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Technical Report

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

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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

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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]).

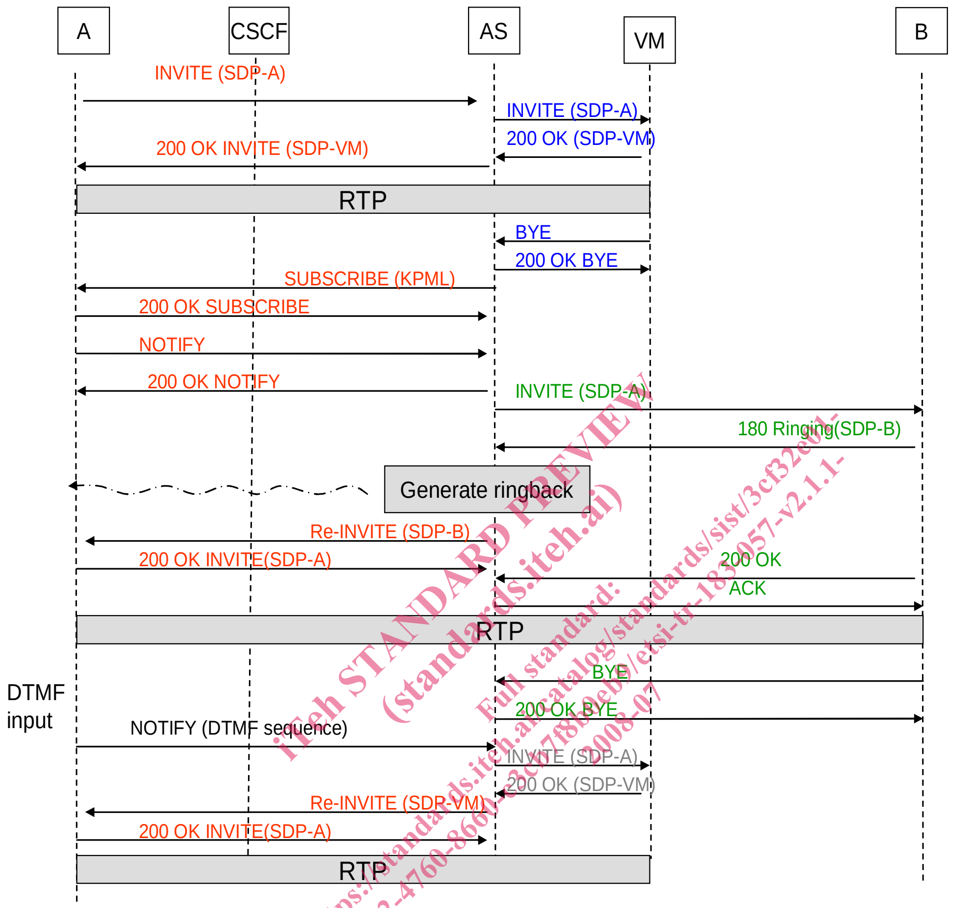

Figure 1: Simplified Call Flow (Return to voicemail browsing after call back)