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CHANGE REQUEST
№ 23.228 CR 225 № rev -1 № Current version: 5.6.0 №

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 Radio Access Network Core Network

Title:	№	Service Invocation	
Source:	№	Lucent Technologies, NEC	
Work item code:	№	IMS-CCR	Date: № 11.11.2002
Category:	№	F	Release: № Rel-5
		Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
		F (correction)	2 (GSM Phase 2)
		A (corresponds to a correction in an earlier release)	R96 (Release 1996)
		B (addition of feature),	R97 (Release 1997)
		C (functional modification of feature)	R98 (Release 1998)
		D (editorial modification)	R99 (Release 1999)
		Detailed explanations of the above categories can be found in 3GPP TR 21.900 .	Rel-4 (Release 4)
			Rel-5 (Release 5)
			Rel-6 (Release 6)

Reason for change:	№	Text within 23.228 and between 23.228 and 24.228 is inconsistent. It has been agreed that the S-CSCF does not do service control. Some text within 23.228 indicates that the S-CSCF provides or performs service control.
Summary of change:	№	Change several occurrences of “provides/performs service control” to “invokes service control”
Consequences if not approved:	№	Inconsistencies between documents may lead to incorrect implementation.

Clauses affected:	№	4.2.3, 5.3.2.2.2, 5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.6.1, 5.6.2, 5.7.1, 5.7.2, 5.9, 5.10.1, 5.10.2, 5.10.3.1.1, 5.10.3.1.2, 5.10.3.2, 5.11.3.4, 5.11.4.1, 5.11.4.2, 5.11.5.1, 5.11.5.2, 5.11.5.2a, 5.11.5.3, 5.11.5.4, 5.11.5.5, 5.11.5.6, 5.11.6.1, and 5.12.1								
Other specs affected:	№	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="width: 20px; text-align: center;"> </td> <td style="width: 20px; text-align: center;"> </td> </tr> <tr> <td style="width: 20px; text-align: center;"> </td> <td style="width: 20px; text-align: center;"> </td> </tr> <tr> <td style="width: 20px; text-align: center;"> </td> <td style="width: 20px; text-align: center;"> </td> </tr> </table> Other core specifications № _____ Test specifications O&M Specifications	Y	N						
Y	N									
Other comments:	№									

*****First Change*****

4.2.3 Support of roaming users

The architecture shall be based on the principle that the service control for Home subscribed services for a roaming subscriber is in the Home network, e.g., the Serving-CSCF is located in the Home network.

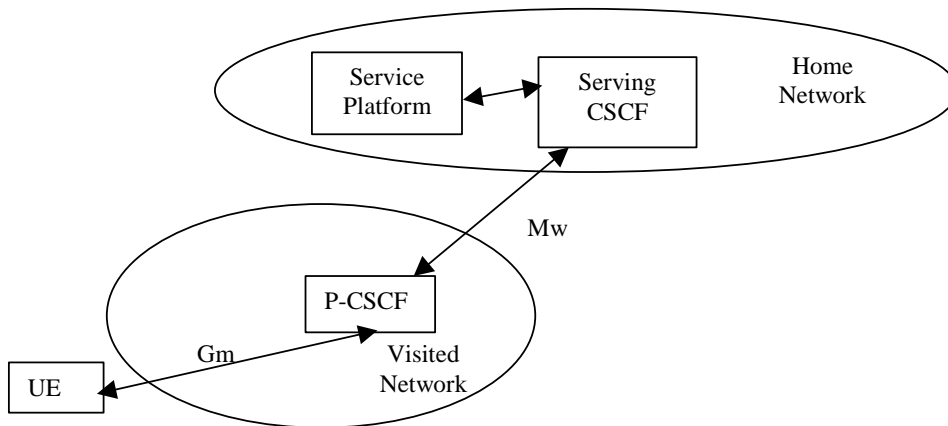


Figure 4-1: Service Platform in Home Network

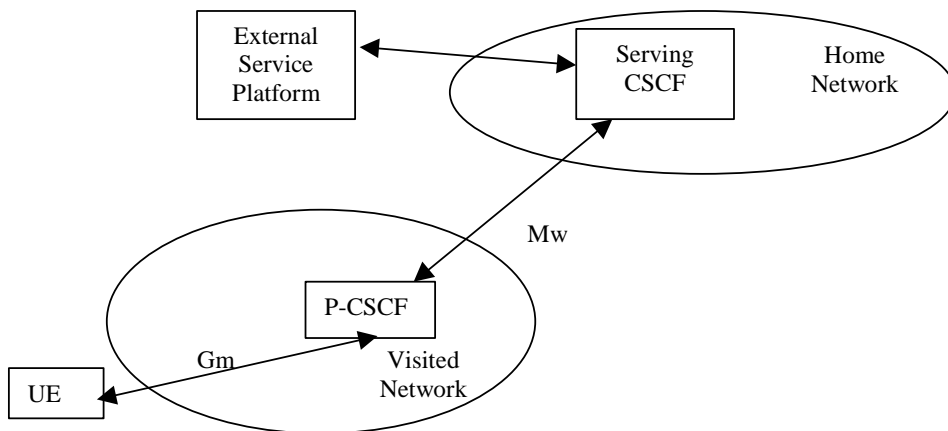


Figure 4-2: External Service Platform

There are two possible scenarios to provide services:

- via the service platform in the Home Network
- via an external service platform (e.g. third party or visited network)

The box representing the external service platform could be located in either the visited network or in the 3rd party platform. The standardised way for secure 3rd party access to IMS services is the OSA framework, see section 4.2.4.

The roles that the CSCF plays are described below.

- The Proxy-CSCF is located in the same network as the GGSN. The Proxy-CSCF shall enable the session control to be passed to the Serving-CSCF.

- The Serving-CSCF is located in the home network. The Serving-CSCF shall ~~provide~~invoke the service ~~control~~logic.

A Proxy-CSCF shall be supported in both roaming and non-roaming case, even when the Serving-CSCF is located in the same IM CN SS.

Reassigning the Proxy-CSCF assigned during CSCF discovery is not a requirement in this release. Procedures to allow registration time Proxy-CSCF reassignment may be considered in future releases.

Network initiated Proxy-CSCF reassignment is not a requirement.

The use of additional CSCFs, that is Interrogating-CSCFs, to be included in the SIP signalling path is optional. Such additional CSCFs may be used to shield the internal structure of a network from other networks.

*****Next Change*****

5.3.2.2.2 Network Initiated De-registration by S-CSCF

A service platform may determine a need to clear a user's SIP registration. This function initiates the de-registration procedure and resides in a service platform.

The following flow shows a service control initiated IMS terminal application (SIP) de-registration. The IP transport infrastructure (e.g., GGSN, SGSN) is not notified. If complete packet access is to be denied, a transport layer administrative mechanism would be used. This scenario does not address the administrative mechanisms used for updating any subscriber records, EIR records, access authorisation, etc. This scenario only addresses the specific action of clearing the SIP application registration that is currently in effect.

As determined by the operator, on-going sessions may be released by using network initiated session release procedures in Section 5.10.3.

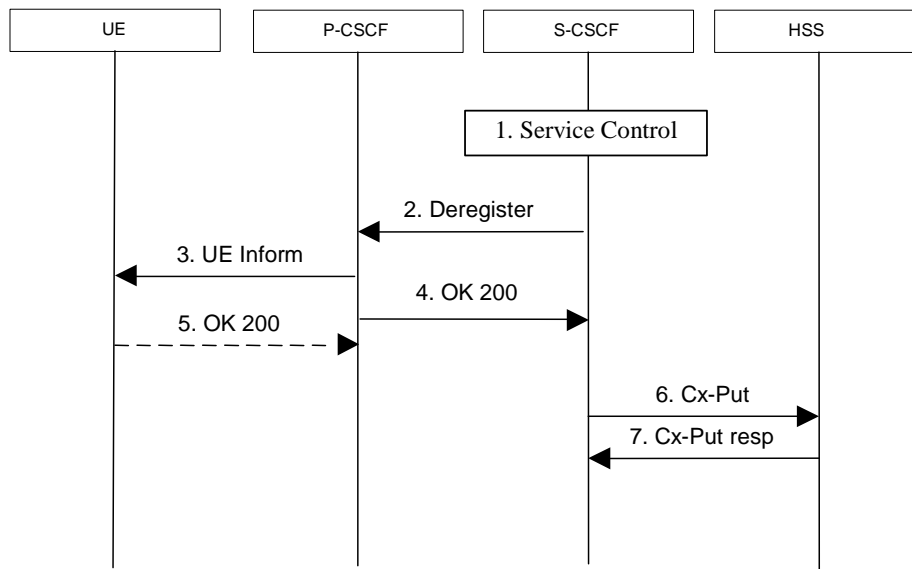


Figure 5.5a: Network initiated application de-registration, service platform

1. The S-CSCF receives de-registration information from the service platform and ~~performs~~invokes whatever service ~~control~~logic procedures are appropriate. This information may include the reason for the de-registration.
2. The S-CSCF issues a de-registration towards the P-CSCF for this user and updates its internal database to remove the user from being registered. The reason for the de-registration shall be included, if available.

3. The P-CSCF informs the UE of the de-registration, and without modification forwards the reason for the de-registration, if available. Due to loss of contact with the mobile, it might be possible that the UE does not receive the information of the de registration.
4. The P-CSCF sends a response to the S-CSCF and updates its internal database to remove the user from being registered.
5. When possible, the UE sends a response to the P-CSCF to acknowledge the de-registration. A misbehaving UE or a UE that is out of P-CSCF coverage could not answer properly to the de-registration request. The P-CSCF should perform the de-registration in any case, e.g., after the timer for this request expires.

If the UE does not perform automatic re-registration due to the de-registration the user shall be informed about the de-registration and of the reason, if available.

Note: Steps 4 and 5 may be done in parallel: the P-CSCF does not wait for an answer from the UE before answering to the S-CSCF

6. The S-CSCF sends an update to the HSS to remove itself as the registered S-CSCF for this user.
7. The HSS confirms the update.

Note: Another trusted/secured party may also initiate the de-registration, for example, by issuing a third party SIP registration with timer set to 0 via S-CSCF.

*****Next Change*****

5.5.1 (S-S#1) Different network operators performing origination and termination

The Serving-CSCF handling session origination performs an analysis of the destination address, and determines that it belongs to a subscriber of a different operator. The request is therefore forwarded (optionally through an I-CSCF(THIG) 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, and finds the user either located in the home service area, or roaming. The I-CSCF therefore forwards the request to the S-CSCF serving the destination user.

Origination sequences that share this common S-S procedure are:

MO#1 Mobile origination, roaming. The "Originating Network" of S-S#1 is therefore a visited network.

MO#2 Mobile origination, home. The "Originating Network" of S-S#1 is therefore the home network.

PSTN-OPSTN origination. The "Originating Network" of S-S#1 is the home network. The element labeled S-CSCF#1 is the MGCF of the PSTN-O procedure.

Termination sequences that share this common S-S procedure are:

MT#1 Mobile termination, roaming. The "Terminating Network" of S-S#1 is a visited network.

MT#2 Mobile termination, located in home service area. The "Terminating Network" of S-S#1 is the home network.

MT#3 Mobile termination, CS Domain roaming. The "Terminating Network" of S-S#1 is a CS domain network.

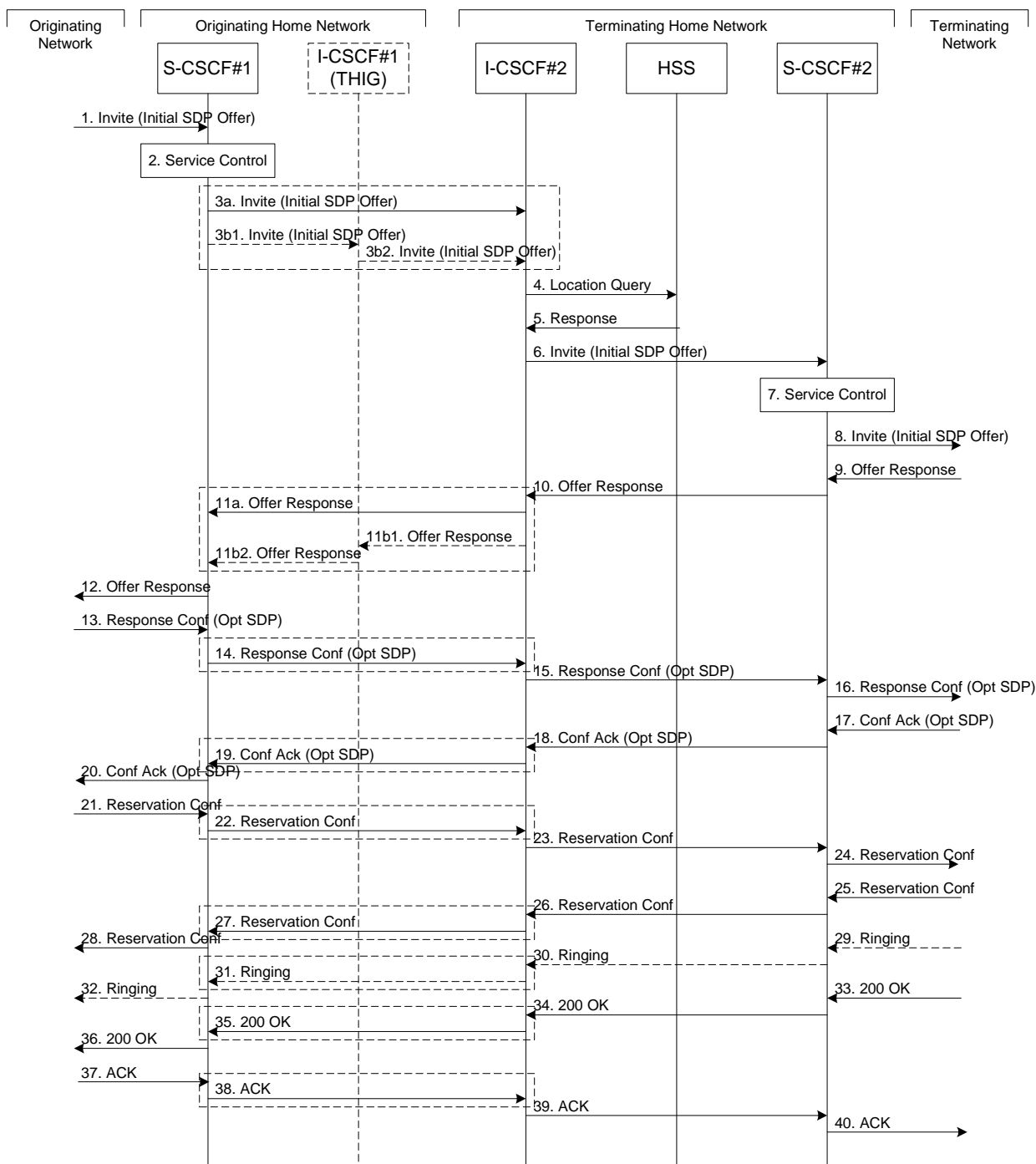


Figure 5.10: Serving to serving procedure - different operators

Procedure S-S#1 is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow. This message should contain the initial media description offer in the SDP.
2. S-CSCF#1 performs invokes whatever service control logic is appropriate for this session attempt.
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the subscriber belongs. For S-S#1, this flow is an inter-operator message to the I-CSCF entry point for the terminating user. If the originating operator desires to keep their internal configuration hidden, then S-CSCF#1

forwards the INVITE request through I-CSCF(THIG)#1 (choice (b)); otherwise S-CSCF#1 forwards the INVITE request directly to I-CSCF#2, the well-known entry point into the terminating user's network (choice (a)).

(3a) If the originating network operator does not desire to keep their network configuration hidden, the INVITE request is sent directly to I-CSCF#2.

(3b) If the originating network operator desires to keep their network configuration hidden, the INVITE request is forwarded through an I-CSCF(THIG) in the originating operator's network, I-CSCF(THIG)#1.

(3b1) The INVITE request is sent from S-CSCF#1 to I-CSCF(THIG)#1

(3b2) I-CSCF(THIG)#1 performs the configuration-hiding modifications to the request and forwards it to I-CSCF#2

4. I-CSCF#2 (at the border of the terminating user's network) may query the HSS for current location information. If I-CSCF#2 cannot determine, based on analysis of the destination number, that the HSS query will fail, then it will send "Cx-location-query" to the HSS to obtain the location information for the destination. If I-CSCF#2 can determine, based on analysis of the destination number, that the HSS query will fail, it will not send the "Cx-location-query" message, allocate a MGCF for a PSTN termination, and continue with step #6.
5. HSS responds with the address of the current Serving-CSCF for the terminating user.
6. I-CSCF#2 forwards the INVITE request to the S-CSCF (S-CSCF#2) that will handle the session termination.
7. S-CSCF#2 ~~invokes~~~~performs~~ whatever service ~~control~~-logic is appropriate for this session setup attempt
8. The sequence continues with the message flows determined by the termination procedure.
9. The media stream capabilities of the destination are returned along the signalling path, as per the termination procedure.
10. S-CSCF#2 forwards the SDP to I-CSCF#2
11. I-CSCF#2 forwards the SDP to S-CSCF#1. Based on the choice made in step #3 above, this may be sent directly to S-CSCF#1 (11a) or may be sent through I-CSCF(THIG)#1 (11b1 and 11b2)
12. S-CSCF#1 forwards the SDP to the originator, as per the originating procedure.
13. The originator decides on the offered set of media streams, confirms receipt of the Offer Response with a Response Confirmation, and forwards this information to S-CSCF#1 by the origination procedures. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response received in Step 12 or a subset.
- 14-15. S-CSCF#1 forwards the offered SDP to S-CSCF#2. This may possibly be routed through I-CSCF#1 and/or I-CSCF#2 depending on operator configuration of the I-CSCFs. Step 14 may be similar to Step 3 depending on whether or not configuration hiding is used.
16. S-CSCF#2 forwards the offered SDP to the terminating endpoint, as per the termination procedure
- 17-20 The terminating end point acknowledges the offer with answered SDP and passes through the session path to the originating end point. Step 19 may be similar to Step 11 depending on whether or not configuration hiding is being used.
- 21-24. Originating end point acknowledges successful resource reservation and the message is forwarded to the terminating end point. This may possibly be routed through I-CSCF#1 and/or I-CSCF#2 depending on operator configuration of the I-CSCFs. Step 22 may be similar to Step 3 depending on whether or not configuration hiding is used.
- 25-28. Terminating end point acknowledges the response and this message is sent to the originating end point through the established session path. Step 27 may be similar to Step 11 depending on whether or not configuration hiding is being used.
- 29-32. Terminating end point then generates ringing and this message is sent to the originating end point through the established session path. Step 31 may be similar to Step 11 depending on whether or not configuration hiding is being used.
- 33-36. Terminating end point then sends 200 OK via the established session path to the originating end point. Step 35 may be similar to Step 11 depending on whether or not configuration hiding is being used.

37-40. Originating end point acknowledges the establishment of the session and sends to the terminating end point via the established session path. This may possibly be routed through I-CSCF#1 and/or I-CSCF#2 depending on operator configuration of the I-CSCFs. Step 38 may be similar to Step 3 depending on whether or not configuration hiding is used.

5.5.2 (S-S#2) Single network operator performing origination and termination

The Serving-CSCF handling session origination 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 user either located in the home service area, or roaming. The I-CSCF therefore forwards the request to the S-CSCF serving the destination user.

Origination sequences that share this common S-S procedure are:

MO#1 Mobile origination, roaming,. The “Originating Network” of S-S#2 is therefore a visited network.

MO#2 Mobile origination, home. The “Originating Network” of S-S#2 is therefore the home network.

PSTN-OPSTN origination. The “Originating Network” of S-S#2 is the home network. The element labelled S-CSCF#1 is the MGCF of the PSTN-O procedure.

Termination sequences that share this common S-S procedure are:

MT#1 Mobile termination, roaming, . The “Terminating Network” of S-S#2 is a visited network.

MT#2 Mobile termination, home. The “Terminating Network” of S-S#2 is the home network.

MT#3 Mobile termination, CS Domain roaming. The “Terminating Network” of S-S#2 is a CS domain network.

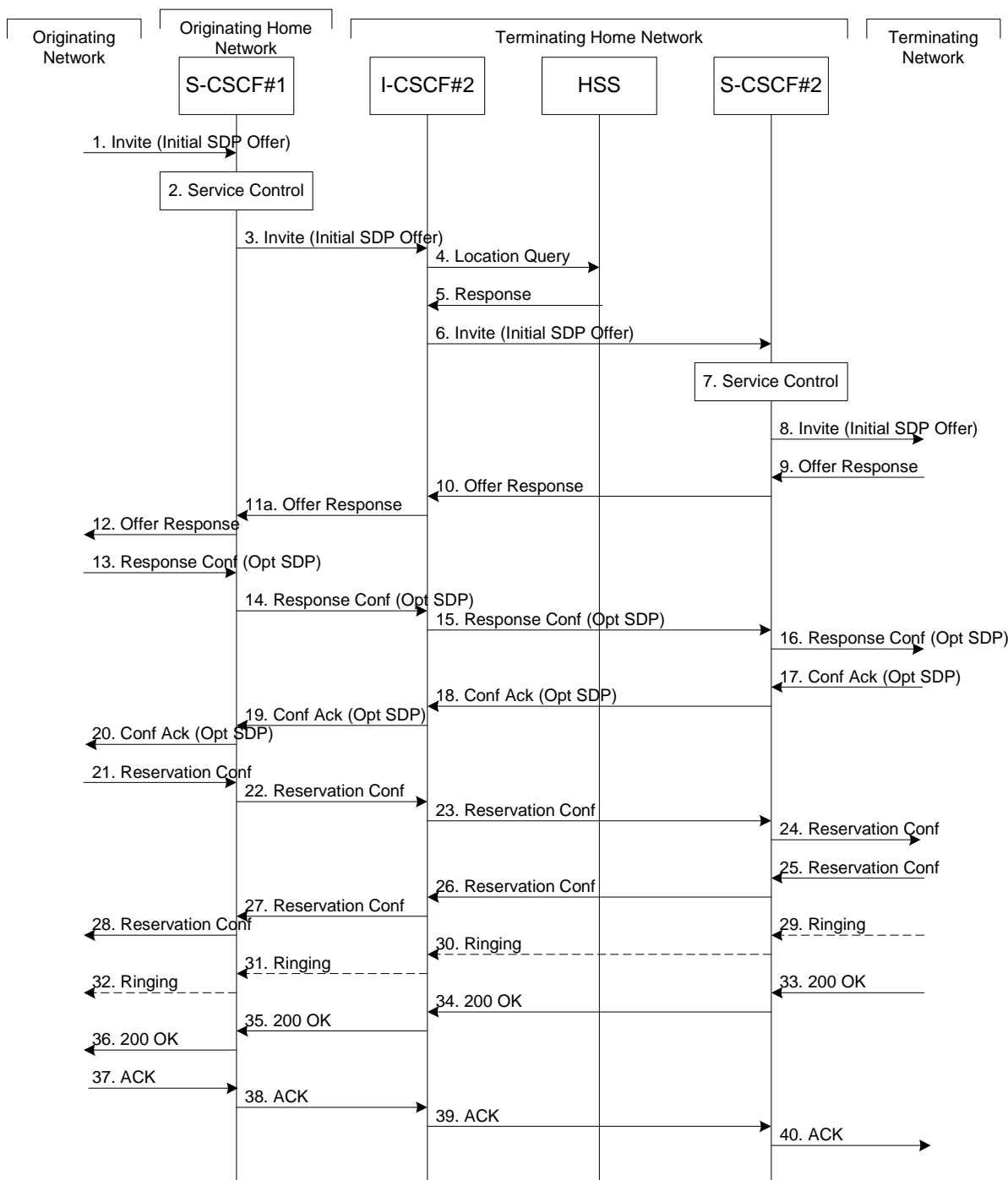


Figure 5.11: Serving to serving procedure - same operator

Procedure S-S#2 is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow. This message should contain the initial media description offer in the SDP.
2. S-CSCF#1 ~~invokes~~~~performs~~ whatever service ~~control~~ logic is appropriate for this session setup attempt
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the subscriber belongs. Since it is local, the request is passed to a local I-CSCF.
4. I-CSCF may query the HSS for current location information. If I-CSCF cannot determine, based on analysis of the destination number, that the HSS query will fail, then it will send “Cx-location-query” to the HSS to obtain

the location information for the destination. If I-CSCF can determine, based on analysis of the destination number, that the HSS query will fail, it will not send the “Cx-location-query” message, allocate a MGCF for a PSTN termination, and continue with step #6.

5. HSS responds with the address of the current Serving-CSCF for the terminating user.
6. I-CSCF forwards the INVITE request to the S-CSCF (S-CSCF#2) that will handle the session termination.
7. S-CSCF#2 ~~invokes~~~~performs~~ whatever service ~~control~~-logic is appropriate for this session setup attempt
8. The sequence continues with the message flows determined by the termination procedure.
- 9-12. The terminating end point responds with an answer to the offered SDP and this message is passed along the established session path.
- 13-16. The originator decides on the offered set of media streams, confirms receipt of the Offer Response with a Response Confirmation, and forwards this information to S-CSCF#1 by the origination procedures. This message is forwarded via the established session path to the terminating end point. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response received in Step 12 or a subset.
- 17-20. Terminating end point responds to the offered SDP and the response is forwarded to the originating end point via the established session path.
- 21-24. Originating end point sends successful resource reservation information towards the terminating end point via the established session path.
- 25-28. Terminating end point sends successful resource reservation acknowledgement towards the originating end point via the established session path
- 29-32. Terminating end point sends ringing message toward the originating end point via the established session path.
- 33-36. The SIP final response, 200-OK, is sent by the terminating endpoint over the signalling path. This is typically generated when the user has accepted the incoming session setup attempt. The message is sent to S-CSCF#2 per the termination procedure.
- 37-40. The originating endpoint sends the final acknowledgement to S-CSCF#1 by the origination procedures and it is then sent over the signalling path to the terminating end point.

5.5.3 (S-S#3) Session origination with PSTN termination in the same network as the S-CSCF.

The Serving-CSCF handling session origination performs an analysis of the destination address, and determines, with support of applications or other databases, that the session is destined to the PSTN. The request is therefore forwarded to a local BGCF. The BGCF determines that the MGCF should be in the same network, and selects a MGCF in that network. The request is then forwarded to the MGCF.

Origination sequences that share this common S-S procedure are:

- MO#1 Mobile origination, roaming. 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.

Termination sequences that share this common S-S procedure are:

PSTN-T PSTN termination. This occurs when the MGCF is selected to be in the same network as the S-CSCF.

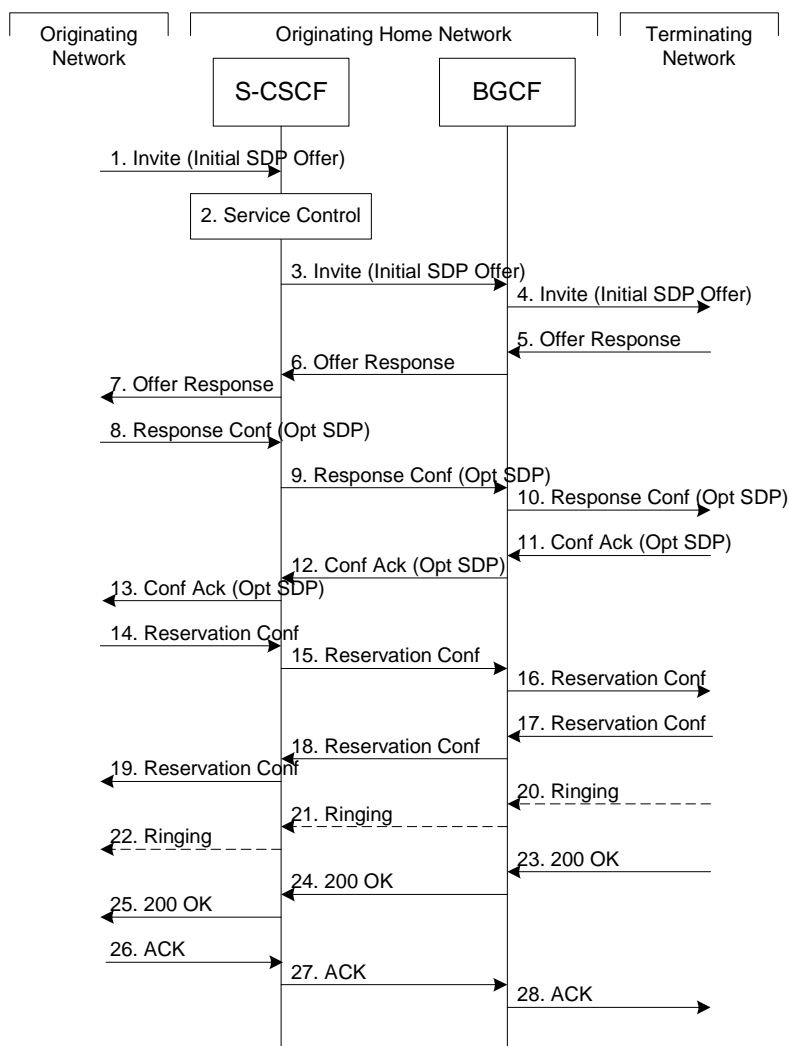


Figure 5.12: Serving to PSTN procedure - same operator

Procedure S-S#3 is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow. This message should contain the initial media description offer in the SDP.
2. S-CSCF#1 ~~invokes~~~~performs~~ whatever service ~~control~~ logic is appropriate for this session setup attempt
3. S-CSCF#1 performs an analysis of the destination address. From the analysis of the destination address, S-CSCF#1 determines that this is for the PSTN, and passes the request to the BGCF.
4. The BGCF determines that the MGCF shall be in the same network, and hence proceeds to select an appropriate MGCF. The SIP INVITE request is forwarded to the MGCF. The PSTN terminating information flows are then followed.
- 5-7. The media stream capabilities of the destination are returned along the signalling path, as per the PSTN termination procedure.
8. The originator decides the offered set of media streams, confirms receipt of the Offer Response with a Response Confirmation, and forwards this information to S-CSCF#1 by the origination procedures. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response received in Step 7 or a subset.
- 9-10. S-CSCF#1 forwards the offered SDP to the terminating endpoint as per the PSTN terminating procedures via the established session path.

- 11-13. The terminating end point answers to the offered SDP and the message is passed through the established session path to the originating end point.
- 14-16. When the originating endpoint has completed the resource reservation procedures, it sends the successful resource reservation message to S-CSCF#1 by the origination procedures and it is passed to the terminating end point through the session path.
- 17-19. . The terminating endpoint acknowledges the result and the message is passed onto the originating end point via the session path.
- 20-22. Terminating end point generates ringing message and forwards it to BGCF which in tern forwards the message to SCSCF#1. S-CSCF#1 forwards the ringing message to the originator, per the origination procedure
23. When the destination party answers, the termination procedure results in a SIP 200-OK final response to the BGCF
- 24-25. The BGCF forwards this information to the S-CSCF#1 and then it is forwarded to the originating end point.
26. The 200-OK is returned to the originating endpoint, by the origination procedure from terminating end point.
27. The originating endpoint sends the final acknowledgement to S-CSCF#1 by the origination procedures.
28. S-CSCF#1 forwards this message to the terminating endpoint as per the PSTN terminating procedures.

5.5.4 (S-S#4) Session origination with PSTN termination in a different network from the S-CSCF.

The Serving-CSCF handling session origination performs an analysis of the destination address, and determines, with support of applications or other databases, that the session is destined to the PSTN. The request is therefore forwarded to a local BGCF. The BGCF determines that the PSTN interworking should occur in another network, and forwards this to a BGCF in the interworking network. The BGCF then selects a MGCF in that network. The request is then forwarded to the MGCF.

Origination sequences that share this common S-S procedure are:

- MO#1 Mobile origination, roaming. 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.

Termination sequences that share this common S-S procedure are:

PSTN-T PSTN termination. This occurs when the MGCF is selected to be in the same network as the S-CSCF.

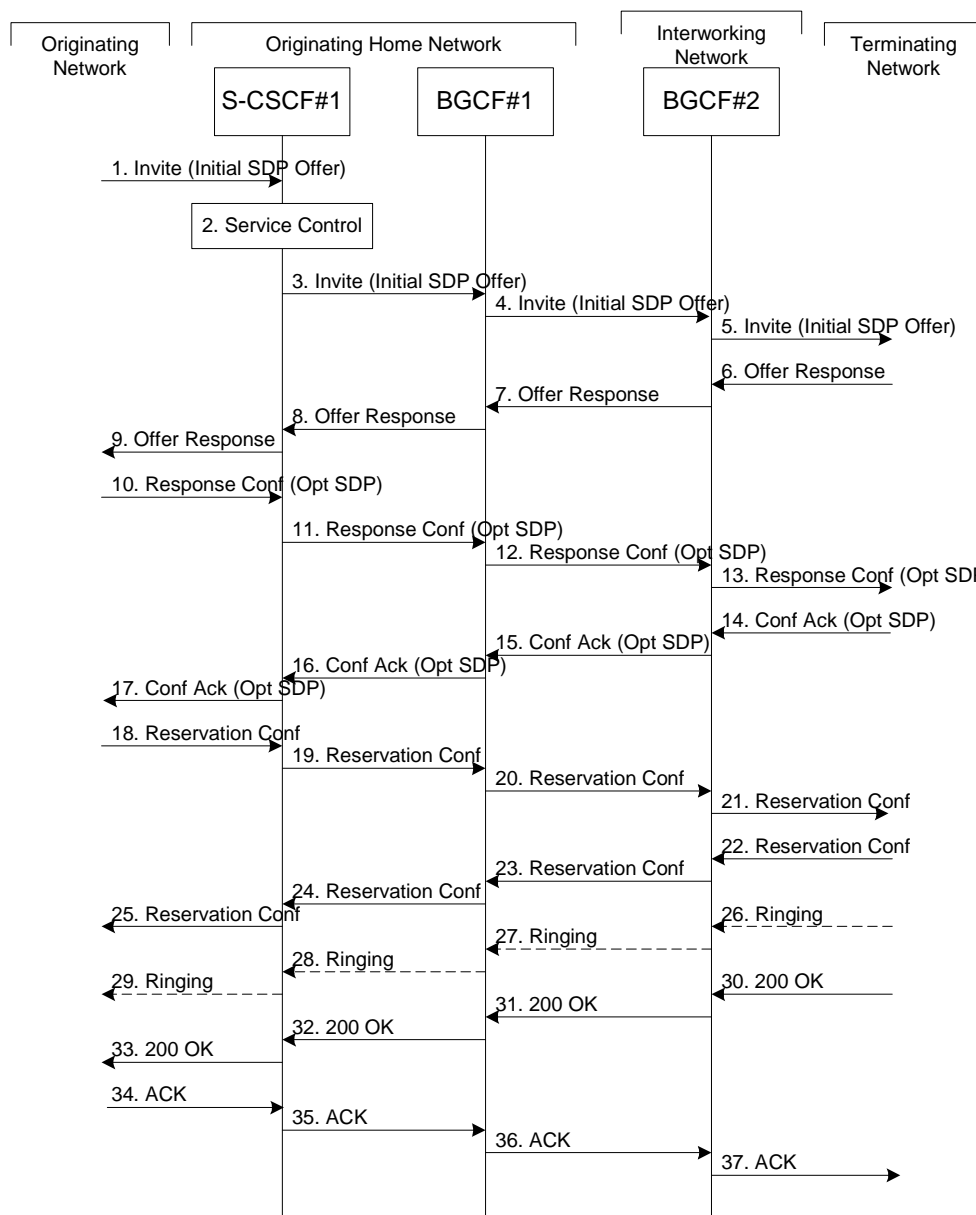


Figure 5.13: Serving to PSTN procedure - different operator

Procedure S-S#4 is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow. This message should contain the initial media description offer in the SDP.
2. S-CSCF#1 invokes performs whatever service control logic is appropriate for this session setup attempt
3. S-CSCF#1 performs an analysis of the destination address. From the analysis of the destination address, S-CSCF#1 determines that this is for the PSTN, and passes the request to the BGCF#1.
4. The BGCF#1 determines that the PSTN interworking should occur in interworking network, and forwards the request on to BGCF#2. For the case that network hiding is required, the request is forwarded through an I-CSCF (THIG).
5. BGCF#2 determines that the MGCF shall be in the same network, and hence proceeds to select an appropriate MGCF. The SIP INVITE request is forwarded to the MGCF. The PSTN terminating information flows are then followed.

- 6-8. The media stream capabilities of the destination are returned along the signalling path, as per the PSTN termination procedure.
9. S-CSCF#1 forwards the SDP to the originator, as per the originating procedure.
10. The originator decides the offered set of media streams, confirms receipt of the Offer Response with a Response Confirmation, and forwards this information to S-CSCF#1 by the origination procedures. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response received in Step 12 or a subset.
- 11-13. S-CSCF#1 forwards the offered SDP to the terminating endpoint, as per the PSTN terminating procedure.
- 14-17. Terminating end point responds to the offer via the established session path towards the originating end point.
- 18-21. When the originating endpoint has completed the resource reservation procedures, it sends the successful resource reservation message to S-CSCF#1 by the origination procedures and it is forwarded to the terminating end point via established session path.
- 22-25. The terminating end point responds to the message towards the originating end point.
- 26-29. Terminating end point generates ringing message towards the originating end point.
- 30-33. Terminating end point sends 200 OK when the originating end answers the session.
- 34-37. Originating end point acknowledges the establishment of the session.

5.6 Origination procedures

This section presents the detailed application level flows to define the Procedures for session originations.

The session origination procedures specify the signalling path between the UE initiating a session setup attempt and the Serving-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 GGSN, performs resource authorisation, and may have additional functions in handling of emergency sessions. The P-CSCF is determined by the CSCF discovery process, described in Section 5.1.1 (Local CSCF Discovery).

As a result of the registration procedure, the P-CSCF determines the next hop toward the Serving-CSCF. This next hop is to the S-CSCF in the home network (possibly through an I-CSCF (THIG) to hide the network configuration) (MO#1). 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. The MGCF uses H.248 [19] to control a Media Gateway, and communicates with the SS7 network. The MGCF initiates the SIP request, and subsequent nodes consider the signalling as if it came from a S-CSCF.

5.6.1 (MO#1) Mobile origination, roaming

This origination procedure applies to roaming users.

The UE is located in a visited network, and determines the P-CSCF via the CSCF discovery procedure described in section 5.1.1. The home network advertises either the S-CSCF or an I-CSCF as the entry point from the visited network.

When registration is complete, P-CSCF knows the name/address of the next hop in the signalling path toward the serving-CSCF, either I-CSCF (THIG) (if the home network wanted to hide their internal configuration) or S-CSCF (if there was no desire to hide the network configuration). I-CSCF, if it exists in the signalling path, knows the name/address of S-CSCF.

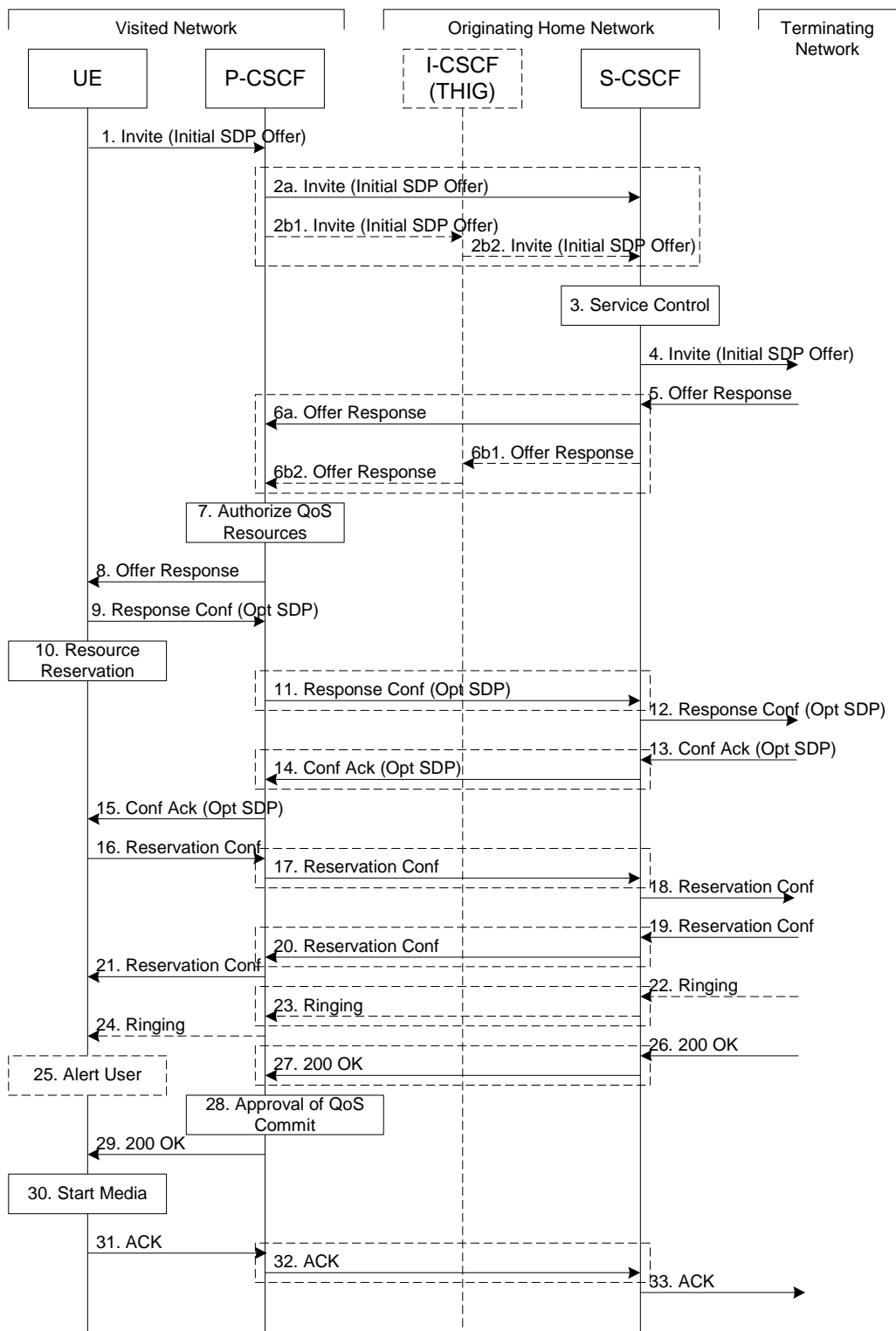


Figure 5.14: Mobile origination procedure - roaming

Procedure MO#1 is as follows:

1. UE sends the SIP 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 multi-media session.
2. P-CSCF remembers (from the registration procedure) the next hop CSCF for this UE.

This next hop is either the S-CSCF that is serving the visiting UE (choice (a)), or an I-CSCF(THIG) within the home network that is performing the configuration hiding function for the home network operator (choice (b)).

(2a) If the home network operator does not desire to keep their network configuration hidden, the name/address of the S-CSCF was provided during registration, and the INVITE request is forwarded directly to the S-CSCF.

(2b) If the home network operator desires to keep their network configuration hidden, the name/address of an I-CSCF(THIG) in the home network was provided during registration, and the INVITE request is forwarded through this I-CSCF(THIG) to the S-CSCF.

(2b1) P-CSCF forwards the INVITE request to I-CSCF(THIG)

(2b2) I-CSCF(THIG) forwards the INVITE request to S-CSCF

3. S-CSCF validates the service profile, and ~~invokes~~~~performs~~ any origination service ~~control~~-~~logic~~ required for this user. This includes authorisation of the requested SDP based on the user's subscription for multi-media services.
4. S-CSCF forwards the request, as specified by the S-S procedures.
5. The media stream capabilities of the destination are returned along the signalling path, per the S-S procedures.
6. S-CSCF forwards the Offer Response message to P-CSCF. Based on the choice made in step #2 above, this may be sent directly to P-CSCF (6a) or may be sent through I-CSCF(THIG) (6b1 and 6b2).
7. P-CSCF authorises the resources necessary for this session. The Authorization-Token is generated by the PCF.
8. The Authorization-Token is included in the Offer Response message. P-CSCF forwards the message to the originating endpoint
9. UE decides the offered set of media streams for this session, confirms receipt of the Offer Response and sends the Response Confirmation to the P-CSCF. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response received in Step 8 or a subset. If new media are defined by this SDP, a new authorization (as in Step 7) will be done by the P-CSCF(PCF) following Step 14. The originating UE is free to continue to offer new media on this operation or on subsequent exchanges using the Update method. Each offer/answer exchange will cause the P-CSCF(PCF) to repeat the Authorization step (Step 7) again.
10. After determining the needed resources in step 8, UE initiates the reservation procedures for the resources needed for this session.
11. P-CSCF forwards the Response Confirmation to S-CSCF. This may possibly be routed through the I-CSCF depending on operator configuration of the I-CSCF. Step 11 may be similar to Step 2 depending on whether or not configuration hiding is used.
12. S-CSCF forwards this message to the terminating endpoint, as per the S-S procedure.
- 13-15. The terminating end point responds to the originating end with an acknowledgement. If Optional SDP is contained in the Response Confirmation, the Confirmation Acknowledge will also contain an SDP response. If the SDP has changed, the P-CSCF validates that the resources are allowed to be used. Step 14 may be similar to Step 6 depending on whether or not configuration hiding is used.
- 16-18. When the resource reservation is completed, UE sends the successful Resource Reservation message to the terminating endpoint, via the signalling path established by the INVITE message. The message is sent first to P-CSCF. Step 17 may be similar to Step 2 depending on whether or not configuration hiding is used.
- 19-21. The terminating end point responds to the originating end when successful resource reservation has occurred. If the SDP has changed, the P-CSCF authorizes that the resources are allowed to be used. Step 20 may be similar to Step 6 depending on whether or not configuration hiding is used.
- 22-24. Terminating end point may generate ringing and it is then forwarded via the session path to the UE.
25. UE indicates to the originating user that the destination is ringing
26. When the destination party answers, the terminating endpoint sends a SIP 200-OK final response, as specified by the termination procedures and the S-S procedures, to S-CSCF.
27. S-CSCF ~~invokes~~~~performs~~ whatever service ~~control~~-~~logic~~ is appropriate for the completed session setup.

27. S-CSCF sends a SIP 200-OK final response along the signalling path back to P-CSCF. Step 23 may be similar to Step 6 depending on whether or not configuration hiding is used.
28. P-CSCF indicates the resources reserved for this session should now be approved for use.
29. P-CSCF sends a SIP 200-OK final response to the session originator
30. UE starts the media flow(s) for this session
- 31-33. UE responds to the 200 OK with a SIP ACK message sent along the signalling path. Step 32 may be similar to Step 2 depending on whether or not configuration hiding is used.

5.6.2 (MO#2) Mobile origination, home

This origination procedure applies to users located in their home service area.

The UE is located in the home network, and determines the P-CSCF via the CSCF discovery procedure described in section 5.1.1. During registration, the home network allocates an S-CSCF in the home network.

When registration is complete, P-CSCF knows the name/address of S-CSCF.

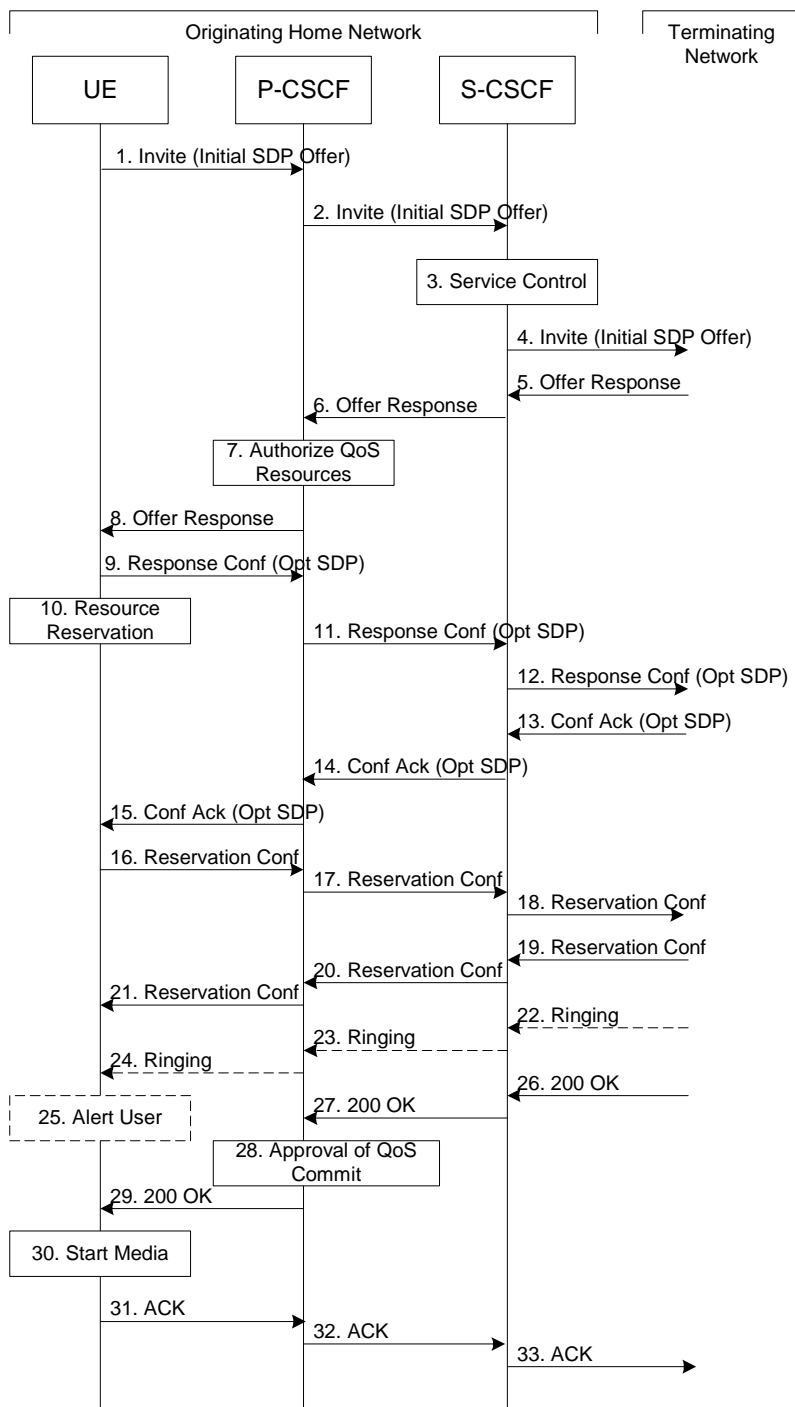


Figure 5.15: Mobile origination procedure - home

Procedure MO#2 is as follows:

1. UE#1 sends the SIP 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 multi-media session.
2. P-CSCF remembers (from the registration procedure) the next hop CSCF for this UE. In this case it forwards the INVITE to the S-CSCF in the home network.
3. S-CSCF validates the service profile, and ~~invokes~~ performs any origination service ~~control~~ logic required for this user. This includes authorisation of the requested SDP based on the user's subscription for multi-media services.

4. S-CSCF forwards the request, as specified by the S-S procedures.
5. The media stream capabilities of the destination are returned along the signalling path, per the S-S procedures.
6. S-CSCF forwards the Offer Response message to P-CSCF
7. P-CSCF authorises the resources necessary for this session. The Authorization-Token is generated by the PCF.
8. The Authorization-Token is included in the Offer Response message. P-CSCF forwards the message to the originating endpoint.
9. UE decides the offered set of media streams for this session, confirms receipt of the Offer Response and sends the Response Confirmation to P-CSCF. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response received in Step 8 or a subset. If new media are defined by this SDP, a new authorization (as in Step 7) will be done by the P-CSCF(PCF) following Step 14. The originating UE is free to continue to offer new media on this operation or on subsequent exchanges using the Update method. Each offer/answer exchange will cause the P-CSCF(PCF) to repeat the Authorization step (Step 7) again.
10. UE initiates resource reservation for the offered media.
11. P-CSCF forwards this message to S-CSCF
12. S-CSCF forwards this message to the terminating endpoint, as per the S-S procedure.
- 13-14. The terminating end point responds to the originating end with an acknowledgement. If Optional SDP is contained in the Response Confirmation, the Confirmation Acknowledge will also contain an SDP response. If the SDP has changed, the PCSCF authorises the media.
15. PCSCF forwards the answered media towards the UE.
- 16-18. When the resource reservation is completed, UE sends the successful Resource Reservation message to the terminating endpoint, via the signalling path established by the INVITE message. The message is sent first to P-CSCF.
- 19-21. The terminating end point responds to the originating end when successful resource reservation has occurred. If the SDP has changed, the P-CSCF again authorizes that the resources are allowed to be used.
- 22-24. The destination UE may optionally perform alerting. If so, it signals this to the originating party by a provisional response indicating Ringing. This message is sent to S-CSCF per the S-S procedure. It is sent from there toward the originating end along the signalling path.
25. UE indicates to the originating user that the destination is ringing.
- 26-27. When the destination party answers, the terminating endpoint sends a SIP 200-OK final response along the signalling path to the originating end, as specified by the termination procedures and the S-S procedures, to S-CSCF.
28. P-CSCF indicates the resources reserved for this session should now be approved for use.
29. P-CSCF passes the 200-OK response back to UE
30. UE starts the media flow(s) for this session.
- 31-33. UE responds to the 200 OK with an ACK message which is sent to P-CSCF and passed along the signalling path to the terminating end.

5.6.3 (PSTN-O) PSTN origination

The MGCF in the IM CN subsystem is a SIP endpoint that initiates requests on behalf of the PSTN 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 GSTN or at the terminating S-CSCF. This origination procedure can be used for any of the S-S procedures.

Due to routing of sessions within the PSTN, this origination procedure will only occur in the home network of the destination subscriber. However due to cases of session forwarding and electronic surveillance, the destination of the session through the IM CN subsystem may actually be another PSTN termination.

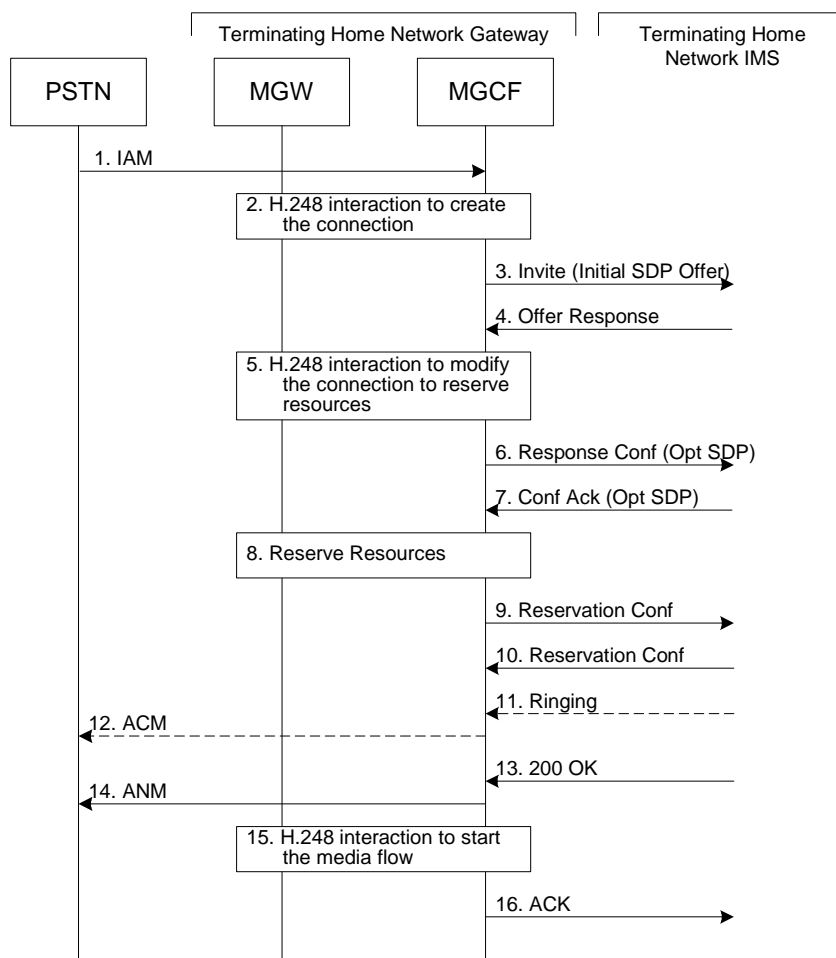


Figure 5.16: PSTN origination procedure

The PSTN Origination procedure is as follows:

1. The PSTN establishes a bearer path to the MGW, and signals to the MGCF with a IAM message, giving the trunk identity and destination information
2. The MGCF initiates a H.248 command, to seize the trunk and an IP port.
3. The MGCF initiates a SIP INVITE request, containing an initial SDP, as per the proper S-S procedure.
4. The media stream capabilities of the destination are returned along the signalling path, per the S-S procedures.
5. MGCF initiates a H.248 command to modify the connection parameters and instruct the MGW to reserve the resources needed for the session.
6. MGCF decides the offered set of media streams for this session, confirms receipt of the Offer Response and sends the Response Confirmation per the S-S procedures.
7. Terminating end point responds to the Response Confirmation. If Optional SDP is contained in the Response Confirmation, the Confirmation Acknowledge will also contain an SDP response.
8. MGW reserves the resources needed for the session
9. When the resource reservation is completed, MGCF sends the successful Resource Reservation message to the terminating endpoint, per the S-S procedures.
10. Terminating end point responds to the successful media resource reservation.
11. The destination endpoint may optionally perform alerting. If so, it signals this to the originating party by a provisional response indicating Ringing. This message is sent to MGCF per the S-S procedure.

12. If alerting is being performed, the MGCF forwards an ACM message to PSTN
13. When the destination party answers, the terminating and S-S procedures result in a SIP 200-OK final response being sent to MGCF
14. MGCF forwards an ANM message to to the PSTN
15. MGCF initiates a H.248 command to alter the connection at MGW to make it bi-directional
16. MGCF acknowledges the SIP final response with a SIP ACK message

5.7 Termination procedures

This section presents the detailed application level flows to define the Procedures for session terminations.

The session termination procedures specify the signalling path between the Serving-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 Section 5.6. Therefore there is a one-to-one correspondence between the origination procedures of section 5.6 and the termination procedures of this section.

A UE always has a proxy (P-CSCF) associated with it. This P-CSCF is located in the same network as the GGSN, and performs resource authorisation for the sessions to the UE. The P-CSCF is determined by the CSCF discovery process, described in Section 5.1.1 (Local CSCF Discovery).

As a result of the registration procedure, the P-CSCF knows the address of the UE. The assigned S-CSCF, knows the name/address of the P-CSCF (procedure MT#3, and MT#4, depending on the location of S-CSCF and P-CSCF). If the network operator owning the S-CSCF wants to keep their configuration private, the S-CSCF will have chosen an I-CSCF(THIG) who will perform the configuration hiding and pass messages to the P-CSCF (procedure MT#1).

Sessions destined to the PSTN are a special case of the Termination procedures. The MGCF uses H.248 to control a Media Gateway, and communicates with the SS7 network. The MGCF receives and processes SIP requests, and subsequent nodes consider the signalling as if it came from a S-CSCF.

5.7.1 (MT#1) Mobile termination, roaming

This termination procedure applies to roaming users.

The UE is located in a visited network, and determines the P-CSCF via the CSCF discovery procedure described in section 5.1.1. The home network advertises either the S-CSCF, or an I-CSCF(THIG), as the entry point from the visited network.

When registration is complete, S-CSCF knows the name/address of its next hop in the signalling path, either I-CSCF or P-CSCF, I-CSCF (if it exists) knows the name/address of P-CSCF, and P-CSCF knows the name/address of the UE.

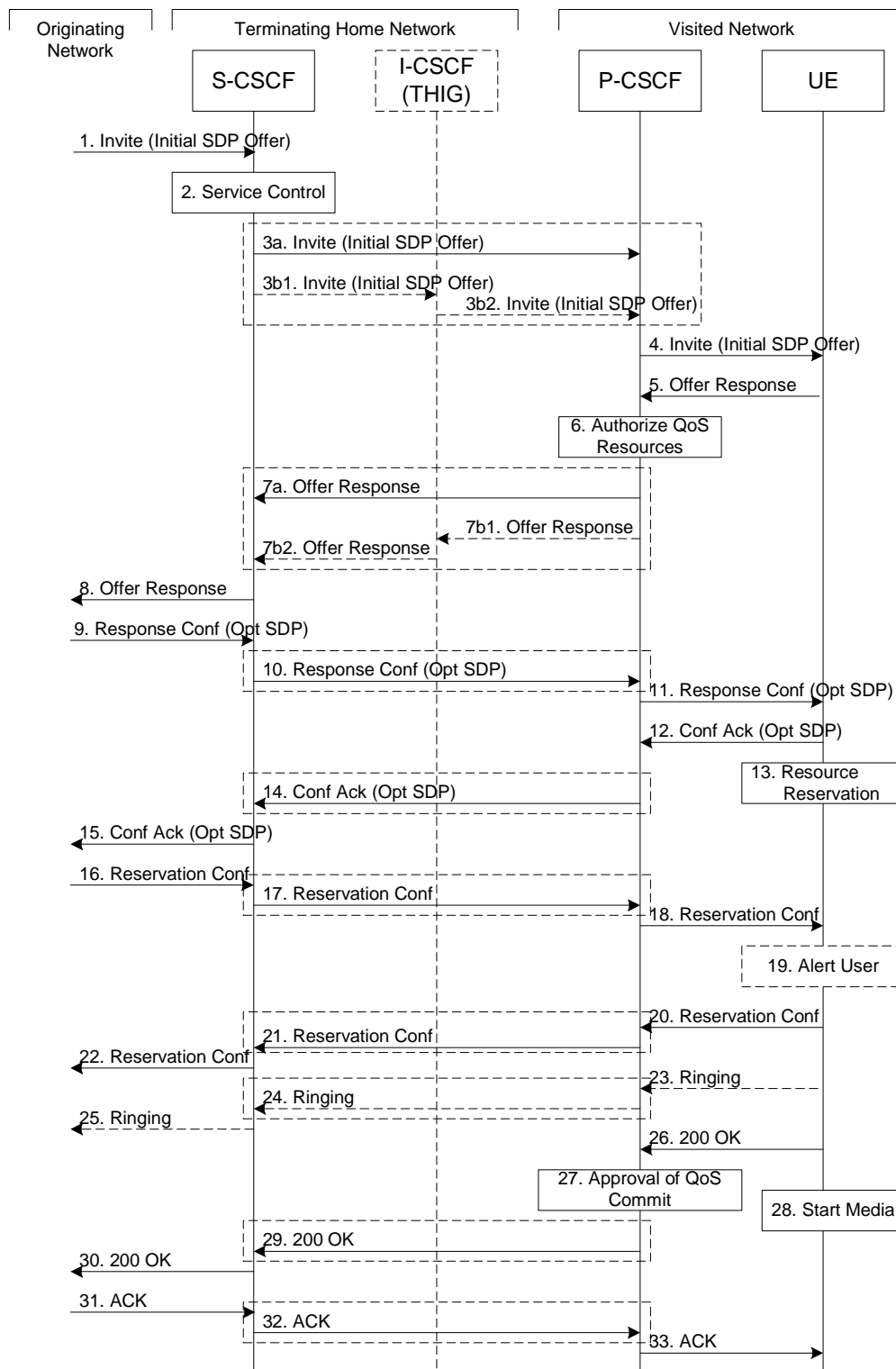


Figure 5.17:

Mobile termination procedure - roaming

Procedure MT#1 is as follows:

1. The originating party sends the SIP INVITE request, containing an initial SDP, via one of the origination procedures, and via one of the Inter-Serving procedures, to the Serving-CSCF for the terminating users.
2. S-CSCF validates the service profile, and invokes performs any termination service control logic required for this user. This includes authorisation of the requested SDP based on the user's subscription for multi-media services.

3. S-CSCF remembers (from the registration procedure) the next hop CSCF for this UE. It forwards the INVITE to the P-CSCF in the visited network, possibly through an I-CSCF.

This next hop is either the P-CSCF that is serving the visiting UE (choice (a)), or an I-CSCF(THIG) within the home network that is performing the configuration hiding function for the home network operator (choice (b)).

(3a) If the home network operator does not desire to keep their network configuration hidden, the INVITE request is forwarded directly to the P-CSCF.

(3b) If the home network operator desires to keep their network configuration hidden, the INVITE request is forwarded through an I-CSCF(THIG) to the P-CSCF.

(3b1) S-CSCF forwards the INVITE request to I-CSCF(THIG)

(3b2) I-CSCF(THIG) forwards the INVITE request to P-CSCF

4. The Authorization-Token is generated by the PCF and included in the INVITE message. P-CSCF remembers (from the registration procedure) the UE address, and forwards the INVITE to the UE.
5. UE determines the subset of the media flows proposed by the originating endpoint that it supports, and responds with an Offer Response message back to the originator. The SDP may represent one or more media for a multi-media session. This response is sent to P-CSCF.
6. P-CSCF authorises the resources necessary for this session.
7. P-CSCF forwards the Offer Response message to S-CSCF. Based on the choice made in step #3 above, this may be sent directly to S-CSCF (7a) or may be sent through I-CSCF(THIG) (7b1 and 7b2).
8. S-CSCF forwards the Offer Response message to the originator, per the S-S procedure.
9. The originating endpoint sends a Response Confirmation via the S-S procedure, to S-CSCF. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response sent in Step 8 or a subset. If new media are defined by this SDP, a new authorization (as in Step 6) will be done by the P-CSCF(PCF) following Step 12. The originating UE is free to continue to offer new media on this operation or on subsequent exchanges using the Update method. Each offer/answer exchange will cause the P-CSCF(PCF) to repeat the Authorization step (Step 6) again.
10. S-CSCF forwards the Response Confirmation to P-CSCF. This may possibly be routed through the I-CSCF depending on operator configuration of the I-CSCF. Step 10 may be similar to Step 3 depending on whether or not configuration hiding is used.
11. P-CSCF forwards the Response Confirmation to UE.
12. UE responds to the Response Confirmation with an acknowledgement. If Optional SDP is contained in the Response Confirmation, the Confirmation Ack will also contain an SDP response. If the SDP has changed, the P-CSCF authorizes that the resources are allowed to be used.
13. UE initiates the reservation procedures for the resources needed for this session.
- 14-15. P-CSCF forwards the Confirmation Ack to the S-CSCF and then to the originating end point via session path. Step 14 may be similar to Step 7 depending on whether or not configuration hiding is used.
- 16-18. When the originating endpoint has completed its resource reservation, it sends the successful Resource Reservation message to S-CSCF, via the S-S procedures. The S-CSCF forwards the message toward the terminating endpoint along the signalling path. Step 17 may be similar to Step 3 depending on whether or not configuration hiding is used.
19. UE#2 alerts the destination user of an incoming session setup attempt.
- 20-22. UE#2 responds to the successful resource reservation towards the originating end point. Step 21 may be similar to Step 7 depending on whether or not configuration hiding is used.
- 23-25. UE may alert the user and wait for an indication from the user before completing the session setup. If so, it indicates this to the originating party by a provisional response indicating Ringing. This message is sent to P-CSCF and along the signalling path to the originating end. Step 24 may be similar to Step 7 depending on whether or not configuration hiding is used.
26. When the destination party answers, the UE sends a SIP 200-OK final response to P-CSCF.

27. P-CSCF indicates the resources reserved for this session should now be committed.
28. UE starts the media flow(s) for this session
- 29-30. P-CSCF sends a SIP 200-OK final response along the signalling path back to the S-CSCF
Step 29 may be similar to Step 7 depending on whether or not configuration hiding is used.
- 31-33. The originating party responds to the 200-OK final response with a SIP ACK message that is sent to S-CSCF via the S-S procedure and forwarded to the terminating end along the signalling path. Step 32 may be similar to Step 3 depending on whether or not configuration hiding is used.

5.7.2 (MT#2) Mobile termination, home

This termination procedure applies to users located in their home service area.

The UE is located in the home network, and determines the P-CSCF via the CSCF discovery procedures described in section 5.1.1.

When registration is complete, S-CSCF knows the name/address of P-CSCF, and P-CSCF knows the name/address of the UE.

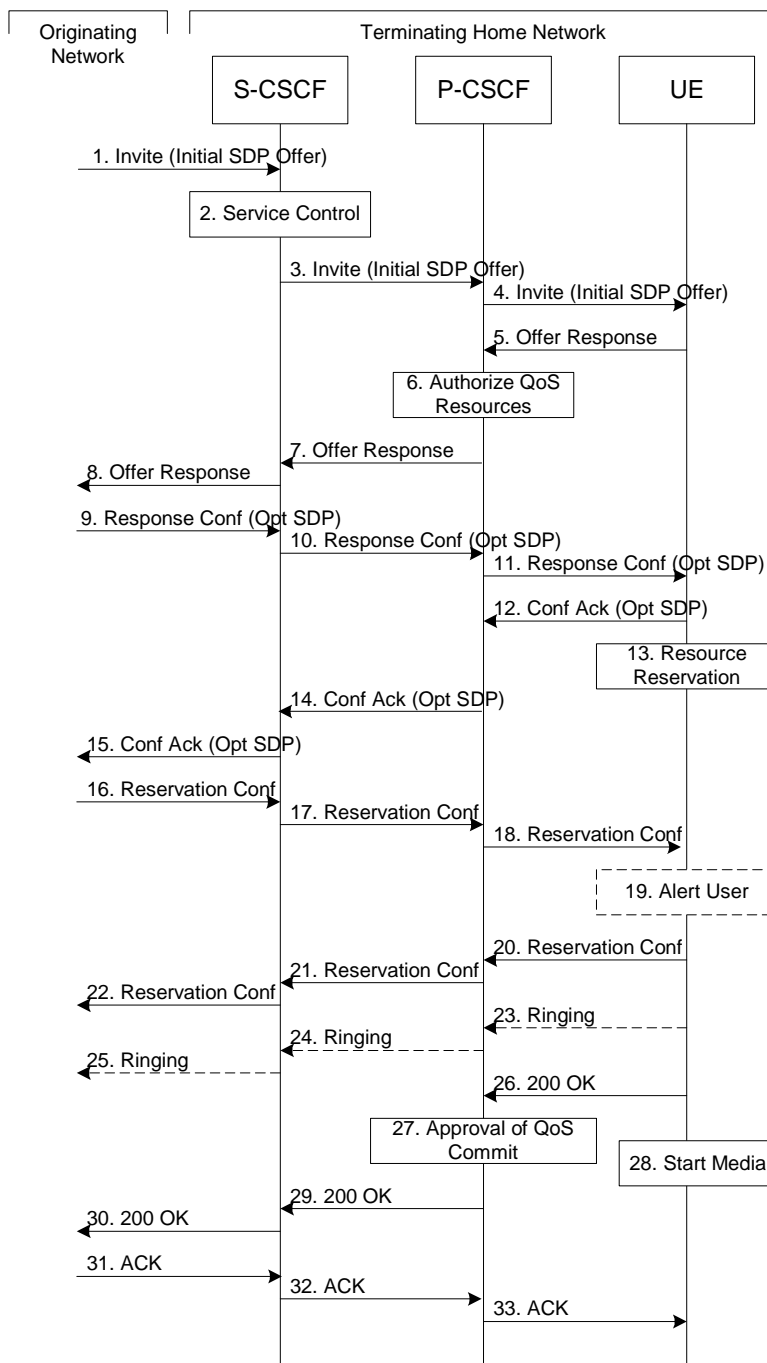


Figure 5.18: Mobile termination procedure - home

Procedure MT#2 is as follows:

1. UE#1 sends the SIP INVITE request, containing an initial SDP, via one of the origination procedures, and via one of the Serving to Serving-CSCF procedures, to the Serving-CSCF for the terminating user.
2. S-CSCF validates the service profile, and invokes performs any termination service control logic required for this user. This includes authorisation of the requested SDP based on the user's subscription for multi-media services.
3. S-CSCF remembers (from the registration procedure) the next hop CSCF for this UE. It forwards the INVITE to the P-CSCF in the home network.
4. The Authorization-Token is generated by the PCF and included in the INVITE message. P-CSCF remembers (from the registration procedure) the UE address, and forwards the INVITE to the UE.

5. UE determines the subset of the media flows proposed by the originating endpoint that it supports, and responds with an Offer Response message back to the originator. The SDP may represent one or more media for a multi-media session. This response is sent to P-CSCF.
6. P-CSCF authorises the resources necessary for this session.
7. P-CSCF forwards the Offer Response message to S-CSCF.
8. S-CSCF forwards the Offer Response message to the originator, per the S-S procedure.
9. The originating endpoint sends a Response Confirmation via the S-S procedure, to S-CSCF. The Response Confirmation may also contain SDP. This may be the same SDP as in the Offer Response sent in Step 8 or a subset. If new media are defined by this SDP, a new authorization (as in Step 6) will be done by the P-CSCF(PCF) following Step 12. The originating UE is free to continue to offer new media on this operation or on subsequent exchanges using the Update method. Each offer/answer exchange will cause the P-CSCF(PCF) to repeat the Authorization step (Step 6) again.
10. S-CSCF forwards the Response Confirmation to P-CSCF.
11. P-CSCF forwards the Response Confirmation to UE.
12. UE responds to the Response Confirmation with an acknowledgement. If Optional SDP is contained in the Response Confirmation, the Confirmation Ack will also contain an SDP response. If the SDP has changed, the P-CSCF authorizes that the resources are allowed to be used.
13. UE initiates the reservation procedures for the resources needed for this session.
- 14-15. The response is forwarded to the originating end point.
- 16-18. When the originating endpoint has completed its resource reservation, it sends the successful Resource Reservation message to S-CSCF, via the S-S procedures. The S-CSCF forwards the message toward the terminating endpoint along the signalling path.
19. UE#2 alerts the destination user of an incoming session setup attempt.
- 20-22. UE#2 responds to the successful resource reservation and the message is forwarded to the originating end.
- 23-25. UE may alert the user and wait for an indication from the user before completing the session. If so, it indicates this to the originating party by a provisional response indicating Ringing. This message is sent to P-CSCF and along the signalling path to the originating end.
26. When the destination party answers, UE sends a SIP 200-OK final response to P-CSCF.
27. P-CSCF indicates the resources reserved for this session should now be committed.
28. UE starts the media flow(s) for this session.
- 29-30. P-CSCF forwards the 200-OK to S-CSCF, following the signaling path.
- 31-33. The session originator responds to the 200-OK by sending the ACK message to S-CSCF via the S-S procedure and it is forwarded to the terminating end along the signalling path..

*****Next Change*****

5.9 Routing of mid-session signalling

During the signalling exchanges that occur to establish an IM Session, the following elements must ensure future signalling messages related to this session are routed through them:

- P-CSCF serving the originating UE, in order to generate the CDR record in the roaming case, and to force release of the resources used for the session

- S-CSCF serving the originating UE, in order to ~~invoke~~~~perform~~ any service ~~control~~~~logic~~ required at session setup completion, and to generate the CDR record at session termination
- S-CSCF serving the terminating UE, in order to ~~perform~~~~invoke~~ any service ~~control~~~~logic~~ required at session setup completion, and to generate the CDR record at session termination
- P-CSCF serving the terminating UE, in order to generate the CDR record in the roaming case, and to force release of the resources used for the session

Other CSCFs (e.g. I-CSCFs) may optionally request this as well, for example if they perform some function needed in handling mid-session changes or session clearing operations.

All signalling message from the UE related to IMS sessions shall be sent to the P-CSCF.

5.10 Session release procedures

This section provides scenarios showing SIP application session release. Note that these flows have avoided the strict use of specific SIP protocol message names. This is in an attempt to focus on the architectural aspects rather than the protocol. SIP is assumed to be the protocol used in these flows.

The session release procedures are necessary to ensure that the appropriate billing information is captured and to reduce the opportunity for theft of service by confirming that the bearers associated with a particular SIP session are deleted at the same time as the SIP control signalling and vice versa. Session release is specified for the following situations;

- Normal session termination resulting from an end user requesting termination of the session using session control signalling or deletion of the IP bearers associated with a session,
- Session termination resulting from network operator intervention,
- Loss of the session control bearer or IP bearer for the transport of the IMS signalling, and
- Loss of one or more radio connections which are used to transport the IMS signalling

As a design principle the session release procedures shall have a high degree of commonality in all situations to avoid complicating the implementation.

5.10.1 Mobile terminal initiated session release

The following flow shows a mobile terminal initiated IM CN subsystem application (SIP) session release. It is assumed that the session is active and that the bearer was established directly between the two visited networks (the visited networks could be the Home network in either or both cases).

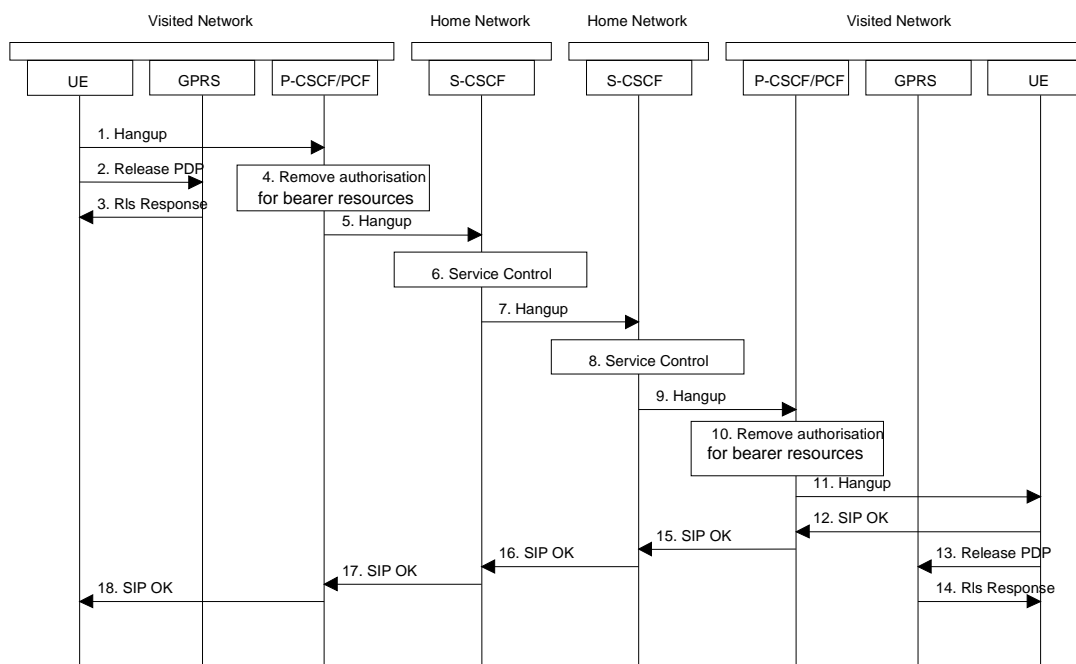


Figure 5.22: Mobile initiated session release

1. One mobile party hangs up, which generates a message (Bye message in SIP) from the UE to the P-CSCF.
2. Steps 2 and 3 may take place before or after Step 1 and in parallel with Step 4. The UE initiates the release of the bearer PDP context. The GPRS subsystem releases the PDP context. The IP network resources that had been reserved for the message receive path to the mobile for this session are now released. This is initiated from the GGSN. If RSVP was used to allocated resources, then the appropriate release messages for that protocol would invoked here.
3. The GPRS subsystem responds to the UE.
4. The P-CSCF/PCF removes the authorisation for resources that had previously been issued for this endpoint for this session. This step will also result in a release indication to the GPRS subsystem to confirm that the IP bearers associated with the session have been deleted
5. The P-CSCF sends a hangup to the S-CSCF of the releasing party.
6. The S-CSCF ~~performs~~ invokes whatever service ~~control~~ logic procedures are appropriate for this ending session.
7. The S-CSCF of the releasing party forwards the Hangup to the S-CSCF of the other party.
8. The S-CSCF ~~invokes~~ performs whatever service ~~control~~ logic procedures are appropriate for this ending session.
9. The S-CSCF of the other party forwards the Hangup on to the P-CSCF.
10. The P-CSCF/PCF removes the authorisation for resources that had previously been issued for this endpoint for this session. This step also results in a release indication to the GPRS subsystem to confirm that the IP bearers associated with the UE#2 session have been deleted.
11. The P-CSCF forwards the Hangup on to the UE.
12. The mobile responds with an acknowledgement, the SIP OK message (number 200), that is sent back to the P-CSCF.
13. Steps 13 and 14 may be done in parallel with step 12. The Mobile initiates the release of the bearer PDP context.
14. The GPRS subsystem releases the PDP context. The IP network resources that were reserved for the message receive path to the mobile for this session are now released. This is initiated from the GGSN. If RSVP was used to allocated resources, then the appropriate release messages for that protocol would invoked here.
15. The SIP OK message is sent to the S-CSCF.

16. The S-CSCF of the other party forwards the OK to the S-CSCF of the releasing.
17. The S-CSCF of the releasing party forwards the OK to the P-CSCF of the releasing.
18. The P-CSCF of the releasing party forwards the OK to the UE.

5.10.2 PSTN initiated session release

The following flow shows a PSTN terminal initiated IM CN subsystem application (SIP) session release. It is assumed that the session is active and that the bearer was established to the PSTN from the Home Network (the visited network could be the Home network in this case).

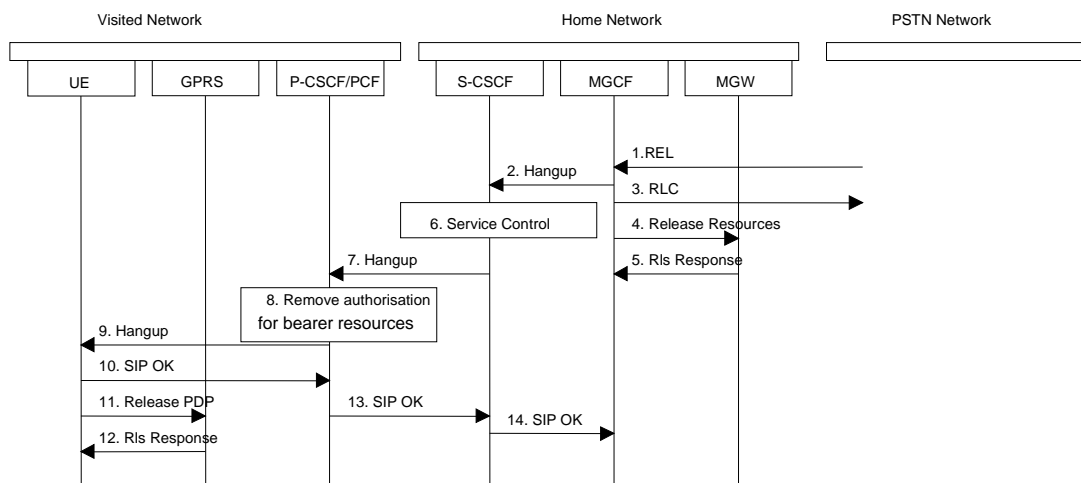


Figure 5.23: PSTN initiated session release

1. PSTN party hangs up, which generates an ISUP REL message to the MGCF.
2. The MGCF sends a Hangup (Bye message in SIP) to the S-CSCF to notify the mobile that the far end party has disconnected.
3. Step 3 may be done in parallel with Step 2. Depending on the GSTN network type Step 3 may need to wait until after step 14. The MGCF notes the reception of the REL and acknowledges it with an RLC. This is consistent with the ISUP protocol.
4. The MGCF requests the MGW to release the vocoder and ISUP trunk using the H.248/MEGACO Transaction Request (subtract). This also results in disconnecting the two parties in the H.248 context. The IP network resources that were reserved for the message receive path to the PSTN for this session are now released. This is initiated from the MGW. If RSVP was used to allocated resources, then the appropriate release messages for that protocol would be invoked here.
5. The MGW sends an acknowledgement to the MGCF upon completion of step 6.
6. The S-CSCF [invokes](#)[performs](#) whatever service [control](#)[logic](#) procedures are appropriate for this ending session.
7. The S-CSCF forwards the Hangup to the P-CSCF.
8. The P-CSCF/PCF removes the authorisation for resources that had previously been issued for this endpoint for this session. This step also results in a release indication to the GPRS subsystem to confirm that the IP bearers associated with the UE#2 session have been deleted.
9. The P-CSCF forwards the Hangup to the UE.
10. The mobile responds with an acknowledgement, the SIP OK message (number 200), which is sent back to the P-CSCF.
11. Steps 11 and 12 may be done in parallel with step 10. The Mobile initiates the release of the bearer PDP context.

12. The GPRS subsystem releases the PDP context. The IP network resources that had been reserved for the message receive path to the mobile for this session are now released. This is initiated from the GGSN. If RSVP was used to allocated resources, then the appropriate release messages for that protocol would invoked here.
13. The SIP OK message is sent to the S-CSCF.
14. The S-CSCF forwards the message to the MGCF.

5.10.3 Network initiated session release

5.10.3.0 Deletion of PDP context used to transport IMS SIP signalling

It is possible that the GPRS subsystem deletes the PDP context used to transport IMS SIP signalling (e.g. due to routing area update, overload situations).

In this case the UE shall initiate a procedure to re-establish a PDP context to transport IMS SIP signalling. If there are any IMS related PDP contexts active the re-establishment of the PDP context to transport IMS signalling shall be performed by using the Secondary PDP Context Activation Procedure as defined in TS 23.060 [23]. If re-establishment fails then the UE shall de-activate all other IMS related PDP context(s).

5.10.3.1 Network initiated session release - P-CSCF initiated

The following flows show a Network initiated IM CN subsystem application (SIP) session release. It is assumed that the session is active and that the bearer was established directly between the two visited networks (the visited networks could be the Home network in either or both cases).

A bearer is removed e.g. triggered by a mobile power down, due to a previous loss of coverage, or accidental/malicious removal, etc. In this case the 'Indication of PDP Context Release' procedure will be performed (see 3GPP TS 23.207). The flow for this case is shown in Figure 5.24.

In the event of loss of coverage, 3G TS 23.060 defines the Iu or RAB Release procedures. In case of PDP context with streaming or conversational class the maximum bitrate of the GTP tunnel between SGSN and GGSN is modified to 0 kbit/s. This is indicated to the P-CSCF / PCF by performing the 'PDP Context Modification' procedure (see 3GPP TS 23.207) as shown in Figure 5.25. For loss of coverage in case of other PDP contexts (background or interactive traffic class), the PDP context is preserved with no modifications.

Other network initiated session release scenarios are of course possible. In particular such scenarios initiated in the home network for administrative reasons might begin with an S-CSCF.

5.10.3.1.1 Network initiated session release - P-CSCF initiated - removal of PDP context

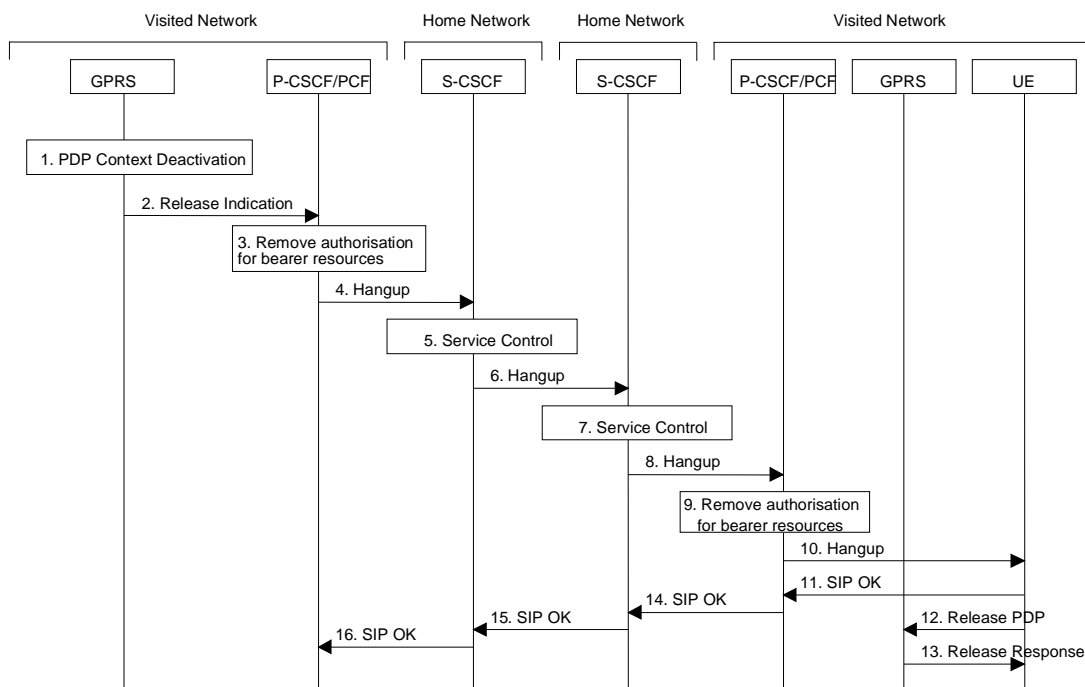


Figure 5.26: Network initiated session release - P-CSCF initiated - removal of PDP context

1. A bearer related to the session is terminated, for example, triggered by a mobile power down, etc. This is noted by the GPRS subsystem.
2. If a request state was created in the PCF at PDP context activation, the GGSN shall send a release indication to the P-CSCF/PCF for the disconnected bearer. The P-CSCF might also note the release due to a SIP Session Timeout.
3. The P-CSCF/PCF removes the authorisation for resources related to the bearer that had previously been issued for this endpoint for this session.

The following steps are only performed in case the P-CSCF/PCF has decided to terminate the session.

4. The P-CSCF generates a Hangup (Bye message in SIP) to the S-CSCF of the releasing party (e.g. if all PDP contexts related to the same IMS session are deleted). It is noted that this message should be able to carry a cause value to indicate the reason for the generation of the hangup.
5. The S-CSCF **invokes/performs** whatever service **control-logic** procedures are appropriate for this ending session.
6. The S-CSCF of the releasing party forwards the Hangup to the S-CSCF of the other party.
7. The S-CSCF **invokes/performs** whatever service **control-logic** procedures are appropriate for this ending session.
8. The S-CSCF of the other party forwards the Hangup on to the P-CSCF.
9. The P-CSCF/PCF removes the authorisation for resources that had previously been issued for this endpoint for this session. This step also results in a release indication to the GPRS subsystem to confirm that the IP bearers associated with the session have been deleted for UE#2.
10. The P-CSCF forwards the Hangup on to the UE.
11. The mobile responds with an acknowledgement, the SIP OK message (number 200), which is sent back to the P-CSCF.
12. Steps 12 and 13 may be done in parallel with step 11. The Mobile initiates the release of the bearer PDP context.

13. The GPRS subsystem releases the PDP context. The IP network resources that had been reserved for the message receive path to the mobile for this session are now released. This is initiated from the GGSN. If RSVP was used to allocated resources, then the appropriate release messages for that protocol would invoked here.
14. The SIP OK message is sent to the S-CSCF.
15. The S-CSCF of the other party forwards the OK to the S-CSCF of the releasing party.
16. The S-CSCF of the releasing party forwards the OK to the P-CSCF of the releasing party.

5.10.3.1.2 P-CSCF initiated session release after loss of radio coverage

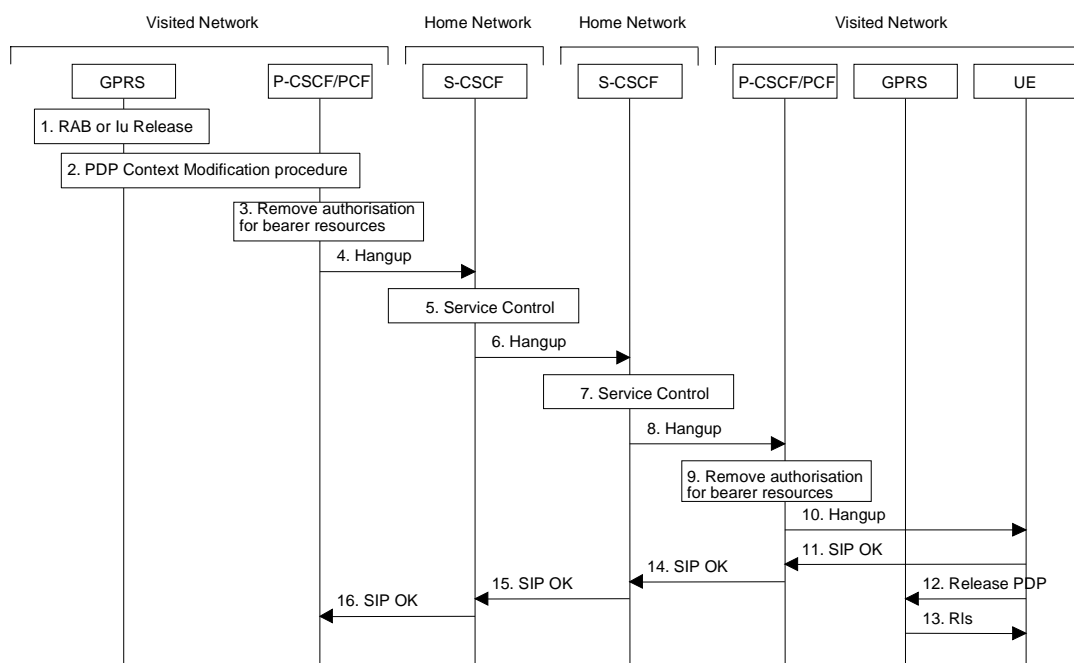


Figure 5.26a: P-CSCF initiated session release after loss of radio coverage

- 1. In the event of loss of radio coverage the Iu connection or RAB(s) are released. In case of PDP context with streaming or conversational class the maximum bitrate of the GTP tunnel between SGSN and GGSN is modified to 0 kbit/s by PDP Context Modification procedures. For PDP contexts using background or interactive traffic class, the PDP context is preserved with no modifications.
- 2. If a request state was created in the PCF at PDP context activation, the GGSN shall initiate the PDP context modification procedure by sending a modify indication to the P-CSCF/PCF for the affected bearers in order to indicate the change of the maximum bitrate to 0 kbit/s. The P-CSCF/PCF shall accept this modification.
- 3. It is optional for the P-CSCF/PCF to deactivate the affected bearer(s) and additionally IP bearers related to the affected session (e.g. a chat session could still be allowed). For these IP bearers the P-CSCF/PCF performs 'Revoke Authorization for UMTS and IP Resources' procedure (see 3GPP TS 23.207). If the P-CSCF decides to terminate the session then the P-CSCF/PCF removes the authorisation for resources that had previously been issued for this endpoint for this session.

The following steps are only performed in case the P-CSCF/PCF has decided to terminate the session.

4. The P-CSCF generates a Hangup (Bye message in SIP) to the S-CSCF of the releasing party. It is noted that this message should be able to carry a cause value to indicate the reason for the generation of the hangup.
5. The S-CSCF ~~invokes~~~~performs~~ whatever service ~~control~~~~logic~~ procedures are appropriate for this ending session.
6. The S-CSCF of the releasing party forwards the Hangup to the S-CSCF of the other party.
7. The S-CSCF ~~invokes~~~~performs~~ whatever service ~~control~~~~logic~~ procedures are appropriate for this ending session.
8. The S-CSCF of the other party forwards the Hangup on to the P-CSCF.

9. The P-CSCF/PCF removes the authorisation for resources that had previously been issued for this endpoint for this session. This step also results in a release indication to the GPRS subsystem to confirm that the IP bearers associated with the session have been deleted for UE#2.
10. The P-CSCF forwards the Hangup on to the UE.
11. The mobile responds with an acknowledgement, the SIP OK message (number 200), which is sent back to the P-CSCF.
12. Steps 12 and 13 may be done in parallel with step 11. The Mobile initiates the release of the bearer PDP context.
13. The GPRS subsystem releases the PDP context. The IP network resources that had been reserved for the message receive path to the mobile for this session are now released. This is initiated from the GGSN. If RSVP was used to allocated resources, then the appropriate release messages for that protocol would invoked here.
14. The SIP OK message is sent to the S-CSCF.
15. The S-CSCF of the other party forwards the OK to the S-CSCF of the releasing party.
16. The S-CSCF of the releasing party forwards the OK to the P-CSCF of the releasing party.

5.10.3.2 Network initiated session release - S-CSCF Initiated

The following flow shows a network-initiated IM CN subsystem application session release, where the release is initiated by the S-CSCF. This can occur in various service scenarios, e.g. administrative, or prepaid.

The procedures for clearing a session, when initiated by an S-CSCF, are as shown in the following information flow.

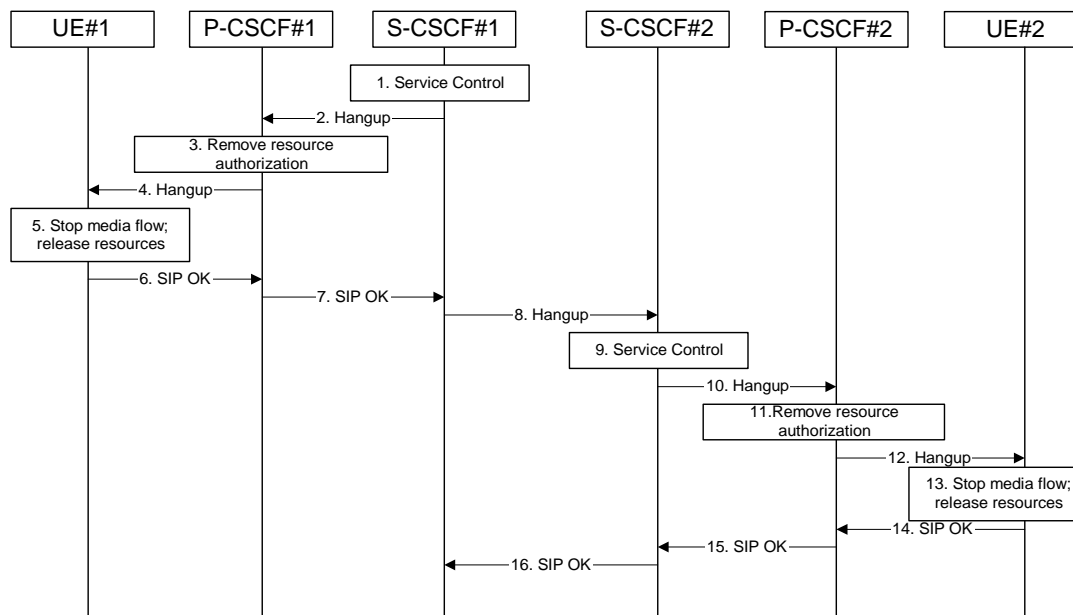


Figure 5.27: Network initiated session release - S-CSCF initiated

Information flow procedures are as follows:

1. S-CSCF#1 decides the session should be terminated, due to administrative reasons or due to service expiration.
2. S-CSCF#1 sends a Hangup message to P-CSCF#1
3. SCF#1 removes the authorisation for resources that had previously been issued for this endpoint for this session. This step also results in a release indication to the GPRS subsystem to confirm that the IP bearers associated with the session have been deleted for UE#1.
4. SCF#1 forwards the Hangup message to UE#1.
5. UE#1 stops sending the media stream to the remote endpoint, and releases the resources used for the session.

6. UE#1 responds with a SIP-OK message to its proxy, P-CSCF#1.
7. P-CSCF#1 forwards the SIP-OK message to S-CSCF#1.
8. S-CSCF#1 sends a Hangup message to S-CSCF#2. This is done at the same time as flow#2
9. S-CSCF#2 ~~invokes~~~~performs~~ whatever service ~~control~~~~logic~~ procedures are appropriate for this ending session.
10. S-CSCF#2 forwards the Hangup message to P-CSCF#2.
11. P-CSCF#2 removes the authorisation for resources that had previously been issued for this endpoint for this session. This step also results in a release indication to the GPRS subsystem to confirm that the IP bearers associated with the session have been deleted for UE#2.
12. P-CSCF#2 forwards the Hangup message to UE#2.
13. UE#2 stops sending the media stream to the remote endpoint, and releases the resources used for the session.
14. UE#2 acknowledges receipt of the Hangup message with a SIP-OK final response, send to P-CSCF#2.
15. P-CSCF#2 forwards the SIP-OK final response to S-CSCF#2.
16. S-CSCF#2 forwards the SIP-OK final response to S-CSCF#1.

*****Next Change*****

5.11.3.4 Sample MM session flow - addition of another media

For this end-to-end session flow, we assume the originator is a UE located within the service area of the network operator to whom the UE is subscribed. The UE has already established an IM CN session and is generating an invite to add another media (e.g., video to a voice call) to the already established session. Note that the invite to add media to an existing session could be originated by either end. The invite, and subsequent flows, are assumed to follow the path determined when the initial session was established. Any I-CSCFs that were included in the initial session would be included in this session.

The originating party addresses a destination that is a subscriber of the same network operator.

The destination party is a UE located within the service area of the network operator to which it is subscribed.

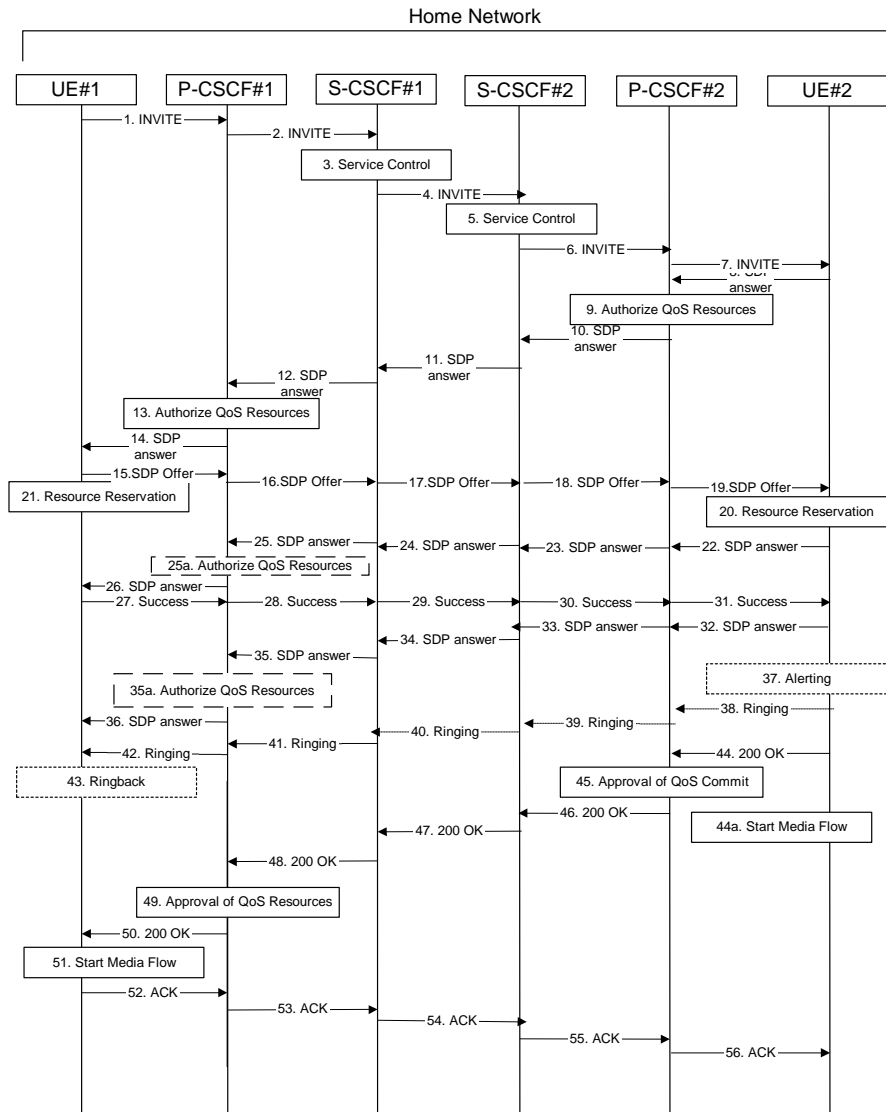


Figure 5.33: Multimedia session flow - addition of another media

Step-by-step processing of this end-to-end session flow is as follows:

1. UE#1 sends a SIP INVITE request, containing new SDP for the new media and including the original SDP, to P-CSCF#1, which was obtained from the CSCF discovery procedures.
2. P-CSCF#1 forwards the INVITE to the next hop name/address, as determined from the registration procedures. In this case the next hop is S-CSCF#1 within the same operator’s network.
3. S-CSCF#1 validates the service profile, and invokes/performs whatever service control logic is appropriate for this session attempt.
4. S-CSCF#1 recognises that this invite applies to an existing session. It therefore forwards the INVITE along the existing path to S-CSCF#2.
5. S-CSCF#2 validates the service profile, and invokes/performs whatever service control logic is appropriate for this session attempt.
6. S-CSCF#2 remembers (from the registration procedure) the next hop CSCF for this UE. It forwards the INVITE to P-CSCF#2 in the home network.
7. P-CSCF#2 remembers (from the registration procedure) the address of UE#2 and forwards the INVITE to UE#2.

8. UE#2 returns the media stream capabilities of the destination to the session originator, along the signalling path established by the INVITE message.
9. P-CSCF#2 authorises the QoS resources required for this additional media.
10. P-CSCF#2 forwards the SDP to S-CSCF#2.
11. S-CSCF#2 forwards the SDP to S-CSCF#1.
12. S-CSCF#1 forwards the SDP message to P-CSCF#1.
13. P-CSCF#1 authorises the additional resources necessary for this new media.
14. P-CSCF#1 forwards the SDP message to the originating endpoint, UE#1.
- 15-19. The originator decides the offered set of media streams for this media addition, and sends the offered SDP to P-CSCF#1.
20. UE#2 initiates the resource reservation procedures for the resources necessary for this additional media.
21. After determining the offered set of media streams for this additional media, step #15 above, UE#1 initiates the reservation procedures for the additional resources needed for this new media.
- 22-25. When UE#2 has successfully reserved the needed resources, it sends the “reservation successful” message to UE#2 along the signaling path established by the INVITE message. The message is sent first to P-CSCF#1.
- 25a. P-CSCF#1 authorises any additional media for the proposed SDP.
26. P-CSCF#1 forwards the message to UE#1.
- 27-31. UE#1 sends the final agreed SDP to UE#2 via the established path.
- 32-35. UE#2 responds to the offered final media.
- 35a. P-CSCF#1 authorises the media agreed.
36. The response is forwarded to UE#1.
37. UE#2 may optionally delay the session establishment in order to alert the user to the incoming additional media.
38. If UE#2 performs alerting, it sends a ringing indication to the originator via the signalling path. The message is sent first to P-CSCF#2.
39. P-CSCF#2 forwards the ringing message to S-CSCF#2.
40. S-CSCF#2 ~~invokes~~~~performs~~ whatever service ~~control~~~~logic~~ is appropriate for this ringing flow.
41. S-CSCF#2 forwards the message to S-CSCF#1.
41. S-CSCF#1 forwards the message to P-CSCF#1.
42. P-CSCF#1 forwards the message to UE#1.
43. UE#1 indicates to the originator that the media addition is being delayed due to alerting. Typically this involves playing a ringback sequence.
44. When the destination party accepts the additional media, UE#2 sends a SIP 200-OK final response along the signalling path back to the originator. The message is sent first to P-CSCF#2.
- 44a. After sending the 200-OK, UE#2 may initiate the new media flow(s).
45. P-CSCF#2 approves the commitment of the QoS resources for this additional media.
46. P-CSCF#2 forwards the final response to S-CSCF#2.
47. S-CSCF#2 forwards the final response to S-CSCF#1.
48. S-CSCF#1 forwards the final response to P-CSCF#1.

9. P-CSCF#1 approves the commitment of the QoS resources for this additional media.
50. P-CSCF#1 forwards the final response to UE#1.
51. UE#1 starts the media flow(s) for this additional media.
52. UE#1 responds to the final response with a SIP ACK message, which is passed to the destination via the signalling path. The message is sent first to P-CSCF#1.
53. P-CSCF#1 forwards the ACK to S-CSCF#1
54. S-CSCF#1 forwards the ACK to S-CSCF#2.
55. S-CSCF#2 forwards the ACK to P-CSCF#2.
56. P-CSCF#2 forwards the ACK to UE#2.

5.11.4 Procedures for providing or blocking identity

Identity is composed of a public user identity and an optional display name:

- The public user identity is used by any user for requesting communications to other users (see section 4.3.3.2).
- The display name is the user's name if available, an indication of privacy or unavailability otherwise. The display name is a text string which may identify the subscriber, the user or the terminal.

This section gives information flows for the procedures for providing the authenticated public user identity and the optional display Name information of the originating party to the terminating party. It also describes the mechanisms for blocking the display of public user identity and optional display name if requested by the originating party.

5.11.4.1 Procedures for providing the authenticated identity of the originating party

Authentication of the subscriber is performed during the registration procedures, as described in section 5.2.2.3. As a result of the registration procedures, one or several public user identity(ies) of the originating party is/are stored in P-CSCF#1. This is shown in the sub-procedure represented in the following information flow in step 1.

When UE#1 attempts to initiate a new session, it includes a public user identity in the INVITE request. P-CSCF#1 verifies that it is present and correct before passing the request to S-CSCF#1.

In the following call flow, it is assumed that no privacy has been required by UE#1. If the public user identity supplied by UE#1 in the INVITE request is incorrect, the P-CSCF may reject the request, or may overwrite with the correct URL.

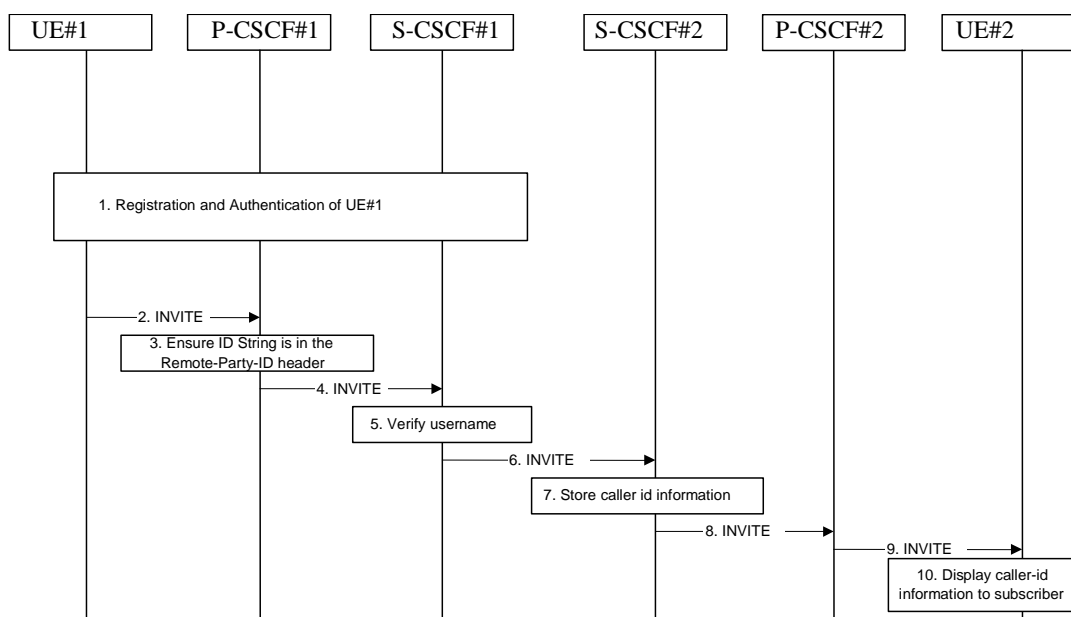


Figure 5.34: Providing the authenticated Identity of the originating party

The detailed procedure is as follows:

1. Registration and authentication of UE#1 is performed.
2. UE#1 initiates a new multi-media session, by sending an INVITE request to P-CSCF#1. This INVITE request includes a public user identity, and may include a display name that may identify the specific person using the UE.
3. P-CSCF#1 checks the public user identity of the originating party, and replaces it (or rejects the request) if it is incorrect.
4. P-CSCF#1 forwards the INVITE request, with the verified public user identity , to S-CSCF#1.
5. S-CSCF#1 ~~invokes~~~~performs~~ whatever service ~~control~~ logic is appropriate for this session set up attempt to check in particular that no identity restriction is active.
6. S-CSCF#1 forwards the INVITE request, with verified public user identity and display name of the originating party if present, to S-CSCF#2.
8. S-CSCF#2 forwards the INVITE request to P-CSCF#2.
9. P-CSCF#2 forwards the INVITE request to UE#2.
10. UE#2 displays the public user identity and the display name information (i.e. user-name if available, indication of privacy or unavailability otherwise) to the terminating party.

5.11.4.2 Procedures for blocking the identity of the originating party

Regulatory agencies, as well as subscribers, may require the ability of an originating party to block the display of their identity either permanently or on a session by session basis. This is a function performed by the destination P-CSCF. In this way, the terminating party is still able to do a session-return, session-trace, transfer, or any other supplementary service.

In this call flow, it is assumed that privacy has been required by UE#1 on public user identity (i.e. 'id' privacy) .

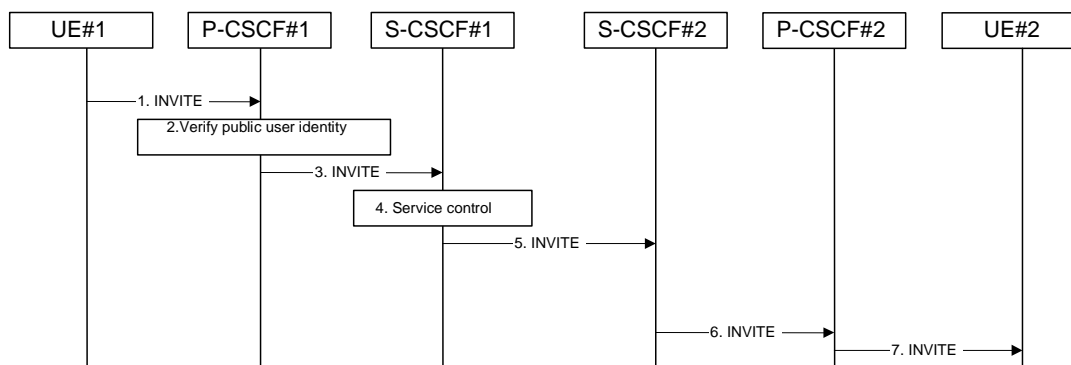


Figure 5.35: Blocking the identity of the originating party

The detailed procedure is as follows:

1. UE#1 initiates a new multi-media session, by sending an INVITE request to P-CSCF#1. This INVITE request includes public user identity, and may include a display name that may identify the specific person using the UE. Also included in this INVITE message is an indication that the identity of the originating party shall not be revealed to the destination.
2. P-CSCF#1 checks the public user identity of the originating party, and replaces it (or rejects the request) if it is incorrect.
3. P-CSCF#1 forwards the INVITE request, with the verified public user identity, to S-CSCF#1.
4. S-CSCF#1 ~~invokes~~~~performs~~ whatever service ~~control~~ logic is appropriate for this session set up attempt. Based on the subscriber's profile, S-CSCF#1 may insert an indication in the INVITE message that the identity of the originating party shall not be revealed to the terminating party. S-CSCF#1 may insert an indication to block the IP address of UE#1 too and may remove other information from the messaging which may identify the caller to the terminating party.
5. S-CSCF#1 forwards the INVITE request, with verified public user identity, and with user-name of the originating party if present, to S-CSCF#2.
6. If the terminating party has an override functionality in S-CSCF#2/Application Server in the terminating network removes the indication of privacy from the message.
7. S-CSCF#2 forwards the INVITE request to P-CSCF#2.
8. If privacy of the user identity is required, P-CSCF#2 removes the public user identity from the message before forwarding the INVITE request to UE#2.

5.11.5 Session Redirection Procedures

This section gives information flows for the procedures for performing session redirection. The decision to redirect a session to a different destination may be made for different reasons by a number of different functional elements, and at different points in the establishment of the session.

Three cases of session redirection prior to bearer establishment are presented, and one case of session redirection after bearer establishment.

These cases enable the typical services of “Session Forward Unconditional”, “Session Forward Busy”, “Session Forward Variable”, “Selective Session Forwarding”, and “Session Forward No Answer”, though it is important to recognise that the implementation is significantly different from the counterparts in the CS domain.

5.11.5.1 Session Redirection initiated by S-CSCF to IMS

One of the functional elements in a basic session flow that may initiate a redirection is the S-CSCF of the destination user. The user profile information obtained from the HSS by the ‘Cx-pull’ during registration may contain complex logic and triggers causing session redirection. S-CSCF#2 sends the SIP INVITE request to the I-CSCF for the new destination (I-CSCF#F in the diagram), who forwards it to S-CSCF#F, who forwards it to the new destination.

In cases when the destination user is not currently registered in the IM CN subsystem, the I-CSCF may assign a temporary S-CSCF to **invoke** the service **control** logic on behalf of the intended destination. This temporary S-CSCF takes the role of S-CSCF#2 in the following information flow.

The service implemented by this information flow is typically “Session Forward Unconditional”, “Session Forward Variable” or “Selective Session Forwarding”. S-CSCF#2 may also make use of knowledge of current sessions in progress at the UE, and implement “Session Forwarding Busy” in this way.

This is shown in the following information flow:

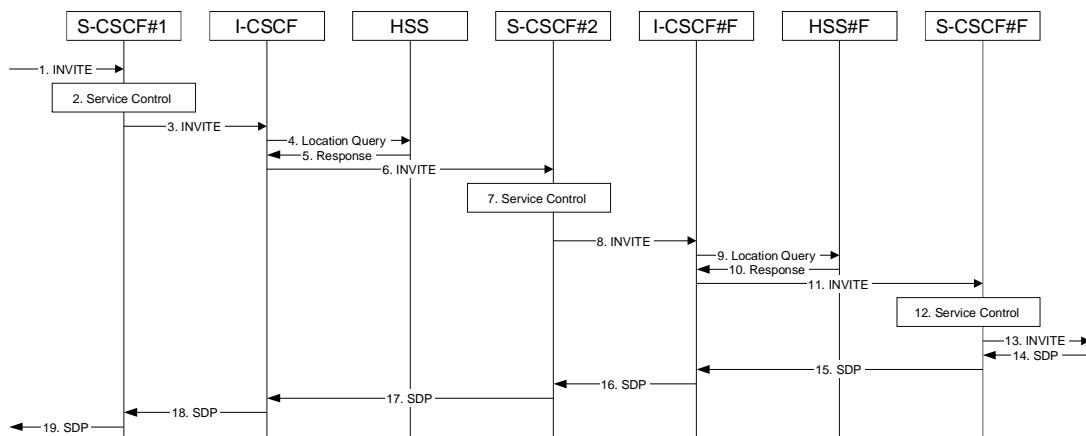


Figure 5.36: Session redirection initiated by S-CSCF to IMS

Step-by-step processing is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow.
2. S-CSCF#1 **performs invokes** whatever service **control** logic is appropriate for this session setup attempt.
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the destination subscriber belongs. The INVITE message is sent to an I-CSCF for that operator, and may optionally go through an I-CSCF(THIG) if S-CSCF#1 is in a different operator’s network than I-CSCF.
4. I-CSCF queries the HSS for current location information of the destination user.
5. HSS responds with the address of the current Serving CSCF (S-CSCF#2) for the terminating user.
6. I-CSCF forwards the INVITE request to S-CSCF#2, who will handle the session termination.
7. S-CSCF#2 **invokes performs** whatever service **control** logic is appropriate for this session setup attempt. As a result of this service control logic, S-CSCF#2 determines that the session should be redirected to a new destination URL within the IP Multimedia Subsystem. Based on operator policy and the user profile, S-CSCF#2 may restrict the media streams allowed in the redirected session.
8. S-CSCF#2 sends a SIP INVITE request to an I-CSCF (I-CSCF#F) for the network operator to whom the forwarded destination subscribes. This INVITE request may optionally go through an I-CSCF(THIG) if S-CSCF#2 is in a different operator’s network than I-CSCF#F.
9. I-CSCF#F queries the HSS (HSS#F) for current location information of the destination user.
10. HSS#F responds with the address of the current Serving CSCF (S-CSCF#F) for the terminating user.
11. I-CSCF forwards the INVITE request to S-CSCF#F, who will handle the session termination.
12. S-CSCF#F **invokes performs** whatever service **control** logic is appropriate for this session setup attempt
13. S-CSCF#F forwards the INVITE toward the destination UE, according to the procedures of the terminating flow.
14. The destination UE responds with the SDP message, and the session establishment proceeds normally.

5.11.5.2 Session Redirection to PSTN Termination (S-CSCF #2 forwards INVITE)

The S-CSCF of the destination user (S-CSCF#2) may determine that the session is to be redirected to a PSTN Termination; e.g. CS-domain endpoint, or to the PSTN. For session redirection to PSTN termination where the S-CSCF of the called party (S-CSCF#2) wishes to remain in the path of SIP signalling, the S-CSCF forwards the INVITE to a BGCF. Then the BGCF (in the local network or in another network) will forward the INVITE to a MGCF, which will forward towards the destination according to the termination flow.

In cases when the destination user is not currently registered in the IM CN subsystem, the I-CSCF may assign a temporary S-CSCF to ~~perform~~ ~~invoke~~ the service ~~control~~ ~~logic~~ on behalf of the intended destination. This temporary S-CSCF takes the role of S-CSCF#2 in the following information flow.

Handling of redirection to a PSTN Termination where the S-CSCF#2 forwards the INVITE is shown in the figure 5.37:

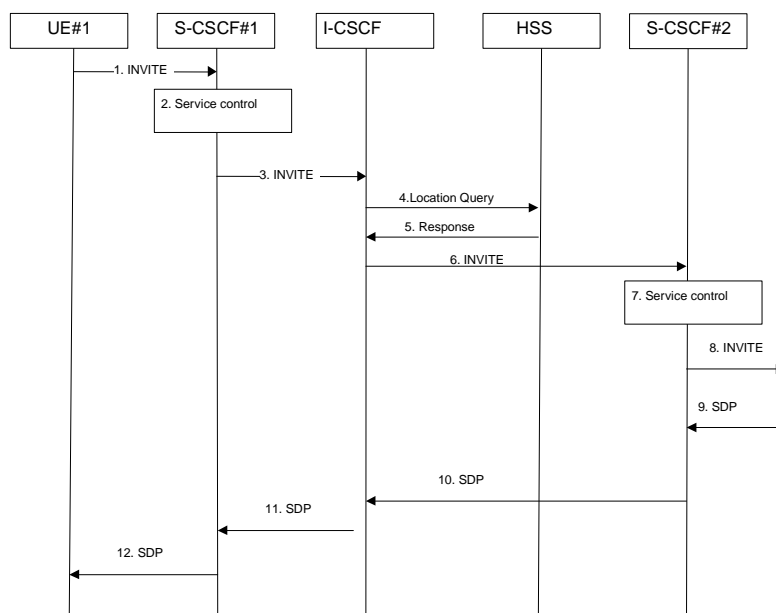


Figure 5.37: Session redirection to PSTN Termination (S-CSCF #2 forwards INVITE)

Step-by-step processing is as follows:

1. The SIP INVITE request is sent from the UE #1 to S-CSCF#1 by the procedures of the originating flow.
2. S-CSCF#1 performs whatever service control logic is appropriate for this session setup attempt.
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the subscriber belongs. The INVITE message is sent to an I-CSCF for that operator, and may optionally go through an I-CSCF (THIG) if S-CSCF#1 is in a different operator's network than I-CSCF.
4. I-CSCF queries the HSS for current location information of the destination user.
5. HSS responds with the address of the current Serving CSCF (S-CSCF#2) for the terminating user.
6. I-CSCF forwards the INVITE request to S-CSCF#2, who will handle the session termination.
7. S-CSCF#2 ~~performs~~ ~~invokes~~ whatever service ~~control~~ ~~logic~~ is appropriate for this session setup attempt. As a result of this service control logic, S-CSCF#2 determines that the session should be redirected to a PSTN termination. . S-CSCF#2 determines that it wishes to remain in the path of the SIP signalling.
8. S-CSCF#2 forwards the INVITE using the Serving to Serving procedures S-S#3 or S-S#4. The PSTN terminating flows are then followed.
9. The destination responds with the SDP message, and the session establishment proceeds normally.

5.11.5.2a Session Redirection to PSTN Termination (REDIRECT to originating UE#1)

The S-CSCF of the destination user (S-CSCF#2) may determine that the session is to be redirected to a PSTN Termination; e.g. CS-domain endpoint, or to the PSTN. For session redirection to PSTN termination where the S-CSCF of the called party (S-CSCF#2) wishes to use the SIP REDIRECT method, the S-CSCF#2 will pass the new destination information (the PSTN Termination information) to the originator (UE#1). The originator (UE#1) can then initiate a new session to the redirected to destination denoted by S-CSCF#2.

Handling of redirection to a PSTN Termination where the S-CSCF#2 REDIRECTS to the originating UE#1 is shown in the figure 5.37a:

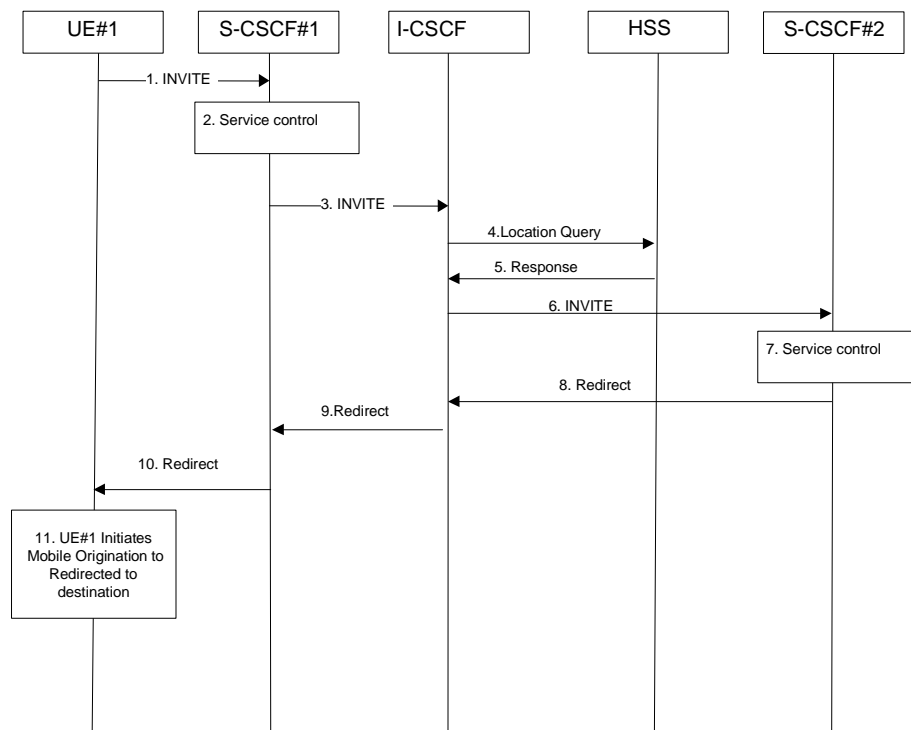


Figure 5.37a: Session redirection to PSTN Termination (REDIRECT to originating UE#1)

Step-by-step processing is as follows:

1. The SIP INVITE request is sent from the UE#1 to S-CSCF#1 by the procedures of the originating flow.
2. S-CSCF#1 **invokes/performs** whatever service **control**-logic is appropriate for this session setup attempt.
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the subscriber belongs. The INVITE message is sent to an I-CSCF for that operator, and may optionally go through an I-CSCF (THIG) if S-CSCF#1 is in a different operator's network than I-CSCF.
4. I-CSCF queries the HSS for current location information of the destination user.
5. HSS responds with the address of the current Serving CSCF (S-CSCF#2) for the terminating user.
6. I-CSCF forwards the INVITE request to S-CSCF#2, who will handle the session termination.
7. S-CSCF#2 **invokes/performs** whatever service **control**-logic is appropriate for this session setup attempt. As a result of this service control logic, S-CSCF#2 determines that the session should be redirected to a PSTN termination. S-CSCF#2 determines that it wishes to use the SIP REDIRECT method to pass the redirection destination information (the 'redirected-to PSTN Termination' information) to the originator (UE#1).
8. S-CSCF#2 sends a SIP Redirect response to I-CSCF with the redirection destination.

9. I-CSCF sends a Redirect response to S-CSCF#1, containing the redirection destination.

10. S-CSCF#2 forwards the Redirect response to UE#1, containing the redirection destination

UE#1 initiates a session to the 'redirected-to PSTN Termination' according to the mobile origination procedures supported in the UE (e.g. CS, IMS).

5.11.5.3 Session Redirection initiated by S-CSCF to general endpoint (REDIRECT to originating UE#1)

The S-CSCF in the scenario above may determine that the session is to be redirected to an endpoint outside the IP MultiMedia System and outside the CS-domain. Examples of these destinations include web pages, email addresses, etc. It recognizes this situation by the redirected URL being other than a sip: or tel: URL.

In cases when the destination subscriber is not currently registered in the IM CN subsystem, the I-CSCF may assign a temporary S-CSCF to ~~perform~~ ~~invoke~~ the service ~~control~~ ~~logic~~ on behalf of the intended destination. This temporary S-CSCF takes the role of S-CSCF#2 in the following information flow.

Handling of redirection to a general URL is shown in the following information flow:

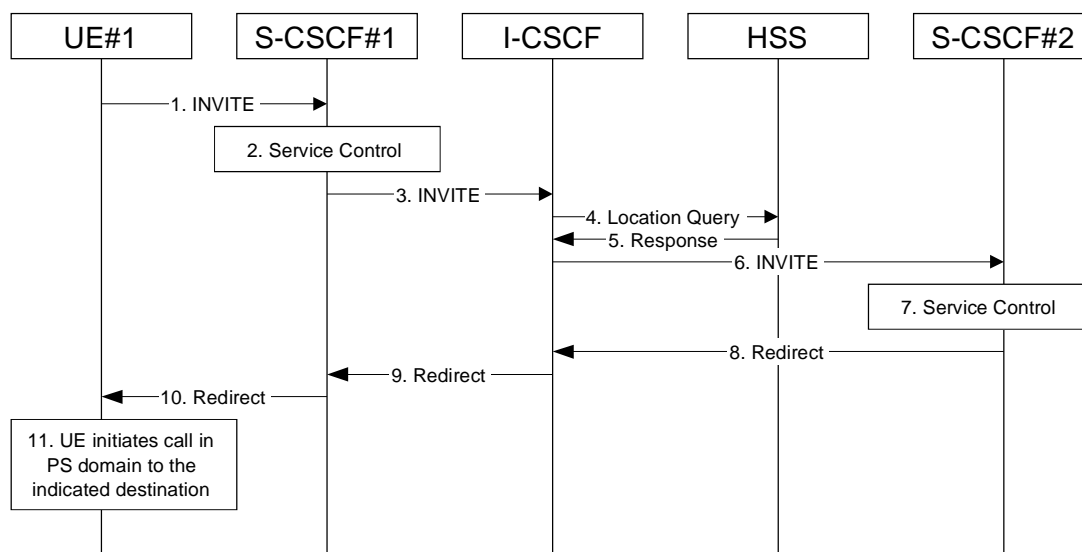


Figure 5.38: Session redirection initiated by S-CSCF to general endpoint

Step-by-step processing is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow.
2. S-CSCF#1 ~~performs~~ ~~invokes~~ whatever service ~~control~~ ~~logic~~ is appropriate for this session setup attempt.
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the subscriber belongs. The INVITE message is sent to an I-CSCF for that operator, and may optionally go through an I-CSCF (THIG) if S-CSCF#1 is in a different operator's network than I-CSCF.
4. I-CSCF queries the HSS for current location information of the destination user.
5. HSS responds with the address of the current Serving CSCF (S-CSCF#2) for the terminating user.
6. I-CSCF forwards the INVITE request to S-CSCF#2, who will handle the session termination.
7. S-CSCF#2 ~~invokes~~ ~~performs~~ whatever service ~~control~~ ~~logic~~ is appropriate for this session setup attempt. As a result of this service control logic, S-CSCF#2 determines that the session should be redirected to a new destination URL outside the IMS and outside the CS domain, i.e. other than a sip: or tel: URL.
8. S-CSCF#2 sends a SIP Redirect response back to I-CSCF, with redirection destination being the general URL.
9. I-CSCF sends a Redirect response back to S-CSCF#1, containing the redirection destination.

10. S-CSCF#1 forwards the Redirect response back to UE#1.
11. UE#1 initiates the session to the indicated destination.

5.11.5.4 Session Redirection initiated by P-CSCF

One of the functional elements in a basic session flow that may initiate a redirection is the P-CSCF of the destination user. In handling of an incoming session setup attempt, the P-CSCF normally sends the INVITE request to the destination UE, and retransmits it as necessary until obtaining an acknowledgement indicating reception by the UE.

In cases when the destination user is not currently reachable in the IM CN subsystem (due to such factors as roaming outside the service area or loss of battery, but the registration has not yet expired), the P-CSCF may initiate a redirection of the session. The P-CSCF informs the S-CSCF of this redirection, without specifying the new location; S-CSCF determines the new destination and performs according to sections 1, 2, or 3 above, based on the type of destination.

This is shown in the following information flow:

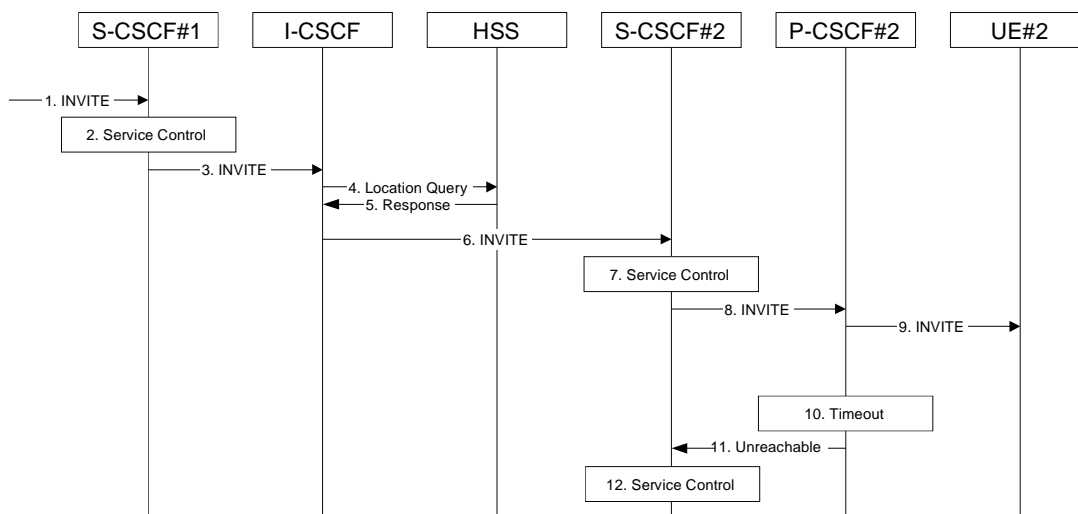


Figure 5.39: Session redirection initiated by P-CSCF

Step-by-step processing is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow.
2. S-CSCF#1 **invokes** **performs** whatever service **control**-logic is appropriate for this session setup attempt.
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the subscriber belongs. The INVITE message is sent to an I-CSCF for that operator, and may optionally go through an I-CSCF (THIG) if S-CSCF#1 is in a different operator's network than I-CSCF.
4. I-CSCF queries the HSS for current location information of the destination user.
5. HSS responds with the address of the current Serving CSCF (S-CSCF#2) for the terminating user.
6. I-CSCF forwards the INVITE request to S-CSCF#2, who will handle the session termination.
7. S-CSCF#2 **invokes** **performs** whatever service **control**-logic is appropriate for this session setup attempt.
8. S-CSCF#2 forwards the INVITE request to P-CSCF#2
9. P-CSCF#2 forwards the INVITE request to UE#2
10. Timeout expires in P-CSCF waiting for a response from UE#2. P-CSCF therefore assumes UE#2 is unreachable.
11. P-CSCF#2 generates an Unavailable response, without including a new destination, and sends the message to S-CSCF#2.

12. S-CSCF#2 **invokesperforms** whatever service **control-logic** is appropriate for this session redirection. If the user does not subscribe to session redirection service, or did not supply a forwarding destination, S-CSCF#2 may terminate the session setup attempt with a failure response. Otherwise, S-CSCF#2 supplies a new destination URL, which may be a phone number, an email address, a web page, or anything else that can be expressed as a URL. Processing continues according to subsections 1, 2, or 3 above, based on the type of destination URL.

5.11.5.5 Session Redirection initiated by UE

The next functional element in a basic session flow that may initiate a redirection is the UE of the destination user. The UE may implement customer-specific feature processing, and base its decision to redirect this session on such things as identity of caller, current sessions in progress, other applications currently being accessed, etc. UE sends the SIP Redirect response to its P-CSCF, who forwards back along the signalling path to S-CSCF#1, who initiates a session to the new destination.

The service implemented by this information flow is typically “Session Forward Busy”, “Session Forward Variable” or “Selective Session Forwarding”.

This is shown in the following information flow:

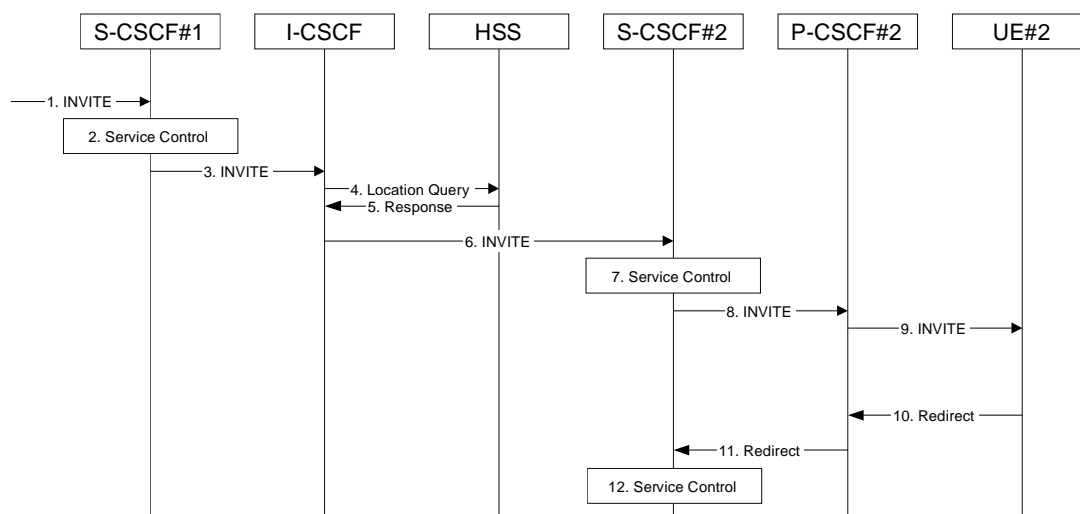


Figure 5.40: Session redirection initiated by UE

Step-by-step processing is as follows:

1. The SIP INVITE request is sent from the UE to S-CSCF#1 by the procedures of the originating flow.
2. S-CSCF#1 **invokesperforms** whatever service **control-logic** is appropriate for this session setup attempt.
3. S-CSCF#1 performs an analysis of the destination address, and determines the network operator to whom the subscriber belongs. The INVITE message is sent to an I-CSCF for that operator, and may optionally go through an I-CSCF (THIG) if S-CSCF#1 is in a different operator’s network than I-CSCF.
4. I-CSCF queries the HSS for current location information of the destination user.
5. HSS responds with the address of the current Serving CSCF (S-CSCF#2) for the terminating user.
6. I-CSCF forwards the INVITE request to S-CSCF#2, who will handle the session termination.
7. S-CSCF#2 **invokesperforms** whatever service **control-logic** is appropriate for this session setup attempt.
8. S-CSCF#2 forwards the INVITE request to P-CSCF#2
9. P-CSCF#2 forwards the INVITE request to UE#2
10. UE#2 determines that this session should be redirected, and optionally supplies the new destination URL. This new destination URL may be a phone number, an email address, a web page, or anything else that can be expressed as a URL. The Redirect response is sent to P-CSCF#2

11. P-CSCF#2 forwards the Redirect response to S-CSCF#2.
12. S-CSCF#2 **invokesperforms** whatever service **logiccontrol** is appropriate for this session redirection. If UE#2 does not subscribe to session redirection service, or did not supply a new destination URL, S-CSCF#2 may supply one or may terminate the session setup attempt with a failure response. The new destination URL may be a phone number, an email address, a web page, or anything else that can be expressed as a URL. The procedures of subsection 1, 2, or 3 given above are followed, based on the type of URL.

5.11.5.6 Session Redirection initiated by originating UE#1 after Bearer Establishment (REDIRECT to originating UE#1)

The UE of the destination user may request the session be redirected after a customer-specified ringing interval. The UE may also implement customer-specific feature processing, and base its decision to redirect this session on such things as identity of caller, current sessions in progress, other applications currently being accessed, etc. UE sends the SIP Redirect response to its P-CSCF, who forwards back along the signaling path to the originating endpoint, who initiates a session to the new destination.

The service implemented by this information flow is typically “Session Forward No Answer”.

Redirect to another IMS endpoint (e.g. a sip: URL) is shown in the following information flow:

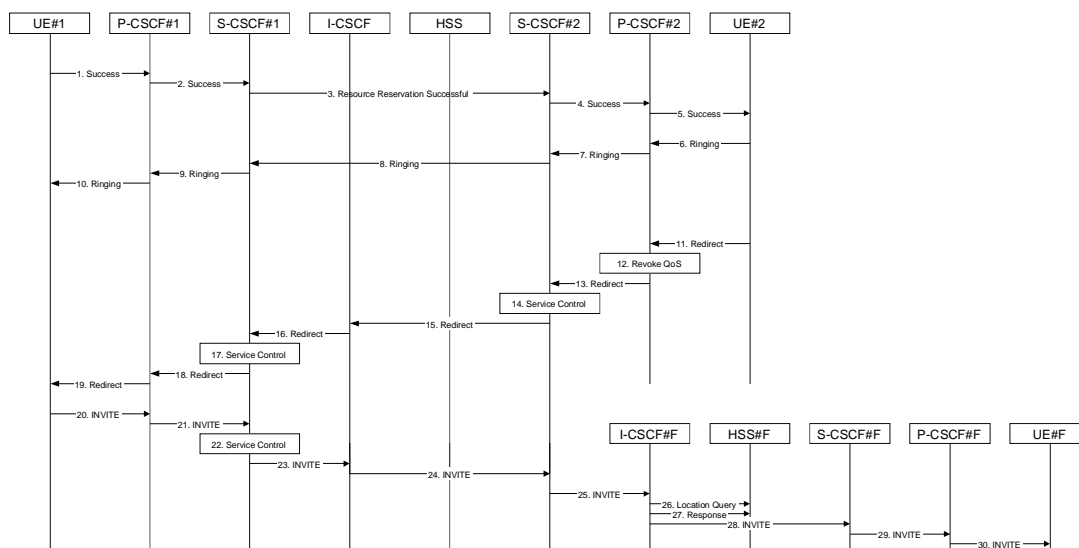


Figure 5.41: Session redirection after bearer establishment

Step-by-step processing is as follows:

- 1-10. Normal handling of a basic session establishment, up through establishment of the bearer channel and alerting of the destination user or by a previous session redirection after bearer establishment procedure.
11. Based on a timeout or other indications, UE#2 decides the current session should be redirected to a new destination URL. This new destination URL may be a phone number, an email address, a web page, or anything else that can be expressed as a URL. The Redirect response is sent to P-CSCF#2.
12. P-CSCF#2 shall revoke any authorisation for QoS for the current session.
13. P-CSCF#2 forwards the Redirect response to S-CSCF#2.
14. S-CSCF#2 **invokesperforms** whatever service **logiccontrol** is appropriate for this session redirection. If UE#2 does not subscribe to session redirection service, or did not supply a new destination URL, S-CSCF#2 may supply one or may terminate the session setup attempt with a failure response. The new destination URL may be a phone number, an email address, a web page, or anything else that can be expressed as a URL. S-CSCF#2 generates a private URL, addressed to itself, containing the new destination.
15. S-CSCF#2 sends a SIP Redirect response back to I-CSCF, containing the private URL addressed to S-CSCF#2.

16. I-CSCF sends a Redirect response back to S-CSCF#1, containing the redirection destination.
17. S-CSCF#1 checks the number of redirections that have occurred for this session setup attempt, and if excessive, aborts the session. S-CSCF#1 stores the new destination information, generates a private URL addressed to itself pointing to the stored information, and generates a modified Redirect response with the private URL.
18. S-CSCF#1 sends the modified Redirect response to P-CSCF#1
19. P-CSCF#1 shall revoke any authorisation for QoS for the current session and sends the Redirect response to UE#1.
20. UE#1 initiates a new INVITE request to the address provided in the Redirect response. The new INVITE request is sent to P-CSCF#1
21. P-CSCF#1 forwards the INVITE request to S-CSCF#1
22. S-CSCF#1 retrieves the destination information saved in step #17, and ~~invokes~~~~performs~~ whatever other service ~~logic~~~~control~~ is appropriate for this new session setup attempt.
23. S-CSCF#1 determines the network operator of the new destination address. The INVITE message is sent to I-CSCF#2, the I-CSCF for S-CSCF#2.
24. I-CSCF forwards the INVITE to S-CSCF#2
25. S-CSCF#2 decodes the private URL, determines the network operator of the new destination, and sends the INVITE request to the I-CSCF for that network operator.
26. The remainder of this session completes as normal.

5.11.6 Session Transfer Procedures

This section gives information flows for the procedures for performing session transfers. This is presented in two steps: first a basic primitive that can be used by endpoints to cause a multi-media session to be transferred, and second the procedures by which this primitive can be used to implement some well-known session-transfer services.

5.11.6.1 Refer operation

The refer primitive is an information flow indicating a “Refer” operation, which includes a component element “Refer-To” and a component element “Referred-By”. An information flow illustrating this is as follows:

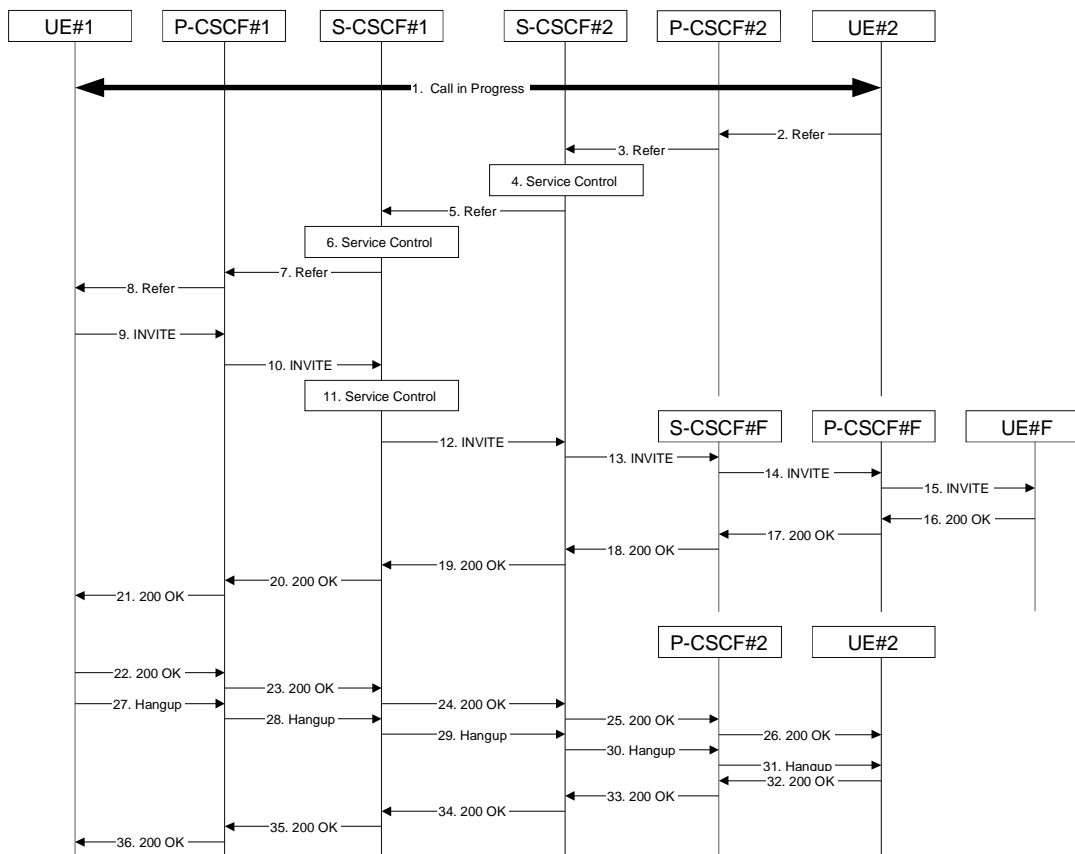


Figure 5.42: Refer operation

Step-by-step description of the information flow:

1. A multi-media session is assumed to already exist between UE#1 and UE#2, established either as a basic session or by one of the supplemental services described in this section.
2. UE#2 sends the Refer command to P-CSCF#2, containing “Refer-To” UE#F and “Referred-By” UE#2.
3. P-CSCF#2 forwards the message to S-CSCF#2
4. S-CSCF#2 **invokes/performs** whatever service **logic/control** is appropriate for this request. If UE#2 does not subscribe to a transfer service, the request is rejected. S-CSCF#2 generates a private URL, addressed to itself, with the new destination information and the billing information that will be needed for the new session. It replaces the “Refer-To” value in the request with the private URL.
5. S-CSCF#2 forwards the updated message to S-CSCF#1
6. S-CSCF#1 **invokes/performs** whatever service **logic/control** is appropriate for this request. It stores the “Refer-To” and “Referred-By” information and replaces it with private URLs, so that UE#1 will not know the identity of UE#2 or UE#F.
7. S-CSCF#1 forwards the updated message to P-CSCF#1
8. P-CSCF#1 forwards the message to UE#1
9. UE#1 initiates a new multi-media session to the destination given by the “Refer-To”, which is a private URL pointing to S-CSCF#1.
10. P-CSCF#1 forwards the INVITE request to S-CSCF#1
11. S-CSCF#1 retrieves the destination information for the new session, and **invokes/performs** whatever service **logic/control** is appropriate for this new session.

12. S-CSCF#1 determines the network operator addressed by the destination URL, and forwards the INVITE to S-CSCF#2 (or I-CSCF#2, the public entry point for S-CSCF#2).
13. S-CSCF#2 decodes the private URL destination, and determines the final destination of the new session. It determines the network operator addressed by the destination URL. The request is then forwarded onward to S-CSCF#F as in a normal session establishment
14. S-CSCF#F ~~invokes~~~~performs~~ whatever service ~~logic~~~~control~~ is appropriate for this new session, and forwards the request to P-CSCF#F
15. P-CSCF#F forwards the request to UE#F
- 16-21. The normal session establishment continues through bearer establishment, optional alerting, and reaches the point when the new session is accepted by UE#F. UE#F then sends the 200-OK final response to P-CSCF#F, which is forwarded through S-CSCF#F, S-CSCF#2, S-CSCF#1, P-CSCF#1, to UE#1. At this point a new session is successfully established between UE#1 and UE#F.
- 22-26. The Refer request was successful, and UE#1 sends a 200-OK final response to UE#2. This response is sent through P-CSCF#1, S-CSCF#1, S-CSCF#2, P-CSCF#2, and to UE#2.
- 27-31. UE#1 clears the original session with UE#2 by sending the BYE message. This message is routed through P-CSCF#1, S-CSCF#1, S-CSCF#2, P-CSCF#2, to UE#2.
- 32-36. UE#2 acknowledges the BYE and terminates the original session. It responds with the 200-OK response, routed through P-CSCF#2, S-CSCF#2, S-CSCF#1, P-CSCF#1, to UE#1.

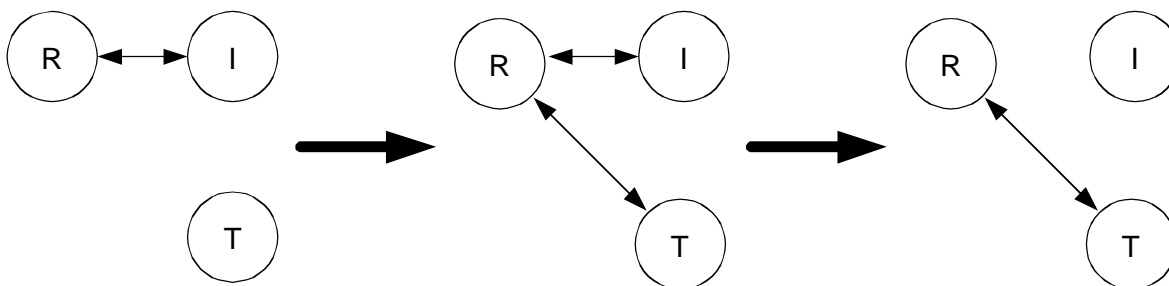
5.11.6.2 Application to Session Transfer Services

This section shows how the Refer primitive given above can be used to provide common session-transfer services.

5.11.6.2.1 Blind Transfer and Assured Transfer

A Blind Transfer starts with an existing session, established between the Initiator (I) and the Recipient (R). In a typical case, this session was actually initiated by R. In the end it is desired that the Recipient has a session with the Target (T).

From the starting configuration, shown in the leftmost diagram, I sends a Refer message to R, who then initiates a session with the Target (T), as shown in the middle diagram. Immediately after sending the Refer message to R, I issues the BYE message to terminate its connection with R. The end configuration is shown in the rightmost diagram.

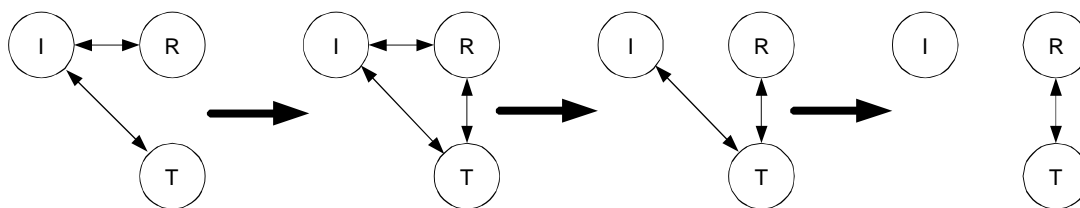


An Assured Transfer is identical to the above, except that I waits until the Refer successfully completes before issuing the BYE message to terminate its connection with R. If the new session from R to T were to fail, R would still have a session with I.

5.11.6.2.2 Consultative Transfer

A Consultative Transfer again starts with an existing session, established from the Initiator (I) to the Recipient (R). The Initiator first consults with the Target (T), then decides to transfer the original session to T.

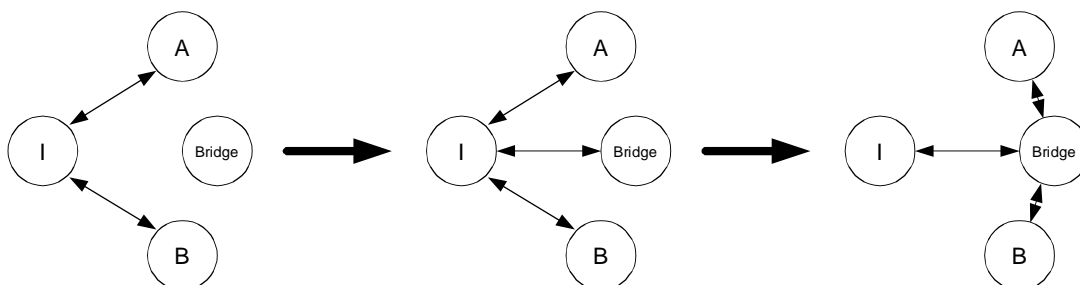
From the starting configuration, as shown in the leftmost diagram in the previous section, I places the session with R on hold and establishes a new session with T. This is shown in the leftmost diagram below. I then sends a Refer message to T, causing T to establish a session with R. This is shown in the second diagram. When the Refer operation completes, I clears its two active sessions, first with R (leaving the configuration as shown in the third diagram) then with T. The end configuration is shown in the rightmost diagram.



5.11.6.2.3 Three-way Session

A three-way session starts with an existing session, between the Initiator (I) and party (A). The initiator places this session on hold, and establishes a second session with party (B). The initiator then decides to create an ad-hoc conference of all three parties.

From the point where the initiator decides to create the ad-hoc conference, shown in the leftmost diagram below, the initiator establishes another session with a third-party conference bridge service. This is shown in the center diagram. The initiator then transfers both of the existing sessions, I->A and I->B, to the bridge, ending in the configuration shown in the rightmost diagram.



The conference bridge service is in control of the termination sequence. On termination of one of the three sessions, it may either terminate the other two sessions by use of the session clearing procedures of section 5.11, or may utilize the procedures of subsection 1 above to transfer one of the remaining endpoints to the other, resulting in a simple two-party session.

5.12 Mobile Terminating call procedures to unregistered Public User Identities

This section describes information flows for the procedures of Mobile Terminating call flows for unregistered IMS Public User Identities. The detection of an unregistered Public User Identity is done in HSS and if this Public User Identity has services related to unregistered state, a S-CSCF is selected for the unregistered Public User Identity. S-CSCF performs whatever further actions are appropriate for the call attempt to the unregistered IMS Public User Identity.

Two basic examples for "services related to unregistered" are call redirection to CS domain and voice mailbox service. Call redirection to CS domain is supported to cover the cases when the UE is not registered in IMS but can be reached via the CS domain. Then, a temporary S-CSCF is selected and performs whatever further actions are appropriate for the call attempt.

The principle established in sub-clause 4.3.3.4, where the public user identifiers for the same profile are allocated to the same S-CSCF, is followed.

5.12.1 Mobile Terminating call procedures to unregistered Public User Identity that has services related to unregistered state

In Figure 5.43 below the Public User Identity is unregistered for IMS and the Public User Identity has services related to unregistered state. In this case, the HSS responds back to I-CSCF with an indication that I-CSCF should select S-CSCF for this MT call to the unregistered Public User Identity of the user or provide the I-CSCF with the previously allocated S-CSCF name. Before S-CSCF selection, I-CSCF shall query HSS for the information related to the required S-CSCF capabilities. I-CSCF selects a S-CSCF to ~~perform invoke~~ service ~~logic control~~ and I-CSCF routes the call further to the selected destination. If the S-CSCF does not have the relevant information from the user profile then the

S-CSCF shall download the relevant information from HSS before it ~~performs~~ invokes service ~~logic~~ control and any further actions in the call attempt. The service implemented by this information flow could be e.g. “Call Forward Unconditional.”

This is shown by the information flow in Figure 5.43:

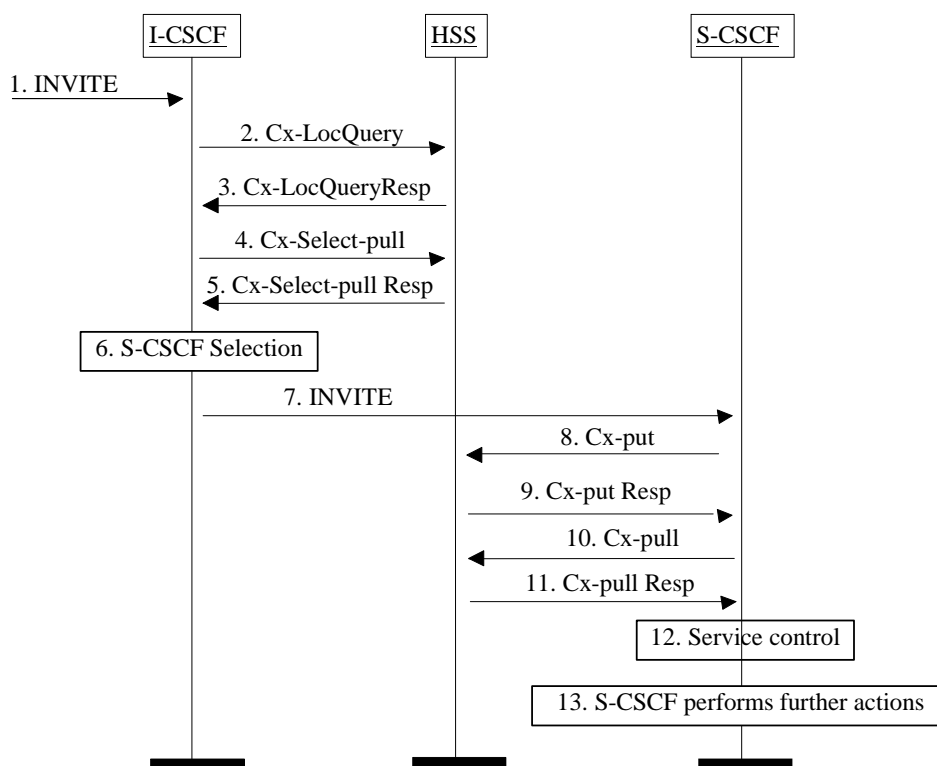


Figure 5.43: Mobile Terminating call procedures to unregistered IMS Public User Identity that has services related to unregistered state

1. I-CSCF receives an INVITE message.
2. I-CSCF queries the HSS for current location information.
3. HSS either responds with an indication that the Public User Identity is unregistered for IMS and I-CSCF should select a S-CSCF for the unregistered Public User Identity of the user or provides the I-CSCF with the previously allocated S-CSCF name for that user.
4. If the I-CSCF has not been provided with the location of the S-CSCF, the I-CSCF may send Cx-Select-Pull (unregistered, Public User Identity) to the HSS to request the information related to the required S-CSCF capabilities which shall be input into the S-CSCF selection function. This query is optional.
5. The HSS shall send Cx-Select-Pull Resp (required S-CSCF capabilities) to the I-CSCF.
6. If the I-CSCF has not been provided with the location of the S-CSCF, the I-CSCF selects an S-CSCF for the unregistered Public User Identity of the user.
7. I-CSCF forwards the INVITE request to the S-CSCF.
8. The S-CSCF sends Cx-Put (Public User Identity, S-CSCF name) to the HSS. When multiple and separately addressable HSSs have been deployed by the network operator, then the S-CSCF needs to query the SLF to resolve the HSS. The HSS stores the S-CSCF name for unregistered Public User Identities of that user. This will result in all terminating traffic for unregistered Public User Identities of that user being routed to this particular S-CSCF until the registration period expires or the user attaches the Public User Identity to the network. Note: Optionally the S-CSCF can omit the Cx-Put request if it has the relevant information from the user profile.

9. The HSS shall send Cx-Put Resp to the I-CSCF to acknowledge the sending of Cx-Put.
10. If the relevant information is not available, the S-CSCF shall send the Cx-Pull information flow (Public User Identity) towards the HSS in order to be able to download the relevant information of the service profile to the S-CSCF.
11. The HSS shall return the information flow Cx-Pull Resp (user information) to the S-CSCF. The S-CSCF shall store it for that indicated Public User Identity.
12. S-CSCF ~~invokes~~ performs whatever service ~~control~~ logic is appropriate for this call attempt.
13. S-CSCF performs whatever further actions are appropriate for this call attempt (in the case where the S-CSCF decides to redirect the session towards CS domain, the Mobile Termination Procedure MT#3 (section 5.7.2a) applies).

The S-CSCF may deregister the Public User Identity at any time (e.g. according to operator network engineering requirements) by issuing a Cx-Put2 (Public User Identity, clear S-CSCF name) clearing the S-CSCF name stored in the HSS. If S-CSCF name stored by the HSS does not match the name of the S-CSCF that originated the Cx-Put2 then the HSS will acknowledge the clearing request but take no further action.