are both roaming and operated by different networks

Figure 7.5.2-1 shows a multimedia signalling flow for the addition of another media where the originator and terminator are both roaming and operated by different networks. Both networks are without I-CSCF providing configuration independence. The UE has already established an IM session carrying voice and is generating an INVITE request to add video media to the already established IM session.

Editor's Note: This figure still needs up dating;


Visited1.net
Home1.net
Home2.net
Visited2.net
UE#1
P-CSCF1
S-CSCF1
S-CSCF2
P-CSCF2
UE#2
1. INVITE
2. 100 Trying
3. INVITE
4. 100 Trying
5. Service Control
6. INVITE
7. 100 Trying
8. Service Control
9. INVITE
10. 100 Trying
11. INVITE
12. 100 Trying
13. 183 Session Progress
14. Authorize QoS Resources
15. 183 Session Progress
16. 183 Session Progress
17. 183 Session Progress
18. Authorize QoS Resources
19. 183 Session Progress
20. PRACK
21. PRACK
22. PRACK
23. PRACK
24. PRACK
25. 200 OK
26. Resource Reservation
27. 200 OK
28. 200 OK
29. 200 OK
30. 200 OK
31. Resource Reservation
32. COMET
33. COMET
34. COMET
35. COMET
36. COMET
37. 200 OK
38. 200 OK
39. 200 OK
40. 200 OK
41. 200 OK
42. Alerting
43.180.Ringing
44.180.Ringing
45. Service Control
46.180.Ringing
47. Service Control
48.180.Ringing
49.180.Ringing
50. Ring Back
51. PRACK
52. PRACK
53. PRACK
54. PRACK
55. PRACK
56. 200 OK
57. 200 OK
58. 200 OK
59. 200 OK
60. 200 OK
61. 200 OK
62. Approval of QoS Commit
63. New media starrts
64. 200 OK
65. Service Control
66. 200 OK
67. Service Control
68. 200 OK
69. Approval of QoS Commit
70. 200 OK
71. New media starrts
72. ACK
73. ACK
74. ACK
75. ACK
76. ACK

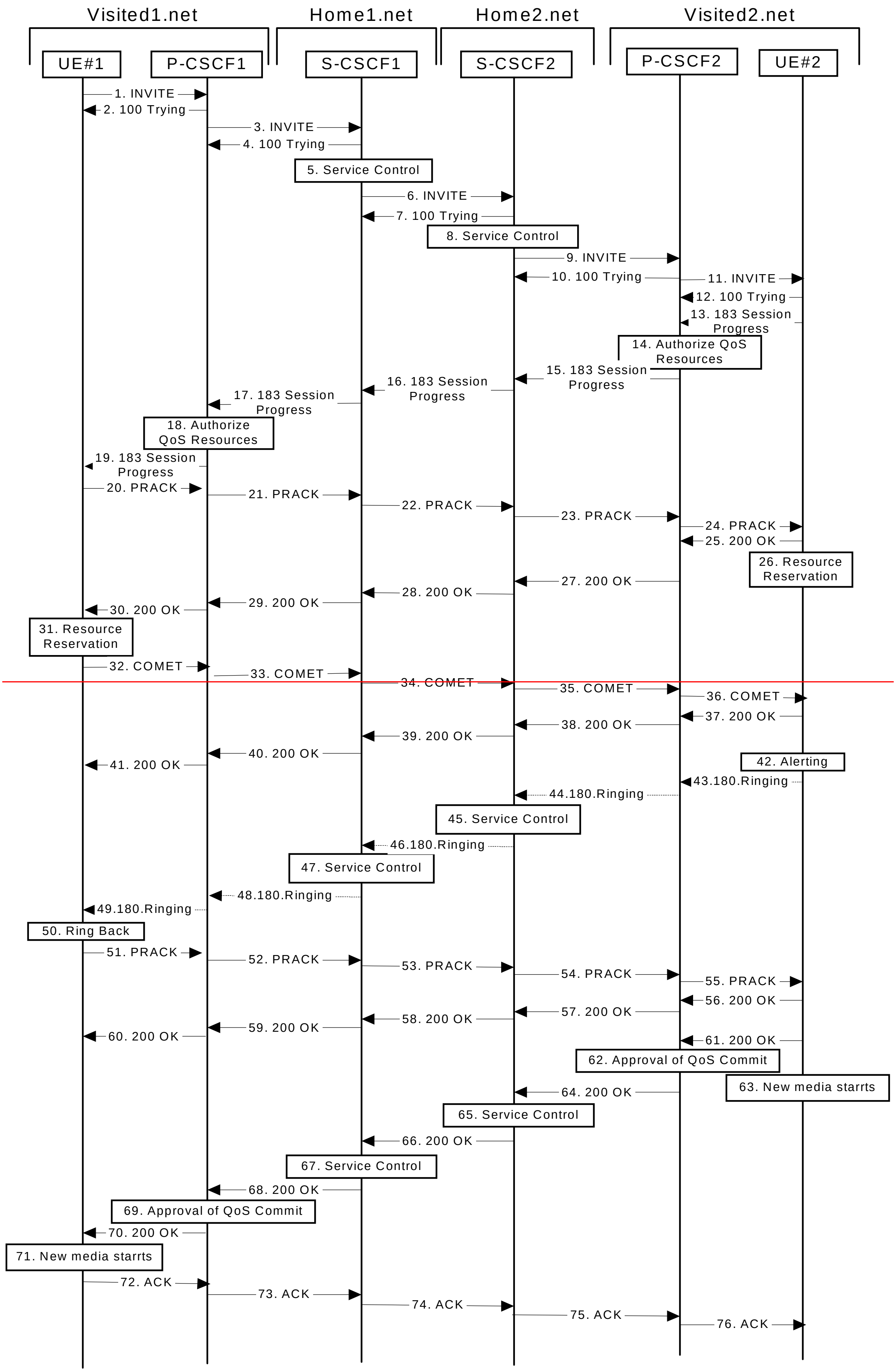


Figure 7.5.2-1: Sample multimedia signalling flow - addition of further media

1. **INVITE (UE1 to P-CSCF1) – see example in table 7.5.2-1**

UE#1 sends a SIP INVITE request, containing new SDP for the new video media and including the original SDP, to P-CSCF1, which is pcscf1.visited1.net in its visited network.

Table 7.5.2-1 INVITE (UE1 to P-CSCF1)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
Supported: 100rel
Remote-Party-IDP-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>;privacy=off
AnonymityPrivacy: noneOff
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 132 INVITE
Require:
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907166275 0
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=qos:mandatory sendrecv
m=video 9544 RTP/AVP 31
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:31:H261/90000
a=rtpmap:31 H261/90000
a=qos:mandatory sendrecv
```

Request-URI: Contains the keyed number from the user.

Via: Contains the IP address or FQDN of the originating UE.

~~Remote-Party-ID~~P-Asserted-Identity: the user provides a hint about the identity to be used for this session.

~~Contains the public user identity. The Display name is optional.~~

From:/To:/Call-ID: Follow the recommendations of draft-ietf-sip-privacy-01, even though anonymity is not being requested for this session.

Cseq: Is a random starting number.

Contact: Is the SIP URL that contains the IP address or FQDN of the originating UE.

2. **100 Trying (P-CSCF1 to UE1) - see example in table 7.5.2-2**

P-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.5.2-2: 100 Trying (P-CSCF1 to UE1)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **INVITE (P-CSCF1 to S-CSCF1) - see example in table 7.5.2-3**

The INVITE request is sent by the P-CSCF to the next hop scscf1.home1.net, which is in UE's home network. Because this a re-invite, so the I-CSCF1 is not involved in sip transaction.

Table 7.5.2-3: INVITE (P-CSCF1 to S-CSCF1)

```
INVITE sip:[5555::eee:fff:aaa:bbb]sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:764z87.1@scscf2.home2.net;lr,
   sip:361k21.1@pcscf2.visited2.net;lr, sip:[5555::eee:fff:aaa:bbb]
Supported:
Remote-Party-IDP-Asserted-Identity:
AnonymityPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

Route: P-CSCF knows the request routing from the previous sip transactions.

Request-URI: The first component in the remembered Path header from Registration.

4. **100 Trying (S-CSCF1 to P-CSCF1) - see example in table 7.5.2-4**

S-CSCF sends the 100 Trying provisional response to P-CSCF.

Table 7.5.2-4: 100 Trying (S-CSCF1 to P-CSCF1)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

5. **Evaluation of initial filter criterias**

   S-CSCF#1 validates the service profile of this subscriber and evaluates the initial filter criterias.

~~**Service Control**~~

   ~~S-CSCF validates the service profile, and performs any origination service control required for this subscriber.~~

   ~~S-CSCF#1 examines the media parameters, and removes any choices that the subscriber does not have authority to request.~~

6. **INVITE (S-CSCF1 to S-CSCF2) - see example in table 7.5.2-6**

   S-CSCF#1 sends the INVITE request to UE's serving CSCF-cscf2.home2.net, which is in the callee (UE2)'s home network. Because this is a re-invite, so the I-CSCF2 is not involved in the sip transaction.

   S-CSCF#1 examines the media parameters, and removes any choices that the subscriber does not have authority to request.

Table 7.5.2-6: INVITE (S-CSCF1 to S-CSCF2)

```
INVITE sip:[5555::eee:fff:aaa:bbb]sip:scscf2.home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:361k21.1@pcscf2.visited2.net;lr,
   sip:[5555::eee:fff:aaa:bbb]
Supported:
Remote-Party-IDP-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>;privacy=off;screen=yes
AnonymityPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

7. **100 Trying (S-CSCF2 to S-CSCF1) - see example in table 7.5.2-7**

   S-CSCF1 receives a 100 Trying provisional response, as specified by the S-CSCF to S-CSCF procedures.

Table 7.5.2-7: 100 Trying (S-CSCF2 to S-CSCF1)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **Evaluation of initial filter criterias**

   S-CSCF2 validates the service profile of this subscriber and evaluates the initial filter criterias.

~~**Service Control**~~

~~S-CSCF2 validates the service profile, and performs any origination service control required for this subscriber.~~

~~S-CSCF#2 examines the media parameters, and removes any choices that the subscriber does not have authority to request.~~

9. **INVITE (S-CSCF2 to P-CSCF2) - see example in table 7.5.2-9**

S-CSCF2 forwards the INVITE request tocallee's P-CSCF pcscf2.visited2.net which is in the UE2's visited network, called visited2.net

S-CSCF#2 examines the media parameters, and removes any choices that the subscriber does not have authority to request.

Editor's Note: Need for additional headers to transport e.g. Billing-Correlation-Identifier is FFS.

Table 7.5.2-9: INVITE (S-CSCF2 to P-CSCF2)

```
INVITE sip:pcscf2.visited2.net, sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
Supported:
Remote-Party-IDP-Asserted-Identity:
AnonymityPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

10. **100 Trying (P-CSCF2 to S-CSCF2) - see example in table 7.5.2-10**

P-CSCF sends a 100 Trying provisional response back to S-CSCF2.

Table 7.5.2-10: 100 Trying (P-CSCF2 to S-CSCF2)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

11. **INVITE (P-CSCF2 to UE2) - see example in table 7.5.2-11**

P-CSCF examines the media parameters, and removes any that the network operator decides, based on local policy, not to allow on the network.

P-CSCF removes the Record-Route and Via headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE.

~~P-CSCF determines the UE address from the value of the Request-URI, and forwards the INVITE request to the UE.~~

Table 7.5.2-11: INVITE (P-CSCF2 to UE2)

```
INVITE sip:[5555::eee:fff:aaa:bbb] sip:+1-212-555-2222@home2.net;user=phone SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
Media-Authorization: 0020000100100101706366322e78797a2e6e6574000c020133315331343363233
Supported:
Remote-Party-IDP-Asserted-Identity:
AnonymityPrivacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

Media-Authorization: A P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf2.xyz.net" with credentials "31S14623".

12. **100 Trying (UE2 to P-CSCF2) - see example in table 7.5.2-12**

P-CSCF receives a 100 Trying provisional response back to S-CSCF2.

Table 7.5.2-12: 100 Trying (UE2 to P-CSCF2)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bKert23.8
From:
To:
Call-ID:
CSeq:
```

13. **183 Session Progress (UE2 to P-CSCF2) - see example in table 7.5.2-13**

The media stream capabilities of the destination are returned along the signalling path, in a 183 Session Progress provisional response.

Table 7.5.2-13: 183 Session Progress response (UE2 to P-CSCF2)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Remote-Party-ID: "John Smith" <tel:+1-212-555-2222>;privacy=off
AnonymityPrivacy: Offnone
Require: 100rel
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Disposition: precondition
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907166275 0
m=audio 6544 RTP/AVP 97
b=AS:25.4 3
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=qos:mandatory sendrecv confirm
m=video 7544 RTP/AVP 31
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:31 H261/90000
a=qos:mandatory sendrecv confirm
```

14. **Authorize QoS Resources**

P-CSCF2 authorizes the resources necessary for this new media.

15. **183 Session Progress (P-CSCF2 to S-CSCF2) - see example in table 7.5.2-15**

P-CSCF2 forwards the 183 Session Progress response to S-CSCF2.

Table 7.5.2-15: 183 Session Progress (P-CSCF2 to S-CSCF2)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>
AnonymityPrivacy:
Require:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Disposition:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

16. **183 Session Progress (S-CSCF2 to S-CSCF1) - see example in table 7.5.2-16**

S-CSCF2 forwards the 183 Session Progress response to caller's S-CSCF.

Table 7.5.2-16: 183 Session Progress (S-CSCF2 to S-CSCF1)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Remote-Party-IDP-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>;privacy=off;screen=yes
AnonymityPrivacy:
Require:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Disposition:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

17. **183 Session Progress (S-CSCF1 to P-CSCF1) - see example in table 7.5.2-17**

S-CSCF1 forwards the 183 Session Progress response to the caller's P-CSCF.

Table 7.5.2-17: 183 Session Progress (S-CSCF1 to P-CSCF1)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Remote-Party-IDP-Asserted-Identity:
AnonymityPrivacy:
Require:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Disposition:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

18. **Authorize QoS Resources**

P-CSCF1 authorizes the resources necessary for this new media.

19. **183 Session Progress (P-CSCF1 to UE1) - see example in table 7.5.2-19**

P-CSCF forwards the 183 Session Progress response to the originating endpoint.

Table 7.5.2-19: 183 Session Progress (P-CSCF1 to UE1)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Media-Authorization: 0020000100100101706366312e78797a2e6e6574000c02013942563330373400
Remote-Party-IDP-Asserted-Identity:
AnonymityPrivacy:
Require:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Disposition:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

Media-Authorization: A P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf1.xyz.net" with credentials "9BV3074".

20. **PRACK (UE1 to P-CSCF1) - see example in table 7.5.2-20**

The originating endpoint sends a PRACK request containing the final SDP to be used in this session to it's P-CSCF.

Table 7.5.2-20: PRACK (UE1 to P-CSCF1)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 133 PRACK
Rack: 9022 132 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=qos:mandatory sendrecv
m=video 9544 RTP/AVP 31
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:31 H261/90000
a=qos:mandatory sendrecv
```

21. **PRACK (P-CSCF1 to S-CSCF1) - see example in table 7.5.2-21**

P-CSCF adds a Route header, with the saved value from the previous response. P-CSCF identifies the proper saved value by the Request-URI.

P-CSCF1 forwards the PRACK request to S-CSCF1.

Table 7.5.2-21: PRACK (P-CSCF1 to S-CSCF1)

```
PRACK sip:[5555::eee:fff:aaa:bbb]~~sip:scscf1.home1.net ~~SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:~~764z87.1@~~scscf2.home2.net;lr,
   sip:~~361k21.1@~~pcscf2.visited2.net;lr~~,~~ ~~sip:[5555::eee:fff:aaa:bbb]~~
From:
To:
Call-ID:
Cseq:
Rack:
Content-Type:
Content-Length: (…)

v=~~0~~
o=~~-~~
s=~~-~~
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

22. **PRACK (S-CSCF1 to S-CSCF2) - see example in table 7.5.2-22**

S-CSCF1 forwards the PRACK request to S-CSCF2.

Table 7.5.2-22: PRACK (S-CSCF1 to S-CSCF2)

```
PRACK sip:[5555::eee:fff:aaa:bbb]~~sip:scscf2.home2.net ~~SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:~~361k21.1@~~pcscf2.visited2.net;lr~~,~~
   ~~sip:[5555::eee:fff:aaa:bbb]~~
From:
To:
Call-ID:
Cseq:
Rack:
Content-Type:
Content-Length: (…)

v=~~0~~
o=~~-~~
s=~~-~~
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

23. **PRACK (S-CSCF2 to P-CSCF2) - see example in table 7.5.2-23**

S-CSCF2 forwards the PRACK request to P-CSCF2.

Table 7.5.2-23: PRACK (S-CSCF2 to P-CSCF2)

```
PRACK sip:pcscf2.visited2.net, sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

24. **PRACK (P-CSCF2 to UE2) - see example in table 7.5.2-24**

P-CSCF2 forwards the PRACK request to callee UE2.

Table 7.5.2-24: PRACK (P-CSCF2 to UE2)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1;
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

25. **200 OK (UE2 to P-CSCF2) - see example in table 7.5.2-25**

UE acknowledges the PRACK request with a 200 OK response.

Table 7.5.2-25: 200 OK (UE2 to P-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq: 133
Rrack
Content-Length: 0

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

26. **Resource Reservation**

UE2 initiates the reservation procedures for the new media.

27. **200 OK (P-CSCF2 to S-CSCF2) - see example in table 7.5.2-27**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.5.2-27: 200 OK (P-CSCF2 to S-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

28. **200 OK (S-CSCF2 to S-CSCF1) - see example in table 7.5.2-28**

S-CSCF2 forwards the 200 OK response to the originator's S-CSCF, scscf1.home1.net.

Table 7.5.2-28: 200 OK (S-CSCF2 to S-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

29. **200 OK (S-CSCF1 to P-CSCF1) - see example in table 7.5.2-29**

S-CSCF1 forwards the 200 OK response to the originator's P-CSCF1.

Table 7.5.2-29: 200 OK (S-CSCF1 to P-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

30. **200 OK (P-CSCF1 to UE1) - see example in table 7.5.2-30**

S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.5.2-30: 200 OK (P-CSCF1 to UE1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

31. **Resource Reservation**

UE1 initiates the reservation procedures for the new media.

32. **~~COMET~~ UPDATE (UE1 to P-CSCF1) - see example in table 7.5.2-32**

When the resource reservation is completed, UE sends the ~~COMET~~ UPDATE request to the terminating endpoint, via the signalling path established by the INVITE request. The request is sent first to P-CSCF.

Table 7.5.2-32: ~~COMET~~ UPDATE (UE1 to P-CSCF1)

```
COMET UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 134 COMETUPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=qos:success sendonly
m=video 9544 RTP/AVP 31
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:31 H261/90000
a=qos:success sendonly
```

33. **~~COMET~~UPDATE (P-CSCF1 to S-CSCF1) - see example in table 7.5.2-33**

P-CSCF1 forwards the ~~COMET~~UPDATE request to S-CSCF1.

Table 7.5.2-33: ~~COMET~~UPDATE (P-CSCF1 to S-CSCF1)

```
COMETUPDATE sip:[5555::eee:fff:aaa:bbb]sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:764z87.1@scscf2.home2.net;lr,
   sip:361k21.1@pcscf2.visited2.net;lr, sip:[5555::eee:fff:aaa:bbb]
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length: (…)

v=0
o=-
s=-
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

34. ~~COMET~~**UPDATE** **(S-CSCF1 to S-CSCF2) - see example in table 7.5.2-34**

S-CSCF1 forwards the ~~COMET~~UPDATE request to S-CSCF2.

Table 7.5.2-34: ~~COMET~~UPDATE (S-CSCF1 to S-CSCF2)

```
COMETUPDATE sip:[5555::eee:fff:aaa:bbb]sip:scscf2.home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:361k21.1@pcscf2.visited2.net;lr,
   sip:[5555::eee:fff:aaa:bbb]
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length: (…)

v=0
o=-
s=-
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

35. ~~COMET~~**UPDATE** **(S-CSCF2 to P-CSCF2) - see example in table 7.5.2-35**

S-CSCF2 forwards the ~~COMET~~UPDATE request to P-CSCF2.

Table 7.5.2-35: ~~COMET~~UPDATE (S-CSCF2 to P-CSCF2)

```
COMETUPDATE sip:pcscf2.visited2.net, sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

36. **~~COMET~~UPDATE (P-CSCF2 to UE2) - see example in table 7.5.2-36**

P-CSCF forwards the ~~COMET~~UPDATE request to UE2.

Table 7.5.2-36: ~~COMET~~UPDATE (P-CSCF2 to UE2)

```
COMETUPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

37. **200 OK (UE2 to P-CSCF2) - see example in table 7.5.2-37**

UE acknowledges the ~~COMET~~UPDATE request with a 200 OK response.

Table 7.5.2-37: 200 OK (UE2 to P-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

38. **200 OK (P-CSCF2 to S-CSCF2) - see example in table 7.5.2-38**

P-CSCF2 forwards the 200 OK response to S-CSCF2.

Table 7.5.2-38: 200 OK (P-CSCF2 to S-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

39. **200 OK (S-CSCF2 to S-CSCF1) - see example in table 7.5.2-39**

S-CSCF2 forwards the 200 OK response to the originator's serving CSCF.

Table 7.5.2-39: 200 OK (S-CSCF2 to S-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

40. **200 OK (S-CSCF1 to P-CSCF1) - see example in table 7.5.2-40**

S-CSCF1 forwards the 200 OK response to the P-CSCF1.

Table 7.5.2-40: 200 OK (S-CSCF1 to P-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

41. **200 OK (P-CSCF1 to UE1) - see example in table 7.5.2-41**

P-CSCF1 forwards the 200 OK response to UE1.

Table 7.5.2-41: 200 OK (P-CSCF1 to UE1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
a=
a=
m=
b=
a=
a=
a=
a=
a=
```

42. **Alerting**

UE#2 may optionally delay the session establishment in order to alert the subscriber to the incoming additional media.

43. **180 Ringing (UE2 to P-CSCF2) – see example in table 7.5.2-43**

Before proceeding with session establishment, the UE waits for two events. First, the resource reservation initiated in step #26 must complete successfully. Second, the resource reservation initiated by the originating endpoint must complete successfully (which is indicated by message #31 received by UE). The UE may now immediately accept the session or alert the destination subscriber of an incoming session attempt; if the latter it indicates this to the calling party by a 180 Ringing provisional response sent to P-CSCF.

Table 7.5.2-43: 180 Ringing (UE2 to P-CSCF2)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Require: 100rel
From:
To:
Call-ID:
CSeq:
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9023
Content-Length: 0
```

44. **180 Ringing (P-CSCF2 to S-CSCF2) - see example in table 7.5.2-44**

P-CSCF2 forwards the 180 Ringing response to S-CSCF2.

Table 7.5.2-44: 180 Ringing (P-CSCF2 to S-CSCF2)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Require:
From:
To:
Call-ID:
CSeq:
Contact:
RSeq:
Content-Length:
```

~~45. **Service Control**~~

~~S-CSCF2 performs whatever service control is appropriate for this ringing.~~

45~~6~~. **180 Ringing (S-CSCF2 to S-CSCF1) - see example in table 7.5.2-45~~6~~**

S-CSCF forwards the 180 Ringing response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.5.2-45~~6~~: 180 Ringing (S-CSCF2 to S-CSCF1)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Require:
From:
To:
Call-ID:
CSeq:
Contact:
RSeq:
Content-Length:
```

~~47. **Service Control**~~

~~S-CSCF1 performs whatever service control is appropriate for this ringing.~~

46~~8~~. **180 Ringing (S-CSCF1 to P-CSCF1) - see example in table 7.5.2-46~~8~~**

S-CSCF1 forwards the 180 Ringing response to the P-CSCF1.

Table 7.5.2-46~~8~~: 180 Ringing (S-CSCF1 to P-CSCF1)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Require:
From:
To:
Call-ID:
CSeq:
Contact:
RSeq:
Content-Length:
```

47~~9~~. **180 Ringing (P-CSCF1 to UE1) - see example in table 7.5.2-47~~9~~**

P-CSCF forwards the 180 Ringing response to the UE1.

Table 7.5.2-~~49~~47: 180 Ringing (P-CSCF1 to UE1)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Require:
From:
To:
Call-ID:
CSeq:
Contact:
RSeq:
Content-Length:
```

~~50~~48. **Ringback**

UE1 indicates to the originator that the media addition is being delayed due to alerting. Typically this involves playing a ringback sequence.

~~51~~49. **PRACK (UE1 to P-CSCF1) - see example in table 7.5.2-~~51~~49**

The originating endpoint sends a PRACK request for the Ringing response to the terminator.

Table 7.5.2-~~51~~49: PRACK (UE1 to P-CSCF1)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 135 PRACK
Rack: 9023 132 INVITE
Content-Length: 0
```

~~52~~50. **PRACK (P-CSCF1 to S-CSCF1) - see example in table 7.5.2-~~52~~50**

P-CSCF adds a Route header, with the saved value from the previous response. P-CSCF identifies the proper saved value by the Request-URI.

P-CSCF1 forwards the PRACK request to S-CSCF1.

Table 7.5.2-~~52~~50: PRACK (P-CSCF1 to S-CSCF1)

```
PRACK sip:[5555::eee:fff:aaa:bbb]~~sip:scscf1.home1.net ~~SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:~~764z87.1@~~scscf2.home2.net;lr,
   sip:~~361k21.1@~~pcscf2.visited2.net;lr~~, sip:[5555::eee:fff:aaa:bbb]~~
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

51~~3~~. **PRACK (S-CSCF1 to S-CSCF2) - see example in table 7.5.2-51~~3~~**

S-CSCF1 forwards the PRACK request to S-CSCF2.

Table 7.5.2-51~~3~~: PRACK (S-CSCF1 to S-CSCF2)

```
PRACK sip:[5555::eee:fff:aaa:bbb]~~sip:scscf2.home2.net ~~SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:~~361k21.1@~~pcscf2.visited2.net;lr~~,~~
   ~~sip:[5555::eee:fff:aaa:bbb]~~
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length: 0
```

52~~4~~. **PRACK (S-CSCF2 to P-CSCF2) - see example in table 7.5.2-52~~4~~**

S-CSCF2 forwards the PRACK request to P-CSCF2.

Table 7.5.2-52~~4~~: PRACK (S-CSCF2 to P-CSCF2)

```
PRACK ~~sip:pcscf2.visited2.net, ~~sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

53~~5~~. **PRACK (P-CSCF2 to UE2) - see example in table 7.5.2-53~~5~~**

P-CSCF2 forwards the PRACK request to callee UE2.

Table 7.5.2-53~~5~~: PRACK (P-CSCF2 to UE2)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

54~~6~~. **200 OK (UE2 to P-CSCF2) - see example in table 7.5.2-54~~6~~**

UE2 acknowledges the PRACK request with a 200 OK response.

Table 7.5.2-54~~6~~: 200 OK (UE2 to P-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

55~~7~~. **200 OK (P-CSCF2 to S-CSCF2) - see example in table 7.5.2-55~~7~~**

P-CSCF2 forwards the 200 OK response to S-CSCF2.

Table 7.5.2-55~~7~~: 200 OK (P-CSCF2 to S-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

56~~8~~. **200 OK (S-CSCF2 to S-CSCF1) - see example in table 7.5.2-56~~8~~**

S-CSCF2 forwards the 200 OK response to the originator's serving CSCF.

Table 7.5.2-56~~8~~: 200 OK (S-CSCF2 to S-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

57~~9~~. **200 OK (S-CSCF1 to P-CSCF1) - see example in table 7.5.2-57~~9~~**

S-CSCF1 forwards the 200 OK response to the P-CSCF1.

Table 7.5.2-57~~9~~: 200 OK (S-CSCF1 to P-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

58~~60~~. **200 OK (P-CSCF1 to UE1) - see example in table 7.5.2-58~~60~~**

P-CSCF1 forwards the 200 OK response to UE1.

Table 7.5.2-58~~60~~: 200 OK (P-CSCF1 to UE1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

59~~61~~. **200 OK (UE2 to P-CSCF2) - see example in table 7.5.2-59~~61~~**

UE acknowledges the Invite request with a 200 OK response.

Table 7.5.2-59~~61~~: 200 OK (UE2 to P-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq: 132 Invite
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Type: application/sdp
Content-Length: ~~(~~0~~...)~~

~~v=0~~
~~o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd~~
~~s=-~~
~~c=IN IP6 5555::eee:fff:aaa:bbb~~
~~t=907166275 0~~
~~m=audio 6544 RTP/AVP 97~~
~~b=AS:25.4~~
~~a=rtpmap:97 AMR~~
~~a=fmtp:97 mode-set=0,2,5,7; maxframes=2~~
~~a=qos:success sendrecv~~
~~m=video 7544 RTP/AVP 31~~
~~b=AS:54.6~~
~~a=rtpmap:31 H261/90000~~
~~a=qos:success sendrecv~~
```

60~~2~~. **Approval of QoS Commit**

P-CSCF2 approves the commitment of the QoS resources for this additional media

61~~3~~. **New media can start here**

62~~4~~. **200 OK (P-CSCF2 to S-CSCF2) - see example in table 7.5.2-62~~4~~**

P-CSCF2 forwards the 200 OK response to S-CSCF2.

Table 7.5.2-62~~4~~: 200 OK (P-CSCF2 to S-CSCF2)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
m=
b=
a=
a=
```

~~65. **Service Control**~~

~~S-CSCF2 performs whatever service control is required for the session completion.~~

63~~6~~. **200 OK (S-CSCF2 to S-CSCF1) - see example in table 7.5.2-63~~6~~**

S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.5.2-63~~6~~: 200 OK (S-CSCF2 to S-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
m=
b=
a=
a=
```

~~67. **Service Control**~~

~~S-CSCF1 performs whatever service control is required for the session completion.~~

64~~8~~. **200 OK (S-CSCF1 to P-CSCF1) - see example in table 7.5.2-64~~8~~**

S-CSCF1 forwards the 200 OK response to the P-CSCF1.

Table 7.5.2-64~~8~~: 200 OK (S-CSCF1 to P-CSCF1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.home1.net;branch=z9hG4bK431h23.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
m=
b=
a=
a=
```

65~~9~~. **Approval of QoS Commit**

P-CSCF1 approves the commitment of the QoS resources for this additional media.

66~~70~~. **200 OK (P-CSCF1 to UE1) - see example in table 7.5.2-66~~70~~**

P-CSCF forwards the 200 OK response to the UE1.

Table 7.5.2-66~~70~~: 200 OK (P-CSCF1 to UE1)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
b=
a=
a=
a=
m=
b=
a=
a=
```

67~~71~~. **New media can start here**

68~~72~~. **ACK (UE1 to P-CSCF1) - see example in table 7.5.2-68~~72~~**

UE1 forwards the ACK request to P-CSCF1.

Table 7.5.2-68~~72~~: ACK (UE1 to P-CSCF1)

```
ACK sip: token9@pcscf1.visited1.net[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 132 ACK
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Length: 0(…)
```

~~73~~69. ACK (P-CSCF1 to S-CSCF1) - see example in table 7.5.2-69~~73~~

P-CSCF1 adds a Route header, with the saved value from the previous response. P-CSCF1 identifies the proper saved value by the Request-URI.

P-CSCF1 forwards the ACK request to S-CSCF1.

Table 7.5.2-69~~73~~: ACK (P-CSCF1 to S-CSCF1)

```
ACK sip:[5555::eee:fff:aaa:bbb]sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Route: sip:scscf1.home1.net;lr, sip:764z87.1@scscf2.home2.net,
   sip:361k21.1@pcscf2.visited2.net;lr, sip:[5555::eee:fff:aaa:bbb]
From:
To:
Call-ID:
Cseq:
Content-Length: (…)
```

70~~4~~. ACK (S-CSCF1 to S-CSCF2) - see example in table 7.5.2-~~74~~70

S-CSCF1 forwards the ACK request to S-CSCF2.

Table 7.5.2-70~~4~~: ACK (S-CSCF1 to S-CSCF2)

```
ACK sip:[5555::eee:fff:aaa:bbb]sip:scscf2.home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:361k21.1@pcscf2.visited2.net;lr,
   sip:[5555::eee:fff:aaa:bbb]
From:
To:
Call-ID:
Cseq:
Content-Length: (…)
```

71~~5~~. ACK (S-CSCF2 to P-CSCF2) - see example in table 7.5.2-71~~5~~

S-CSCF2 forwards the ACK request to P-CSCF2.

Table 7.5.2-71~~5~~: ACK (S-CSCF2 to P-CSCF2)

```
ACK sip:pcscf2.visited2.net, sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1 SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

72~~6~~. **ACK (P-CSCF2 to UE2) - see example in table 7.5.2-72~~6~~**

P-CSCF forwards the ACK request to UE2.

Table 7.5.2-72~~6~~: ACK (P-CSCF2 to UE2)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Length:
```

7.6 Error handling: session initiation (not provided)

An example of this flow is not shown in the present document.

3GPP TSG-CN1 Meeting #25
Helsinki, Finland, 29 July – 2 August

Tdoc N1-021778

CR-Form-v7

CHANGE REQUEST

⌘ 24.228	CR 063	⌘ rev 1	⌘ Current version:	5.1.0 ⌘

For ***HELP*** *on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Correction to the DNS procedures		
Source:	⌘	Alcatel		
Work item code:	⌘	IMS-CCR	***Date:*** ⌘	29/07/02
Category:	⌘	F	***Release:*** ⌘	Rel-5
		Use one of the following categories: ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)*

Reason for change:	⌘	The current procedures contain some errors
Summary of change:	⌘	Correction and clarification of the procedures
Consequences if not approved:	⌘	The specification will be wrong and misleading

Clauses affected:	⌘	5.2.2, 6.2 and 16.2			
		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

Modification of section 5.2.2

5.2.2 DHCP procedure for P-CSCF discovery

In DHCP procedures for P-CSCF discovery, the UE employs Dynamic Host Configuration Protocol for IPv6 (DHCPv6) [15A], the DCHPv6 option for SIP servers [15B] and if needed DNS to obtain the P-CSCF address.

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

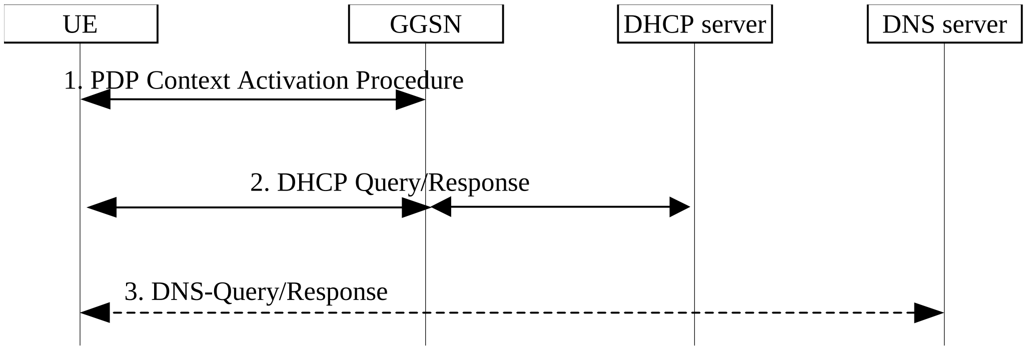


Figure 5.2.2-1: P-CSCF discovery using DHCP and DNS

1. **PDP Context Establishment Procedure (UE to GPRS)**

   Establishment of appropriate PDP context bearer by using the PDP Context Establishment procedure as specified in 3GPP TS 24.008.

2. **DHCP Query/Response (UE to DHCP)**

   The UE sends a request to a DHCP server. It may requesta list of fully qualified domain names of P-CSCF(s) and the IP addresses of the DNS servers, or it may request a list of P-CSCF(s) IP address(es) as described in clause 4 of the DHCPv6 options for SIP servers [15B]. Multiple DHCP Query/Response message exchange may be required to retrieve the requested information.

3. DNS Query/Response (UE to DNS)

   If P-CSCF address(es) are not received in the DHCP Query/Response, and the transport protocol and port number are not known to UE, the UE performs a NAPTR query (for the domain returned in DHCP response) to select the transport protocol. Subsequently, the UE performs a SRV DNS query to retrieve a list of P-CSCF(s) IP addresses from which one is selected. If the response does not contain the IP addresses an additional AAAA DNS query is needed to resolve a Fully Qualified Domain Name (FQDN) to an IP address.

Table 5.2.2-3a DNS: DNS Query (UE to DNS)

```
OPCODE=SQUERY
QNAME=pcscf.visited1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 5.2.2-3b DNS Query Response (DNS to UE)

OPCODE=SQUERY, RESPONSE, AA
QNAME=pcscf.visited1.net, QCLASS=IN, QTYPE=NAPTR

~~registrar.home1.net~~pcscf.visited1.net 0 IN NAPTR 50 50 "s" "SIP+D2U" "" _sip._udp.
pcscf.visited1.net~~.net~~

```
                        0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp. pcscf.visited1.net~~.net~~
                        0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp. pcscf.visited1.net~~.net~~
```

Based on the order and preference of the NAPTR record, and the local preference~~policy~~, UDP is preferred and ~~Since the UDP is prefered~~, the UE performs a DNS SRV lookup according to RFC 2782 [4].

Table 5.2.2-3c DNS: DNS Query (UE to DNS)

```
OPCODE=SQUERY
QNAME=_sip._udp.pcscf.visited1.net, QCLASS=IN, QTYPE=SRV
```

The DNS records are retrieved according to RFC 2782 [4].

Table 5.2.2-3d DNS Query Response (DNS to UE)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=_sip._udp.pcscf.visited1.net, QCLASS=IN, QTYPE=SRV

_sip._udp.pcscf.visited1.net            0 IN SRV 1 10 5060 pcscf1.visited1.net
                                        0 IN SRV 1  0 5060 pcscf7.visited1.net

pcscf1.visited1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
pcscf7.visited1.net                 0 IN AAAA     5555::a1a:b2b:c3c:d4d
```

In the Answer field of the query-response each P-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 RFC 2782 [4] is used to select the P-CSCF (i.e. the pcscf1.visited1.net). Since the Additional Data field of the query-response also contains the IP address of the selected P-CSCF (i.e. 5555::aba:dab:aaa:daa), a new query to the DNS is not required.

End of modification

Modification of section 6.2

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. This flow also shows the authentication of the private user identity. In this signalling flow, the home network does not have network configuration hiding active.

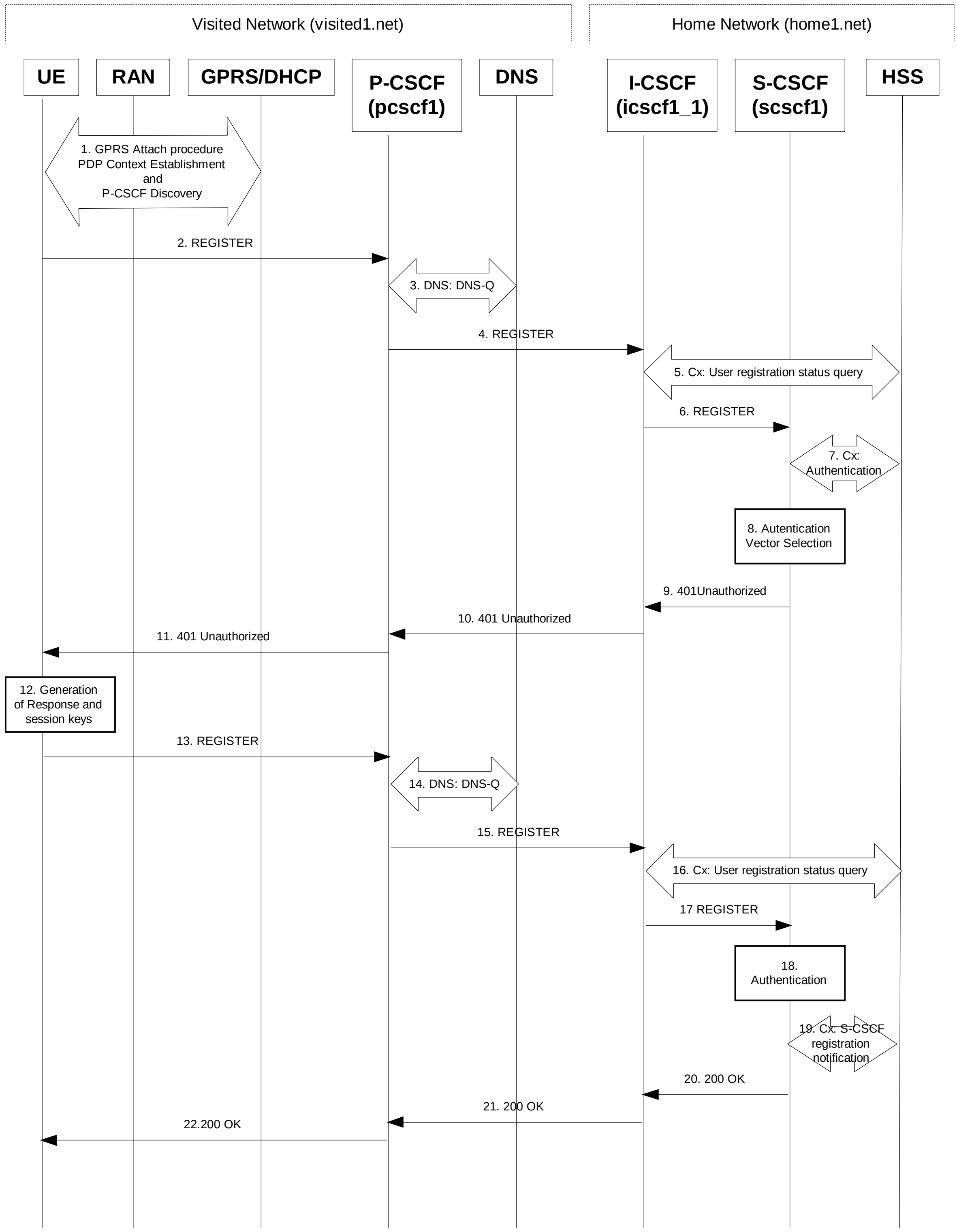


Figure 6.2-1: Registration signalling: user not registered

1. **GPRS Attach / PDP Context Establishment and P-CSCF Discovery (UE to GPRS)**

   This signalling flow is shown to indicate prerequisites for the registration signalling.

   See subclause 5.2 for details.

2. **REGISTER request (UE to P-CSCF) – see example in table 6.2-2**

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 6.2-2: REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response=""
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789; Port_U_UDP=1357;
Port_U_TCP=1358
Require: sec-agree
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 routing a SIP request describe how to use DNS to resolve this domain name ("registrar.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 address of the SIP session allocated during the PDP Context Activation process.

Max-Forwards: Set to 70 by the UE and used to prevent loops.

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

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

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 and S-CSCF.

Authorization: It carries authentication information. The private user identity (user1_private@home1.net) is carried in theusername field of the Digest AKA protocol. The uri parameter (directive) contains the same value as the Request-URI. The realm parameter (directive) contains the network name where the username is authenticated. The Request-URI and the realm parameter (directive) value are obtained from the same field in the USIM and therefore, are identical. In this example, it is assumed that a new UICC card was just inserted into the terminal, and there is no other cached information to send. Therefore, nonce and response parameters (directives) are empty.

Security-Client: lists the supported algorithm(s) by the UE. It encapsulates the detail of each mechanism to be negotiated.

SPI value is the UE’s SA_ID. Two SA_IDs are inserted, one for the SA using transport UDP, the other for TCP. The UE needs to choose the SA_IDs in such a way that those uniquely identify the inbound SAs at the UE.

Port_U_UDP and Port_U_TCP contain the port number the UE would like receive the SA protected messages.

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

3. **DNS: DNS-Q**

Based on the user's URI, the P-CSCF determines that UE is registering from a visiting domain and performs the DNS queries 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 REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port number are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.2-3a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.2-3b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Based on the order and preference of the NAPTR record and the local ~~policy~~preference, UDP is preferred and the ~~Since the UDP is prefered, the~~ P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 6.2-3c: DNS: 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 RFC 2782 [4].

Table 6.2-3d: 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_p.home1.net
                                        0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

4. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.2-4**

   The P-CSCF needs to be in the path for all mobile originated and mobile terminated requests for this user. To ensure this, the P-CSCF adds itself to the Path header value for future requests.

   The P-CSCF binds the public user identity under registration to the Contact header supplied by the user.

   The P-CSCF adds also the Roaming-Info header (if not present). The P-CSCF adds the *vnid* parameter with the contents of the identifier of the P-CSCF network. This may be the visited network domain name or any other identifier that identifies the visited network at the home network.

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

   P-CSCF removes the Security-Client and Require: sec-agree headers prior to forwarding the message.

Table 6.2-4: REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
   Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
        [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response="", integrity-protected="no"
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.

Roaming-Info: The *vnid* parameter contains the identifier of the P-CSCF network at the home network.

5. **Cx: User registration status query procedure**

   The I-CSCF makes a request for information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

   For detailed message flows see 3GPP TS 29.228.

   Table 6.2-5a provides the parameters in the REGISTER request (flow 4) which are sent to the HSS.

Table 6.2-5a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.

	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	Roaming Info: vnid	This information indicates the network identifier of the visited network

6. **REGISTER request (I-CSCF to S-CSCF) – see example in table 6.2-6**

I-CSCF does not modify the Path header.

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 6.2-6: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
   Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
        pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
        [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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 may set its SIP registration timer for this UE to the Expires time in this request or the S-CSCF may assign another registration timer for this registration

7. **Cx: Authentication procedure**

As the REGISTER request arrived without integrity protection to the P-CSCF, the S-CSCF shall challenge it. For this, the S-CSCF requires at least one authentication vector to be used in the challenge to the user. If a valid AV is not available, then the S-CSCF requests at least one AV from the HSS.

The S-CSCF indicates to the HSS that it has been assigned to serve this user.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-7a provides the parameters in the REGISTER request (flow 6) which are sent to the HSS.

Table 6.2-7a Cx: S-CSCF authentication information procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.

	S-CSCF Name	Request-URI:	This information element contains the name of the S-CSCF. The presence of this IE indicates that the user has not been authenticated yet by the S-CSCF

8. **Authentication vector selection**

The S-CSCF selects an authentication vector for use in the authentication challenge. For detailed description of the authentication vector, see 3GPP TS 33.203.

NOTE 1: The authentication vector may be of the form as in 3GPP TS 33.203 (if IMS AKA is the selected authentication scheme):

- AV = $RAND_n||AUTN_n||XRES_n||CK_n||IK_n$ where:
  - RAND: random number used to generate the XRES, CK, IK, and part of the AUTN. It is also used to generate the RES at the UE.
  - AUTN: Authentication token (including MAC and SQN).
  - XRES: Expected (correct) result from the UE.
  - CK: Cipher key (optional).
  - IK: Integrity key.

9. **401 Unauthorized response (S-CSCF to I-CSCF) - see example in table 6.2-9**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.2-9: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
   Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
       pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
       [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID: apb03a0s09dkjdfglkj49111
   WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
                   data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
                   ck="ffeeddccbbaa11223344556677889900"
CSeq: 1 REGISTER
Content-Length: 0
```

WWW-Authenticate: The S-CSCF challenges the user. The nonce includes the quoted string, base64 encoded value of the concatenation of the AKA RAND, AKA AUTN and server specific data. The S-CSCF appends also the Integrity Key (IK) and the Cyphering key (CK).

NOTE 2: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

10. **401 Unauthorized response (I-CSCF to P-CSCF) - see example in table 6.2-10**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 6.2-10: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
   Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
       [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
```

```
Content-Length:
```

11. **401 Unauthorized response (P-CSCF to UE) - see example in table 6.2-11**

The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 6.2-11: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
   WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
                    data), algorithm=AKAv1-MD5
   Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
                    Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

Security-Server: q is the preference value, 0.1 means IPsec is the first preferred choice. The q value represents only relative degradation of all mechanisms listed here. The lower value, the higher prority.

12. **Generation of response and session keys at UE**

Upon receiving the Unauthorised response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

13. **REGISTER request (UE to P-CSCF) - see example in table 6.2-13**

Table 6.2-13 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49112
   Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
                 nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
                 uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
   Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531;
                 Port_P_TCP=8642
CSeq: 2 REGISTER
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 11 along with the private user identity, the realm, the nonce, the URI and the algorithm.

This message is protected by the IPsec SA negotiated.

14. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port number are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 6.2-14a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 6.2-14b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Based on the order and preference of the NAPTR record and the local ~~policy~~preferences, UDP is preferred and the ~~Since the UDP is prefered, the~~ P-CSCF finds the I-CSCF by an DNS SRV lookup according to RFC 2782 [4].

Table 6.2-14c DNS: 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 RFC 2782 [4].

Table 6.2-14d 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_p.home1.net
                                        0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

15. **REGISTER request (P-CSCF to I-CSCF) - see example in table 6.2-15**

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

Table 6.2-15 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
   Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
        [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
```

```
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
   Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
                 nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
                 uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1",
                 integrity-protected="yes"
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.

16. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF name which was previously selected in step 5 (Cx: User registration status query procedure).

For detailed message flows see 3GPP TS 29.228.

Table 6.2-16a provides the parameters in the REGISTER request (flow 15), which are sent to the HSS.

Table 6.2-16a Cx: User registration status query procedure (I-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
I-CSCF to HSS	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	Public User Identity	To:	Identity which is used to communicate with other users
	Visited Network Identifier	Roaming-Info: vnid	This information indicates the network identifier of the visited network

17. **REGISTER request (I-CSCF to S-CSCF) - see example in table 6.2-17**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF.

Table 6.2-17: REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
   Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
        pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
        [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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.

18. **Authentication**

Upon receiving an integrity protected REGISTER request carrying the authentication response, RES, the S-CSCF checks that the user's active, XRES matches the received RES. If the check is successful then the user has been authenticated and the public user identity is registered in the S-CSCF.

19. **Cx: S-CSCF registration notification procedure**

On registering a user the S-CSCF informs the HSS that the user has been registered at this instance. Upon being requested by the S-CSCF , the HSS will also include the user profile in the response sent to the S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-19a provides the parameters in the REGISTER request (flow 17), which are sent to the HSS.

Table 6.2-19a Cx: S-CSCF registration notification procedure (S-CSCF to HSS)

Message source & destination	Cx Information element name	Information Source in REGISTER	Description
S-CSCF to HSS	Public User Identify	To:	Identity which is used to communicate with other users
	Private User Identity	Authorization:	The Private User Identity is encoded in the username field according to the Authorization protocol.
	S-CSCF name	Request-URI:	This information indicates the serving CSCF's name of that user

20. **200 OK response (S-CSCF to I-CSCF) - see example in table 6.2-20**

The S-CSCF sends acknowledgement to the I-CSCF indicating that Registration was successful.

Table 6.2-20: 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
   Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
        pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
        [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 7200
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-1111
Content-Length:
```

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

21. **200 OK response (I-CSCF to P-CSCF) - see example in table 6.2-21**

The I-CSCF forwards acknowledgement from the S-CSCF to the P-CSCF indicating that Registration was successful.

Table 6.2-21: 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
```

```
   Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
        [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

22. **200 OK response (P-CSCF to UE) - see example in table 6.2-22**

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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

Table 6.2-22: 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

End of modification

Modification of section 16.2

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. This flow also shows the authentication of the private user identity. In this signalling flow, the home network has network configuration hiding active.

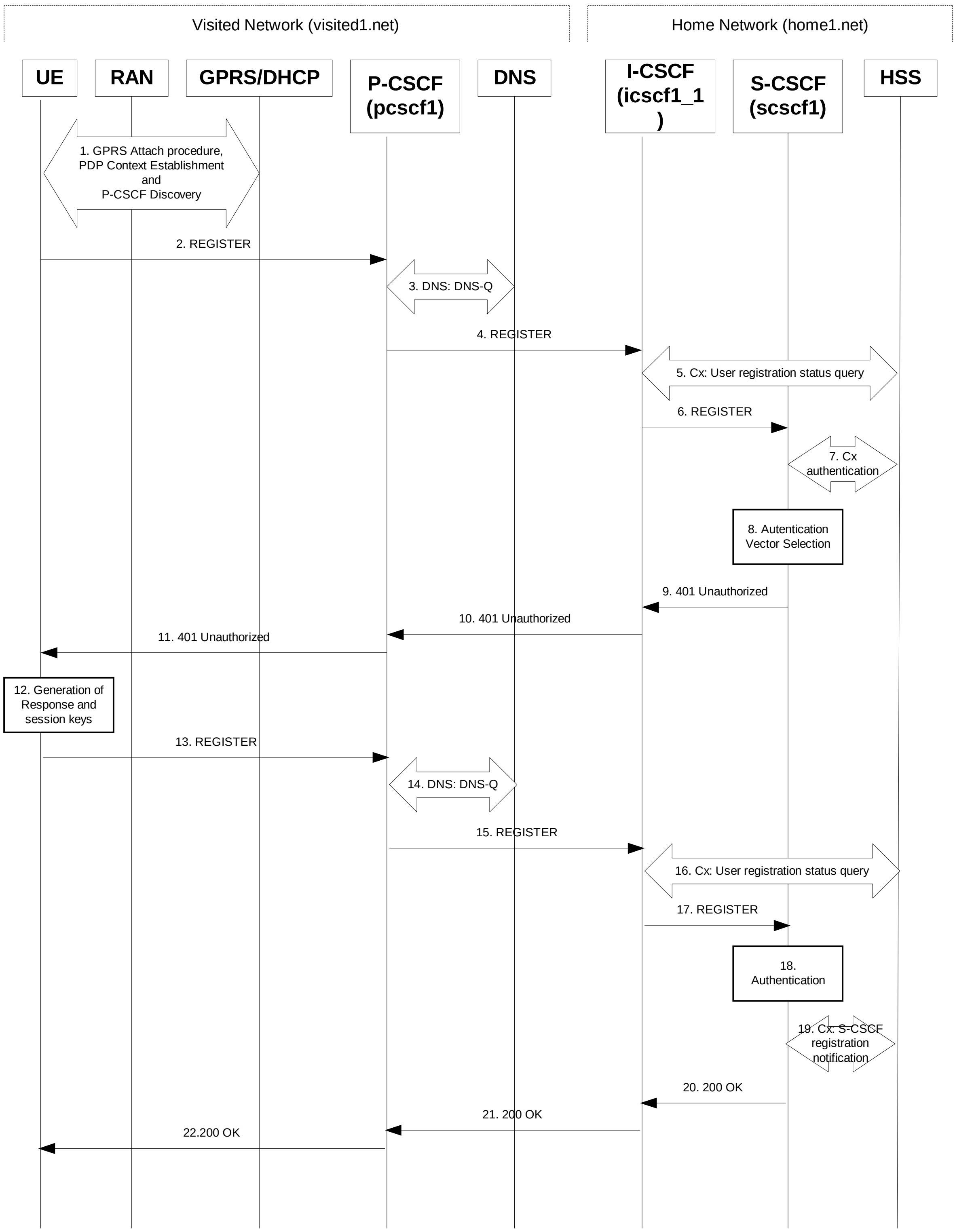


Figure 16.2-1: Registration when UE roaming

1. **GPRS Attach / PDP Context Establishment and P-CSCF Discovery (UE to GPRS)**

   This signalling flow is shown to indicate prerequisites for the registration signalling.

   See subclause 5.2 for details.

2. **REGISTER request (UE to P-CSCF) – see example in table 16.2-2**

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 16.2-2 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49111
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response=""
Security-Client: ipsec-man; alg=HMAC-SHA1; SPI_U_UDP=12345678; SPI_U_TCP=23456789; Port_U_UDP=1357; Port_U_TCP=1358
Require: sec-agree
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 routing a SIP request describe how to use DNS to resolve this domain name ("registrar.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.

Max-Forwards: Set to 70 by the UE and used to prevent loops.

From: This indicates the public user identity originating the REGISTER request. The public user identity may be obtained from the USIM.

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

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 and S-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 identity (user1_private@home1.net) is carried in the username field of the Digest AKA protocol. The uri parameter (directive) contains the same value as the Request-URI. The realm parameter (directive) contains the network name where the username is authenticated. The Request-URI and the realm parameter (directive) value are obtained from the same field in the USIM, and therefore, are identical. In this example, it is assumed that a new UICC card was just inserted into the terminal, and there is no other cached information to send. Therefore, nonce and response parameters (directives) are empty.

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

3. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 16.2-3a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 16.2-3b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Based on the order and preference of the NAPTR record and the local preference, UDP is preferred and ~~policy, the~~ ~~Since the UDP is prefered,~~ the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 16.2-3c DNS: 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 RFC 2782 [4].

Table 16.2-3d DNS: 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_p.home1.com
                                        0 IN SRV 1  0 5060 icscf7_p.home1.com

icscf1_p.home1.net                      0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

4. **REGISTER request (P-CSCF to I-CSCF) – see example in table 16.2-4**

   The P-CSCF needs to be in the path for all mobile originated and mobile terminated requests for this user. To ensure this, the P-CSCF adds itself to the path for future requests.

   The P-CSCF binds the public user identity under registration to the Contact header supplied by the user.

   The P-CSCF adds also the Roaming-Info header (if not present). The P-CSCF adds the *vnid* parameter with the contents of the identifier of the P-CSCF network. This may be the visited network domain name or any other identifier that identifies the visited network at the home network.

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

Table 16.2-4 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net", nonce="",
uri="sip:registrar.home1.net", response="", integrity-protected="no"
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.

Roaming-Info: The *vnid* parameter contains the identifier of the P-CSCF network at the home network.

5. **Cx: User registration status query procedure**

   The I-CSCF makes a request for information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

   For detailed message flows see 3GPP TS 29.228.

   Table 6.2-5a provides the parameters in the REGISTER request (flow 4) which need to been sent to HSS.

6. **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.2-6**

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

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

Table 16.2-6 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
```

```
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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.

7. **Cx: S-CSCF authentication procedure**

   As the REGISTER request arrived without integrity protection to the P-CSCF, the S-CSCF shall challenge it. For this, the S-CSCF requires at least one authentication vector to be used in the challenge to the user. If a valid AV is not available, then the S-CSCF requests at least one AV from the HSS.

   For detailed message flows see 3GPP TS 29.228.

   Table 6.2-7a provides the parameters in the REGISTER request (flow 6) which need to be sent to HSS.

8. **Authentication vector selection**

   The S-CSCF selects an authentication vector for use in the authentication challenge. For detailed description of the authentication vector, see 3GPP TS 33.203.

NOTE 1: The authentication vector may be of the form 3GPP TS 33.203 (if IMS AKA is the selected authentication scheme):

$AV = RAND_n||AUTN_n||XRES_n||CK_n||IK_n$ where:

- RAND: random number used to generate the XRES, CK, IK, and part of the AUTN. It is also used to generate the RES at the UE.
- AUTN: Authentication token (including MAC and SQN).
- XRES: Expected (correct) result from the UE.
- CK: Cipher key (optional).
- IK: Integrity key.

9. **401 Unauthorized response (S-CSCF to I-CSCF) – see example in table 16.2-9**

   The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 16.2-9: 401 Unauthorized response (S-CSCF to I-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To: <sip:user1_public1@home1.net>; tag=5ef4
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
data), algorithm=AKAv1-MD5, ik="00112233445566778899aabbccddeeff",
ck="ffeeddccbbaa11223344556677889900"
CSeq:
Content-Length:
```

WWW-Authenticate: The S-CSCF challenges the user. The nonce includes the quoted string, base64 encoded value of the concatenation of the AKA RAND, AKA AUTN and server specific data. The S-CSCF appends also the Integrity Key (IK) and the Cyphering key (CK).

NOTE: The actual nonce value in the WWW-Authenticate header field is encoded in base64, and it may look like: nonce="A34Cm+Fva37UYWpGNB34JP"

10. **401 Unauthorized response (I-CSCF to P-CSCF) – see example in table 16.2-10**

The authentication challenge is sent in the 401 Unauthorized response towards the UE.

Table 16.2-10: 401 Unauthorized response (I-CSCF to P-CSCF)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate:
CSeq:
Content-Length:
```

11. **401 Unauthorized response (P-CSCF to UE) – see example in table 16.2-11**

The P-CSCF removes any keys received in the 401 Unauthorized response and forwards the rest of the response to the UE.

Table 16.2-11: 401 Unauthorized response (P-CSCF to UE)

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
WWW-Authenticate: Digest realm="registrar.home1.net", nonce=base64(RAND + AUTN + server specific
data), algorithm=AKAv1-MD5
Security-Server: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
CSeq:
Content-Length:
```

WWW-Authenticate: The P-CSCF removes the ik and ck parameters (directives) from the header.

12. **Generation of response and session keys at UE**

Upon receiving the Unauthorized response, the UE extracts the MAC and the SQN from the AUTN. The UE calculates the XMAC and checks that XMAC matches the received MAC and that the SQN is in the correct range. If both these checks are successful the UE calculates the response, RES, and also computes the session keys IK and CK. The RES is put into the Authorization header and sent back to the registrar in the REGISTER request.

13. **REGISTER request (UE to P-CSCF) – see example in table 16.2-13**

Table 16.2-13 REGISTER request (UE to P-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
From: <sip:user1_public1@home1.net>;tag=4fa3
To: <sip:user1_public1@home1.net>; tag=5ef4
Contact: <sip:[5555::aaa:bbb:ccc:ddd]>
Call-ID: apb03a0s09dkjdfglkj49112
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1"
Security-Verify: ipsec-man; q=0.1; alg=HMAC-SHA1; SPI_P_UDP=87654321; SPI_P_TCP=98765432; Port_P_UDP=7531; Port_P_TCP=8642
CSeq: 2 REGISTER
```

```
Expires: 7200
Content-Length: 0
```

Authorization: This carries the response to the authentication challenge received in step 11 along with the private user identity , the realm, the nonce, the URI and the algorithm.

14. **DNS: DNS-Q**

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

The P-CSCF sends the REGISTER request - after local processing - to the address indicated in the Request-URI. When forwarding the REGISTER 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 REGISTER request. The P-CSCF tries to find this information by querying the DNS. Since the Request-URI does not specify a numeric IP address, and the transport protocol and port are not indicated, the P-CSCF performs an NAPTR query for the domain specified in the Request-URI.

Table 16.2-14a DNS: DNS Query (P-CSCF to DNS)

```
OPCODE=SQUERY
QNAME=registrar.home1.net, QCLASS=IN, QTYPE=NAPTR
```

The DNS records are retrieved according to RFC 3263 [14].

Table 16.2-14b DNS Query Response (DNS to P-CSCF)

```
OPCODE=SQUERY, RESPONSE, AA
QNAME=registrar.home1.net,  QCLASS=IN, QTYPE=NAPTR

registrar.home1.net         0 IN NAPTR 50   50 "s" "SIP+D2U"    ""  _sip._udp.registrar.home1.net
                            0 IN NAPTR 90   50 "s" "SIP+D2T"    ""  _sip._tcp.registrar.home1.net
                            0 IN NAPTR 100  50 "s" "SIPS+D2T"   ""  _sips._tcp.registrar.home1.net
```

Based on the order and preference of the NAPTR record and the local ~~policy~~preference, UDP is preferred and ~~Since the UDP is prefered,~~ the P-CSCF finds the I-CSCF by a DNS SRV lookup according to RFC 2782 [4].

Table 16.2-14c DNS: 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 RFC 2782 [4].

Table 16.2-14d 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_p.home1.net
                                        0 IN SRV 1  0 5060 icscf7_p.home1.net

icscf1_p.home1.net                 0 IN AAAA     5555::aba:dab:aaa:daa
icscf7_p.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 RFC 2782 [4] is used to select the I-CSCF (i.e. the icscf1_p.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 REGISTER request to this IP address (i.e. 5555::aba:dab:aaa:daa) using the UDP protocol and port number 5060.

15. **REGISTER request (P-CSCF to I-CSCF) – see example in table 16.2-15**

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

Table 16.2-15 REGISTER request (P-CSCF to I-CSCF)

```
REGISTER sip:registrar.home1.net SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Path: <sip:pcscf1.visited1.net>
Proxy-require: path
Require: path
Roaming-Info: vnid="Visited Network Number 1"
From:
To:
Contact:
Call-ID:
Authorization: Digest username="user1_private@home1.net", realm="registrar.home1.net",
nonce=base64(RAND + AUTN + server specific data), algorithm=AKAv1-MD5,
uri="sip:registrar.home1.net", response="6629fae49393a05397450978507c4ef1", integrity-
protected="yes"
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.

16. **Cx: User registration status query procedure**

The I-CSCF requests information related to the Subscriber registration status by sending the private user identity, public user identity and visited domain name to the HSS. The HSS returns the S-CSCF required capabilities and the I-CSCF uses this information to select a suitable S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-16a provides the parameters in the REGISTER request (flow 15) which need to been sent to HSS.

17. **REGISTER request (I-CSCF to S-CSCF) – see example in table 16.2-17**

This signalling flow forwards the REGISTER request from the I-CSCF to the S-CSCF selected.

Table 16.2-17 REGISTER request (I-CSCF to S-CSCF)

```
REGISTER sip:scscf1.home1.net SIP/2.0
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Path: <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
Proxy-require:
Require:
Roaming-Info:
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.

18. **Authentication**

Upon receiving an integrity protected REGISTER request, carrying the authentication response, RES, the S-CSCF checks that the user's active XRES matches the received RES. If the check is successful then the user has been authenticated and the public user identity is registered in the S-CSCF.

19. **Cx: S-CSCF registration notification procedure**

On registering a user the S-CSCF informs the HSS that the user has been registered at this instance. The HSS stores the S-CSCF name for that subscriber. For a positive response, the HSS will include the user profile in the response sent to the S-CSCF.

For detailed message flows see 3GPP TS 29.228.

Table 6.2-19a provides the parameters in the SIP REGISTER request (flow 17) which need to been sent to HSS.

20. **200 OK response (S-CSCF to I-CSCF) – see example in table 16.2-20**

The S-CSCF sends acknowledgement 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 16.2-20 200 OK response (S-CSCF to I-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf1_p.home1.net;branch=z9hG4bK351g45.1, SIP/2.0/UDP
pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:scscf1.home1.net>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
CSeq:
Date: Wed, 11 July 2001 08:49:37 GMT
Expires: 7200
P-Associated-URI: sip:user1_public2@home1.net, sip:user1_public3@home1.net, tel:+1-212-555-1111
Content-Length:
```

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

21. **200 OK response (I-CSCF to P-CSCF) – see example in table 16.2-21**

The I-CSCF translates the S-CSCF name in the Path header. The I-CSCF forwards acknowledgement 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 16.2-21 200 OK response (I-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
[5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Path: <sip:token(scscf1.home1.net)>, <sip:icscf1_p.home1.net>, <sip:pcscf1.visited1.net>
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

22. **200 OK response (P-CSCF to UE) – see example in table 16.2-22**

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 acknowledgement from the I-CSCF to the UE indicating that Registration was successful.

Table 16.2-22 200 OK response (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
Contact:
CSeq:
Date:
Expires:
P-Associated-URI:
Content-Length:
```

End of modification

3GPP TSG-CN1 Meeting #25 **_Tdoc N1-021798_**
Helsinki, Finland, 29 July – 2 August **Revision of N1-021600**

CR-Form-v7

CHANGE REQUEST

⌘	**24.228**	**CR**	**064**	⌘ **rev**	**1**	⌘	Current version:	**5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Add P-header examples to call flow MO#1a		
Source:	⌘	Lucent Technologies, Vodafone		
Work item code:	⌘	IMS-CCR	***Date:*** ⌘	July 19, 2002
Category:	⌘	**F** *Use one of the following categories:* ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	***Release:*** ⌘	Rel-5 *Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)*

Reason for change:	⌘	Now that the P-headers from the internet drafts are moving towards RFC status and there are procedures in 24.229 for the P-headers, it is time to finish adding in examples into the call flows in 24.228. This CR adds the P-Access-Network-Info header.
Summary of change:	⌘	Examples for P-Access-Network-Info are added to call flow MO#1a.
Consequences if not approved:	⌘	The example call flows will not be complete in showing compliance with 24.229 procedures.

Clauses affected:	⌘	7.2.2				
		Y	**N**			
Other specs affected:	⌘		**X**	Other core specifications	⌘	
			X	Test specifications		
			X	O&M Specifications		
Other comments:	⌘	Once this CR is approved, it can become the template for changing other call flows to include these P-header examples. It is also related to CRs 065 and 066.				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.2.2 MO#1a

7.2.2.1 (MO#1a) Mobile origination, roaming (S-S#1a, MT#1a assumed)

Figure 7.2.2.1-1 shows an origination procedure which applies to roaming subscribers when the home network operator does not desire to keep its internal configuration hidden from the visited network. The UE is located in a visited network, and determines the P-CSCF via the CSCF discovery procedure. During registration, the home network allocates a S-CSCF. The home network provides the S-CSCF name/address as the entry point from the visited network.

When registration is complete, P-CSCF knows the name/address of the S-CSCF.

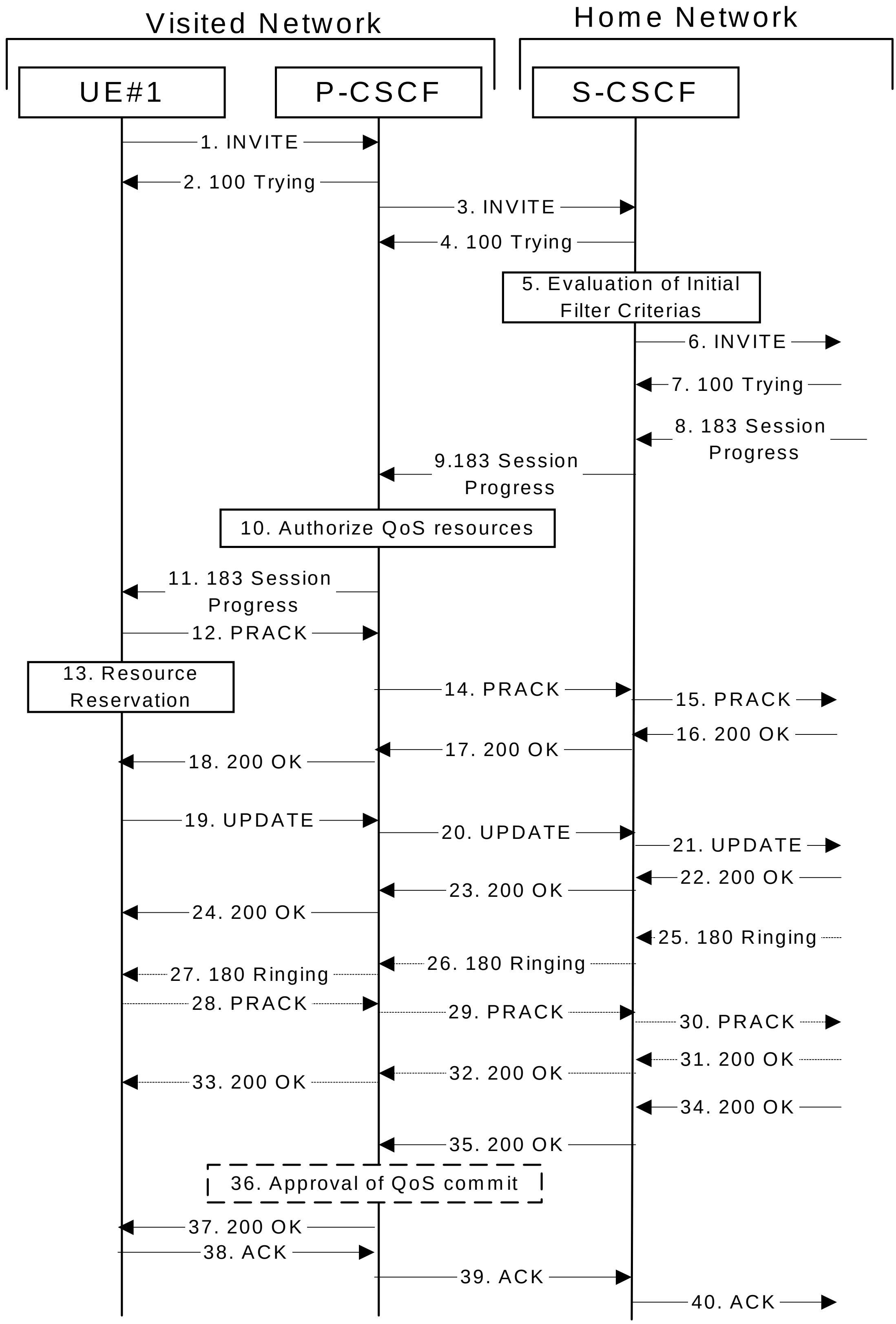


Figure 7.2.2.1-1: MO#1a

Procedure MO#1a is as follows:

1. **INVITE (UE to P-CSCF) - see example in table 7.2.2.1-1**

UE#1 determines the complete set of codecs that it is capable of supporting for this session. It builds a SDP containing bandwidth requirements and characteristics of each, and assigns local port numbers for each possible media flow. Multiple media flows may be offered, and for each media flow (m= line in SDP), there may be multiple codec choices offered.

For this example, assume UE#1 is capable of sending two simultaneous video streams, either H261 or MPV format, and two simultaneous audio streams, either AMR, G726-32, PCMU, or G728.

UE sends the INVITE request, containing an initial SDP, to the P-CSCF determined via the CSCF discovery mechanism. The initial SDP may represent one or more media for a multimedia session.

Editor's Note: Need to insure the codec negotiation procedures are compatible with the procedures brought into release 4 for CS domain services (BICC).

Table 7.2.2.1-1: INVITE (UE to P-CSCF)

```
INVITE tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Privacy: none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported: 100rel
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 98 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:98 H261
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 98 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:98 H261
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Request-URI: contains the keyed number from the user.

Via: contains the IP address or FQDN of the originating UE.

Privacy: the user does not require privacy, therefore the Privacy header is set to the value “none” as specified in draft-ietf-sip-asserted-identity [17] and draft-ietf-sip-privacy-general [13].

P-Asserted-Identity: the user provides a hint about the identity to be used for this session.

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

From: the user does not require privacy, the From header contains the value requested by the user.

Cseq: is a random starting number.

Contact: is a SIP URL that contains the IP address or FQDN of the originating UE.

SDP The SDP contains a set of codecs supported by UE#1 and desired by the user at UE#1 for this session.

Upon receiving the INVITE, the P-CSCF stores the following information about this session, for use in possible error recovery actions - see example in table 7.2.2.1-1b.

Table 7.2.2.1-1b: Storage of information at P-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
Cseq(2orig): none
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

2. **100 Trying (P-CSCF to UE) - see example in table 7.2.2.1-2**

P-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.2.2.1-2: 100 Trying (P-CSCF to UE)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **INVITE (P-CSCF to S-CSCF) - see example in table 7.2.2.1-3**

P-CSCF remembers (from the registration procedure) the request routing for this UE. This becomes a Route header in the request. This next hop is the S-CSCF within the home network of UE#1.

P-CSCF adds itself to the Record-Route header and Via header.

P-CSCF examines the media parameters, and removes any choices that the network operator decides based on local policy, not to allow on the network.

For this example, assume the network operator disallows H261 video encoding.

The INVITE request is forwarded to the S-CSCF.

Table 7.2.2.1-3: INVITE (P-CSCF to S-CSCF)

```
INVITE sip:tel:+1-212-555-2222 SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
Record-Route: sip:pcscf1.visited1.net;lr
Route: sip:scscf1.home1.net;lr
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 3400 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 3402 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Route: contains the elements from the Path header from registration.

P-Asserted-Identity: The P-CSCF inserts this header based on the user's hint present in the incoming P-Asserted-Identity header.

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the video media streams no longer list code 98 (H261).

Upon receiving the INVITE, the S-CSCF stores the following information about this session, for use in charging or possible error recovery actions - see example in table 7.2.2.1-3b.

Table 7.2.2.1-3b: Storage of information at S-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
Cseq(2orig): none
Route(2orig): sip:pcscf1.visited1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

4. **100 Trying (S-CSCF to P-CSCF) - see example in table 7.2.2.1-4**

   S-CSCF responds to the INVITE request (3) with a 100 Trying provisional response.

Table 7.2.2.1-4: 100 Trying (S-CSCF to P-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

5. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber and evaluates the initial filter criterias.

6. **INVITE (MO#1 to S-S) - see example in table 7.2.2.1-6**

   S-CSCF examines the media parameters, and removes any choices that the subscriber does not have authority to request. For this example, assume the subscriber is not allowed video.

   S-CSCF forwards the INVITE request, as specified by the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-6: INVITE request (MO#1a to S-S)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Doe" <tel:+1-212-555-1111>
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
Content-Type:
Content-Length: (...)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the video media streams show a port number zero, which removes them from the negotiation.

Request-URI: In the case where the Request-URI of the incoming INVITE request to S-CSCF contains a TEL-URL [5], it has to be translated to a globally routable SIP-URL before applying it as Request-URI of the outgoing INVITE request. For this address translation the S-CSCF shall use the services of an ENUM-DNS protocol according to RFC 2916 [6], or any other suitable translation database. Database aspects of ENUM are outside the scope of this specification.

7. **100 Trying (S-S to MO#1a) - see example in table 7.2.2.1-7 (related to table 7.2.2.1-6)**

S-CSCF receives a 100 Trying provisional response, as specified by the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-7: 100 Trying (S-S to MO#1a)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **183 Session Progress (S-S to MO#1a) - see example in table 7.2.2.1-8 (related to table 7.2.2.1-6)**

   The media stream capabilities of the destination are returned along the signalling path, in a 183 Session Progress provisional response (to 6), per the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-8: 183 Session Progress (S-S to MO#1a)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Smith" <sip:user2_public1@home2.net>
P-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>
Privacy: none
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

Upon receiving the 183 Session Progress, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.2.2.1-8b.

Table 7.2.2.1-8b: Storage of information at S-CSCF

```
Request-URI: sip:user2_public1@home2.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:scscf2.home2.net,sip:pcscf2.visited2.net
Route(2orig): sip:pcscf1.visited1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

9. **183 Session Progress (S-CSCF to P-CSCF) - see example in table 7.2.2.1-9**

S-CSCF forwards the 183 Session Progress response to P-CSCF.

Table 7.2.2.1-9: 183 Session Progress (S-CSCF to P-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:

Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

Upon receiving the 183 Session Progress, the P-CSCF removes the Record-Route headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE. The saved value of the information for this session is - see example in table 7.2.2.1-9b.

Table 7.2.2.1-9b: Storage of information at P-CSCF

```
Request-URI: tel:+1-212-555-2222
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:scscf1.home1.net, sip:scscf2.home2.net, pcscf2.visited2.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

10. **Authorize QoS Resources**

P-CSCF authorizes the resources necessary for this session. The approval of QoS commitment either happens at this stage or after 200 OK of INVITE (35) based on operator local policy.

11. **183 Session Progress (P-CSCF to UE) – see example in table 7.2.2.1-11**

P-CSCF forwards the 183 Session Progress response to the originating endpoint.

Table 7.2.2.1-11: 183 Session Progress (P-CSCF to UE)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
P-Media-Authorization:00200001001001017063663l2e78797a2e6e6574000c02013942563330373200
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

P-Media-Authorization: a P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf1.xyz.net" with credentials "9BV3072". "00" at the end of the authorization token is required to pad to a multiple of 4 bytes.

12. **PRACK (UE to P-CSCF) - see example in table 7.2.2.1-12**

UE#1 determines which media flows should be used for this session, and which codecs should be used for each of those media flows. If there was any change in media flows, or if there was more than one choice of codec for a media flow, then UE#1 includes a new SDP offer in the PRACK message sent to UE#2.

For this example, assume UE#1 chooses AMR as the codec to use for the single audio stream.

UE includes this information in the PRACK request to P-CSCF.

Table 7.2.2.1-12: PRACK (UE to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

Request-URI: takes the value of the Contact header of the received 183 Session Progress response.

Via: takes the value of either the IP address or FQDN of the originating UE.

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

From:/To:/Call-ID: copied from the 183 Session Progress response so that they include any tag parameter.

Cseq: takes a higher value than that in the previous request.

13. **Resource Reservation**

After determining the final media streams in step #11, UE initiates the reservation procedures for the resources needed for this session.

14. **PRACK (P-CSCF to S-CSCF) – see example in table 7.2.2.1-14**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the PRACK request to S-CSCF.

Table 7.2.2.1-14: PRACK (P-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

Route: saved from the Record-Route header of the 183 Session Progress response.

15. **PRACK (MO#1a to S-S) – see example in table 7.2.2.1-15**

S-CSCF forwards the PRACK request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-15: PRACK (MO#1a to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

16. **200 OK (S-S to MO#1a) – see example in table 7.2.2.1-16 (related to table 7.2.2.1-15)**

    The destination endpoint responds to the PRACK request (14) with a 200 OK response, per the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-16: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

17. **200 OK (S-CSCF to P-CSCF) - see example in table 7.2.2.1-17**

    S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.2.1-17: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

18. **200 OK (P-CSCF to UE) - see example in table 7.2.2.1-18**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.2.1-18: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

19. **UPDATE (UE to P-CSCF) – see example in table 7.2.2.1-19**

When the resource reservation is completed, UE sends the UPDATE request to the terminating endpoint, via the signalling path established by the INVITE request.

Table 7.2.2.1-19: UPDATE (UE to P-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

Request-URI: takes the value of the Contact header of the received 183 Session Progress response.

Via: takes the value of either the IP address or FQDN of the originating UE.

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

From:/To:/Call-ID: copied from the 183 Session Progress response so that they include any tag parameters.

Cseq: takes a higher value than that in the previous request.

The SDP indicates that the resource reservation was successful in the local segment.

20. **UPDATE (P-CSCF to S-CSCF) – see example in table 7.2.2.1-20**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the UPDATE request to S-CSCF.

Table 7.2.2.1-20: UPDATE (P-CSCF to S-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Route: saved from the Record-Route header of the 183 Session Progress response.

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

21. **UPDATE (MO#1a to S-S) - see example in table 7.2.2.1-21**

S-CSCF forwards the UPDATE request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-21: UPDATE (MO#1a to S-S)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

22. **200 OK (S-S to MO#1a) – see example in table 7.2.2.1-22 (related to table 7.2.2.1-21)**

    The destination endpoint responds to the UPDATE request (21) with a 200 OK, per the S-CSCF to S-CSCF procedures.

Table 7.2.2.1-22: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote sendrecv
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

The SDP indicates that the resource reservation was successful both in the local and the remote segment.

23. **200 OK (S-CSCF to P-CSCF) - see example in table 7.2.2.1-23**

    S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.2.1-23: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

24. **200 OK (P-CSCF to UE) – see example in table 7.2.2.1-24**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.2.1-24: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

25. **180 Ringing (S-S to MO#1a) – see example in table 7.2.2.1-25 (related to table 7.2.2.1-6)**

The called UE may optionally perform alerting. If so, it signals this to the calling party by a 180 Ringing provisional response to (6). This response is sent to S-CSCF per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-25: 180 Ringing (S-S to MO#1a)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

26. **180 Ringing (S-CSCF to P-CSCF) – see example in table 7.2.2.1-26**

S-CSCF forwards the 180 Ringing response to P-CSCF.

Table 7.2.2.1-26: 180 Ringing (S-CSCF to P-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

27. **180 Ringing (P-CSCF to UE) - see example in table 7.1.1-27**

P-CSCF removes the Record-Route headers.

P-CSCF forwards the 180 Ringing response to UE.

Table 7.2.2.1-27: 180 Ringing (P-CSCF to UE)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

28. **PRACK (UE to P-CSCF) – see example in table 7.2.2.1-28**

UE indicates to the originating subscriber that the destination is ringing. It responds to the 180 Ringing provisional response (28) with a PRACK request.

Table 7.2.2.1-28: PRACK (UE to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

Request-URI: takes the value of the Contact header of the received 180 Ringing response.

Via: takes the value of either the IP address or FQDN of the originating UE.

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

From:/To:/Call-ID: copied from the 180 Ringing response so that they include any revised tag parameters.

Cseq: takes a higher value than in the previous request.

29. **PRACK (P-CSCF to S-CSCF) – see example in table 7.2.2.1-29**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the PRACK request to S-CSCF.

Table 7.2.2.1-29: PRACK (P-CSCF to S-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

30. **PRACK (MO#1a to S-S) - see example in table 7.2.2.1-30**

S-CSCF forwards the PRACK request to the terminating endpoint, as per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-30: PRACK (MO#1a to S-S)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

31. **200 OK (S-S to MO#1a) - see example in table 7.2.2.1-31 (related to table 7.2.2.1-30)**

The destination endpoint responds to the PRACK request (30) with a 200 OK response.

Table 7.2.2.1-31: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

32. **200 OK (S-CSCF to P-CSCF) - see example in table 7.2.2.1-32**

S-CSCF forwards the 200 OK response to P-CSCF.

Table 7.2.2.1-32: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

33. **200 OK (P-CSCF to UE) – see example in table 7.2.2.1-33**

P-CSCF forwards the 200 OK response to UE.

Table 7.2.2.1-33: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **200 OK (S-S to MO#1a) – see example in table 7.2.2.1-34 (related to table 7.2.2.1-6)**

When the called party answers, the terminating endpoint sends a 200 OK final response to the INVITE request (6), as specified by the termination procedures and the S-CSCF to S-CSCF procedures, to S-CSCF.

Table 7.2.2.1-34: 200 OK (S-S to MO#1a)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length:0
```

35. **200 OK (S-CSCF to P-CSCF) – see example in table 7.2.2.1-35**

S-CSCF sends a 200 OK final response along the signalling path back to P-CSCF.

Table 7.2.2.1-35: 200 OK (S-CSCF to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

36. **Approval of QoS Commit**

The P-CSCF approves the commitment of the QoS resources if it was not approved already in step (10).

37. **200 OK (P-CSCF to UE) – see example in table 7.2.2.1-37**

P-CSCF forwards the 200 OK final response to the session originator. UE can start the media flow(s) for this session.

Table 7.2.2.1-37: 200 OK (P-CSCF to UE)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

38. **ACK (UE to P-CSCF) – see example in table 7.2.2.1-38**

UE starts the media flow for this session, and responds to the 200 OK (37) with an ACK request sent to P-CSCF.

Table 7.2.2.1-38: ACK (UE to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 70
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 ACK
Content-Length: 0
```

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

Cseq: is required to be the same value as Cseq contained in original INVITE request [3].

39. **ACK (P-CSCF to S-CSCF) – see example in table 7.2.2.1-39**

P-CSCF adds the Route header corresponding to the session.

P-CSCF forwards the ACK request to S-CSCF.

Table 7.2.2.1-38: ACK (P-CSCF to S-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 69
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Route: sip:scscf1.home1.net;lr, sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

Route: saved from the Record-Route header of the 183 Session Progress response.

40. **ACK (MO#1a to S-S) - see example in table 7.2.2.1-40**

S-CSCF forwards the ACK request to the terminating endpoint, per the S-CSCF to S-CSCF procedure.

Table 7.2.2.1-40: ACK (MO#1a to S-S)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
     pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
     [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

3GPP TSG-CN1 Meeting #25
Helsinki, Finland, 29 July – 2 August

Tdoc N1-021800
Revision of N1-021602

CR-Form-v7

CHANGE REQUEST

⌘ **24.228**	**CR 066**	⌘ **rev**	**1** ⌘	Current version:	**5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

Title:	⌘ Add P-header examples to call flow MT#1a		
Source:	⌘ Lucent Technologies, Vodafone		
Work item code:	⌘ IMS-CCR	***Date:*** ⌘	July 19, 2002
Category:	⌘ **F**	***Release:*** ⌘	Rel-5
	Use one of the following categories: ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *Rel-4 (Release 4)* *Rel-5 (Release 5)* *Rel-6 (Release 6)*	

Reason for change:	⌘ Now that the P-headers from the internet drafts are moving towards RFC status and there are procedures in 24.229 for the P-headers, it is time to add in examples into the call flows in 24.228. This CR adds the P-Access-Network-Info header.
Summary of change:	⌘ Examples for P-Access-Network-Info are added to call flow MT#1a.
Consequences if not approved:	⌘ The example call flows will not be complete in showing compliance with 24.229 procedures.

Clauses affected:	⌘ 7.4.2				
		Y	**N**		
Other specs affected:	⌘		**X**	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘ Once this CR is approved, it can become the template for changing other call flows to include these P-header examples. It is also related to CRs 064 and 065.				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.4.2 MT#1a

7.4.2.1 (MT#1a) Mobile termination, roaming (MO#1a, S-S#1a assumed)

Figure 7.4.2.1 shows a termination procedure which applies to roaming subscribers when the home network operator does not desire to keep its internal configuration hidden from the visited network. The UE is located in a visited network, and determines the P-CSCF via the P-CSCF discovery procedure. During registration, the home network allocates the S-CSCF.

When registration is complete, S-CSCF knows the name/address of P-CSCF and the UE Contact address, and P-CSCF obtains the name/address of the UE.

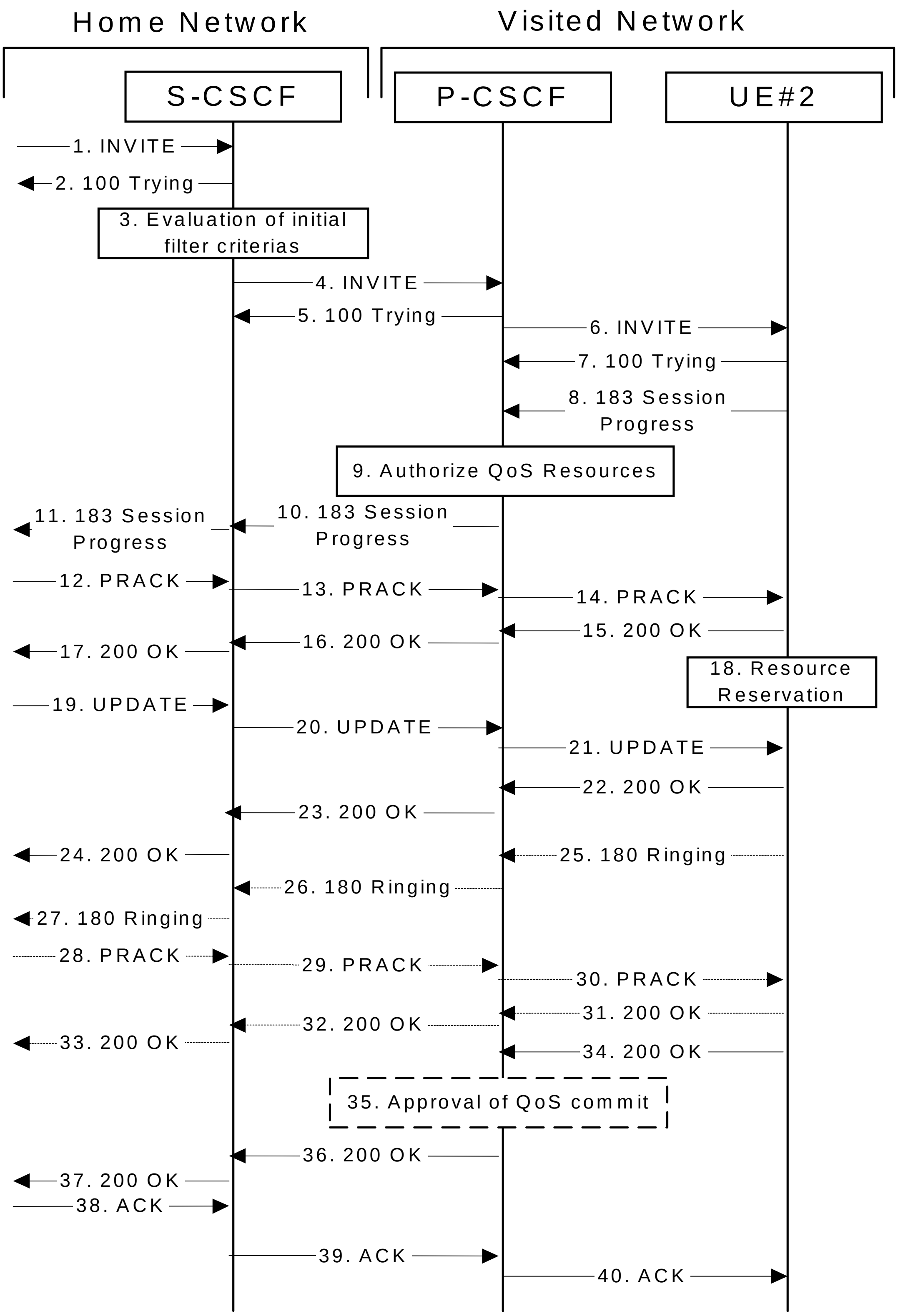


Figure 7.4.2.1-1: MT#1a

Procedure MT#1a is as follows:

1. **INVITE (S-S to MT#1a) – see example in table 7.4.2.1-1**

   The calling party sends the INVITE request, via one of the origination procedures and via one of the S-CSCF to S-CSCF procedures, to the S-CSCF for the terminating subscriber.

Table 7.4.2.1-1: INVITE (S-S to MT#1a)

```
INVITE sip:user2_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Record-Route: sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
Route: sip:scscf2.home2.net;lr
P-Asserted-Identity: "John Doe" <sip:user1_public1@home1.net>;screen=yes
P-Asserted-Identity: <tel:+1-212-555-1111>
Privacy: none
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 127 INVITE
Require: precondition
Supported:
Contact: sip:[5555::aaa:bbb:ccc:ddd]
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 3458 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

SDP The SDP contains the complete set of supported codecs from the session originator, as restricted by the originating network operator. The "m=" lines for the video media streams show a port number zero, which removes them from the negotiation.

Upon receipt of the INVITE, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.2.1-1b.

Table 7.4.2.1-1b: Storage of information at S-CSCF

```
Request-URI: sip:user2_public1@home2.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

2. **100 Trying (MT#1a to S-S) – see example in table 7.4.2.1-2**

   S-CSCF responds to the INVITE request (1) with a 100 Trying provisional response.

Table 7.4.2.1-2: 100 Trying (MT#1a to S-S)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

3. **Evaluation of initial filter criterias**

   S-CSCF validates the service profile of this subscriber, and evaluates the initial filter criterias.

4. **INVITE (S-CSCF to P-CSCF) – see example in table 83.2-4**

   S-CSCF remembers (from the registration procedure) the UE Contact address and the next hop CSCF for this UE. It forwards the INVITE to the P-CSCF.

   S-CSCF examines the media parameters, and removes any choices that the destination subscriber does not have authority to request. For this example, assume the destination subscriber is not allowed stereo, so only a single audio stream is permitted.

Table 7.4.2.1-4: INVITE (S-CSCF to P-CSCF)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 66
Route: sip:pcscf2.visited2.net;lr
Record-Route: sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr, sip:pcscf1.visited1.net;lr
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID: sip:user2_public1@home2.net
Content-Type:
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Route: Built from the Path header stored at registration.

P-Called-Party-ID: Includes the dialled URL with its parameters.

Via:/Record-Route: S-CSCF adds itself.

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the second audio stream shows a port number zero, which removes it from the negotiation.

P-CSCF saves information from the received INVITE request. The saved value of the information for this session is – see example in table 7.4.2.1-4b.

Table 7.4.2.1-4b: Storage of information at P-CSCF

```
Request-URI: sip:+1-212-555-2222@home2.net;user=phone
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf2.home2.net, sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

5. **100 Trying (P-CSCF to S-CSCF) – see example in table 7.4.2.1-5**

   P-CSCF responds to the INVITE request (4) with a 100 Trying provisional response.

Table 7.4.2.1-5: 100 Trying (P-CSCF to S-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

6. **INVITE (P-CSCF to UE) – see example in table 7.4.2.1-6**

   P-CSCF examines the media parameters, and removes any that the network operator decides, based on local policy, not to allow on the network.

   For this example, assume the network operator does not allow 64 kb/s audio, so the PCMU codec is removed.

   P-CSCF removes the Record-Route and Via headers, calculates the proper Route header to add to future requests, and saves that information without passing it to UE.

Table 7.4.2.1-6: INVITE (P-CSCF to UE)

```
INVITE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 65
P-Asserted-Identity:
P-Asserted-Identity:
Privacy:
P-Media-Authorization: 0020000100100101706366322e78797a2e6e6574000c02013331533134363231
From:
To:
Call-ID:
Cseq:
Require:
Supported:
Contact:
P-Called-Party-ID:
Content-Type:
Content-Length: (...)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=video 0 RTP/AVP 99
b=AS:54.6
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:99:MPV
m=audio 3456 RTP/AVP 97 96 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos none remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saves values. It inserts this as a branch value on its Via header.

P-Media-Authorization: A P-CSCF generated authorization token. This particular example shows a Policy-Element generated by "pcf2.xyz.net" with credentials "31S14621".

SDP The SDP contains the restricted set of codecs allowed by the network operator. The "m=" lines for the first audio stream no longer contains codec "0" (PCMU), which removes it from the negotiation.

7. **100 Trying (UE to P-CSCF) – see example in table 7.4.2.1-7**

UE may optionally send a 100 Trying provisional response to P-CSCF.

Table 7.4.2.1-7: 100 Trying (UE to P-CSCF)

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

8. **183 Session Progress (UE to P-CSCF) – see example in table 7.4.2.1-8**

UE#2 determines the complete set of codecs that it is capable of supporting for this session. It determines the intersection with those appearing in the SDP in the INVITE request. For each media flow that is not supported, UE#2 inserts a SDP entry for media (m= line) with port=0. For each media flow that is supported, UE#2 inserts a SDP entry with an assigned port and with the codecs in common with those in the SDP from UE#1.

For this example, assume UE#2 supports both AMR and G726, but not G728 (code 15).

UE responds with a 183 Session Progress response containing SDP back to the originator. This SDP may represent one or more media for a multimedia session. This response is sent to P-CSCF.

Table 7.4.2.1-8: 183 Session Progress (UE to P-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Privacy: none
From:
To: tel:+1-212-555-2222; tag=314159
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9021
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97 96
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
a=rtpmap:96 G726-32/8000
m=audio 0 RTP/AVP 97 96 0 15
```

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

To: A tag is added to the To header.

Contact: Contains a SIP URL with the IP address or FQDN of the UE.

SDP The SDP contains the subset of codecs supported by UE. It requests a confirmation of the QoS preconditions for establishing the session

Upon receipt of the 183 Session Progress, the P-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.2.1-8b.

Table 7.4.2.1-8b: Storage of information at P-CSCF

```
Request-URI: sip:[5555::eee:fff:aaa:bbb]
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2orig): sip:scscf2.home2.net, sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

9. **Authorize QoS Resources**

P-CSCF authorizes the resources necessary for this session. The approval of QoS commitment either happens at this stage or after 200 OK of INVITE (34) based on operator local policy.

10. **183 Session Progress (P-CSCF to S-CSCF) – see example in table 7.4.2.1-10**

P-CSCF forwards the 183 Session Progress response to S-CSCF.

Table 7.4.2.1-10: 183 Session Progress (P-CSCF to S-CSCF)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7)
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
P-Asserted-Identity: "John Smith" <sip:user2_public1@home2.net>
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

Via:/Record-Route: P-CSCF restores the Via headers and Record-Route headers from the branch value in its Via.

P-Asserted-Identity: The P-CSCF inserts this header based on the user's hint present in the incoming P-Asserted-Identity header.

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

Upon receipt of the 183 Session Progress, the S-CSCF stores the following information about this session, for use in providing enhanced services or in possible error recovery actions – see example in table 7.4.2.1-10b.

Table 7.4.2.1-10b: Storage of information at S-CSCF

```
Request-URI: sip:user2_public1@home2.net
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222
Call-ID: cb03a0s09a2sdfglkj490333
CSeq(2dest): 127 INVITE
CSeq(2orig): none
Route(2dest): sip:pcscf2.visited2.net
Route(2orig): sip:scscf1.home1.net, sip:pcscf1.visited1.net
Contact(dest): sip:[5555::eee:fff:aaa:bbb]
Contact(orig): sip:[5555::aaa:bbb:ccc:ddd]
```

11. **183 Session Progress (MT#1a to S-S) – see example in table 7.4.2.1-11**

S-CSCF forwards the 183 Session Progress response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-11: 183 Session Progress (MT#1a to S-S)

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
P-Asserted-Identity:
P-Asserted-Identity: "John Smith" <tel:+1-212-555-2222>
Privacy:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
a=
m=
```

12. **PRACK (S-S to MT#1a) – see example in table 7.4.2.1-12**

The originating endpoint sends a PRACK request containing the final SDP to be used in this session, via the S-CSCF to S-CSCF procedure, to S-CSCF.

Table 7.4.2.1-12: PRACK (S-S to MT#1a)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222; tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 128 PRACK
Require: precondition
Rack: 9021 127 INVITE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

13. **PRACK (S-CSCF to P-CSCF) – see example in table 7.4.2.1-13**

    S-CSCF forwards the PRACK request to P-CSCF.

Table 7.4.2.1-13: PRACK (S-CSCF to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

14. **PRACK (P-CSCF to UE) – see example in table 7.4.2.1-14**

    P-CSCF forwards the PRACK request to UE.

Table 7.4.2.1-14: PRACK (P-CSCF to UE)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Require:
Rack:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

15. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-15**

UE acknowledges the PRACK request (14) with a 200 OK response.

Table 7.4.2.1-15: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=conf:qos remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

16. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-16**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.2.1-16: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

17. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-17**

S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-17: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
a=
m=
```

18. **Resource Reservation**

    UE initiates the reservation procedures for the resources needed for this session.

19. **UPDATE (S-S to MT#1a) – see example in table 7.4.2.1-19**

    When the originating endpoint has completed its resource reservation, it sends the UPDATE request to S-CSCF, via the S-CSCF to S-CSCF procedures.

Table 7.4.2.1-19: UPDATE (S-S to MT#1a)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From: sip:user1_public1@home1.net; tag=171828
To: tel:+1-212-555-2222;tag=314159
Call-ID: cb03a0s09a2sdfglkj490333
Cseq: 129 UPDATE
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::aaa:bbb:ccc:ddd
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 3456 RTP/AVP 97
b=AS:25.4
a=curr:qos local sendrecv
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

20. **UPDATE (S-CSCF to P-CSCF) – see example in table 7.4.2.1-20**

S-CSCF forwards the UPDATE request to P-CSCF.

Table 7.4.2.1-20: UPDATE (S-CSCF to P-CSCF)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Contact:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

21. **UPDATE (P-CSCF to UE) – see example in table 7.4.2.1-21**

P-CSCF forwards the UPDATE request to UE.

Table 7.4.2.1-21: UPDATE (P-CSCF to UE)

```
UPDATE sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

22. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-22**

UE acknowledges the UPDATE request (21) with a 200 OK response.

Table 7.4.2.1-22: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq:
Content-Type: application/sdp
Content-Length: (…)

v=0
o=- 2987933615 2987933615 IN IP6 5555::aaa:bbb:ccc:ddd
s=-
c=IN IP6 5555::eee:fff:aaa:bbb
t=907165275 0
m=video 0 RTP/AVP 99
m=video 0 RTP/AVP 99
m=audio 6544 RTP/AVP 97
b=AS:25.4
a=curr:qos local none
a=curr:qos remote none
a=des:qos mandatory local sendrecv
a=des:qos mandatory remote sendrecv
a=rtpmap:97 AMR
a=fmtp:97 mode-set=0,2,5,7; maxframes=2
m=audio 0 RTP/AVP 97 96 0 15
```

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

23. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-23**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.2.1-23: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

24. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-24**

S-CSCF forwards the 200 OK response to the originator, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-24: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Type:
Content-Length:

v=
o=
s=
c=
t=
m=
m=
m=
b=
a=
a=
a=
a=
a=
a=
m=
```

25. **180 Ringing (UE to P-CSCF) – see example in table 7.4.2.1-25**

Before proceeding with session establishment, the UE waits for two events. First, the resource reservation initiated in step #17 must complete successfully. Second, the resource reservation initiated by the originating endpoint must complete successfully (which is indicated by message #20 received by UE). The UE may now immediately accept the session (and proceed with step #34), or alert the destination subscriber of an incoming session attempt; if the latter it indicates this to the calling party by a 180 Ringing provisional response sent to P-CSCF.

Table 7.4.2.1-25: 180 Ringing (UE to P-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq:
Require: 100rel
Contact: sip:[5555::eee:fff:aaa:bbb]
RSeq: 9022
Content-Length: 0
```

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

26. **180 Ringing (P-CSCF to S-CSCF) – see example in table 7.4.2.1-26**

P-CSCF forwards the 180 Ringing response to S-CSCF.

Table 7.4.2.1-26: 180 Ringing (P-CSCF to S-CSCF)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr,sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

27. **180 Ringing (MT#1a to S-S) – see example in table 7.4.2.1-27**

S-CSCF forwards the 180 Ringing response to the originating endpoint, per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-27: 180 Ringing (MT#1a to S-S)

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Require:
Contact:
RSeq:
Content-Length:
```

28. **PRACK (S-S to MT#1a) – see example in table 7.4.2.1-28**

The originator acknowledges the 180 Ringing response (27) with a PRACK request.

Table 7.4.2.1-28: PRACK (S-S to MT#1a)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq: 130 PRACK
Rack: 9022 127 INVITE
Content-Length: 0
```

29. **PRACK (S-CSCF to P-CSCF) – see example in table 7.4.2.1-29**

S-CSCF forwards the PRACK request to P-CSCF.

Table 7.4.2.1-29: PRACK (S-CSCF to P-CSCF)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

30. **PRACK (P-CSCF to UE) – see example in table 7.4.2.1-30**

P-CSCF forwards the PRACK request to UE.

Table 7.4.2.1-30: PRACK (P-CSCF to UE)

```
PRACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Rack:
Content-Length:
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.

31. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-31**

UE acknowledges the PRACK request (31) with a 200 OK response.

Table 7.4.2.1-31: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
From:
To:
Call-ID:
CSeq:
Content-Length: 0
```

32. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-32**

P-CSCF forwards the 200 OK response to S-CSCF.

Table 7.4.2.1-32: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

33. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-33**

S-CSCF forwards the 200 OK response to the session originator, per the S-CSCF to S-CSCF procedures.

Table 7.4.2.1-33: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
From:
To:
Call-ID:
CSeq:
Content-Length:
```

34. **200 OK (UE to P-CSCF) – see example in table 7.4.2.1-34**

When the called party answers the UE sends a 200 OK final response to the INVITE request (6) to P-CSCF, and starts the media flow(s) for this session.

Table 7.4.2.1-34: 200 OK (UE to P-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq: 127 INVITE
Contact: sip:[5555::eee:fff:aaa:bbb]
Content-Length:0
```

P-Access-Network-Info: the UE provides the access-type and access-info, related to the serving access network as specified in sub-clause ' Additional coding rules for P-access-network-info header', in 3GPP TS 24.229 [16].

35. **Approval of QoS Commit**

The P-CSCF approves the commitment of the QoS resources if it was not approved already in step (9).

36. **200 OK (P-CSCF to S-CSCF) – see example in table 7.4.2.1-36**

P-CSCF sends the 200 OK final response to S-CSCF.

Table 7.4.2.1-36: 200 OK (P-CSCF to S-CSCF)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route: sip:pcscf2.visited2.net;lr, sip:scscf2.home2.net;lr, sip:scscf1.home1.net;lr,
   sip:pcscf1.visited1.net;lr
P-Access-Network-Info: 3GPP-UTRAN-TDD; utran-cell-id-3gpp=234151D0FCE11
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

P-Access-Network-Info: this header contains information from the UE and shall be removed and stored by the S-CSCF.

37. **200 OK (MT#1a to S-S) – see example in table 7.4.2.1-37**

S-CSCF forwards the 200 OK final response along the signalling path back to the session originator, as per the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-37: 200 OK (MT#1a to S-S)

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP icscf2_s.home2.net;branch=z9hG4bK871y12.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Record-Route:
From:
To:
Call-ID:
CSeq:
Contact:
Content-Length:
```

38. **ACK (S-S to MT#1a) – see example in table 7.4.2.1-38**

The calling party responds to the 200 OK final response (37) with an ACK request which is sent to S-CSCF via the S-CSCF to S-CSCF procedure.

Table 7.4.2.1-38: ACK (S-S to MT#1a)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 68
Route: sip:scscf2.home2.net;lr, sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq: 127 ACK
Content-Length: 0
```

39. **ACK (S-CSCF to P-CSCF) – see example in table 7.4.2.1-39**

S-CSCF forwards the ACK request to P-CSCF.

Table 7.4.2.1-39: ACK (S-CSCF to P-CSCF)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP scscf2.home2.net;branch=z9hG4bK764z87.1, SIP/2.0/UDP
   scscf1.home1.net;branch=z9hG4bK332b23.1, SIP/2.0/UDP
   pcscf1.visited1.net;branch=z9hG4bK240f34.1, SIP/2.0/UDP
   [5555::aaa:bbb:ccc:ddd];branch=z9hG4bKnashds7
Max-Forwards: 67
Route: sip:pcscf2.visited2.net;lr
From:
To:
Call-ID:
Cseq:
Content-Length:
```

40. **ACK (P-CSCF to UE) – see example in table 7.4.2.1-40**

P-CSCF forwards the ACK request to UE.

Table 7.4.2.1-40: ACK (P-CSCF to UE)

```
ACK sip:[5555::eee:fff:aaa:bbb] SIP/2.0
Via: SIP/2.0/UDP pcscf2.visited2.net;branch=z9hG4bK361k21.1
Max-Forwards: 66
From:
To:
Call-ID:
Cseq:
Content-Length:
```

Via: P-CSCF removes the Via headers, and generates a locally unique token to identify the saved values. It inserts this as a branch value on its Via header.