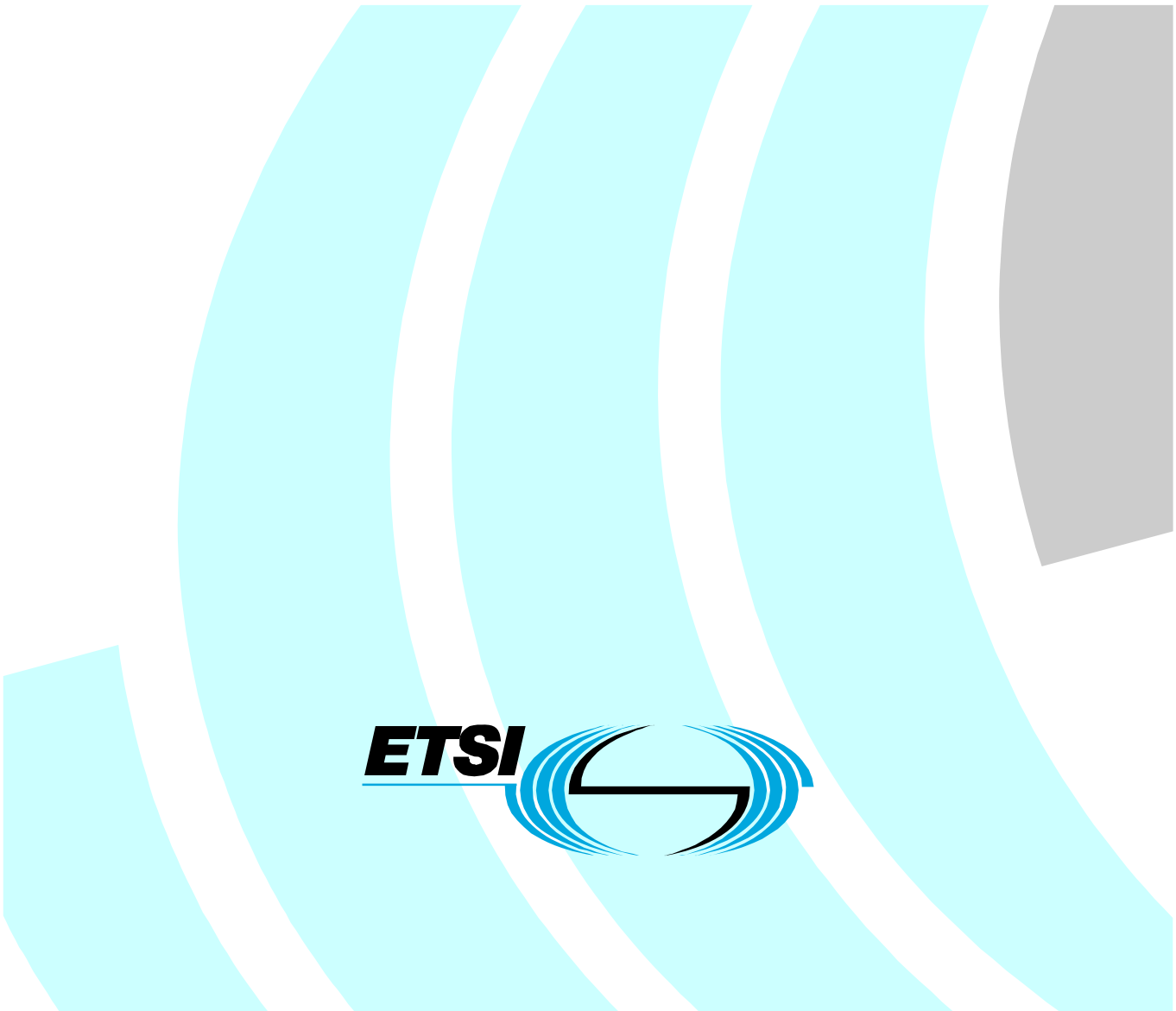
ETSI TR 183 057 V2.1.1 (2008-07)

Technical Report

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Feasibility study on Out-of-band DTMF



Reference
DTR/TISPAN-03112-NGN-R2

Keywords
DTMF, outband

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

1 Scope

The purpose of the present document is to analyse the requirements for out-of-band DTMF transport in IMS, to assess the possible technical solutions addressing these requirements, to select a solution and to identify and derive the required changes to the relevant IMS specifications.

NOTE: The consequence of the TR will most certainly lead to developing CRs against ETSI TISPAN Release 2 IMS specifications and the corresponding 3GPP specifications.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

Not applicable.

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1] ETSI ES 283 003: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); IP Multimedia Call Control Protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP) Stage 3 [3GPP TS 24.229 (Release 7), modified]".

[i.2] IETF RFC 2833: "RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals".

[i.3] IETF RFC 2976: "The SIP INFO Method".

[i.4] IETF RFC 4730: "A Session Initiation Protocol (SIP) Event Package for Key Press Stimulus (KPML)".

[i.5] 3GPP TR 24.880: "3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals Media server control using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3".

[i.6] draft-mcglashan-mscp-03: "Media Server Control Protocol (MSCP)".

[i.7] draft-ietf-sip-gruu: "Obtaining and Using Globally Routable User Agent (UA) URIs (GRUU) in the Session Initiation Protocol (SIP)".

[i.8] draft-ietf-sipping-dialogusage: "Multiple Dialog Usages in the Session Initiation Protocol".

[i.9] draft-kaplan-sip-info-events-00: "SIP INFO Event Framework".

[i.10] draft-kaplan-sipping-dtmf-package-00: "DTMF Info-Event Package".

[i.11] http://www1.ietf.org/mail-archive/web/sip/current/msg20982.html.

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AS	Application Server
B2BUA	Back to Back User Agent
CSCF	Call Session Control Function
DTMF	Dual Tone Multi Frequency
GRUU	Globally Routable UA URI
IMS	IP Multimedia Core Network Subsystem
IVR	Interactive Voice Response
KPML	Key Press Markup Language
MRF	Media Resource Function
MSCP	Media Server Control Protocol
MSML	Media Server Markup Language
NGN	Next Generation Network
PSTN	Public Switched Telecommunications Network
RTP	Real-Time Transport Protocol
SDP	Session Description Protocol
SIP	Session Initiation Protocol
UA	User Agent
UE	User Equipment
URI	Uniform Resource Identifier
XML	eXtended Markup Language

4 Introduction and use cases

4.1 Introduction

The TISPAN Release 1 set of standards supports transport of DTMF using in-band signals in the form of RTP packets. The actual waveforms may be encoded using a voice codec (e.g. G.711) or represented using a dedicated format defined in RFC 2833 [i.2].

In-band transport provides a suitable solution to cover all use cases where DTMF has to be exchanged within the framework of an established media link between two entities. This typically occurs when the user explicitly connects to a DTMF-driven menu (e.g. voicemail browsing, televoting, etc.) or when a call is directed to an intermediary entity (e.g. an MRF) so that a user interaction procedure can take place prior to completing the establishment of the call (e.g. credit card calling).

However, this solution is far less suitable when DTMF is used as a means to invoke a particular feature in a network entity that has no inherent reason for being in the media path at the moment this feature is invoked. Although the network entity could be artificially inserted (maintained) in the media path (using e.g. conferencing capabilities) for the purpose of collecting DTMF, an "out of band" transport mechanism would definitely provide a more efficient solution.

In the context of the present document, "Out-of-band" transport of DTMF should be understood as means to transport, outside the media path, signals representing key press stimuli.

4.2 Use cases

The need for an "out of band" transport mechanism has been identified in the framework of several services when advanced features are provided to the end users. Two examples are provided below.

1) **Return to voicemail browsing after call back:** The requirement appears when a user calls back the individual who left a message on a voicemail system and wishes to return to the top-level menu at the end of the call. The user expresses willingness to return to the voicemail menu by pressing a DTMF key. This signal needs to be transported out-of-band from the user to the voicemail system, unless the voicemail system was kept in the media path during the call.

2) **Address Book with Voice Activated Dialling:** This type of service enables a user to use speech recognition to establish a call to a person or an organization registered in his address book. It generally provides users with the ability to request a follow-on call at the end of each call, usually by pressing a DTMF key. This signal needs to be transported out-of-band from the user to the server hosting the address book, unless this system was kept in the media path during the call.

The first use case can be further exemplified using the following sequence of events:

1) A user connects to its voicemail system, via an Application Server.

2) After listening one of the new messages, the user requests the voicemail system (using inband DTMF) to establish a call to the person who left this message.

3) The voicemail system interacts with the Application Server to get this call established.

4) The AS releases the current call leg to the voicemail system and establishes a call leg to the new party.

5) A call is established between the calling party and the person who left the message on the mailbox.

6) At the end of this call, the calling party wishes to listen to subsequent messages left on the mailbox and enters a DTMF sequence.

When Step 6 is reached, the voicemail system is no longer in the media path and therefore cannot receive a request expressed in the form of an inband DTMF (RFC 2833 [i.2] or G.711 Waves).

5 Needs

As touched in the previous sections, a palliative solution to support such services would be to maintain the intermediate entity (e.g. the voicemail system) in the media path. However, this would obviously be to the detriment of its processing capacity or cost. Therefore, there is a need for a transport mechanism enabling conveying, out-of-band, a sequence of DTMF signals from a service request or to an application capable of interpreting the DTMF sequence. This application may then decide to bring the intermediate entity back in the media path for running additional user interaction procedures.

This requirement may be found in association with three different call configurations, all of which need to be taken into account in the design of a solution:

- Both the sender and the receiver of the DTMF are attached to the IMS (e.g. the sender is a UE, while the receiver is an AS, an MRF and/or another UE).

- The sender is attached to the IMS (e.g. the sender is a UE) while the receiver is located in another type of network (e.g. PSTN or H.323).

- The receiver is attached to the IMS (e.g. the receiver is an AS, an MRF or a UE) while the sender is located in another type of network (e.g. PSTN or H.323).

Moreover, a solution to support the above use cases should not disrupt other services that use DTMF for different purposes. In particular DTMF sequences that are sent to an intermediary service should not be received by peer media entities (e.g. if a user engaged in an in-band interaction with an IVR receives an incoming call and presses a key to reject it, the corresponding DTMF signal should not be sent to the IVR).

6 Overview of technical solutions

6.1 General

Two broad categories of solutions can be identified, depending on whether DTMF signals are transported along the session signalling path or not.

6.2 DTMF transport along the session signalling path

This type of solution consists in sending DTMF in SIP messages so that they can be intercepted by any entity along the session signalling path (e.g. an Application Server). A well-known realization of this type of solution relies on the use of the INFO method (RFC 2976 [i.3]), where the DTMF signals are carried in the message body. However, it should be noted that the use of the INFO method for that purpose has been ruled out by the SIP community on several occasions (see archives of the SIPPING mailing list).

This type of solution may be used as a single method to support the requirements of all types of services (i.e. any DTMF signal sent from a User Equipment is carried out-of-band) or be used in parallel with an in-band method. The latter approach assumes that the sequences to be reported out-of-band can be easily distinguished by the UE (i.e. using pre-configured patterns) from other sequences that remain transmitted in-band.

The INFO method, as it is currently specified, is not appropriate for such a need. An improvement would be to indicate in the initial INVITE request what type of body message of INFO is exactly required/supported (negotiation and subscription stage) and then to send the DTMF information in the body of an INFO request during the dialog (notification stage).

There are currently some discussions at the IETF ([i.9], [i.10] and [i.11]) on updating the INFO method in order to carry Event Packages and to include a negotiation of supported Event Packages in the INVITE-initiated dialog. The INVITE request and its responses are used to indicate and negotiate supported Event Packages, thanks to two new headers: "Send-Event" and "Recv-Event". The INFO request indicates the specific Event Package it is associated with, in a new header "Event", and the associated body for that Event Package.

6.3 DTMF transport outside the session signalling path

6.3.1 General

These types of solutions assume that applications interested in particular DTMF sequences will make an explicit request to the UE. These solutions are intended to be used in parallel with in-band transmission. DTMF sequences that are not requested by an application are sent in-band.

Two solutions falling in this category are identified in the following clauses.

6.3.2 Use of SIP Event Management capabilities

6.3.2.1 Description

This solution enables a SIP entity to request another SIP entity to notify the occurrence of particular DTMF sequences. It relies on the SIP framework for event management and a particular event package known as KPML (RFC 4730 [i.4]).

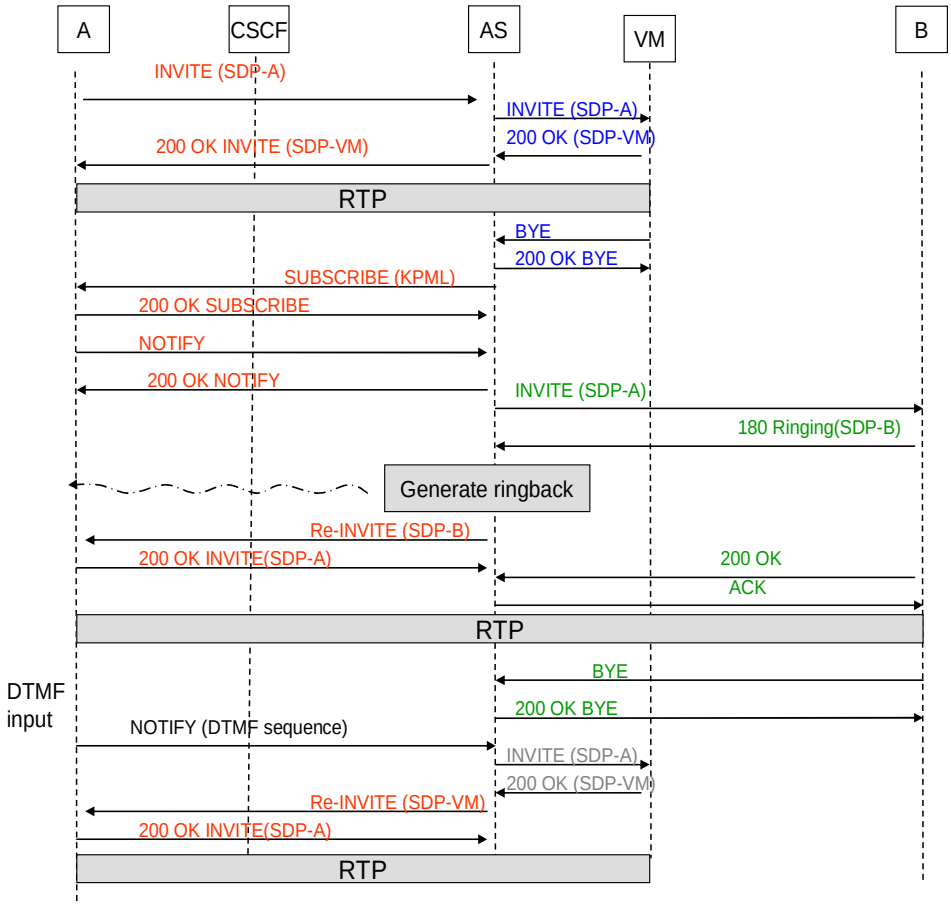


Figure 1: Simplified Call Flow (Return to voicemail browsing after call back)

6.3.2.2 Dialog correlation

As described in [i.8], dialogs with multiple usages are not recommended because they may lead to interoperability issues. That is the reason why the SUBSCRIBE request is recommended to be sent outside the INVITE-initiated dialog.

The event header field of the SUBSCRIBE request contains three parameters that identify the target media stream where the DTMF are expected to occur by referencing the dialog identifiers (call-id; remote-tag; local-tag) of the session responsible for this media stream. In order to ensure that the dialog identifiers known by the requesting application and by the end device generating the DTMF events are always identical, it is necessary that all network entities in the signalling path acting as B2BUA on the dialog used to establish this media stream are able to update this dialog information. Otherwise, an end user device running several dialogs in parallel would not have any means to correlate a SUBSCRIBE request with a media stream.

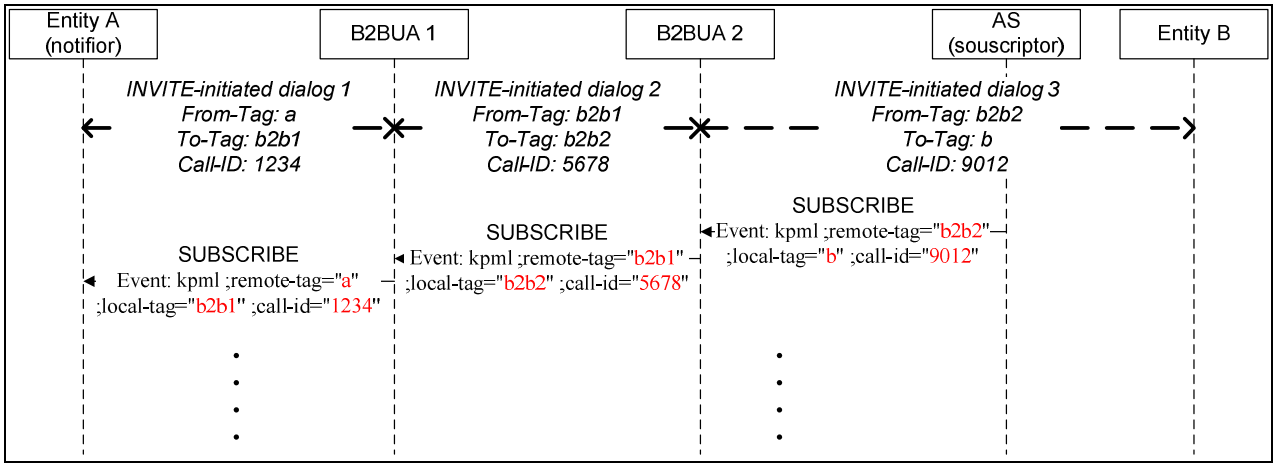


Figure 2: Dialog correlation

Sending SUBSCRIBE requests for KMPL outside of an existing dialog requires all B2BUA network entities to be in the signalling path of both the INVITE requests that might create a session where KPML notification could be expected and of these SUBSCRIBE requests. This is necessary to correlate dialog identifiers. This requirement does not exist if KPML requests are sent inside the INVITE-initiated dialog. However, it should be noted that dialogs with multiple usages are not recommended by IETF because they may lead to interoperability issues [i.8].

So, the sending of a KPML request outside an INVITE-initiated dialog raises specific problems regarding the correlation between SIP dialogues, and the sending of a KPML request inside an INVITE-initiated dialog is not recommended because of interoperability issues.

6.3.2.3 Forking

As specified in [i.4], KPML requests are not allowed to fork. For KPML subscriptions sent outside the INVITE-initiated dialog, this can be ensured only if SUBSCRIBE requests for this event type are sent to SIP URIs that have GRUU properties [i.7].

6.3.3 Use of a dedicated control channel

A dedicated control channel is setup between the UE and the network entity hosting the application interested in DTMF sequences. This channel is established on the initiative of the application using the SDP Offer/Answer model. Seen from the UE, two "media" channels are typically negotiated using SDP: An RTP channel and a control channel (see figure 2).

If the application is implemented using a distributed architecture comprising an Application Server and a Media Server, the control channel terminates on the Application Server while the RTP channel terminates at the called party's side (or on the Media Server during certain types of user-interaction phases).

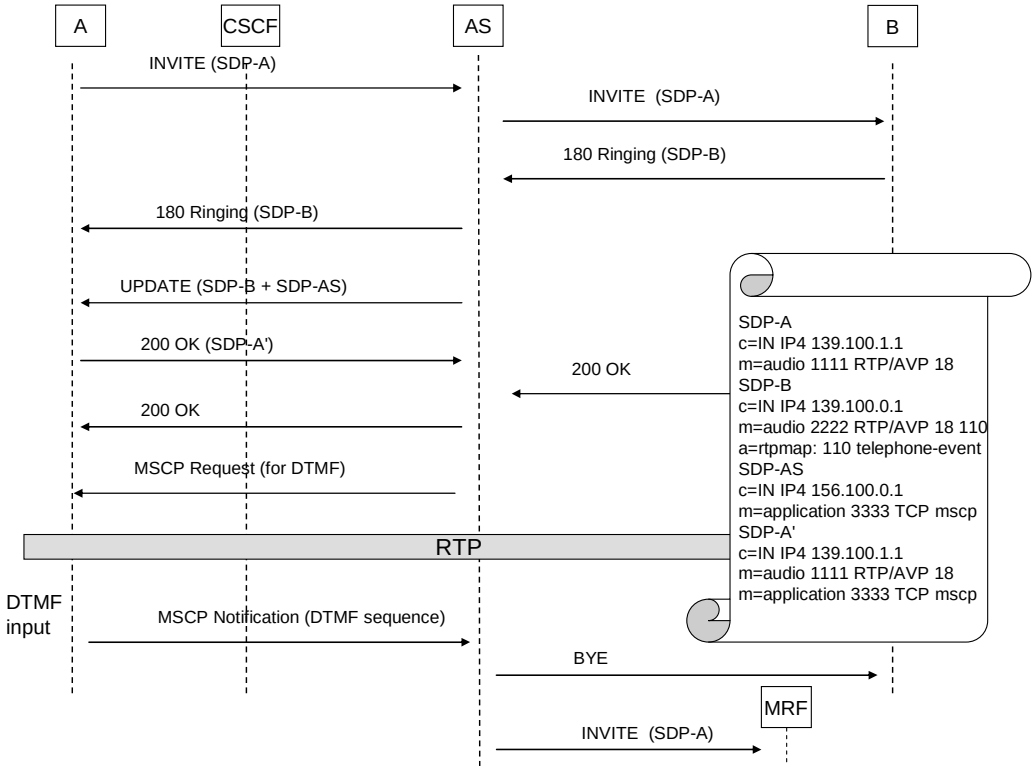


Figure 3: Simplified Call Flow

The control channel conveys messages enabling the application to request the User Equipment to collect particular DTMF sequences and the User Equipment to report such sequences. The Application Server interacts with the User Equipment as if it were a Media Resource Function (MRF). Protocols such as those evaluated in the framework of 3GPP TR 24.880 [i.5] (e.g. MSCP or MSML) may be used. This solution is not limited to the support of DTMF and enables other forms of user interactions.

7 Comparison of solutions

The KPML Event Package is interesting because it allows to be notified of the occurrence of particular DTMF sequences, it supports regular-expression pattern, and it provides a rich set of capabilities.

On the one hand, the use of the SUBSCRIBE/NOTIFY methods to transport the KPML Event Package, whether inside or outside the INVITE-initiated dialog, may lead to some issues (see clause 6.3.2). On the other hand, an updated INFO method (see end of clause 6.2, [i.9], [i.10] and [i.11]) provides a negotiation mechanism and an indication of content context using Event Packages.

Thus, the use of this updated INFO method currently being worked on by IETF (see clause 6.2) to convey DTMF using info-events seems to be the best solution for an out-of-band transport of DTMF.

In order to harmonize DTMF processing along and outside the session signalling path in an Application Server, it seems that the best solution is to define these info-events in such that the XML body of the INFO message sent from the network to the UE contains an XML document compliant to the schema in clause 5.2 "KPML request" of the RFC 4730 [i.4] on KPML, and that the XML body of the INFO message sent from the UE to the network contains an XML document compliant to the schema in clause 5.3 "KPML response" of the RFC 4730 [i.4] on KPML.

History

Document history		
V2.1.1	July 2008	Publication