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Technical Report

3rd Generation Partnership Project; Technical Specification Group Core Network Signalling interworking between the 3GPP profile of the Session Initiation Protocol (SIP) and non-3GPP SIP usage (Release 6)



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Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
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- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document investigates the SIP signalling interworking between IMS network entities behaving as specified in the 3GPP profile of SIP in TS 24.229 [1], with related callflow examples in TS 24.228 [2] and stage 2 work in TS 23.228 [3], and SIP network entities external to the 3GPP network, which may not adhere to the 3GPP profile of SIP.

Non-GPRS access to IMS may have implications on the TR, which are not yet discussed.

The considered SIP network entities external to the 3GPP network may feature different SIP capabilities, such as the support of arbitrary SIP packages

The document focuses on scenarios where the non-3GPP UA does not support one or more of the following SIP extensions:

Preconditions: “Integration of Resource Management and SIP” RFC 3312 [5]

Update: “The Session Initiation Protocol UPDATE Method”, RFC 3311 [7]

100rel: “Reliability of Provisional Responses in SIP”, RFC 3262 [6]

Security interworking may also have implications on the TR, which are not yet discussed.

The present document does not make any a-priory assumptions where a possible interworking is performed within the 3GPP network. Any SIP network entity within the 3GPP network may take part in the interworking. The network entities that may become involved in a certain interworking topic are identified for each of these topics separately.

The present document features a discussion of topics, where an interworking is possibly required. Aspects of the 3GPP profile of SIP, which obviously do not require any interworking, are not discussed. An assessment of the impact and probability of occurrence of the discussed scenarios is also provided.

Problems due to network elements within the 3GPP network, which do not or only partly satisfy the 3GPP profile of SIP, in particular not fully 3GPP conformant SIP terminals, are out of scope of the present document.

The present document is dedicated exclusively to issues inherent in the SIP signalling. Related topics in a wider sense, such as Ipv6 to Ipv4 address translation or user plane transcoding are out of scope.

It is foreseen that future non-3GPP SIP clients will support the above required SIP extensions, and it is envisaged that it is unlikely that interworking solutions will then be required.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TS 24.229: "IP multimedia Call Control Protocol based on SIP and SDP"
- [2] 3GPP TS 24.228: "Signalling flows for the IP multimedia call control based on SIP and SDP"
- [3] 3GPP TS 23.228: "IP Multimedia (IM) Subsystem - Stage 2"
- [4] IETF RFC 3261: "SIP: Session Initiation Protocol"
- [5] IETF RFC 3312: "Integration of Resource Management and SIP"
- [6] IETF RFC 3262: "Reliability of Provisional Responses in SIP"
- [7] IETF RFC 3311: "The Session Initiation Protocol UPDATE Method"
- [8] IETF RFC 3264 "An Offer/Answer Model with SDP"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 24.229 [1] and RFC 3261 [4] and the following apply.

The 3GPP profile of SIP: The specification of the usage of SIP within 3GPP networks in TS 24.229 [1].

SIP-preconditions extension: The SIP and SDP "precondition" extensions, as defined in RFC 3312 [5]

SIP update extension: The SIP "update" extension, including the SIP "UPDATE" method, as defined in RFC 3311 [7]

SIP 100rel extension: The SIP "100rel" extension, including the SIP "PRACK" method, as defined in RFC 3262 [6]

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TS 24.229 [1] and RFC 3261 [4] apply.

4. Interworking Scenarios

Each topic is contained in an own subsection with the structure defined in Annex A. Further structure may be introduced to the present section by grouping related topics.

4.1 calling 3GPP UA to called non-3GPP UA

The following scenarios are not considered, since they are not compliant with RFC 3312 [5], Section 11:

- 3GPP UA to non-3GPP UA supporting the SIP precondition extension, but not supporting the SIP 100rel extension.
- 3GPP UA to non-3GPP UA supporting the SIP preconditions extension, but not supporting the SIP update extension.

4.1.1 3GPP UA to non-3GPP UA supporting the SIP 100rel extension and the SIP update extension, but not supporting the SIP preconditions extension

4.1.1.1 Description of interworking issue

The call fails, as detailed in Section 4.1.2.2

Within 3GPP, the SIP update extension is only required to convey SDP offer/answer with SDP attributes defined in the SIP precondition extension with the help of the SIP UPDATE method.

A fixed UE supporting the SIP update extension may use features of this extension for purposes not related to the SIP precondition extension. As a result, various extra messages may be inserted into the callflow.

4.1.1.2 Proposed Resolutions to interworking issue

4.1.1.2.1 B2B UA

A B2B UA is used.

4.1.1.2.1.1 Insertion of B2B UA

How the B2B UA is inserted is discussed within Section 4.1.2.4.1.1

4.1.1.2.1.2 Functionality of B2B UA

4.1.1.2.1.2.1 Description

The functionality of the B2B UA is as discussed in Section 4.1.2.4.1.2.1

The B2B UA shall pass additional UPDATE messages, which are not related to the precondition extension, and related provisional acknowledge messages.

4.1.1.2.1.2.2 Advantages

General advantages of the B2B UA are discussed in Section 4.1.2.4.1.2.2

Both the calling and called UA may send UPDATE messages at various places within the callflow. Those messages may include additional SDP offers. Due to the large number of possibilities, such callflows can not depicted. The dialog state is not altered by UPDATE requests, and thus these messages probably do not have harmful side effects.

4.1.1.2.1.2.3 Disadvantages

General disadvantages of the B2B UA are discussed in Section 4.1.2.4.1.2.3

Future use of UPDATE is not predictable. Thus, harmful effects may not be ruled out.

4.1.1.2.2 Modified end-to-end callflow

4.1.1.2.2.1 Description

Editor's Note: This section details the suggestion. The involved 3GPP network entities are identified.

4.1.1.2.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.1.1.2.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

4.1.2 3GPP UA to non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP precondition extension and the SIP update extension

4.1.2.1 Description of interworking issue

Since the calling 3GPP UA requires the SIP precondition extension in the SIP INVITE request, the call will be aborted.

4.1.2.2 Flow diagram

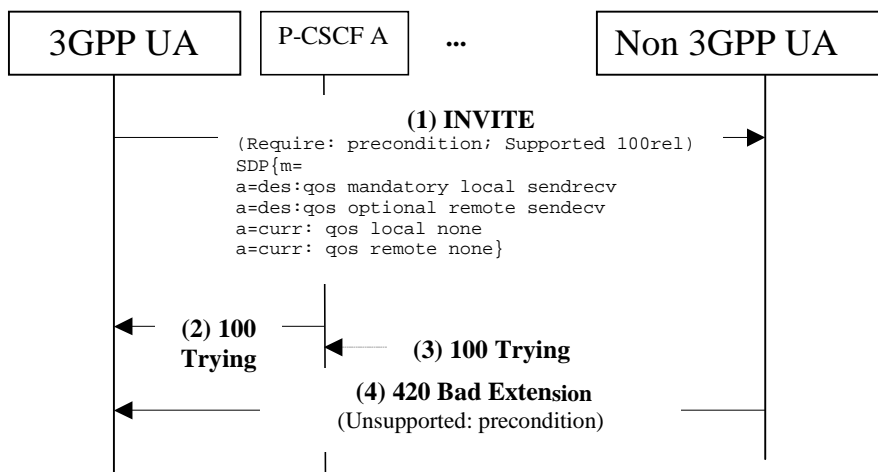


Figure 4.1.2.2/1: 3GPP UA to non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP precondition extension and the SIP update extension

4.1.2.3 Impact of Identified interworking issue

The call fails.

4.1.2.4 Proposed resolutions to interworking issue

A B2B UA is used.

4.1.2.4.1 B2B UA

4.1.2.4.1.1 Insertion of B2B UA

4.1.2.4.1.1.1 Static Insertion of B2B UA

4.1.2.4.1.1.1.1 Description

A B2B UA is permanently inserted at connections between the IMS and a given external network. This B2B UA handles all calls, including calls where the callflows may be passed without modification.

Editor's Note: It has to be clarified how the network finds out that the call terminates outside a 3GPP IMS.

4.1.2.4.1.1.1.2 Advantages

4.1.2.4.1.1.1.3 Disadvantages

Additional processing load.

Additional delay

Lack of signalling transparency may restrict the compatibility with future extensions for all calls.

4.1.2.4.1.2 Functionality of B2B UA

4.1.2.4.1.2.1 Description

The B2B UA relies messages as indicated by the red dotted arrows in the figures below.

The called UA may also send no "Session progress" message and include the SDP answer in the "200 OK(INVITE)" instead. This case is discussed in Section 4.1.3.4.1.2

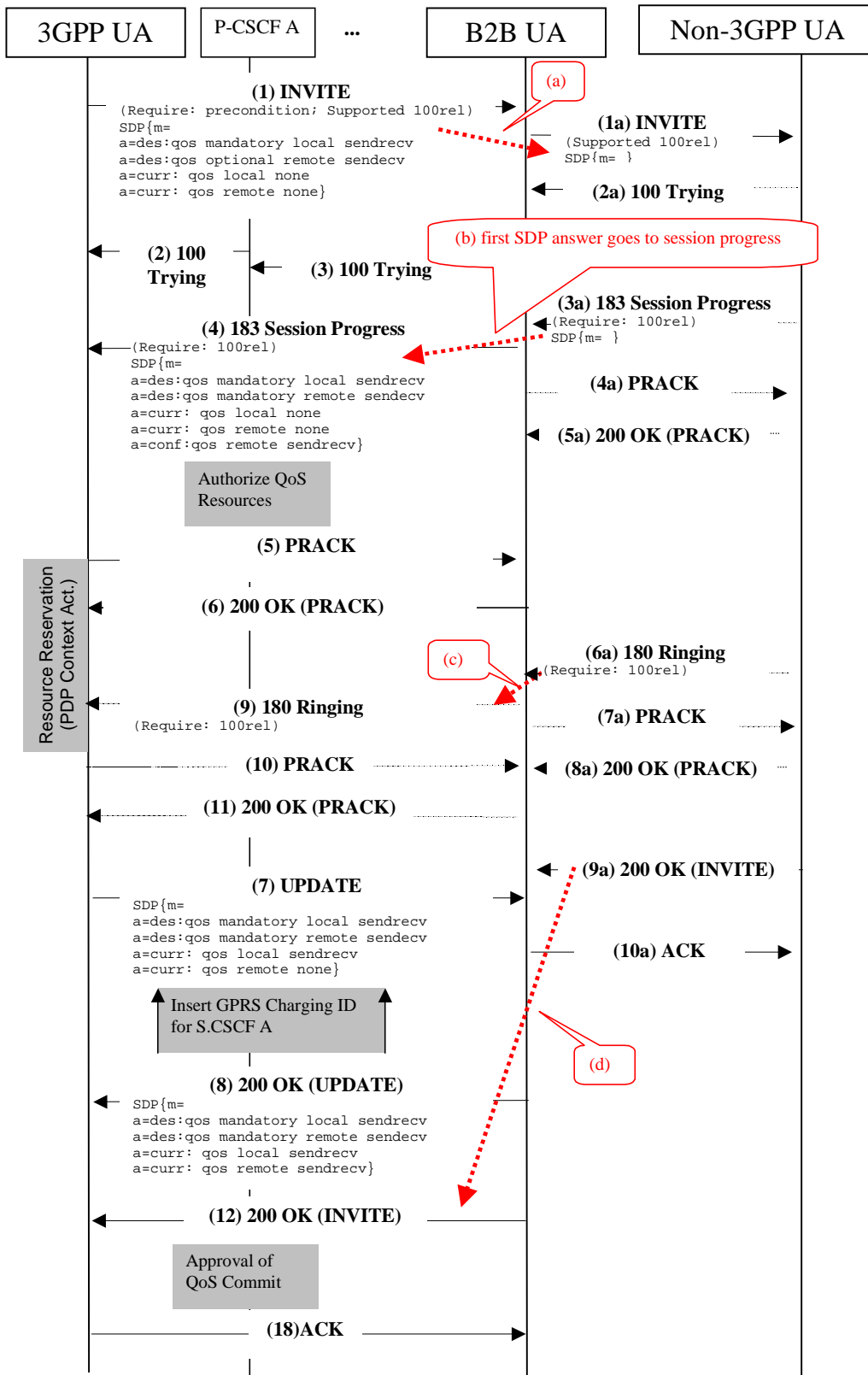


Figure 4.1.2.4.1.2.1/1: Functionality of B2B UA connecting 3GPP UA to non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension. Calling UA includes SDP answer in 183 “Session Progress”. Calling UA sends no second SDP offer

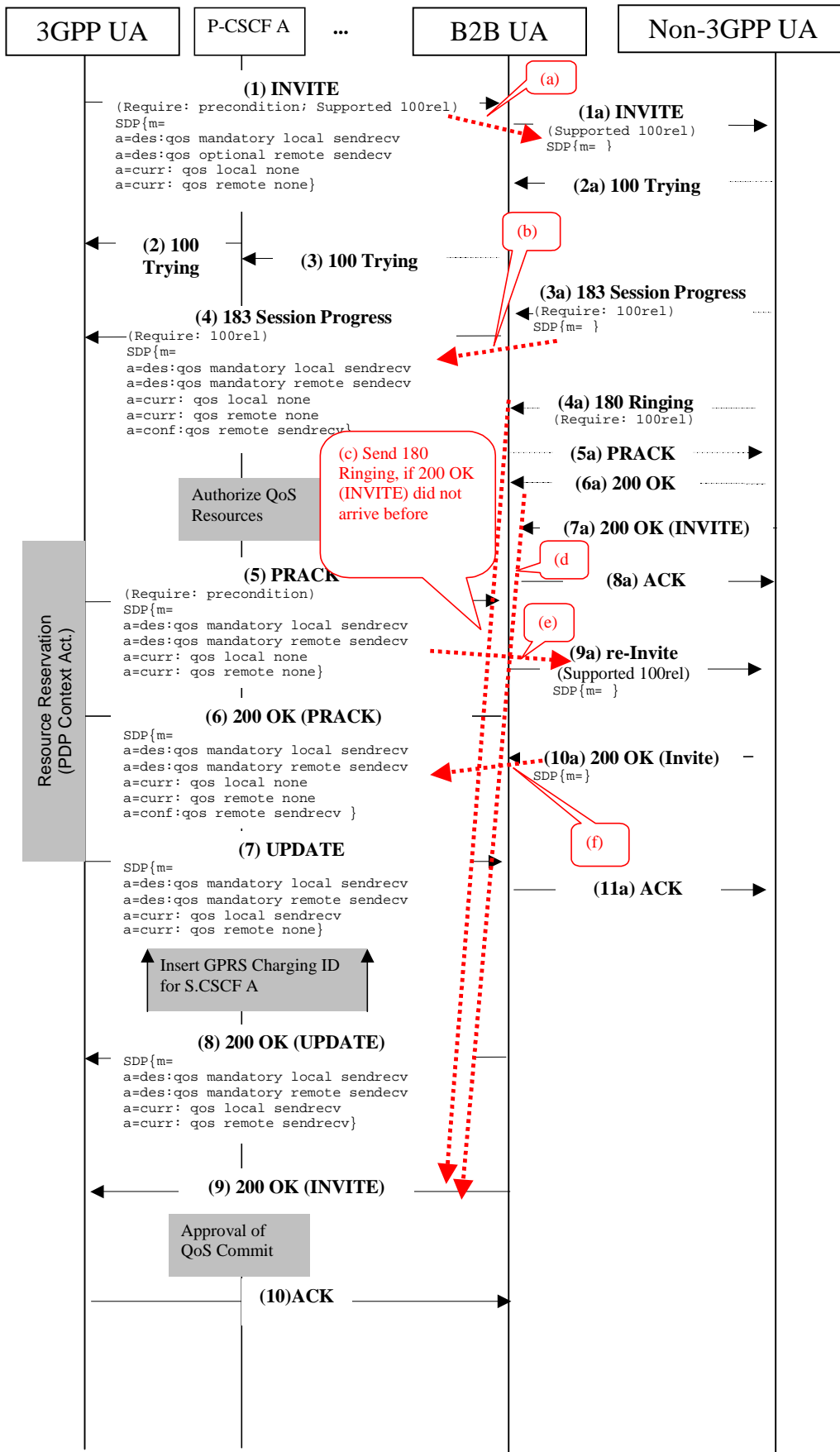


Figure 4.1.2.4.1.2.1/2: Functionality of B2B UA connecting 3GPP UA to non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension. Called UA includes SDP answer in 183 “Session Progress”. Calling UA sends second SDP offer

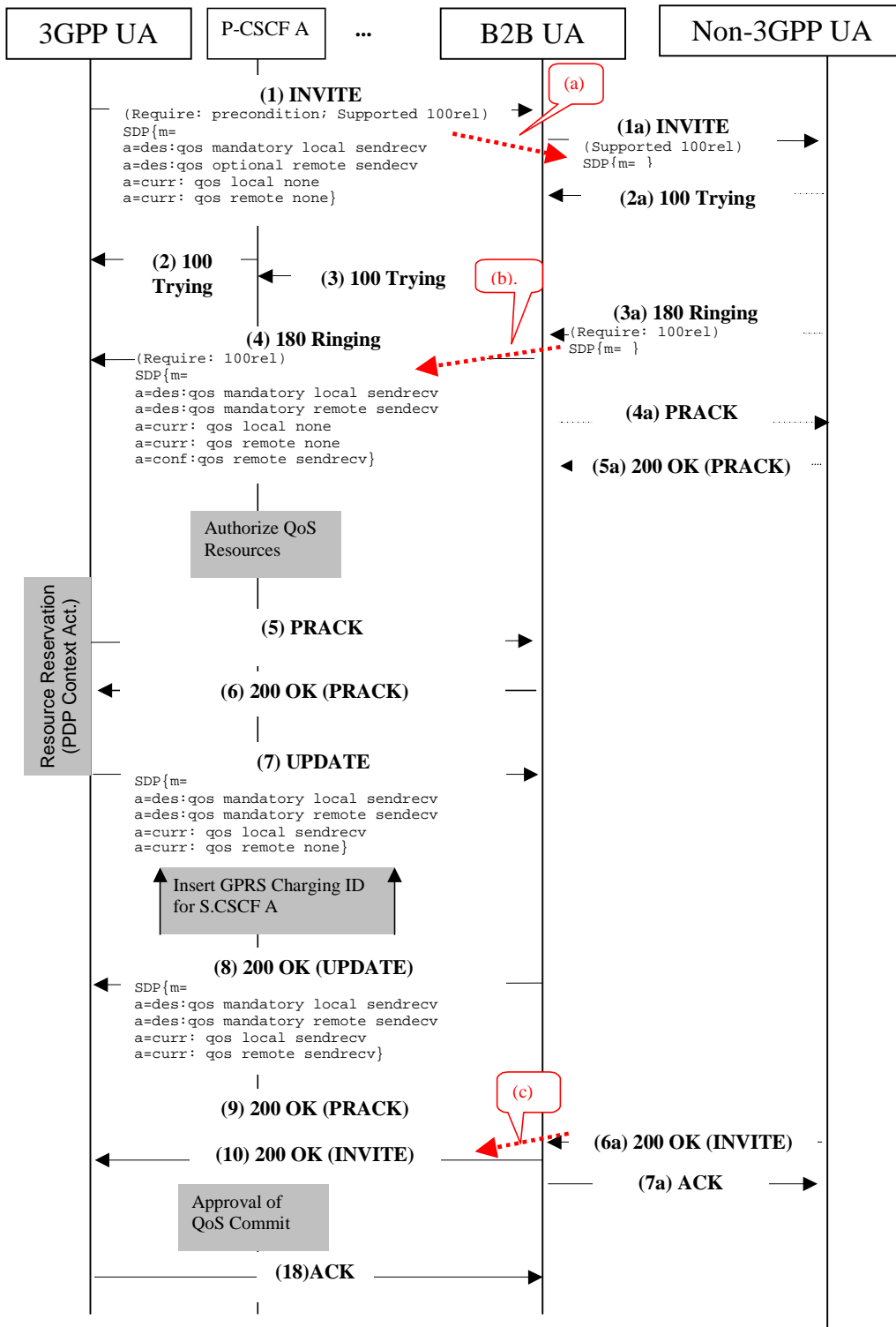


Figure 4.1.2.4.1.2.1/3: Functionality of B2B UA connecting 3GPP UA to non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension. Called UA includes SDP answer in 180 “Ringing”. Calling UA sends no second SDP offer

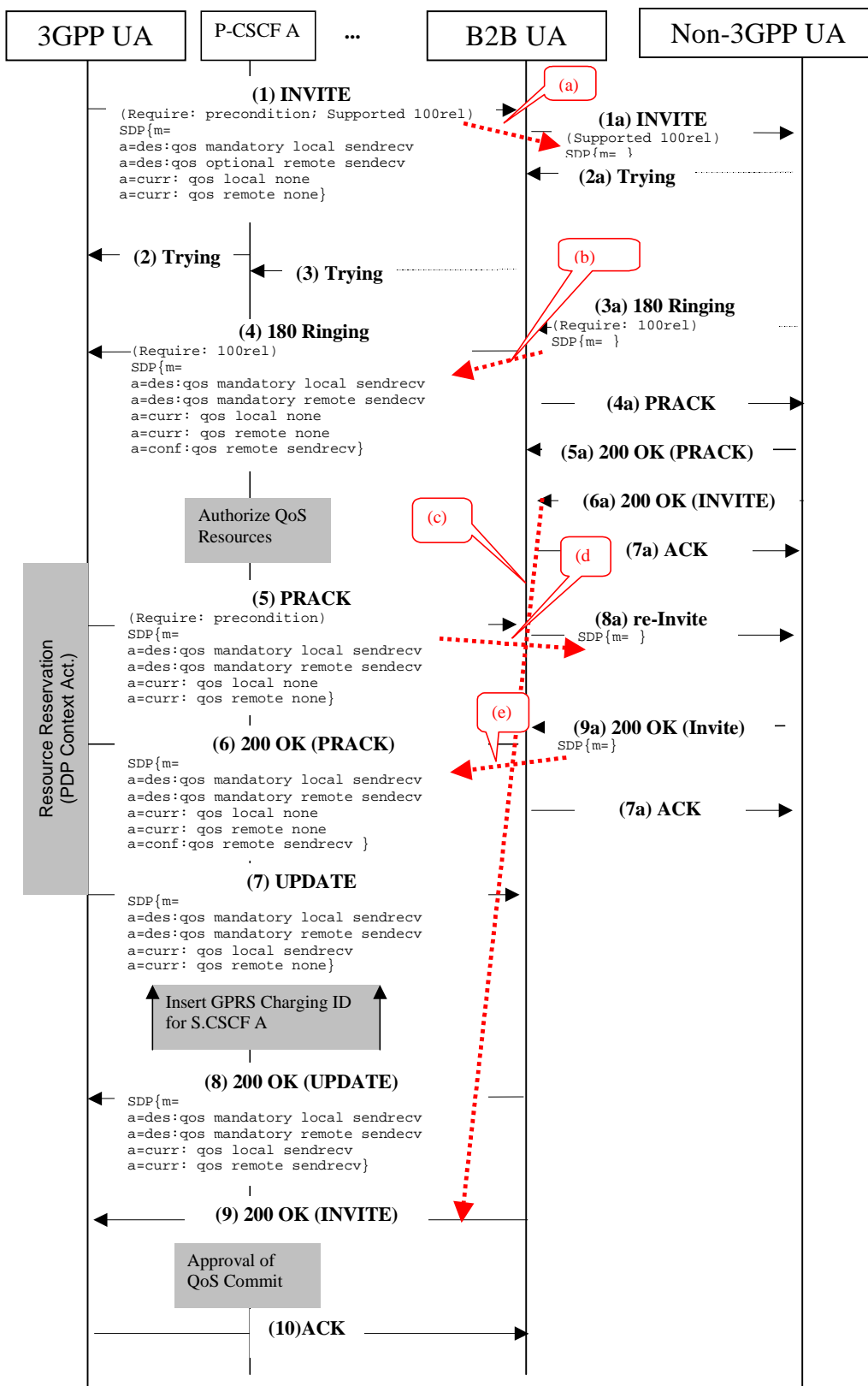


Figure 4.1.2.4.1.2.1/4: Functionality of B2B UA connecting calling 3GPP UA to called non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension. Called UA includes SDP answer in 180 “Ringing”. Calling UA sends second SDP offer

4.1.2.4.1.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.1.2.4.1.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

The functionality and implementation of the B2B UA is complicated and will have to include the following features:

- Storage of SDP.
- Own timer supervision of dialogues on both call legs.

The compatibility with future SIP extensions may be limited by the need to update the B2B UA. This may limit the network's ability to deploy new IP multimedia applications.

4.1.2.4.2 Modified end-to-end callflow

4.1.2.4.2.1 Description

Editor's Note: This section details the suggestion. The involved 3GPP network entities are identified.

4.1.2.4.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.1.2.4.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

4.1.3 3GPP UA to non-3GPP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension

4.1.3.1 Description of interworking issue

The call fails, as detailed in Section 4.1.2.2

4.1.3.2 Proposed Resolutions to interworking issue

4.1.3.2.1 B2B UA

A B2B UA is used.

4.1.3.2.1.1 Insertion of B2B UA

How the B2B UA is inserted is discussed within Section 4.1.2.4.1.1

4.1.3.2.1.2 Functionality of B2B UA

4.1.3.2.1.2.1 Description

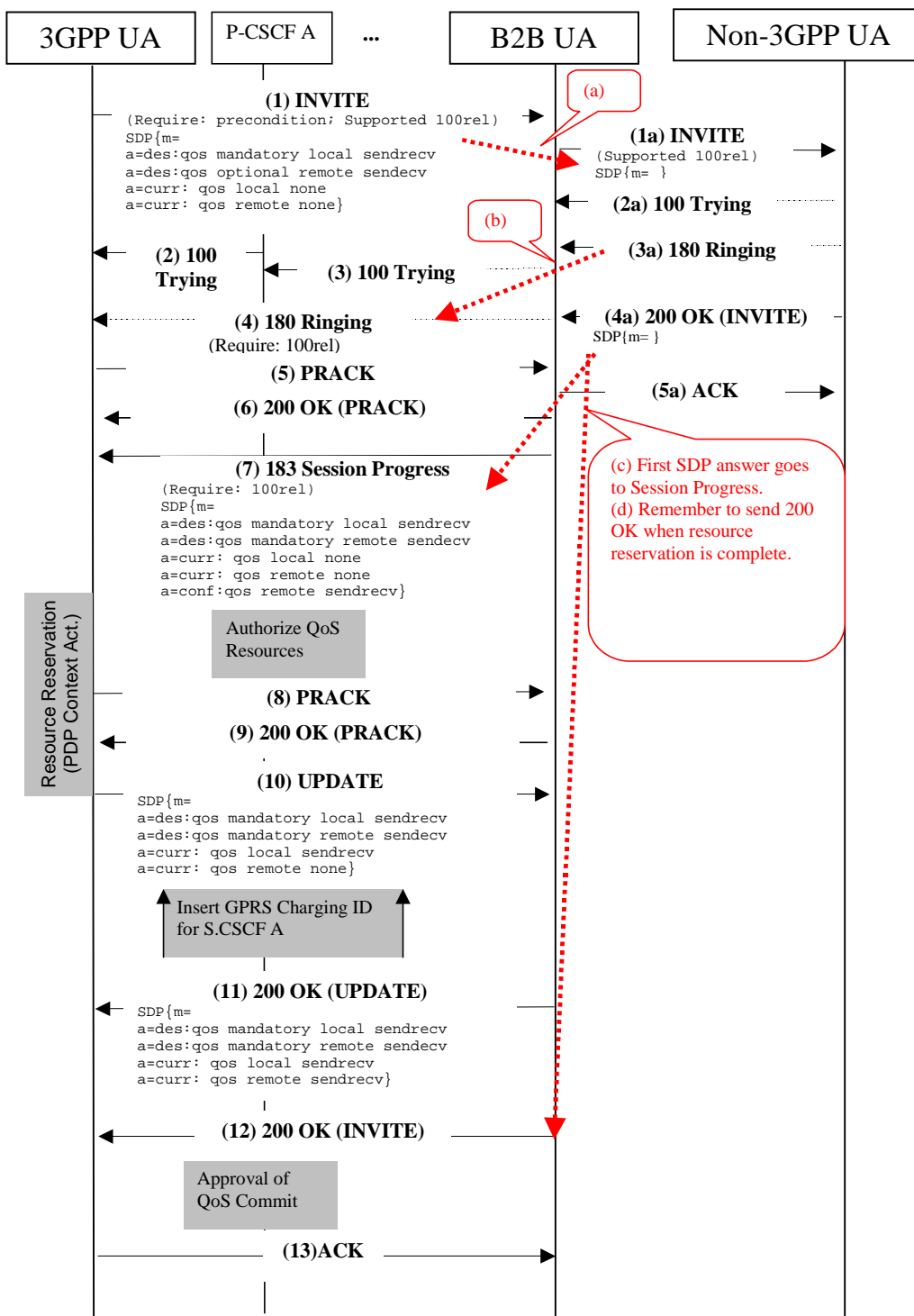


Figure 4.1.3.2.1.2/1: Functionality of B2B UA connecting calling 3GPP UA to called non-3GPP UA not supporting the SIP preconditions extension, the SIP update extension and the SIP 100rel extension. Calling UA sends no second SDP offer

There may be re-transmissions of the INVITE (1) by the 3GPP UA, which should be passed transparently by the B2B UA, as indicated in interaction (a).

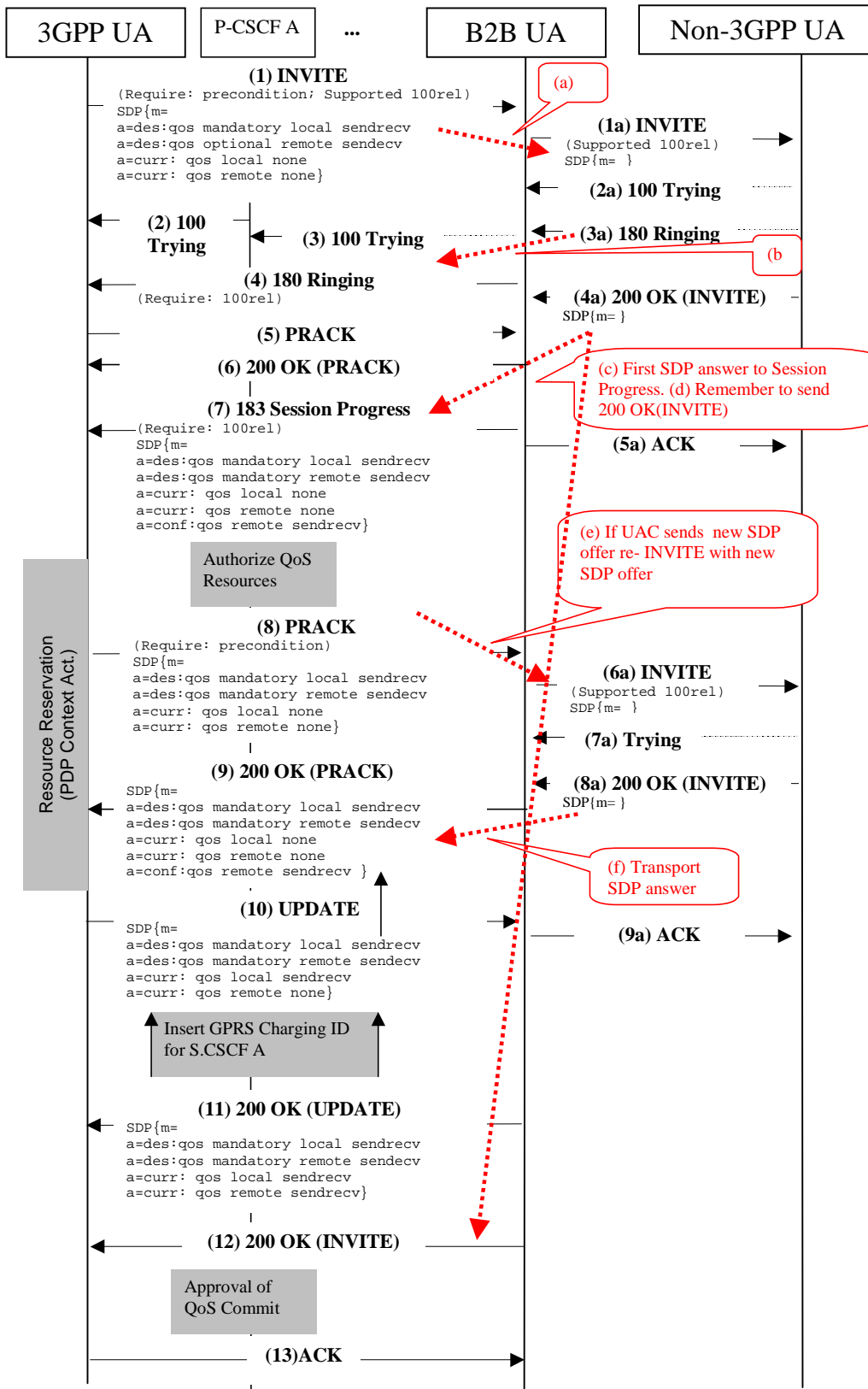


Figure 4.1.3.2.1.2/2: Functionality of B2B UA connecting calling 3GPP UA to called non-3GPP UA not supporting the SIP preconditions extension, the SIP update extension and the SIP 100rel extension. Calling UA sends second SDP offer

Editor's Note: It has to be clarified how the B2B UA decides that the called non-3GPP UA is not supporting preconditions.

4.1.3.2.1.2.2 Advantages

Editor's Note: This section lists possible advantages of this suggestion compared to competing suggestions.

General advantages of the B2B UA are discussed in Section 4.1.2.4.1.2.2.

4.1.3.2.1.2.3 Disadvantages

Editor's Note: This section lists possible disadvantages of this suggestion compared to competing suggestions.

General disadvantages of the B2B UA are discussed in Section 4.1.2.4.1.2.3.

The 3GPP user perception suffers if the non-3GPP UA does not answer the call immediately, but does not send a ringing message.

The non-3GPP UA may suffer clipping.

4.1.3.2.2 Modified end-to-end callflow

4.1.3.2.2.1 Description

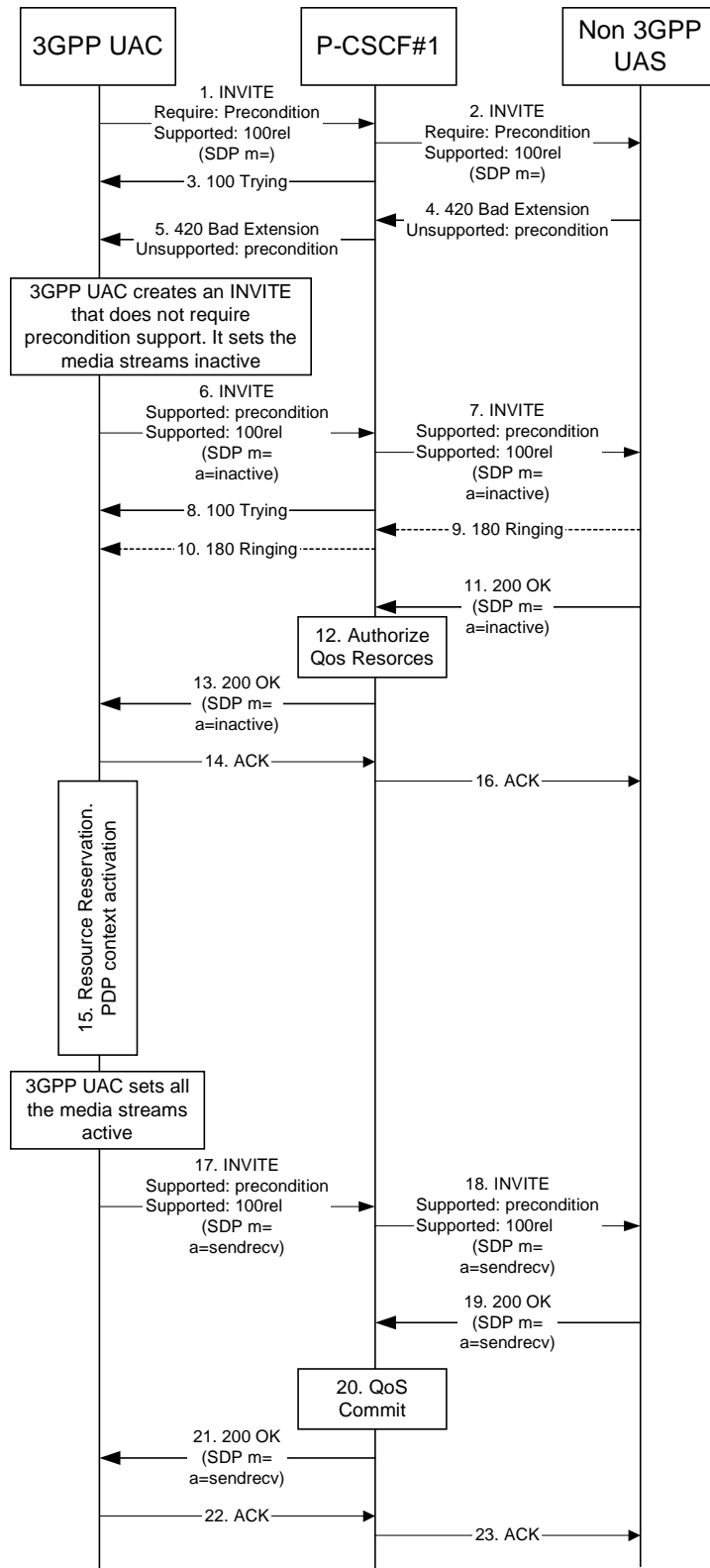


Figure 4.1.3.2.2.2/1: Using re-invite to connect calling 3GPP UA to called non-3GPP UA not supporting the SIP preconditions extension, the SIP update extension and the SIP 100rel extension.

Editor's Note: This call flow is for further investigation. The correctness has to be verified. Rules to decide when to insert GPRS Charging ID and when to commit QoS at the P-CSCF/PCF, at when to start IMS service charging at the S-CSCF have to be provided.

4.1.3.2.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.1.3.2.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

4.2 Calling non-3GPP UA to Called 3GPP UA

The following scenarios are not considered, since they are not compliant with RFC 3312 [5], Section 11:

- Non-3GPP UA supporting the SIP precondition extension, but not supporting the SIP 100rel extension, to 3GPP UA.
- Non-3GPP UA supporting the SIP preconditions extension, but not supporting the SIP update extension, to 3GPP UA.

4.2.1 Non-3GPP UA supporting the SIP 100rel extension and the SIP update extension, but not supporting the SIP preconditions extension, to 3GPP UA

4.2.1.1 Description of interworking issue

The call fails, as detailed in Section 4.2.2.2

Within 3GPP, the SIP update extension is only required to convey SDP offer/answer with SDP attributes defined in the SIP precondition extension with the help of the SIP UPDATE method.

A fixed UE supporting the SIP update extension may use features of this extension for purposes not related to the SIP precondition extension. As a result, various extra messages may be inserted into the callflow.

4.2.1.2 Proposed Resolutions to interworking issue

4.2.1.2.1 B2B UA

A B2B UA is used.

4.2.1.2.1.1 Insertion of B2B UA

How the B2B UA is inserted is discussed within Section 4.2.2.4.1.1

4.2.1.2.1.2 Functionality of B2B UA

4.2.1.2.1.2.1 Description

The functionality of the B2B UA is as discussed in Section 4.2.2.4.1.2.1

The B2B UA shall pass additional UPDATE messages, which are not related to the precondition extension, and related provisional acknowledge messages.

4.2.1.2.1.2.2 Advantages

General advantages of the B2B UA are discussed in Section 4.2.2.4.1.2.2.

The calling and the called UA may send UPDATE messages at various places within the callflow. Those messages may include additional SDP offers. Due to the large number of possibilities, such callflows can not depicted. The dialog state is not altered by UPDATE requests, and thus these messages probably do not have harmful side effects.

4.2.1.2.1.2.3 Disadvantages

General disadvantages of the B2B UA are discussed in Section 4.2.2.4.1.2.3.

Future use of UPDATE is not predictable. Thus, harmful effects may not be ruled out.

4.2.1.2.2 Modified end-to-end callflow

4.2.1.2.2.1 Description

Editor's Note: This section details the suggestion. The involved 3GPP network entities are identified.

4.2.1.2.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.2.1.2.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

4.2.2 Non-3GPP SIP UA supporting the SIP 100rel extension, but not supporting the SIP precondition extension and the SIP update extension, to 3GPP UA

4.2.2.1 Description of interworking issue

Since the calling 3GPP UA mandates the support of the SIP precondition extension in the SIP INVITE request, the call will be aborted.

4.2.2.2 Flow diagram

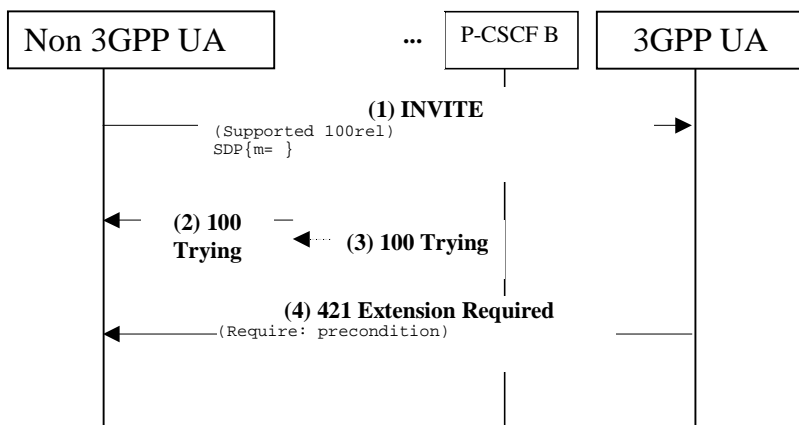


Figure 4.2.2.2/1: Non-3GPP SIP UA not supporting the SIP precondition extension and the SIP update extension, to 3GPP UA.

4.2.2.3 Implications of Identified interworking issue

The call fails.

4.2.2.4 Proposed resolutions to interworking issue

4.2.2.4.1 B2B UA

A B2B UA is used.

4.2.2.4.1.1 Insertion of B2B UA

4.2.2.4.1.1.1 Static Insertion of B2B UA

4.2.2.4.1.1.1.1 Description

A B2B UA is permanently inserted at connection between IMS and a given external network. This B2B UA handles all calls, including calls where the callflows may be passed without modification.

4.2.2.4.1.1.1.2 Advantages

4.2.2.4.1.1.1.3 Disadvantages

Additional processing load.

Additional delay

Lack of signalling transparency may restrict the compatibility with future extensions for all calls.

4.2.2.4.1.2 Functionality of B2B UA

4.2.2.4.1.2.1 Description

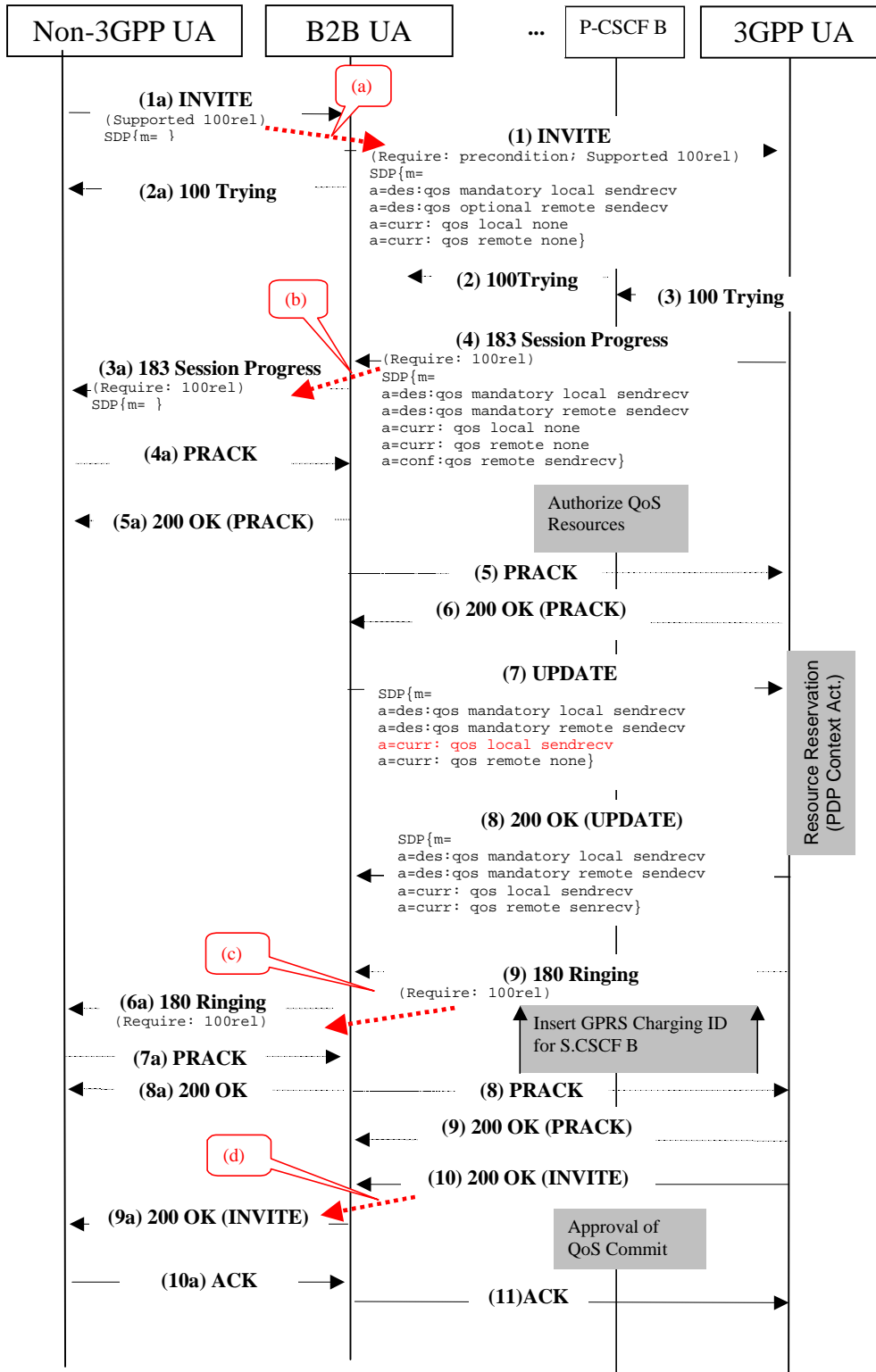


Figure 4.2.2.4.1.2.1/1: Functionality of B2B UA connecting calling non-3GPP SIP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension, to called 3GPP UA.

4.2.2.4.1.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.2.2.4.1.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

The functionality and implementation of the B2B UA is complicated and will have to include the following features:

- Storage of SDP.
- Own timer supervision of dialogues on both call legs.

The compatibility with future SIP extensions may be limited by the need to update the B2B UA. This may limit the network's ability to deploy new IP multimedia applications.

4.2.2.4.2 Modified end-to-end callflow

4.2.2.4.2.1 Description

Editor's Note: This section details the suggestion. The involved 3GPP network entities are identified.

4.2.2.4.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.2.2.4.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

4.2.3 Non-3GPP SIP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension, to 3GPP UA

4.2.3.1 Description of interworking issue

The call fails, as detailed in Section 4.2.2.2

4.2.3.2 Proposed Resolutions to interworking issue

4.2.3.2.1 B2B UA

A B2B UA is used.

4.2.3.2.1.1 Insertion of B2B UA

How the B2B UA is inserted is discussed within Section 4.2.2.4.1.1

4.2.3.2.1.2 Functionality of B2B UA

4.2.3.2.1.2.1 Description

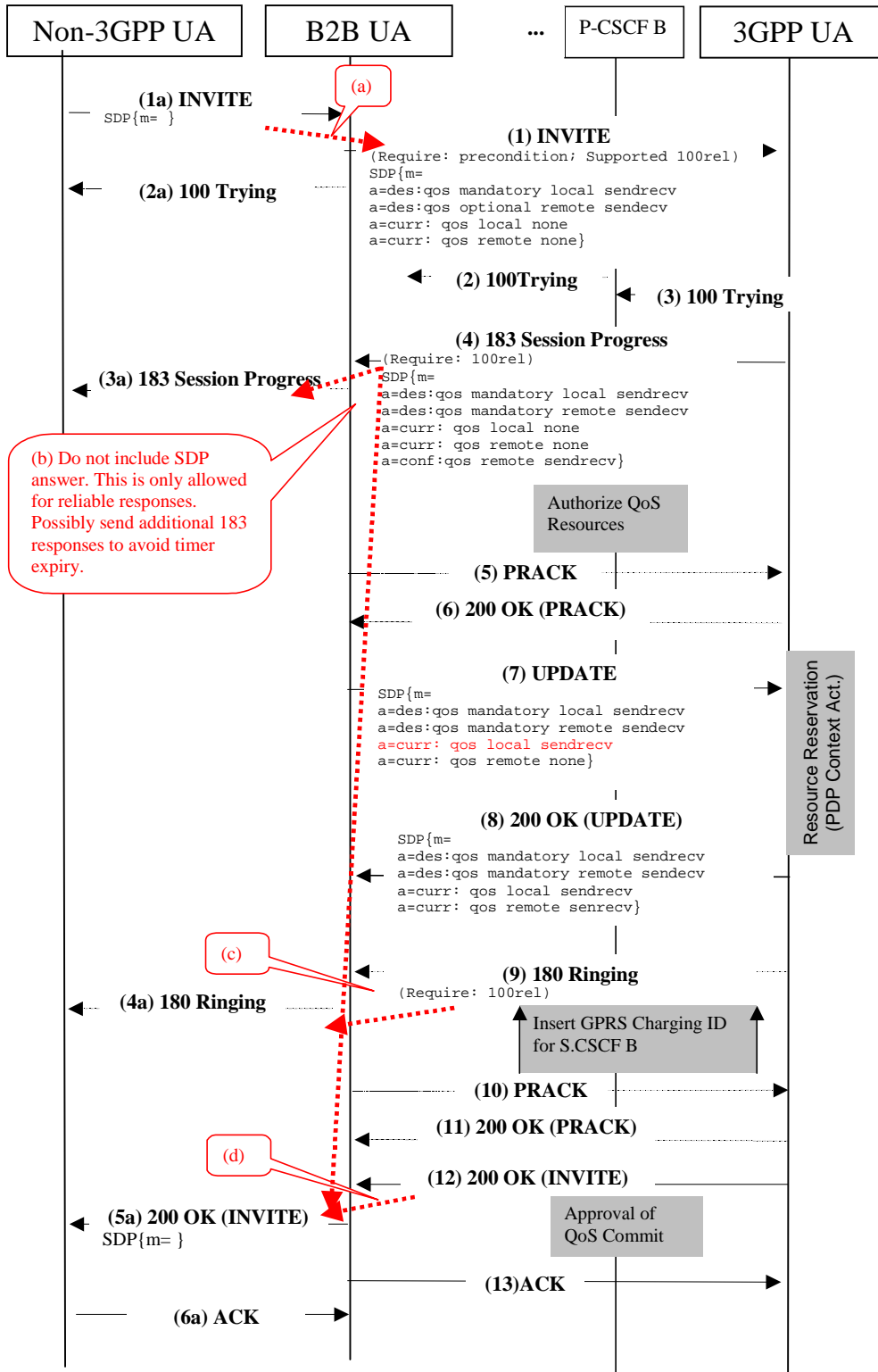


Figure 4.2.3.2.1.2.1/1: Functionality of B2B UA connecting calling non-3GPP SIP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension, to called 3GPP UA. SDP offer in INVITE request.

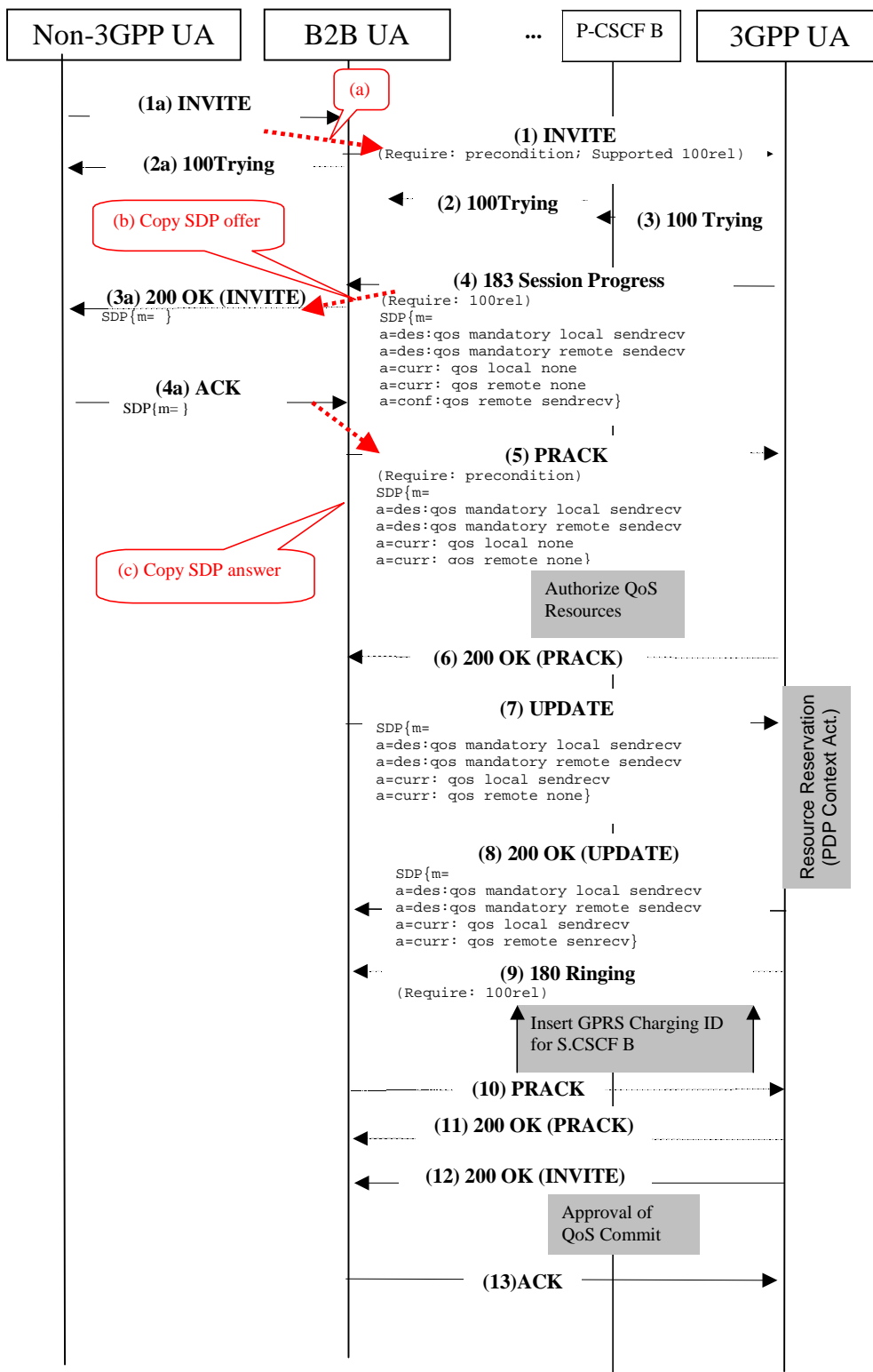


Figure 4.2.3.2.1.2.1/2: Functionality of B2B UA connecting calling non-3GPP SIP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension, to called 3GPP UA. SDP offer in OK response.

4.2.3.2.1.2.2 Advantages

Editor’s Note: This section list possible advantages of this suggestion compared to competing suggestions.

General advantages of the B2B UA are discussed in Section 4.2.2.4.1.2.2.

4.2.3.2.1.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

General disadvantages of the B2B UA are discussed in Section 4.2.3.4.1.2.3.

4.2.3.2.2 Modified end-to-end callflow

4.2.3.2.2.1 Description

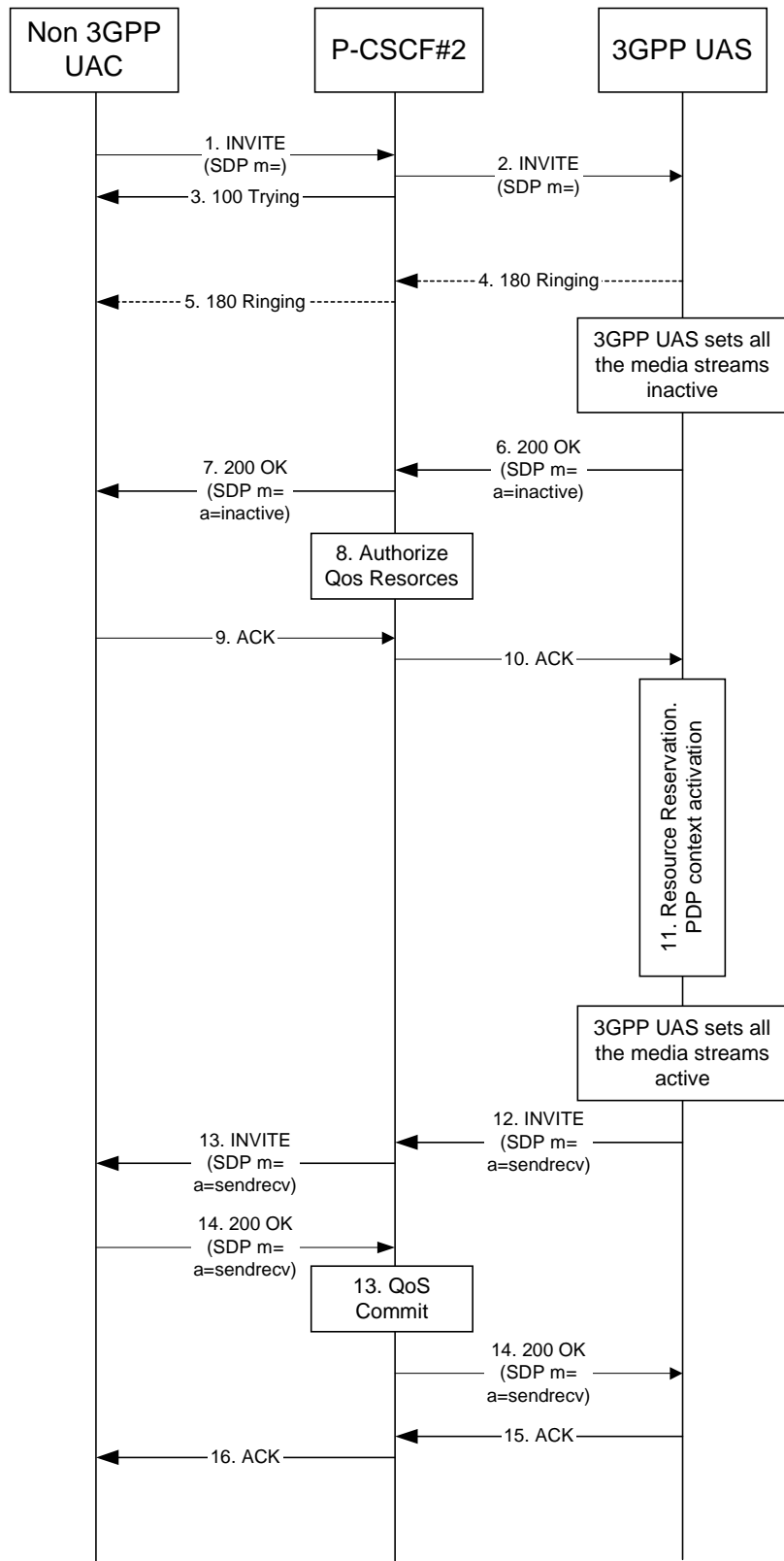


Figure 4.2.3.2.2.2/1: Using re-invite to connect calling non-3GPP UA not supporting the SIP preconditions extension, the SIP update extension and the SIP 100rel extension to called 3GPP UA. The INVITE contains SDP.

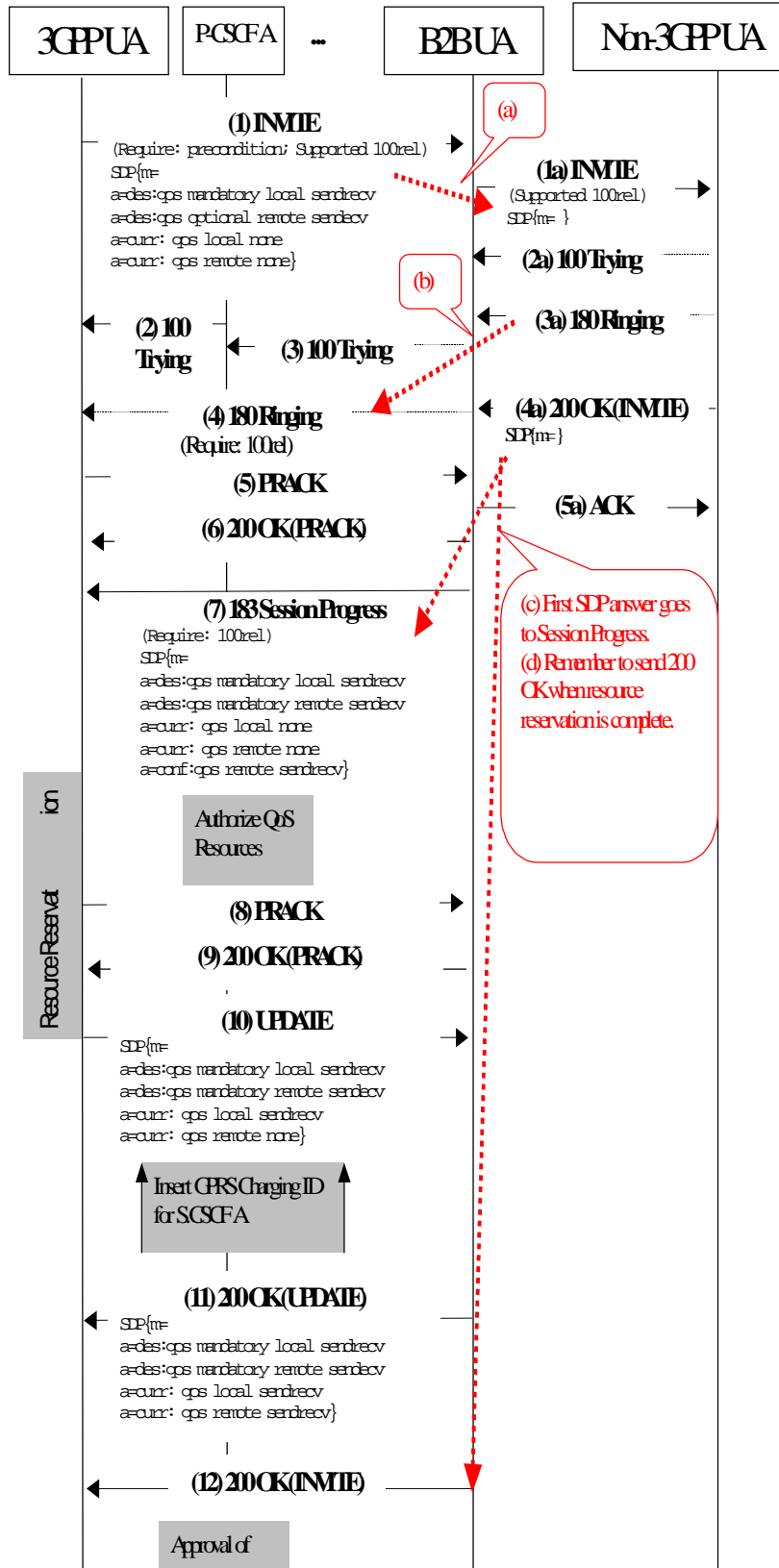


Figure 4.2.3.2.2/2: Using re-invite to connect calling non-3GPP UA not supporting the SIP preconditions extension, the SIP update extension and the SIP 100rel extension to called 3GPP UA. The INVITE contains no SDP.

Editor's Note: These call flows are for further investigation. The correctness has to be verified. Rules to decide when to insert GPRS Charging ID and when to commit QoS at the P-CSCF/PCF, at when to start IMS service charging at the S-CSCF have to be provided.

4.2.3.2.2.2 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.2.3.2.2.3 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

Annex A: Interworking topic template

4.x *Topic Name*

4.x.1 Description of interworking issue

Editor's Note: This section contains the technical description of the possible interworking topic. This section also details capabilities, or the lack of capabilities, of the SIP client outside the 3GPP network, which are relevant to make the considered topic applicable.

4.x.2 Flow diagram

Editor's Note: This section contains the technical description of the possible interworking topic.

4.x.3 Impact of Identified interworking issue

Editor's Note: Identified interworking issues to be considered

- User interaction (call setup time, delay etc)
- Charging and Billing Implications (no charging etc)
- SIP Media authorization (Interaction with Go Interface for token validation)
- SIP Media allocation (Interaction with Go Interface for "Gating" service)
- Fraudulent opportunities and security risks
- Network operator control (e.g. unable to cut calls)
- Network resource management/coordination allocation; (incorrect tear down resulting in hanging calls etc)
- Probability of occurrence

4.x.4 Proposed Resolutions to interworking issue

Editor's Note: This section contains one or more suggestions how an interworking may be performed.

4.x.4.y *Suggestion yy*

4.x.4.y.1 Description

Editor's Note: This section details the suggestion. The involved 3GPP network entities are identified.

4.x.4.y.1 Advantages

Editor's Note: This section list possible advantages of this suggestion compared to competing suggestions.

4.x.4.y.1 Disadvantages

Editor's Note: This section list possible disadvantages of this suggestion compared to competing suggestions.

4.x.5 Preferred Suggestion

Editor's Note: This section identifies the preferred of the above suggestions, if a consensus has been found.

Annex B: Mechanisms allowing optional Additions within SIP

Excerpts from RFC 3261

8.1 UAC Behavior

...

8.1.1.9 Supported and Require. If the UAC supports extensions to SIP that can be applied by the server to the response, the UAC SHOULD include a **Supported** header field in the request listing the option tags (Section 19.2) for those extensions. The option tags listed MUST only refer to extensions defined in standards-track RFCs. This is to prevent servers from insisting that clients implement non-standard, vendor-defined features in order to receive service. Extensions defined by experimental and informational RFCs are explicitly excluded from usage with the **Supported** header field in a request, since they too are often used to document vendor-defined extensions. If the UAC wishes to insist that a UAS understand an extension that the UAC will apply to the request in order to process the request, it MUST insert a **Require** header field into the request listing the option tag for that extension. If the UAC wishes to apply an extension to the request and insist that any proxies that are traversed understand that extension, it MUST insert a **Proxy-Require** header field into the request listing the option tag for that extension. As with the **Supported** header field, the option tags in the **Require** and **Proxy-Require** header fields MUST only refer to extensions defined in standards-track RFCs.

...

8.1.3.2 Unrecognized Responses. A UAC MUST treat any final response it does not recognize as being equivalent to the x00 response code of that class, and MUST be able to process the x00 response code for all classes. For example, if a UAC receives an unrecognized response code of 431, it can safely assume that there was something wrong with its request and treat the response as if it had received a 400 (Bad Request) response code. A UAC MUST treat any provisional response different than 100 that it does not recognize as 183 (Session Progress). A UAC MUST be able to process 100 and 183 responses.

...

8.1.3.5 Processing 4xx Responses Certain 4xx response codes require specific UA processing, independent of the method.

...

If a 420 (Bad Extension) response is received (Section 21.4.15), the request contained a **Require** or **Proxy-Require** header field listing an option-tag for a feature not supported by a proxy or UAS. The UAC SHOULD retry the request, this time omitting any extensions listed in the **Unsupported** header field in the response. In all of the above cases, the request is retried by creating a new request with the appropriate modifications. This new request SHOULD have the same value of the **Call-ID**, **To**, and **From** of the previous request, but the **CSeq** should contain a new sequence number that is one higher than the previous.

...

8.2 UAS Behavior

...

8.2.1 Method Inspection

Once a request is authenticated (or authentication is skipped), the UAS MUST inspect the method of the request. If the UAS recognizes but does not support the method of a request, it MUST generate a 405 (Method Not Allowed) response. Procedures for generating responses are described in Section 8.2.6. The UAS MUST also add an Allow header field to the 405 (Method Not Allowed) response. The Allow header field MUST list the set of methods supported by the UAS generating the message. The Allow header field is presented in Section 20.5. If the method is one supported by the server, processing continues.

8.2.2 Header Inspection

If a UAS does not understand a header field in a request (that is, the header field is not defined in this specification or in any supported extension), the server MUST ignore that header field and continue processing the message. A UAS SHOULD ignore any malformed header fields that are not necessary for processing requests.

...

8.2.2.3 Require Assuming the UAS decides that it is the proper element to process the request, it examines the Require header field, if present. The Require header field is used by a UAC to tell a UAS about SIP extensions that the UAC expects the UAS to support in order to process the request properly. Its format is described in Section 20.32. If a UAS does not understand an option-tag listed in a Require header field, it MUST respond by generating a response with status code 420 (Bad Extension). The UAS MUST add an Unsupported header field, and list in it those options it does not understand amongst those in the Require header field of the request. Note that Require and Proxy-Require MUST NOT be used in a SIP CANCEL request, or in an ACK request sent for a non-2xx response. These header fields MUST be ignored if they are present in these requests. An ACK request for a 2xx response MUST contain only those Require and Proxy-Require values that were present in the initial request.

...

8.2.4 Applying Extensions

A UAS that wishes to apply some extension when generating the response MUST NOT do so unless support for that extension is indicated in the Supported header field in the request. If the desired extension is not supported, the server SHOULD rely only on baseline SIP and any other extensions supported by the client. In rare circumstances, where the server cannot process the request without the extension, the server MAY send a 421 (Extension Required) response. This response indicates that the proper response cannot be generated without support of a specific extension. The needed extension(s) MUST be included in a Require header field in the response. This behavior is NOT RECOMMENDED, as it will generally break interoperability.

Any extensions applied to a non-421 response MUST be listed in a Require header field included in the response. Of course, the server MUST NOT apply extensions not listed in the Supported header field in the request. As a result of this, the Require header field in a response will only ever contain option tags defined in standards-track RFCs.

...

20 Header Fields

...

20.5 Allow

The Allow header field lists the set of methods supported by the UA generating the message. All methods, including ACK and CANCEL, understood by the UA MUST be included in the list of methods in the Allow header field, when present. The absence of an Allow header field MUST NOT be interpreted to mean that the UA sending the message supports no methods. Rather, it implies that the UA is not providing any information on what methods it supports.

Supplying an Allow header field in responses to methods other than OPTIONS reduces the number of messages needed. Example:

```
Allow: INVITE, ACK, OPTIONS, CANCEL, BYE
```

...

20.29 Proxy-Require

The Proxy-Require header field is used to indicate proxy-sensitive features that must be supported by the proxy. See Section 20.32 for more details on the mechanics of this message and a usage example. Example:

```
Proxy-Require: foo
```

...

20.32 Require

The Require header field is used by UACs to tell UASs about options that the UAC expects the UAS to support in order to process the request. Although an optional header field, the Require MUST NOT be ignored if it is present. The Require header field contains a list of option tags, described in Section 19.2. Each option tag defines a SIP extension that MUST be understood to process the request. Frequently, this is used to indicate that a specific set of extension header fields need to be understood. A UAC compliant to this specification MUST only include option tags corresponding to standards-track RFCs. Example:

```
Require: 100rel
```

...

20.37 Supported

The Supported header field enumerates all the extensions supported by the UAC or UAS.

The Supported header field contains a list of option tags, described in Section 19.2, that are understood by the UAC or UAS. A UA compliant to this specification MUST only include option tags corresponding to standards-track RFCs. If empty, it means that no extensions are supported.

Example:

```
Supported: 100rel
```

...

21 Response Codes

...

21.4.15 420 Bad Extension

The server did not understand the protocol extension specified in a Proxy-Require (Section 20.29) or Require (Section 20.32) header field. The server MUST include a list of the unsupported extensions in an Unsupported header field in the response. UAC processing of this response is described in Section 8.1.3.5.

21.4.16 421 Extension Required

The UAS needs a particular extension to process the request, but this extension is not listed in a Supported header field in the request. Responses with this status code MUST contain a Require header field listing the required extensions.

Annex C: Callflows between rogue 3GPP UA to non-3GPP UA, if SIP extensions mandated by 3GPP are not applied.

According to TS 24.229, a 3GPP UA shall use the SIP 100rel, update, and precondition extensions. The 3GPP UA shall abort the call set-up in manners detailed in the main part of this TR, if the non-3GPP UA does not support or use these extensions.

This annex details the consequences, in case a rogue 3GPP UA does not behave according to TS 24.229 and does not apply some or all of the above SIP extensions.

The numbering of this Annex corresponds to the numbering of Section 4. For example, Sections C.2.1 and 4.2.1 consider the same scenario.

C.1 calling rogue 3GPP UA to called non-3GPP UA

C.1.1 rogue 3GPP UA to non-3GPP UA supporting the SIP 100rel extension and the SIP update extension, but not supporting the SIP preconditions extension

Within 3GPP, the SIP update extension is only required to convey SDP offer/answer with SDP attributes defined in the SIP precondition extension with the help of the SIP UPDATE method.

If the non-3GPP SIP UA supports the SIP update extension, but does not use them, the situation is similar to Section C.1.2 and the discussion in this Section is applicable for the present scenario.

A fixed UE supporting the SIP update extension, may use features of this extension for purposes not related to the SIP precondition extension.

As a result, various extra messages may be inserted into the callflow:

- The calling or the called UA may send UPDATE messages at various places within the callflow. Those messages may include additional SDP offers. Due to the large number of possibilities, such callflows are not depicted. The dialog state is not altered by UPDATE requests, and thus they probably do not have harmful side effects. Again, the discussion in Section C.1.2 applies.

C.1.2 rogue 3GPP UA to non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension

C.1.2.1 Description of interworking issue

Since the 3GPP UA, requires the SIP precondition extension in the SIP INVITE request, the call will be aborted.

After this failure, the calling rogue 3GPP UA may decide to invite the called non-3GPP not requiring the SIP precondition extension. In what follows, the consequences of this behaviour are discussed.

As outlined in Section C.1.1, Note 7, the “183 Session Progress” provisional response may be omitted, if the rogue 3GPP UA does not require SIP preconditions. The use of the “180 Ringing” provisional response also is optional. If both are omitted, the flow diagram and discussion in Section C.1.3 applies. Severe IMS Charging implications have been identified.

Here, it shall be assumed that both the “183 Session Progress” provisional response and the “180 Ringing” provisional response are used.

C.1.2.2 Flow diagram

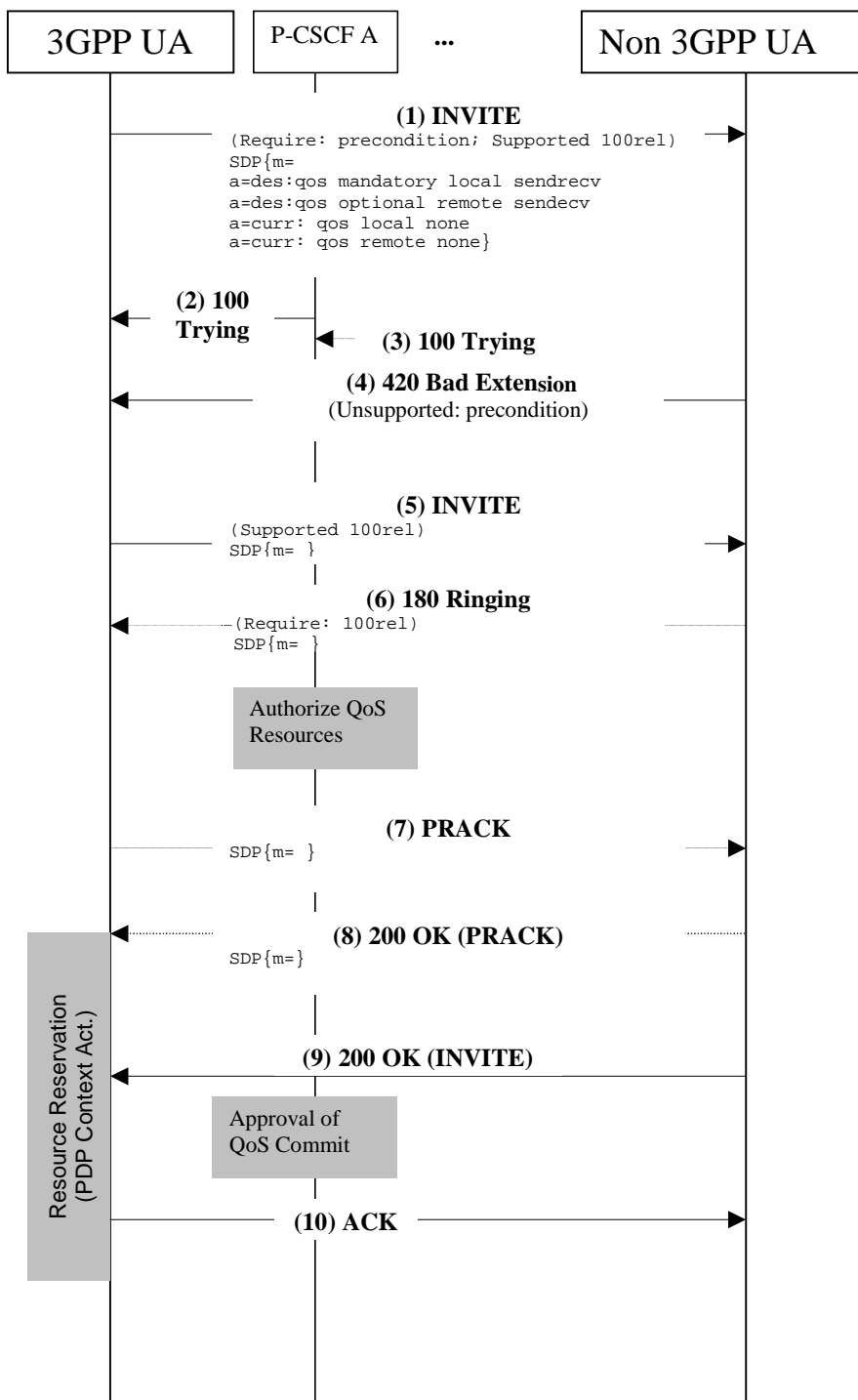


Figure C.1.2.2/1: rogue 3GPP UA to non-3GPP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension

C.1.2.3 Impacts of Identified interworking issue

User at the called non-3GPP UA is alerted before resource reservation at the calling rogue 3GPP UA is complete. The call may still fail at this stage.

IMS Charging fails because the Update message is not available to transport GPRS-Charging ID from P-CSCF A to S-CSCF A. There is no other message to replace the UPDATE request for this purpose, which is certain to be sent after the interaction at the Go interface, which delivers the GPRS-Charging-ID to the P-CSCF.

Moreover, if this problem is solved, the Charging (triggered by the 200 OK(INVITE) response) may commence before the resources are available.

A user might invoke this scenario with the purpose to avoid charging.

C.1.3 Rogue 3GPP UA to non-3GPP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension

C.1.3.1 Description of interworking issue

Since the calling 3GPP UA, requires the SIP precondition extension in the SIP INVITE request, the call will be aborted.

After this failure, the calling rogue 3GPP UA may decide to invite the non-3GPP UA not requiring the SIP precondition extension. In what follows, the consequences of this behaviour are discussed.

According to RFC3261 [4], Section 13.2.1, “If the initial (SDP) offer is an INVITE request, the answer MUST be in a reliable non-failure message from UAS back to UAC which is correlated to that INVITE.” Since the non-3GPP UE does not support the 100rel extension, provisional responses, such as “183 Session progress” and “180 Ringing”, cannot be send reliably, and UE B must include the SDP answer in the 200 OK message.

Thus, resource reservation at the rogue calling 3GPP UA and resource authorisation at P-CSCF will be triggered by this message.

C.1.3.2 Flow diagram

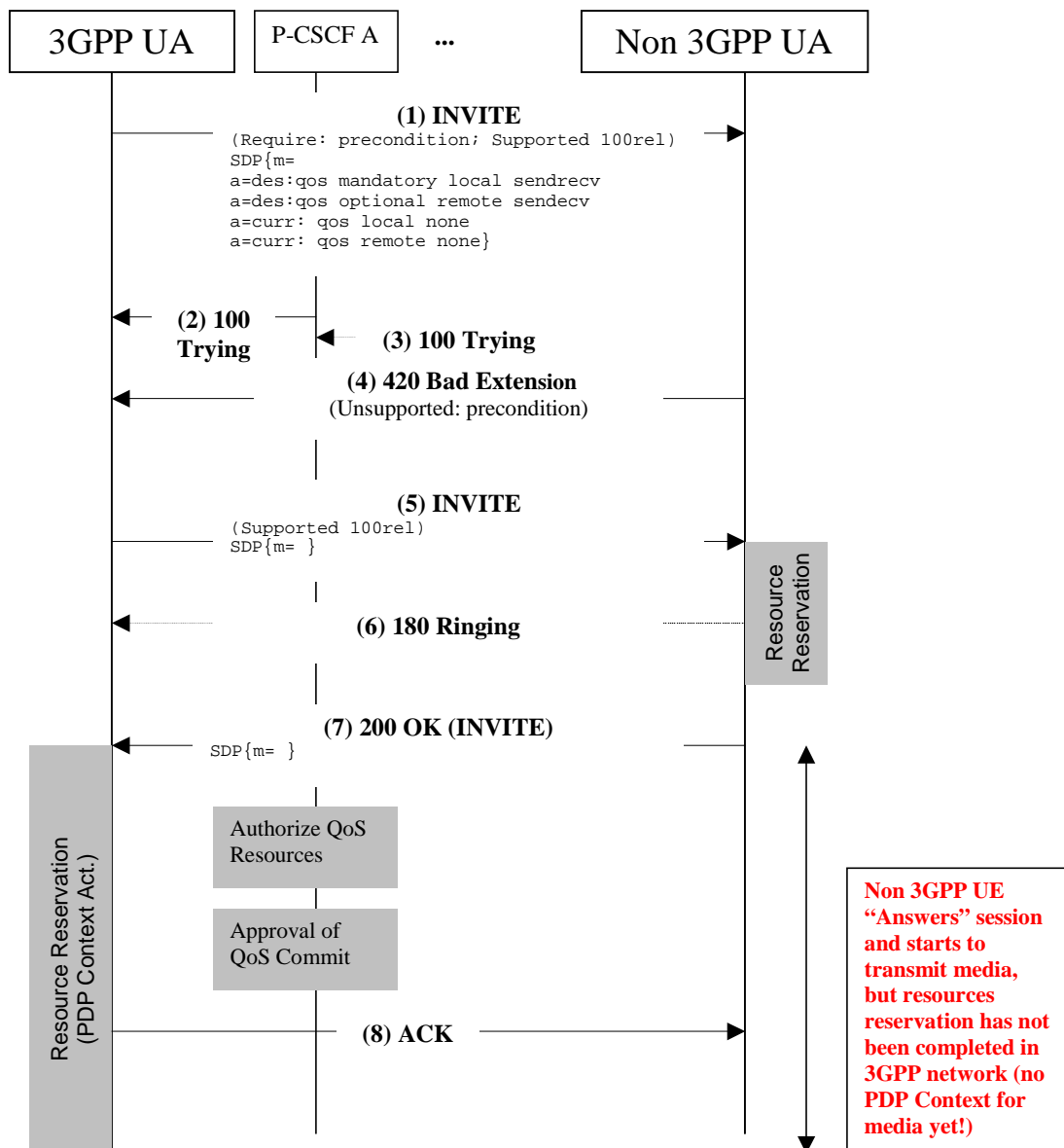


Figure C.1.3.2/1: 3GPP UA to non-3GPP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension

1. (5) INVITE

The 3GPP UE sends the “INVITE” message to the Non 3GPP UE. This includes the “SUPPORTED: 100Rel” line which indicates that the 3GPP UE supports the “Reliability of Provisional Responses” extension.

2. (6) 180 Ringing

The Non 3GPP UE may optionally send the “180 Ringing” message to the 3GPP UE. As the non 3GPP UE does not support the “100Rel” SIP extension, then there is no mention of the “100Rel” extension in the response back to the 3GPP UE.

3. (7) 200 OK (Answer)

The Non 3GPP UE sends the “200 OK” message to the 3GPP UE to indicate that the called party has answered. As the Non 3GPP UE has the “media” RTP port and IP addresses (from the initial INVITE), then it starts to transmit “media” packets (i.e. Speech) to the 3GPP UE.

The 3GPP UE cannot send or receive “media” until the Resource Reservation (PDP Context Setup) phase has ended.

4. (8) ACK

The 3GPP UE sends the “ACK” message to the Non 3GPP UE to acknowledge the 200 OK “final response” message.

C.1.3.3 Impacts of Identified interworking issue

C.1.3.3.1 User interaction

Due to the fact that the call can be “answered” before the media channel is established, the user would experience a delay upon answer of the call. The user experience would be very poor, as users expect to be able to hear/speak to the other party immediately once the call is answered.

C.1.3.3.2 Charging and Billing Implications

IMS Charging fails because the Update message is not available to transport GPRS-Charging ID from P-CSCF A to S-CSCF A. There is no other message to replace the UPDATE request for this purpose, which is certain to be sent after the interaction at the Go interface, which delivers the GPRS-Charging-ID to the P-CSCF.

Moreover, if this problem is solved, the Charging (triggered by the 200 OK(INVITE) response) may commence before the resources are available.

C.1.3.3.3 SIP Media authorization

The P-CSCF would have to authorise QoS in the PCF and provide a token, which would be sent to the UE A at the earliest possible time, i.e. in the 200 OK message

C.1.3.3.4 SIP Media allocation

The “Approval of QoS Commit” procedure (“open gate”) would have to occur at the same time as the bearer authorisation. In normal operation, the 200 OK (INVITE) message would be the trigger to send the “COPS” DEC message on the Go from the PCF to the GGSN to open the Gate for the media. However, here it also triggers the “PDP Context activation” procedure for the media, and as such bearer authorisation via the Go is also requested. This may cause unstable conditions in the P-CSCF(PCF).

C.1.3.3.5 Fraudulent and security risks

A user might invoke this scenario with the purpose to avoid charging.

C.2 Calling non-3GPP UA to called rogue 3GPP UA

C.2.1 Non-3GPP UA supporting the SIP 100rel extension and the SIP update extension, but not supporting the SIP preconditions extension, to rogue 3GPP UA

Within 3GPP, the SIP update extension is only required to convey SDP offer/answer with SDP attributes defined in the SIP precondition extension with the help of the SIP UPDATE method.

If the non-3GPP SIP UA supports the SIP update extension, but does not use them, the situation is similar to Section C.2.2 and the discussion in this Section is applicable for the present scenario.

A non-3GPP UA supporting the SIP update extension may use features of this extension for purposes not related to the SIP precondition extension. As a result, various extra messages may be inserted into the callflow. The UA, may send UPDATE messages at various places within the callflow. Those messages may include additional SDP offers. Due to the large number of possibilities, such callflows are not depicted. The dialog state is not altered by UPDATE requests, and thus they probably do not have harmful side effects. Again, the discussion in Section C.2.2 applies.

C.2.2 Non-3GPP SIP UA supporting the SIP 100rel extension, but not supporting the SIP preconditions extension and the SIP update extension, to rogue 3GPP UA

C.2.2.1 Description of interworking issue

The called rogue 3GPP UA accepts the INVITE, although no support of preconditions is indicated.

The called rogue 3GPP UA does not need to send UPDATE requests requiring preconditions, because this would not alter the behaviour of the calling UA. Note that, according to the SIP precondition extension, only the called UA is required to suspend the session set-up until mandatory preconditions are met.

According to TS 24.229 [3], the called 3GPP UA shall send the 200 (OK) response to the initial INVITE request only after the local resource reservation has been completed.

C.2.2.2 Flow diagram

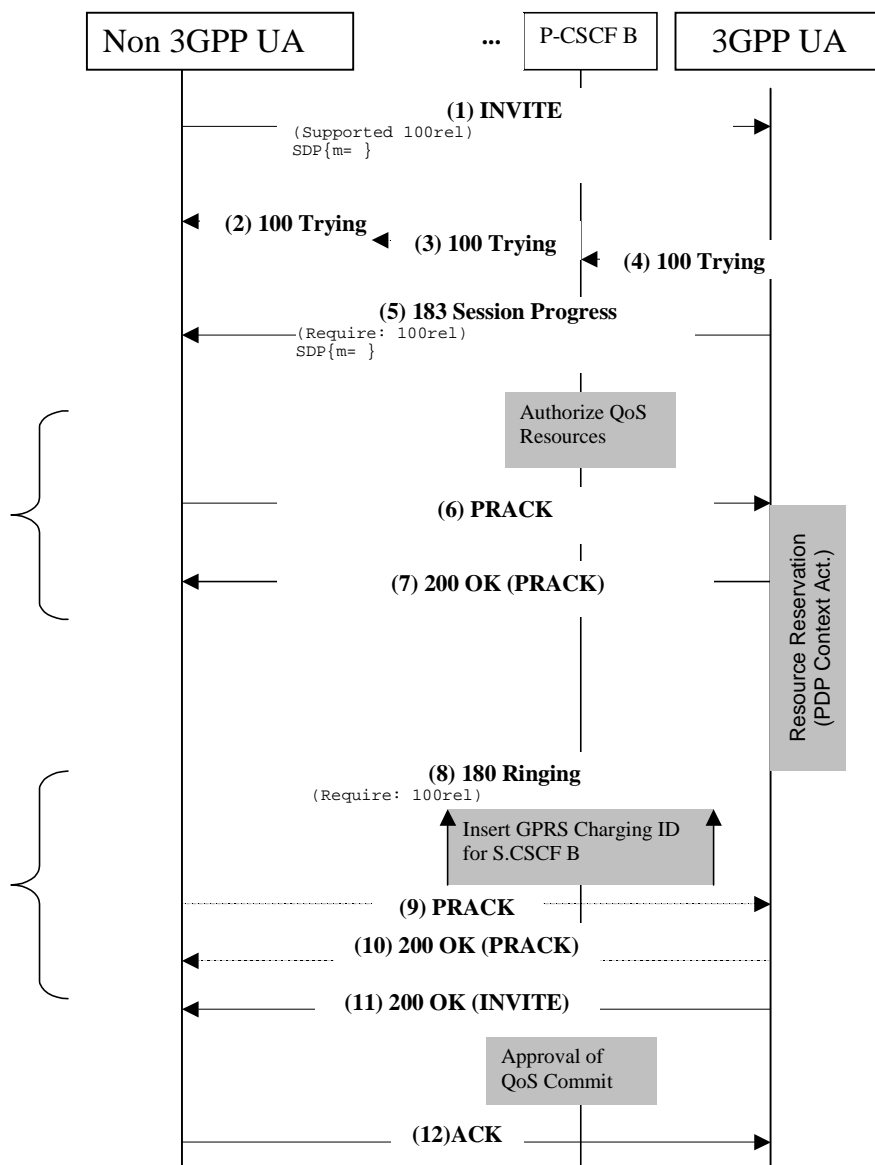


Figure C.2.2.2/1: Non-3GPP UA supporting the 100rel SIP extension, but not supporting the the SIP preconditions extension and the SIP update extension, to rogue 3GPP UA

C.2.2.3 Impacts of Identified interworking issue

No negative impacts have been identified.

C.2.3 Non-3GPP SIP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension, to rogue 3GPP UA

C.2.3.1 Description of interworking issue

According to the SIP 100rel extension, Section 3, “the UAS may send any non-100 provisional response to INVITE reliably, so long as the initial INVITE request contained a Supported header field with option tag 100rel.” Thus, the 3GPP UAS must not send any provisional responses reliably.

Two cases may occur, and are discussed in what follows:

- According to RFC3261 [5], Section 13.2.1, “If the initial (SDP) offer is an INVITE request, the answer MUST be in a reliable non-failure message from UAS back to UAC which is correlated to that INVITE.” UAS must include the SDP answer in the 200 OK message.
- According to RFC3261 [5], Section 13.2.1, the initial (SDP) offer must be, if not in an INVITE, in the first reliable non-failure message send from UAS back to UAC. If the SIP 100rel extension is not supported, this is the final 2xx response. The SDP answer must be in the ACK message.

C.2.3.2 Flow diagram

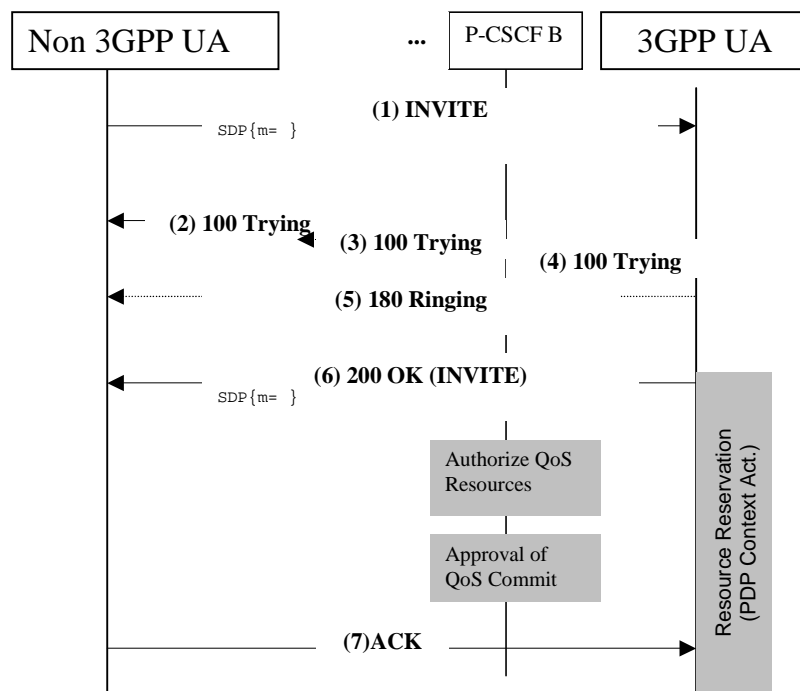


Figure C.2.3.2/1: Non-3GPP SIP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension, to rogue 3GPP UA. SDP offer in INVITE request.

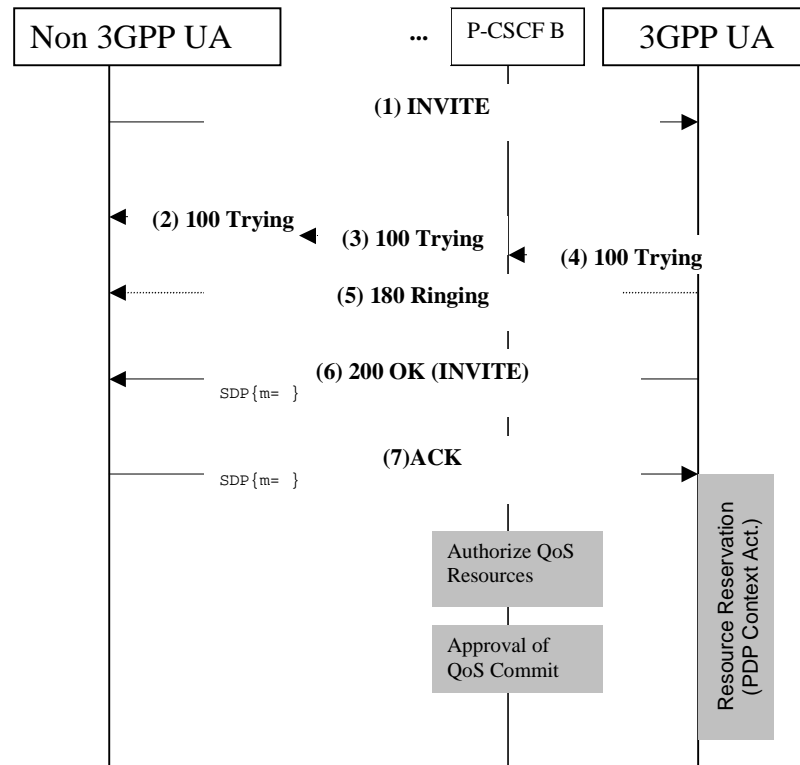


Figure C.2.3.2/2: Non-3GPP SIP UA not supporting the SIP 100rel extension, the SIP preconditions extension and the SIP update extension, to rogue 3GPP UA. SDP offer in OK response.

C.2.3.3 Impacts of Identified interworking issue

3GPP user may be alerted before resources are available. Calls may fail after this point. Moreover, if media offer is transported within 200 OK (Invite) Response Message, user may be alerted before the success of the media negotiation.

IMS Charging is likely to fail, because there are no means to transport the GPRS-Charging-ID from P-CSCF B to S-CSCF B.

A user might invoke this scenario on purpose to avoid charging.

Annex D: Reference Callflow from 3GPP UA to 3GPP UA

The interworking between calling 3GPP UA and called 3GPP UA is as defined in 3GPP TS 24.229. No interworking issues exist, but the flow diagram is depicted here for comparison.

Notes:

1. The message flow between the 3GPP UEs is depicted.
2. SIP proxies are omitted with the exception of the P-CSCFs and the S-CSCFs, which are depicted in this callflow but will be omitted in most other callflows.
3. The 100 TRYING response (2), (3), (4) to the INVITE message (1) is send hop-by-hop, as indicated in this flow diagram. It will be omitted in all subsequent flow diagrams for simplicity. All other messages are generated by the 3GPP UEs.
4. Most parts of the SIP messages are omitted for simplicity. Only the “require”, “supported” and “allowed” header fields are depicted.

5. Most parts of the SDP are omitted for simplicity. Only the SDP preconditions for one medium are depicted. There may be an arbitrary number of number of media, each with own preconditions
6. The P-CSCF inspects each SDP, in order to identify offer/answer pairs [8]. The P-CSCF may modify the QoS authorisation (8,9) when processing each SDP answer.
7. The use of the “183 Session Progress” (7) provisional response is optional according to IETF specifications. However, if the SIP precondition extension [6] is used and SDP with mandatory preconditions that the called UA is not capable of meeting unilaterally is included in the initial INVITE (1), a 101-199 provisional response, such as the “183 Session Progress”, is required to transport the SDP answer including the mandated “confirmation status” SDP attribute (Ref. [6], Section 6). Moreover, the “180 Ringing” message is not suitable because the user should not be alerted until the preconditions are met.
8. It is optional to convey a new SDP offer/answer within the PRACK (11) and OK(PRACK) (12) messages. A calling 3GPP UA will refrain from generating a new SDP offer within PRACK (11), if it does not wish to further restrict the set of codecs selected within the first offer/answer pair.
9. According to IETF Ref. 6, Section 5, the called UA should start the resource reservation (13) immediately after having send the SDP answer within of the “183 Session Progress” (7) provisional response. However, a called 3GPP UA may expect a second SDP offer, and thus wait for the next message until starting resource reservation. The called 3GPP UA can be certain to receive a new message soon, since it demands the PRACK message with the “Require 100rel” SIP header within the “183 Session Progress” (7) provisional response.
10. The use of the “Update” Request (14) is optional according to IETF specifications [5], [7], unless certain conditions make it mandatory. In particular, if a threshold specified in a previous SDP “confirm-status” attribute (e.g. in message (7)) is reached or surpassed, the UA must send an SDP offer reflecting the new current status (Ref. [5], Section 7). The only suitable way to convey the new SDP offer/answer may be via an UPDATE request.
11. If the “UPDATE” (14) request is not used, the subsequent” OK(UPDATE)” (17) response is also not present.
12. The use of the “180 Ringing” provisional response (18) is optional according to IETF and 3GPP specifications. The “180 Ringing” provisional response is used to convey the GPRS charging ID from P-CSCF B to S-CSCF-B. If the “180 Ringing” provisional response is omitted, the GPRS Charging ID is transported within the “200 OK(INVITE)” (23) response.
13. The “UPDATE” (14) request is used to convey the GPRS charging ID from P-CSCF A to S-CSCF-A. [1]
14. According to TS 24.229 [3], the called 3GPP UA shall send the 200 (OK) response to the initial INVITE request only after the local resource reservation has been completed.

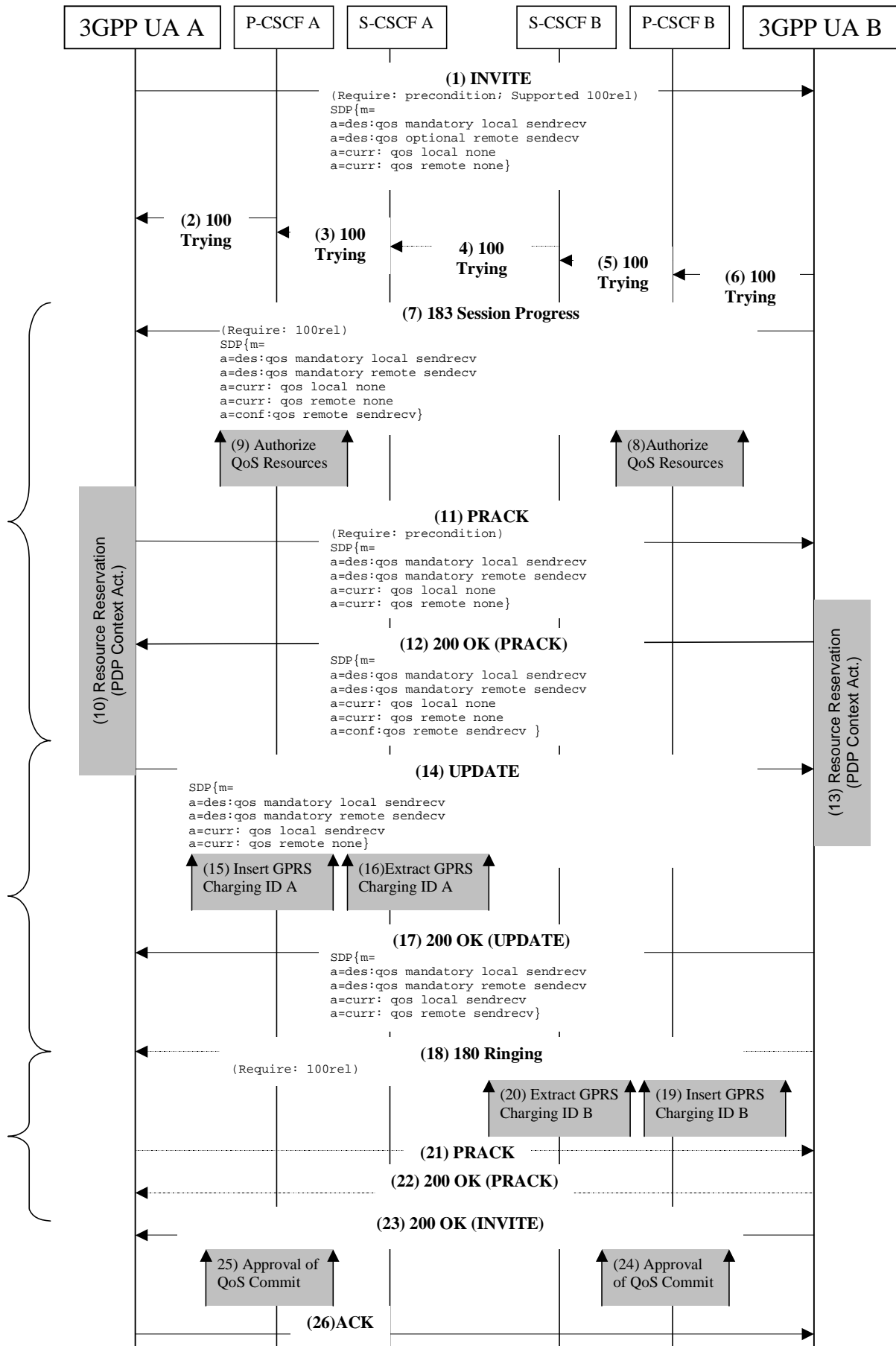


Figure D/1: 3GPP UA to 3GPP UA Call flow

Annex E: Scenarios without identified interworking issues

This Annex contains scenarios which result in callflows that deviate to some extent from the reference callflow in Annex D. These scenarios have been investigated, but no interworking problems have been identified.

E.1 Calling non-3GPP UA supporting the 100rel SIP extension, the SIP preconditions extension and the SIP update extension, but not performing QoS reservation, to called 3GPP UA.

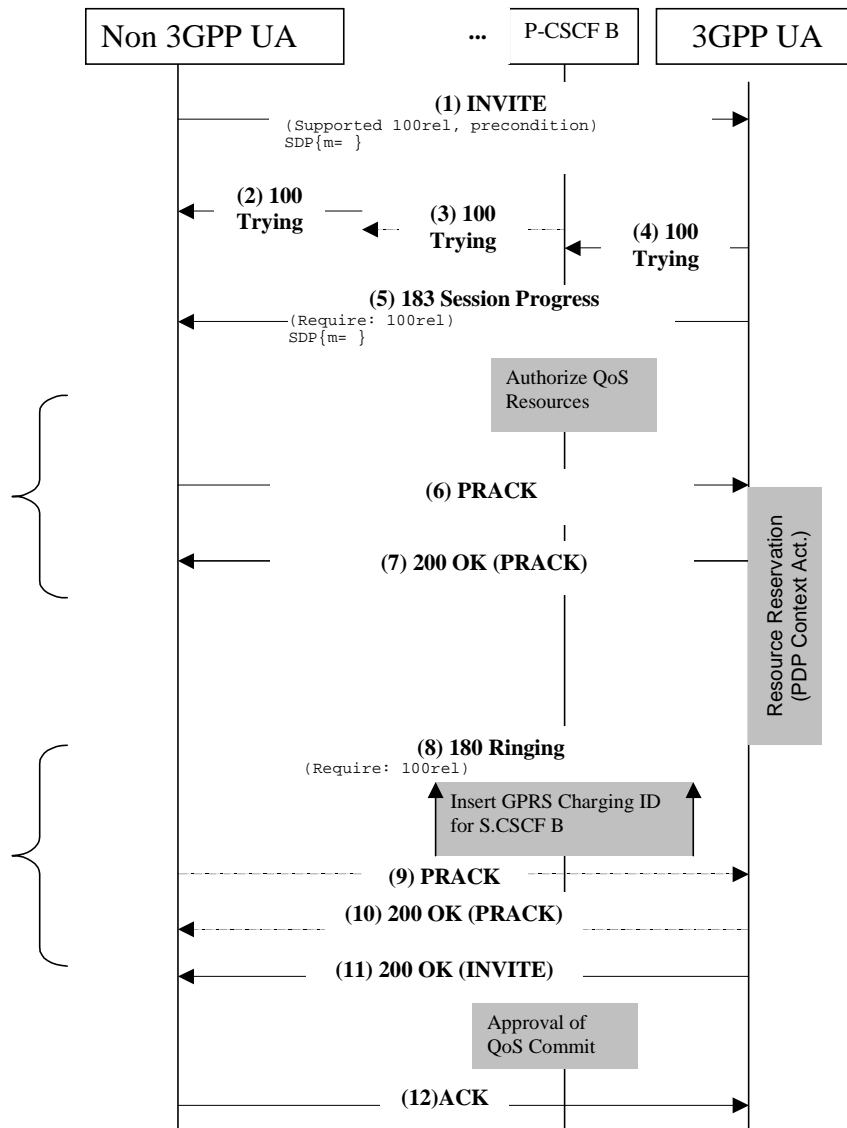


Figure E.1/1: Non-3GPP UA supporting the 100rel SIP extension, the SIP preconditions extension and the SIP update extension, and not performing QoS reservation, to 3GPP UA

E.2 Calling non-3GPP UA supporting the 100rel SIP extension, the SIP preconditions extension and the SIP update extension, but not including the SDP offer in the initial invite, to called 3GPP UA.

According to TS 24.229, Section 5.1.4.1, the called 3GPP UA must send a provisional response (otherwise it can not complete the resource reservation before sending the 200 OK(INVITE)) and require the 100rel extension within this message. According to RFC 3261, Section 13.2.1, “the initial offer MUST be in either an INVITE or, if not there, in the first reliable non-failure message from the UAS back to the UAC”.

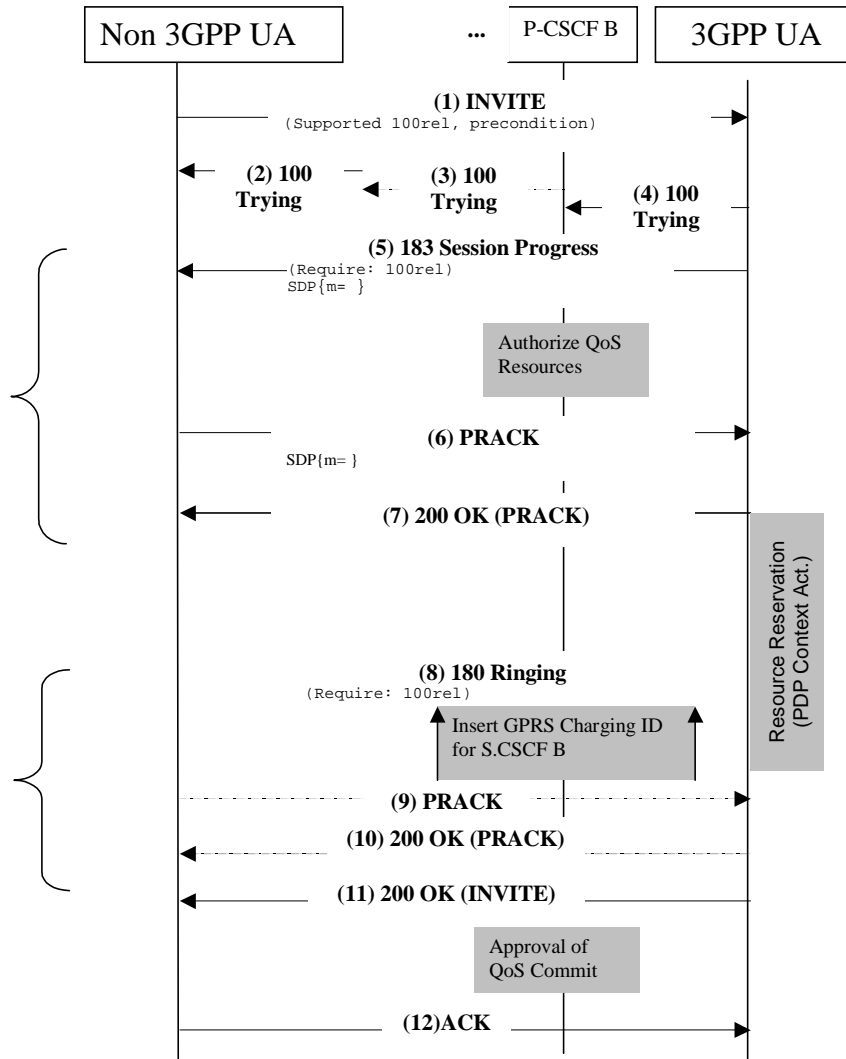


Figure E.2/1: Non-3GPP UA supporting the 100rel SIP extension, the SIP preconditions extension and the SIP update extension, but not including the SDP offer in the initial invite, to 3GPP UA

Annex F: Change history

| Change history | | | | | | | |
|----------------|--------|-----------|----|-----|--|-------|-------|
| Date | TSG # | TSG Doc. | CR | Rev | Subject/Comment | Old | New |
| 2002-01 | CN3#21 | | | | <i>Creation of document</i> | - | 0.1.0 |
| 2002-07 | CN3#24 | | | | <i>Include suggestions for B2BUA</i> | 0.1.0 | 0.2.0 |
| 2002-11 | CN3#26 | | | | <i>Output of drafting group included, presented to CN#18 for information</i> | 0.2.0 | 1.0.0 |
| 2002-12 | NP-18 | NP-020610 | | | Presented to Plenary NP#18 for information | 1.0.0 | |
| | | | | | | | |