Technical Specification Group Services and System Aspects
Meeting #18, New Orleans, USA, 9-12 December 2002

TSGS#18(02)0766

3GPP TSG-SA WG2 meeting #28
Bangkok, Thailand 11th – 15th November 2002

Tdoc S2-023678rev3

Title:	**SA2 response to "Response to IETF LS on Interoperability Issues and SIP in IMS"**
Response to:	**Liaison Statement on Response to IETF LS on Interoperability Issues and SIP in IMS (SP-020627 (02059), N1-022160, S3-020578)**
To:	**SA, CN, CN1, SA3**
CC:	
Source:	**SA2**
Agenda item:	**12**
Document for:	**DECISION**

Contact Person:
Name: Shabnam Sultana
Tel. Number: +46-70-265-9067
E-mail Address: Shabnam.sultana@era.ericsson.se

Attachments: **S2-023547, S2-023548 and S2-023600rev1**

1. Overall Description:

SA2 thanks SA, CN1 & SA3 TSGs for the liaisons related to "Response to Liaison Statement on Interoperability Issues and SIP in IMS".

SA2 WG has discussed the LS in SA2 meeting #27 & #28.
During SA2#27, SA1 & SA2 held joint session to discuss implications on the requirements and any possible changes that may be required. The conclusion from that meeting has confirmed that SA1 requirements are valid and mostly require no changes.
During SA2#28, SA2 & CN1 held joint session to discuss the main issues identified to architectural and require stage 2 inputs to come to a conclusion. The joint session addressed issues for which member companies provided contributions.

The following is SA2 opinion on the issues identified by the LS(s):

1) The P-CSCF initiating BYE requests

"The P-CSCF may send a BYE on behalf of the UA, generally because the P-CSCF has been notified by the radio layer that the UA has lost contact. Of course, the P-CSCF doesn't have the credentials to provide authentication of the BYE, so many UAs will consider this to be a forged message. This also renders 3GPP UAs vulnerable to denial of service attacks using forged BYEs."

SA2 understanding of the issue is that 3GPP requires the ability to terminate an ongoing session from the network, i.e. CSCF nodes. This is essential for charging and policy functions for IMS in 3GPP. As there are no alternative approaches available, no changes are feasible in Release 5, even though there are some valid concerns that have been identified by CN1 & SA3.

2) The P-CSCF stripping headers

"*The P-CSCF strips away Route, Record-Route, Via, Path, and Service-Route headers before passing messages on to the UA. It then reinserts them messages in the other direction, and may also strip out Route headers inserted by the UA. This breaks end-to-end protection using S/MIME and prevents the UA from accessing external services using loose routing. It also prevents the UA from knowing about any proxies that may have piggybacked on its registration using the Path mechanism, which is a serious violation of the openness principle and leaves 3GPP users registering with external servers subject to certain man-in-the-middle attacks affecting REGISTER messages without any way to detect those attacks.*"

SA2 & CN1 have agreed to address this issue in Release 5 in order to not introduce backward compatibility aspects towards the UE in future releases and also to reduce/eliminate options for different solutions. Discussion paper and CRs for SA2 & CN1 impacts were presented for the discussion. In order to make 3GPP UEs and the P-CSCFs more compliant to IETF SIP, the requirement to strip headers have been removed. Additionally, it is still possible, based on operator policy to enforce predefined routes in the P-CSCF as supported with header stripping. Corresponding CRs have been submitted and handled at the joint SA2-CN1 session. SA2 has then approved the stage-2 CR for 23.228 (S2-023547).
Note that one company has expressed concern regarding this change and two other companies have expressed concerns regarding the delay this may cause in CN1 WG to complete the affected specifications by December plenary.

3) CSCFs editing SDP

"*The CSCF may edit SDP sent from or to the UA in order to force the selection of codecs considered favorable to the operator. This has the side effect of breaking end-to-end protection of the SDP using S/MIME. It also precludes interoperating with external elements when both the IMS UA and the external UA share only a common codec not supported by the P-CSCF.*"

Many companies believe that 3GPP should provide a solution without breaking the end-to-end concept in regards to modifying SDP (e.g. restricting Codec usage) in the network without the end points awareness.

Appropriate CRs supported by several companies were available to provide a solution that fulfils operators' requirement to restrict users from using services that are not allowed by the operators and allows terminals to get appropriate information to proceed with the sessions according to operators allowed policy. The stage-2 CR for 23.228 is attached in S2-0233600rev1

But the group could not agree to the solution described in S2-023600rev1 at this session. Some companies believed that the solution proposed has disadvantages, which do not outweigh the benefit of addressing the IETF concern partially (e.g. the use of S/MIME is not addressed with the proposed revised approach).

Note that the use of S/MIME can't be addressed within 3GPP Release 5 as elaborated in the LS from SA3 & CN1.

6) Network configuration hiding

"The I-CSCF (or THIG) may encrypt Via and Route information when acting in topology-hiding mode. This was allowed for in earlier SIP specifications, but the use has been deprecated for a variety of reasons. The exact impact on interoperability remains unknown."

This issue has been discussed and it was clarified that it is an operator's choice if they want such implementation in their IMS networks and 3GPP specifications provide the solution on how to achieve this. Stage-2 CR S2-23548 was presented at the meeting and has been approved in SA2.

Additionally, SA2 has taken into account inputs from CN1 and SA3 and agrees with the conclusion with additional clarifications provided through this LS & associated CRs.

2. Actions:

To SA, CN, SA3, CN1 groups:

SA2 would like the relevant groups to take into account the inputs in the LS for the proposed way forward.

3. Date of Next CN and SA meetings:

TSG SA WG2#29 20th January – 24th January 2003 San Francisco, USA

3GPP TSG-SA2 Meeting #28
Bangkok, Thailand, 11th-15th November, 2002

Tdoc ⌘S2-023547

CR-Form-v7

CHANGE REQUEST

⌘ **23.228** **CR** **232** ⌘**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 [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Remove header stripping requirement from P-CSCF
Source:	⌘	Ericsson
Work item code:	⌘	IMS-CCR
Date:	⌘	25/10/02
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	-Currently stage 2 adds requirement that p-CSCF shall strip certain headers on SIP messages towards UE. This violates IETF-SIP principles (as highlighted in the LS from IETF-SIP-WG) and it does not achieve the necessary goals and introduces compatibility towards future and restricts current UE behavior.
Summary of change:	⌘	Remove header stripping but still allow operator policy to overwrite headers provided by the UE
Consequences if not approved:	⌘	Future compatibility, backward compatibility introduced now that will make IMS complex and IETF misalignment.

Clauses affected:	⌘	5.4.5			
		Y	**N**		
Other specs affected:	⌘	**X**		Other core specifications	⌘ 24.228, 24.229
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

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

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

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

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

**********First Modified section**********

5.4.5 Storing of session path information

There is a need to store the session path that is determined during the session initiation request in order to route the subsequent session requests through this determined path. This is needed in order to route these session requests through certain nodes, e.g. the ones performing Service Control. CSCFs are assumed to perform certain actions:

1. CSCFs (Proxy and Serving) store a certain part of the session path determined during session initiation. This allows CSCFs to generate requests that traverse all elements on a Route path.

2. ~~P-CSCF will remove the network generated contents of the Via and Record-Route headers of the SIP requests to be sent to the UE. This increases security and reduces SIP message sizes and thus transmission delay over the air interface.~~ The P-CSCF shall check correct usage of the header values. Should an UE build inaccurate header(s) in a SIP request, the P-CSCF may reject the request. If an operator policy requires enforcing the routes stored in P-CSCF, the P-CSCF shall overwrite the header(s) provided by the UE with the appropriate values.

3GPP TSG-SA2 Meeting #28
Bangkok, Thailand, 11-15.11.2002

S2-023548

CR-Form-v7

CHANGE REQUEST

⌘ **23.228** **CR** **235** ⌘**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:	⌘	Clarification on Network Configuration Hiding
Source:	⌘	Alcatel, Ericsson, Hutchinson 3G, Nokia, Siemens, Vodafone Group
Work item code:	⌘	IMS-CCR
Date:	⌘	13/11/2002
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
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R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	From the current text in 23.228 the role of network configuration hiding in the stage 2 specification is not clear. This is the source of misunderstandings and concerns, for example those expressed in the IETF liaison on the use of SIP.
Summary of change:	⌘	It is clearified that the I-CSCF (THIG) may be used to provide network configuration hiding.
Consequences if not approved:	⌘	Unclear status of network hiding in stage 2 specification, thus stage 2 specification remains a source of misunderstandings. Unresolved concerns from IETF.

Clauses affected:	⌘	4.2.3, 4.4, Annex C

		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	

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********** First set of changes **********

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.

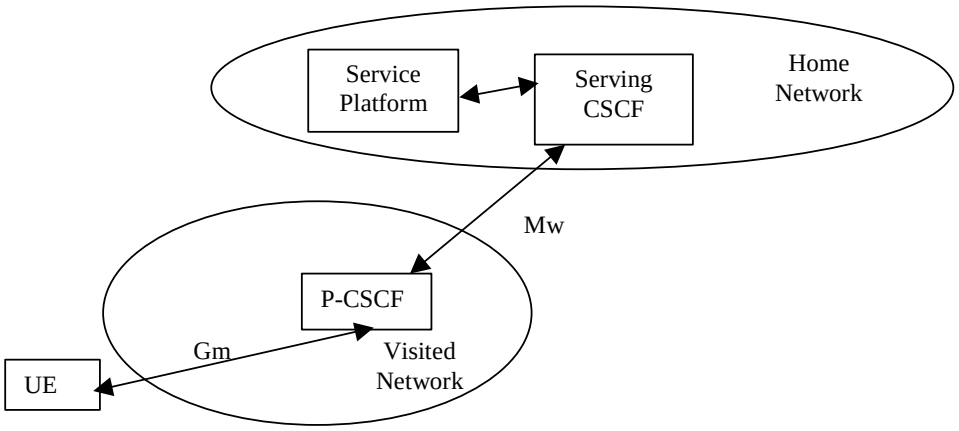

Figure 4-1: Service Platform in Home Network

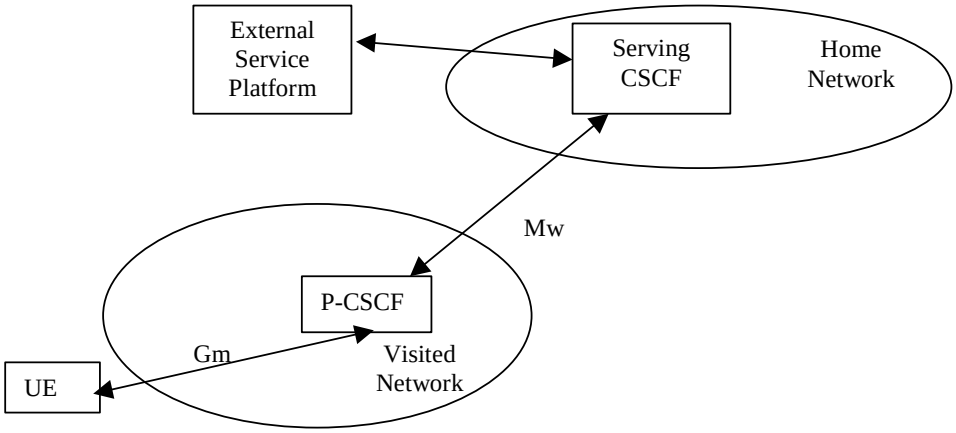

Figure 4-2: External Service Platform

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 the service control.

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-CSCF(THIG)s, 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. See also sub-clauses 4.4 and 4.6.2.1.

********** Next set of changes **********

4.4 Signalling concepts

A Single session control between the UE and CSCF. For Multi-Media type services delivered via the PS Domain within this architecture, a single session control protocol shall be used between the user equipment UE and the CSCF (over the Gm reference point).

Protocols over the Gm reference point. The single protocol applied between the UE and CSCF (over the Gm reference point) within this architecture will be based on SIP (as defined by RFC 3261 [12], other relevant RFC's, and additional enhancements required to support 3GPP's needs).

A Single session control on the Mw, Mm, Mg, Mi, Mj, Mk. A single session control protocol shall be used on the session control interfaces between:

- MGCF and CSCF (Mg),
- between CSCFs (Mw), and
- between a CSCF and external IP networks (Mm).
- Between CSCF and BGCF (Mi)
- Between BGCF and MGCF (Mj)
- Between BGCF and BGCF (Mk)

Protocols for the Mw, Mm, Mg, Mi, Mj, Mk. The single session control protocol applied to these interfaces will be based on SIP (as defined by RFC 3261 [12], other relevant RFC's, and additional enhancements required to support 3GPP´s needs).

UNI vs. NNI session control. The SIP based signalling interactions between CN elements may be different then SIP based signalling between the UE and the CSCF.

Based on operator preference, network configuration hiding may be applied.~~Network configuration independence.~~ If network configuration hiding is applied, then the I-CSCF(THIG) shall be used in order to fulfil the requirements as identified in TS 22.228 [8]~~the I-CSCF(THIG)may be used~~. It is used to ~~It is a requirement that it shall be possible to hide the network topology from other operators. It shall be possible to~~ restrict the following information from being passed outside of an operator's network: exact number of S-CSCFs, capabilities of S-CSCFs, or capacity of the network. A more detailed ~~explanation of this requirement~~motivation for such functionality is given in Annex C.

Restrict access from external networks. The signalling solution shall allow the operator to restrict access from external networks (application level).

Access to HSS. A network operator can control access to the HSS.

********** Next set of changes **********

Annex C (informative): Optional configuration independence between operator networks

The I-CSCF (THIG) functionality may be used ~~It is a requirement that it shall be possible~~ to hide the network topology from other operators. It shall be possible to restrict the following information from being passed outside of an operator's network: exact number of S-CSCFs, capabilities of S-CSCFs, or capacity of the network.

~~The details of the mechanism to fulfil this requirement are yet to be determined.~~ The specific mechanism chosen needs to take into account the following separate aspects ~~of this requirement~~:

Network management. In the case that network details (i.e. S-CSCF addresses) are visible by other external network elements, any (temporary or permanent) changes to the network topology need to be propagated to network elements outside of the operator's network. This is highly undesirable from a network management perspective.

Network scalability. Establishing security associations on a pair-wise basis among all CSCFs is likely to be unscalable. The security associations shall be independent of the number of network elements.

Competitivity aspects. The operational details of an operator's network are sensitive business information that operators are reluctant to share with their competitors. While there may be situations (partnerships or other business relations) where the sharing of such information is appropriate, the possibility should exist for an operator to determine whether or not the internals of its network need to be hidden.

Security aspects. Network element hiding may help to reduce the vulnerability of the overall system to external attacks (e.g. denial of service attacks). Further work is needed in this area.

********** End of all changes **********

3GPP TSG-SA2 Meeting #28
Bangkok, Thailand, 11-15.11.2002

S2-023600rev1

CR-Form-v7

CHANGE REQUEST

⌘ **23.228** **CR** **237** ⌘ **rev** **2~~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:	⌘	Handling of SDP manipulation issue in stage-2 specifications
Source:	⌘	Dynamicsoft, Ericsson, Nokia, Vodafone group, AT&T Wireless
Work item code:	⌘	IMS-CCR
Date:	⌘	11/11/2002
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
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R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The end-to-end codec negotiation flows currently specified allow CSCFs to tamper with the SDP message bodies of session initiation and modification requests. Concerns have been raised with this function both in 3GPP from end-user experience perspective, and in the IETF from SIP protocol compliancy perspective. At the same time, the requirement of operators being able to police IMS session initiations and modifications passing through their network has to be fulfilled.
Summary of change:	⌘	The stage-2 end-to-end codec negotiation flows have been adjusted to ensure end-user friendly and IETF-compliant means of handling IMS sessions while allowing operators to police IMS session initiations and modifications passing through their network.
Consequences if not approved:	⌘	Conflicts with consistent end-user experience and IETF compliancy would remain. Fixing of these conflicts would be impossible in later releases due to backwards compatibility reasons.

Clauses affected:	⌘	5.11.3, 5.11.3.1, 5.11.3.3

Other specs affected:	⌘	Y	N		⌘	
		X		Other core specifications	⌘	24.229
			X	Test specifications		
			X	O&M Specifications		

Other comments:	⌘	In order to allow future protocol development, the changes to the stage 3 in 24.229 are needed irrespective of this change. Failure to perform such stage 3 changes would revert long established practices first adopted in phase 1 GSM 04.08 and maintained ever since.

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********** First set of changes **********

5.11.3 Procedures for codec and media characteristics flow negotiations

This section gives information flows for:

- the procedures for determining the set of negotiated ~~characteritics~~characteristics between the endpoints of a multi-media session, determining the initial media characteristics (including common codecs) to be used for the multi-media session, and

- the procedures for modifying a session within the existing resources reservation or with a new resources reservation (adding/deleting a media flow, changing media characteristics including codecs, changing bandwidth requirements) when the session is already established.

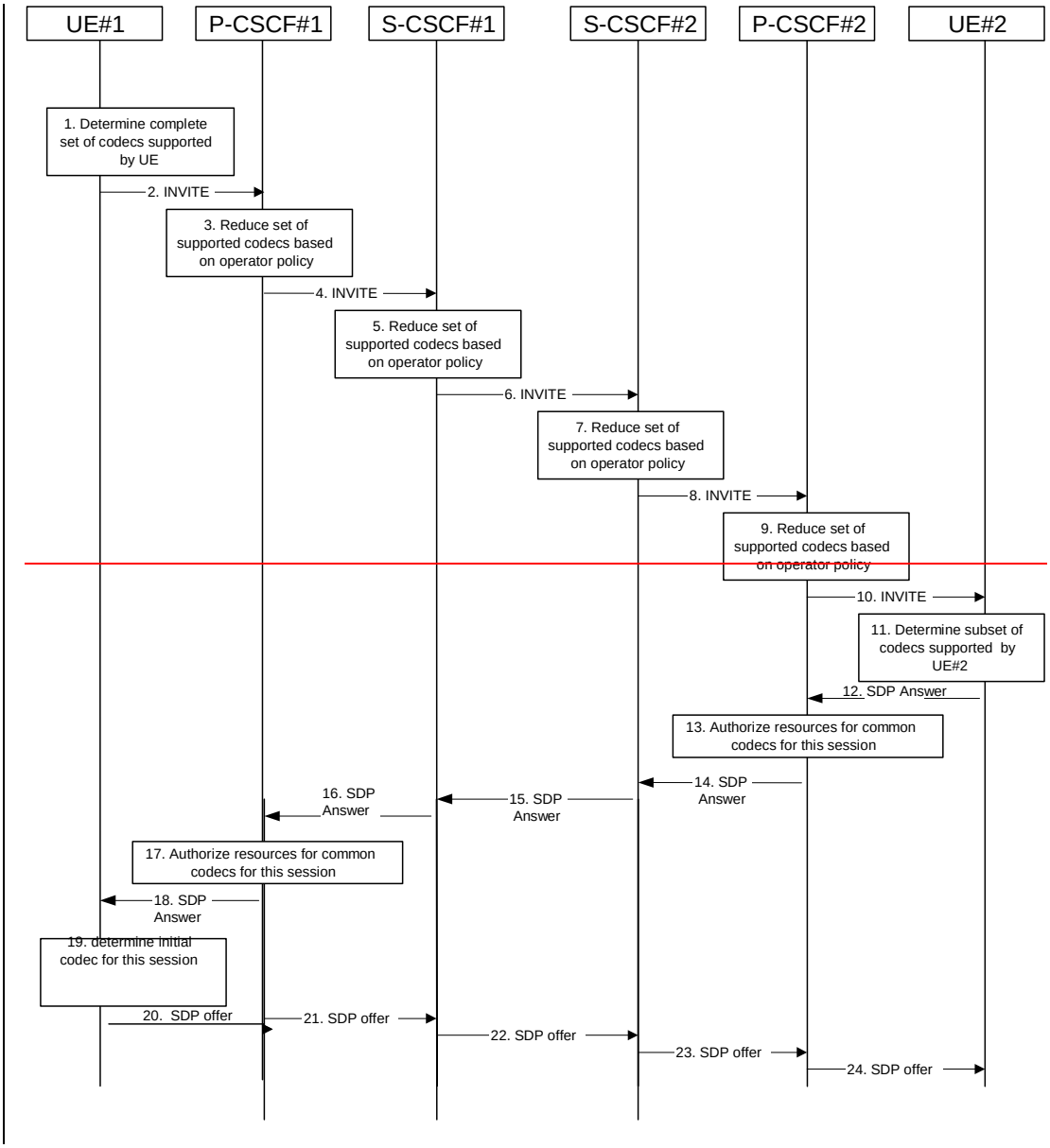
5.11.3.1 Codec and media characteristics flow negotiation during initial session establishment

Initial session establishment in the IM CN subsystem must determine a negotiated set of media characteristics (including a common codec or set of common codecs for multi-media sessions) that will be used for the session. This is done through an end-to-end message exchange to determine the complete set of media characteristics, then the decision is made by the session initiator as to the initial set of media flows.

The session initiator includes an SDP in the SIP INVITE message that lists every media characteristics (including codecs) that the originator is willing to support for this session. When the message arrives at the destination endpoint, it responds with the media characteristics (e.g. common subset of codecs) that it is also willing to support for the session. Media authorisation is performed for these media characteristics. The session initiator, upon receiving the common subset, determines the media characteristics (including codecs) to be used initially.

The negotiation may take multiple media offered and answered between the end points until the media set is agreed upon.

Once the session is established, the procedures of section 5.11.3.2 may be used by either endpoint to change to a different media characteristic (e.g. codec) that was included in the initial session description, and for which no additional resources are required for media transport. The procedures of section 5.11.3.3 may be used by either endpoint to change the session, which requires resources beyond those allocated to the existing session.


UE#1
P-CSCF#1
S-CSCF#1
S-CSCF#2
P-CSCF#2
UE#2
1. Determine complete set of codecs supported by UE
2. INVITE
3. Reduce set of supported codecs based on operator policy
4. INVITE
5. Reduce set of supported codecs based on operator policy
6. INVITE
7. Reduce set of supported codecs based on operator policy
8. INVITE
9. Reduce set of supported codecs based on operator policy
10. INVITE
11. Determine subset of codecs supported by UE#2
12. SDP Answer
13. Authorize resources for common codecs for this session
14. SDP Answer
15. SDP Answer
16. SDP Answer
17. Authorize resources for common codecs for this session
18. SDP Answer
19. determine initial codec for this session
20. SDP offer
21. SDP offer
22. SDP offer
23. SDP offer
24. SDP offer

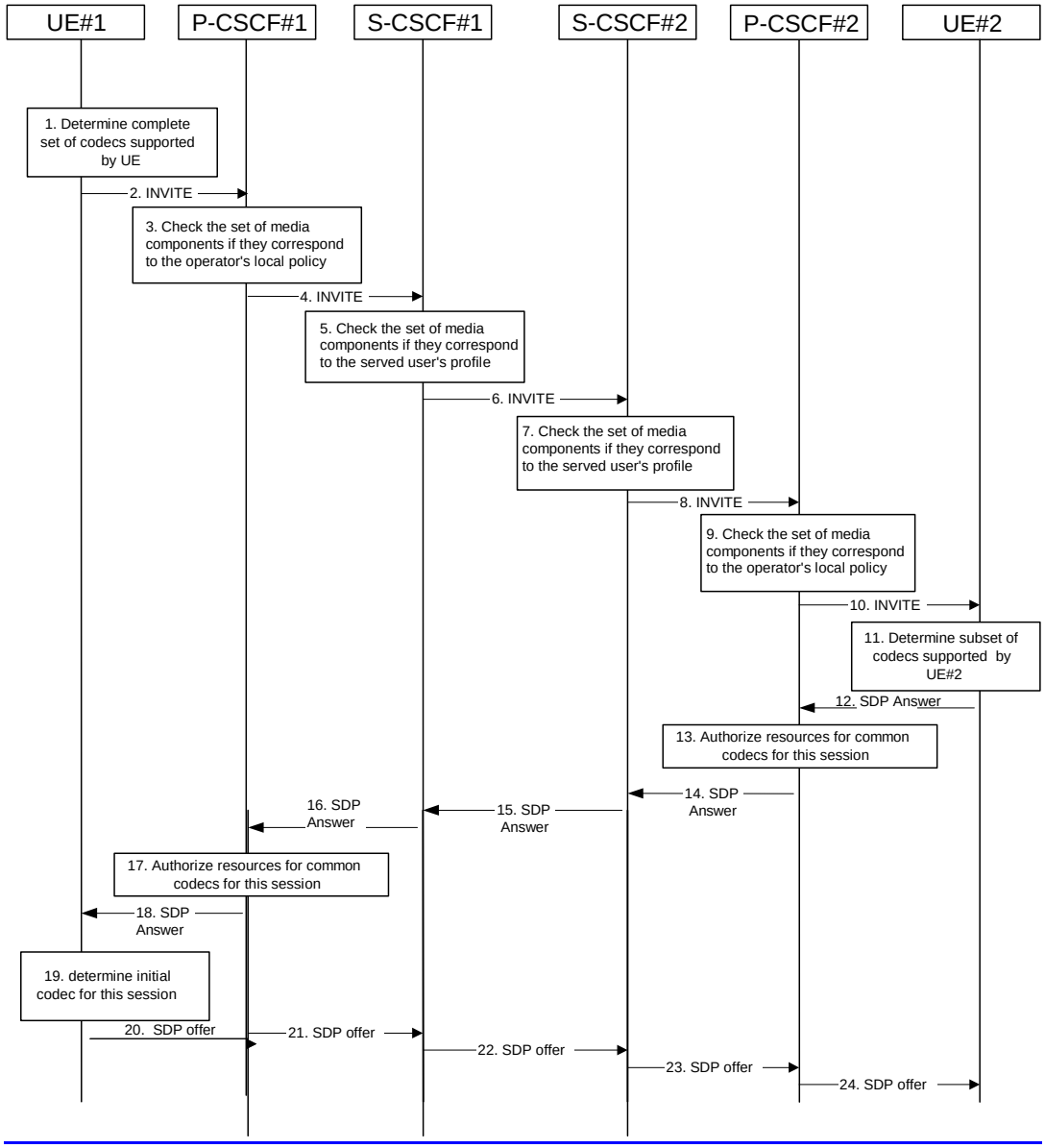


Figure 5.30: Codec negotiation during initial session establishment

The detailed procedure is as follows:

1. UE#1 inserts the codec(s) to a SDP payload. The inserted codec(s) shall reflect the UE#1's terminal capabilities and user preferences for the session~~.~~ capable of supporting for this session. It builds a SDP containing bandwidth requirements and characteristics of each, and assigns local port numbers for each possible media flow. Multiple media flows may be offered, and for each media flow (m= line in SDP), there may be multiple codec choices offered.

2. UE#1 sends the initial INVITE message to P-CSCF#1 containing this SDP

3. ~~P-CSCF#1 examines the media parameters, and removes any choices that the nework operator decides based on local policy, not to allow on the network.~~P-CSCF#1 examines the media parameters. If P-CSCF#1 finds media parameters that local policy does not allow to be used within an IMS session, it rejects the session initiation attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session initiation with media parameters that are allowed by local policy of P-CSCF#1's network according to the procedures specified in RFC 3261 [12]~~based on the original SDP offer of UE#1~~. In this flow described in Figure 5.30 above the P-CSCF#1 allows the initial session initiation attempt to continue.

4. P-CSCF#1 forwards the INVITE message to S-CSCF#1

5. ~~S-CSCF#1 examines the media parameters, and removes any choices that the user does not have authority to request. As part of the S-CSCF session processing an 'application server' may be involved. When an 'application server' is involved the application server may also examine the media parameters and revise the session description.~~S-CSCF#1 examines the media parameters. If S-CSCF#1 finds media parameters that local policy or the originating user's subscriber profile does not allow to be used within an IMS session, it rejects the session initiation attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session initiation with media parameters that are allowed by the originating user's subscriber profile and by local policy of S-CSCF#1's network according to the procedures specified in RFC 3261 [12]~~based on the original SDP offer of UE#1~~.
   In this flow described in Figure 5.30 above the S-CSCF#1 allows the initial session initiation attempt to continue.

6. S-CSCF#1 forwards the INVITE, through the S-S Session Flow Procedures, to S-CSCF#2

7. ~~S-CSCF#2 examines the media parameters, and removes any choices that the destination user does not have authority to request. As part of the S-CSCF session processing an 'application server' may be involved. When an 'application server' is involved the application server may also examine the media parameters and revise the session description.~~ S-CSCF#2 examines the media parameters. If S-CSCF#2 finds media parameters that local policy or the terminating user's subscriber profile does not allow to be used within an IMS session, it rejects the session initiation attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session initiation with media parameters that are allowed by the terminating user's subscriber profile and by local policy of S-CSCF#2's network according to the procedures specified in RFC 3261 [12]~~based on the original SDP offer of UE#1~~.
   In this flow described in Figure 5.30 above the S-CSCF#2 allows the initial session initiation attempt to continue.

8. S-CSCF#2~~3~~ forwards the INVITE message to P-CSCF#2.

9. ~~P-CSCF#2 examines the media parameters, and removes any that the network operator decides, based on local policy, not to allow on the network.~~ P-CSCF#2 examines the media parameters. If P-CSCF#2 finds media parameters that local policy does not allow to be used within an IMS session, it rejects the session initiation attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session initiation with media parameters that are allowed by local policy of P-CSCF#2's network according to the procedures specified in RFC 3261 [12]~~based on the original SDP offer of UE#1~~.
   In this flow described in Figure 5.30 above the P-CSCF#2 allows the initial session initiation attempt to continue.
   The Authorization-Token is generated by the PCF.

10. The Authorization-Token is included in the INVITE message. P-CSCF#2 forwards the INVITE message to UE#2

11. UE#2 determines the complete set of codecs that it is capable of supporting for this session. It determines the intersection with those appearing in the SDP in the INVITE message. For each media flow that is not supported, UE#2 inserts a SDP entry for media (m= line) with port=0. For each media flow that is supported, UE#2 inserts a SDP entry with an assigned port and with the codecs in common with those in the SDP from UE#1.

12. UE#2 returns the SDP listing common media flows and codecs to P-CSCF#2

13. P-CSCF#2 authorises the QoS resources for the remaining media flows and codec choices.

14. P-CSCF#2 forwards the SDP response to S-CSCF#2.

15. S-CSCF#2 forwards the SDP response to S-CSCF#1

16. S-CSCF#1 forwards the SDP response to P-CSCF#1

17. P-CSCF#1 authorises the QoS resources for the remaining media flows and codec choices. The Authorization-Token is generated by the PCF.

18. The Authorization-Token is included in the SDP message. P-CSCF#1 forwards the SDP response to UE#1

19. UE#1 determines which media flows should be used for this session, and which codecs should be used for each of those media flows. If there was more than one media flow, or if there was more than one choice of codec for a media flow, then UE#1 need to renegotiate the codecs by sending another offer to reduce codec to one with the UE#2.

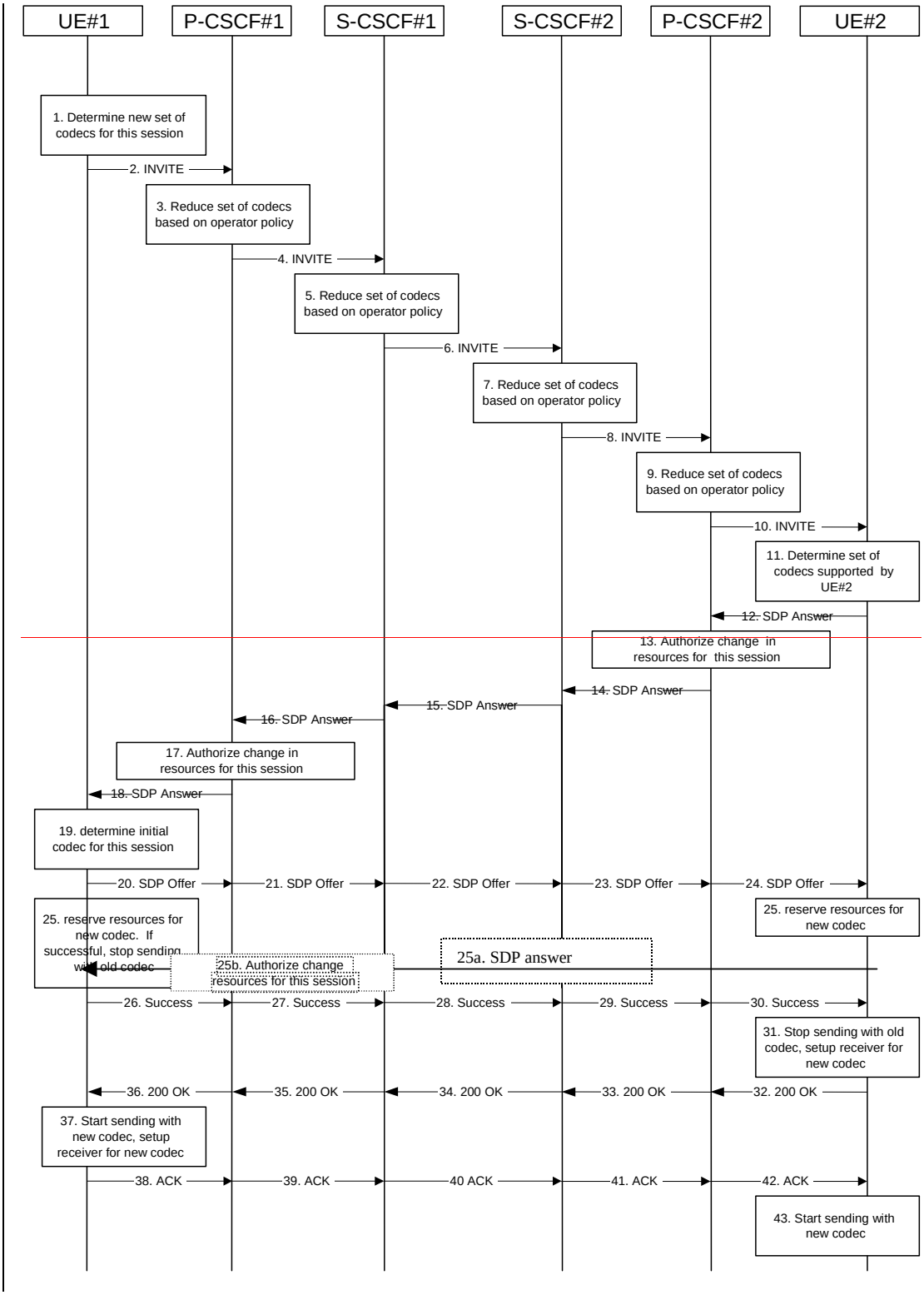
20-24. UE#2 sends the “Offered SDP” message to UE#1, along the signalling path established by the INVITE request

The remainder of the multi-media session completes identically to a single media/single codec session, if the negotiation results in a single codec per media.

********** Second set of changes **********

5.11.3.3 Codec or media characteristics flow change requiring new resources and/or authorisation

After the multi-media session is established, it is possible for either endpoint to change the set of media flows or media characteristics (e.g. codecs) for media flow(s). If the change requires different resources beyond those previously reserved, then it is necessary to perform the resource reservation and bearer establishment procedures. If the reservation request fails for whatever reason, the original multi-media session remains in progress.


UE#1
P-CSCF#1
S-CSCF#1
S-CSCF#2
P-CSCF#2
UE#2
1. Determine new set of codecs for this session
2. INVITE
3. Reduce set of codecs based on operator policy
4. INVITE
5. Reduce set of codecs based on operator policy
6. INVITE
7. Reduce set of codecs based on operator policy
8. INVITE
9. Reduce set of codecs based on operator policy
10. INVITE
11. Determine set of codecs supported by UE#2
12. SDP Answer
13. Authorize change in resources for this session
14. SDP Answer
15. SDP Answer
16. SDP Answer
17. Authorize change in resources for this session
18. SDP Answer
19. determine initial codec for this session
20. SDP Offer
21. SDP Offer
22. SDP Offer
23. SDP Offer
24. SDP Offer
25. reserve resources for new codec
25. reserve resources for new codec. If successful, stop sending with old codec
25b. Authorize change resources for this session
25a. SDP answer
26. Success
27. Success
28. Success
29. Success
30. Success
31. Stop sending with old codec, setup receiver for new codec
36. 200 OK
35. 200 OK
34. 200 OK
33. 200 OK
32. 200 OK
37. Start sending with new codec, setup receiver for new codec
38. ACK
39. ACK
40 ACK
41. ACK
42. ACK
43. Start sending with new codec

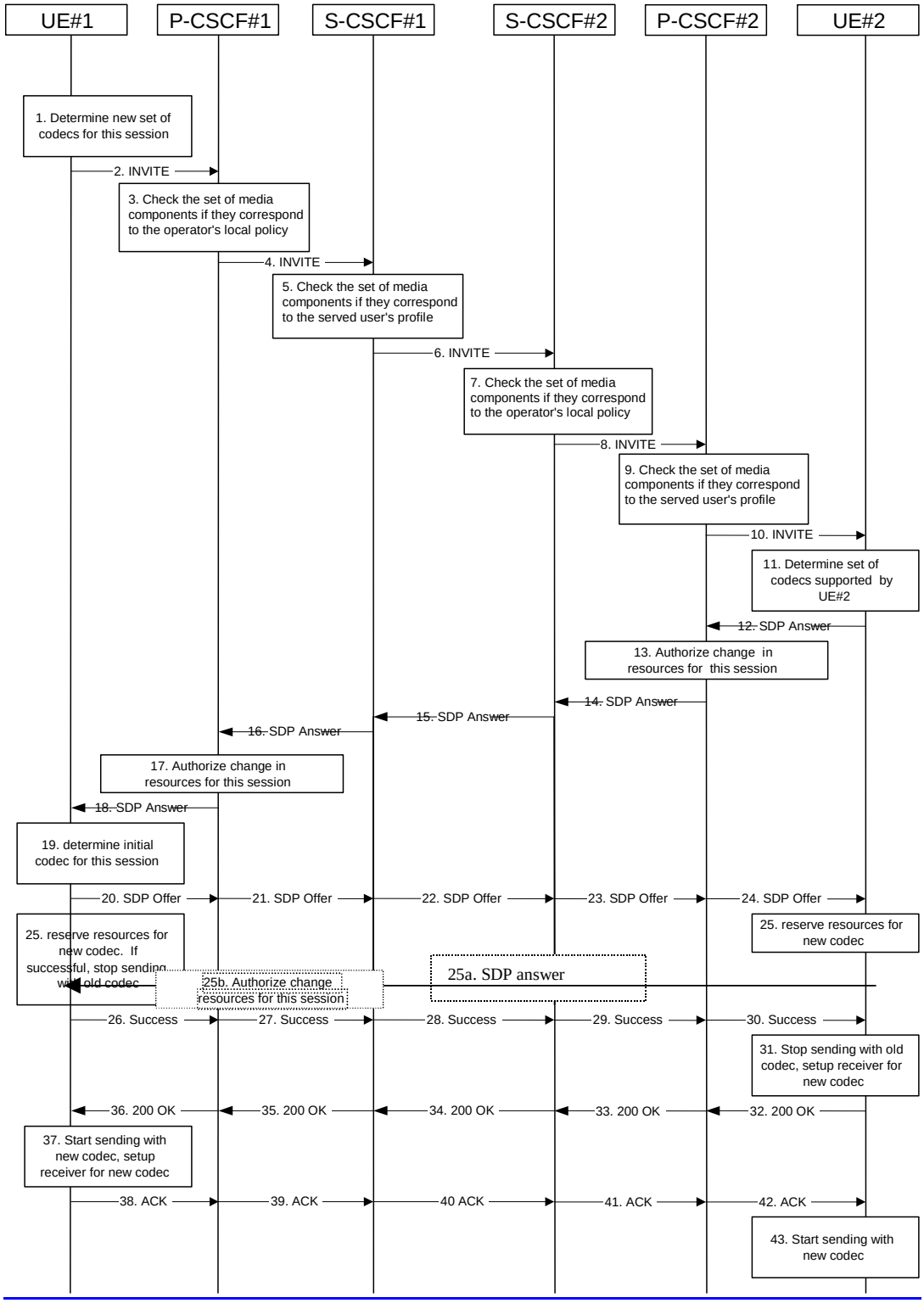


Figure 5.32: Codec or media flow change - new reservation

The detailed procedure is as follows:

1. UE#1 inserts the revised set of codecs to a SDP payload. The inserted codec(s) shall reflect the UE#1's terminal capabilities and user preferences for the session. It builds a SDP containing bandwidth requirements and characteristics of each, and assigns local port numbers for each possible media flow. Multiple media flows may be offered, and for each media flow (m= line in SDP), there may be multiple codec choices offered.

2. UE#1 sends an INVITE message to P-CSCF#1 containing this SDP

3. ~~P-CSCF#1 examines the media parameters, and removes any choices that the network operator decides, based on local policy, not to allow on the network.~~ P-CSCF#1 examines the media parameters. If P-CSCF#1 finds media parameters that local policy does not allow to be used within an IMS session, it rejects the session modification attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session modification with media parameters that are allowed by local policy of P-CSCF#1's network according to the procedures specified in RFC 3261 [12]~~based on the SDP offer of UE#1~~.
   In this flow described in Figure 5.32 above the P-CSCF#1 allows the initial session modification attempt to continue.

4. P-CSCF#1 forwards the INVITE message to S-CSCF#1

5. ~~S-CSCF#1 examines the media parameters, and removes any choices that the user does not have authority to request. As part of the S-CSCF session processing an 'application server' may be involved. When an 'application server' is involved the application server may also examine the media parameters and revise the session description.~~S-CSCF#1 examines the media parameters. If S-CSCF#1 finds media parameters that local policy or the originating user's subscriber profile does not allow to be used within an IMS session, it rejects the session modification attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session modification with media parameters that are allowed by the originating user's subscriber profile and by local policy of S-CSCF#1's network according to the procedures specified in RFC 3261 [12]~~based on the original SDP offer of UE#1~~.
   In this flow described in Figure 5.32 above the S-CSCF#1 allows the initial session modification attempt to continue.

6. S-CSCF#1 forwards the INVITE, through the S-S Session Flow Procedures, to S-CSCF#2

7. ~~S-CSCF#2 examines the media parameters, and removes any choices that the destination user does not have authority to request. As part of the S-CSCF session processing an 'application server' may be involved. When an 'application server' is involved the application server may also examine the media parameters and revise the session description.~~S-CSCF#2 examines the media parameters. If S-CSCF#2 finds media parameters that local policy or the originating user's subscriber profile does not allow to be used within an IMS session, it rejects the session modification attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session modification with media parameters that are allowed by the originating user's subscriber profile and by local policy of S-CSCF#2's network according to the procedures specified in RFC 3261 [12]~~based on the original SDP offer of UE#1~~.
   In this flow described in Figure 5.32 above the S-CSCF#2 allows the initial session modification attempt to continue.

8. S-CSCF#3 forwards the INVITE message to P-CSCF#2.

9. ~~P-CSCF#2 examines the media flows and the codec choices, and removes any that the destination network operator decides, based on local policy, not to allow on the network.~~ P-CSCF#2 examines the media parameters. If P-CSCF#2 finds media parameters that local policy does not allow to be used within an IMS session, it rejects the session modification attempt. This rejection shall contain sufficient information for the originating UE to re-attempt session modification with media parameters that are allowed by local policy of P-CSCF#2's network according to the procedures specified in RFC 3261 [12]~~based on the SDP offer of UE#1~~.
   In this flow described in Figure 5.32 above the P-CSCF#2 allows the initial session modification attempt to continue.

10. P-CSCF#2 forwards the INVITE message to UE#2

11. UE#2 determines the complete set of codecs that it is capable of supporting for this session. It determines the intersection with those appearing in the SDP in the INVITE message. For each media flow that is not supported, UE#2 inserts a SDP entry for media (m= line) with port=0. For each media flow that is supported, UE#2 inserts a SDP entry with an assigned port and with the codecs in common with those in the SDP from UE#1.

12. UE#2 returns the SDP listing common media flows and codecs to P-CSCF#2. It may additionally provide more codecs than originally offered and then the offered set need to be renegotiated.

13. P-CSCF#2 increases the authorisation for the QoS resources, if needed, for the remaining media flows and codec choices.

14. P-CSCF#2 forwards the SDP response to S-CSCF#2.

15. S-CSCF#2 forwards the SDP response to S-CSCF#1

16. S-CSCF#1 forwards the SDP response to P-CSCF#1

17. P-CSCF#1 increases the authorisation for the QoS resources, if needed, for the remaining media flows and codec choices.

18. P-CSCF#1 forwards the SDP response to UE#1

19. UE#1 determines which media flows should be used for this session, and which codecs should be used for each of those media flows. If there was more than one media flow, or if there was more than one choice of codec for a media flow, then UE#1 must include an SDP in the response message by including SDP to UE#2.

20-24. UE#1 sends the offered SDP message to UE#2, including the SDP from step #19 if needed.

25. UE#1 and UE#2 reserve the resources needed for the added or changed media flows. If the reservation is successfully completed by UE#1, it stops transmitting any deleted media streams.

25a. If UE#1 has sent an updated offer of SDP in steps 20-24, then UE#2 responds to the offer.

25b. P-CSCF#1 authorises the offered SDP sent by UE#2,

26-30. UE#1 sends the successful Resource Reservation Successful message with final SDP to UE#2, via the signalling path through the CSCFs.

31. UE#2 stops sending the media streams to be deleted, and initialises its media receivers for the new codec.

32-36. UE#2 sends the 200-OK final response to UE#1, along the signalling path

37. UE#1 starts sending media using the new codecs. UE#1 also releases any excess resources no longer needed.

38-40. UE#1 sends the SIP final acknowledgement, ACK, to UE#2 along the signalling path

43. UE#2 starts sending media using the new codecs. UE#2 also releases any excess resources no longer needed