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A Method To Improve The Call Handling On Reciprocal Peer To Peer Calls

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**Description of the technical solution:**

In Communication solutions, the first usage is the peer to peer call and it is of course a “must to have”. With this usage, users experience different situations that are more or less satisfactory. One of these situations is the following:

Alice calls Bob and in the same time, Bob calls Alice.

The traditional result is that these two calls fail and Alice or Bob must initiate the call, with the hope that the other one doesn’t try to join him/her simultaneously again.

The two calls fail because there are not considered as the same session by the communication system. This is a poor user experience for both users.

In real life, if Alice talks to Bob and simultaneously Bob talks to Alice, the conversation starts after some polite excuses. Why a modern communications system cannot do better?

The idea, and the problem to solve, is that the communications system recognizes the two calls can be merged into the same call.

This merge is possible if:

- The call of Alice and the call of Bob are still not in established state
- Or one call is still not established and the other one is now connected to a voice guide, voice mail system or automated attendant.

The solution consists in implementation of algorithms inside the call handling to determine if two distinct calls have finally the same objective and could automatically be merged.

In traditional PBX systems, the solution is handled by multi-line feature. If Alice or Bob use multi-line phones he/she can see the other call, release his/her initial call and take the current.

The user experience is not good and often lead to end-user confusion (hanging-on the right call, etc...).

Our idea is to simulate that both calls are in fact the same call.

The invention itself is:

1- Implementation of an algorithm in the call handling that analyzes at each call context creation:
a. If there is a reciprocal (same participants) other call context ongoing. To do that, it takes into account:
   i. Contacts information “Initial Callee”, “Callee” and “Caller”
   ii. Multi-device cases
   iii. Advanced routing cases like manager/assistant, call forward/overflow or supervision call pick up
b. If yes, these two call contexts could be merged, according to their respective call states
c. If yes, selection of the appropriate call handling treatment to execute, according to call states and media compatibilities status

2- Implementation of some new call handling rules to automatically establish together the two distinct calls

For the illustrations, let consider a SIP Communication solution with two Users:
- User 1 : Alice
- User 2 : Bob

The use case: Alice calls Bob (Call 1), and reciprocally Bob calls Alice (Call 2)

The first figure shows the traditional call handling treatment, without the invention.

The next figures show the call handling treatments with the invention. Only some cases are illustrated, it does not cover all possible situations.

Note: we describe the invention using SIP call flows but globally it applies to any call handling system (not only SIP based systems).

1) Traditional call handling treatment – sessions crossing

This illustration shows the traditional call handling treatment: each call context is managed separately by the SIP Server, as a result the calls stay distincts. Alice receives a call from Bob while in the same time Bob receives a call from Alice.
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2) Improved call handling treatment - no sessions crossing - SDP offers compatible

The call handling receives simultaneously (or almost) the new call contexts: C1 from Alice, C2 from Bob.

Before propagating the INVITEs, the call handling determines that C1 and C2 are analog, both call contexts are therefore merged.

Then the call handling verifies compatibility of the SDP1 and SDP2 offers: it is compatible. As a result, the call handling establishes immediately the SIP calls C1 and C2 by 200 OK messages.

Alice and Bob are in conversation.
3) Improved call handling treatment - sessions crossing - SDP offers compatible

The call handling receives a new call context: C1 from Alice. It propagates the INVITE to Bob, as C3.

Just after, the call handling receives another new call context: C2 from Bob. Before propagating the INVITE to Alice, the call handling determines that C1 and C2 are analog, both call contexts are therefore merged.

Then the call handling verifies compatibility of the SDP1 and SDP2 offers: it is compatible.

Compared to previous case, there is a need to cancel C3 for Bob: the call handling cancels C3 for Bob. Once C3 is cancelled, it establishes immediately the SIP calls C1 and C2 by 200 OK messages.

Alice and Bob are in conversation.
4) Improved call handling treatment - no sessions crossing - SDP offers partially compatible

The call handling receives simultaneously (or almost) the new call contexts: C1 from Alice, C2 from Bob.

Before propagating the INVITEs, the call handling determines that C1 and C2 are analog because “From” and “To” destinations are reciprocal, both call contexts are therefore merged.

Then the call handling verifies compatibility of the SDP1 and SDP2 offers: it is partially compatible. New SDP offers are built: SDP3 and SDP4. The call handling establishes immediately the SIP calls C1 and C2 by 200 OK messages with the new SDP offers.

Alice and Bob are in conversation.
5) Improved call handling treatment - no sessions crossing - SDP offers not compatible

The call handling receives simultaneously (or almost) the new call contexts: C1 from Alice, C2 from Bob.

Before propagating the INVITEs, the call handling determines that C1 and C2 are analog because “From” and “To” destinations are reciprocal, both call contexts are therefore merged.

Then the call handling verifies compatibility of the SDP1 and SDP2 offers: it is not compatible.

The call handling creates a conference on his Media Server with SDP1 and SDP2. The Media Server accepts with new respective SDP offers: SDP3 and SDP4. The call handling establishes immediately the SIP calls C1 and C2 by 200 OK messages with the new SDP offers SDP3 and SDP4. Alice and Bob are in conversation through a conference.

Then the call handling tries to establish a direct connection with REINVITE mechanism (SDP1 proposed to Bob and 200 OK with SDP5, SDP5 proposed to Alice and 200 OK with SDP6). Direct connection is established, conference resources on Media Server are released.

Alice and Bob are in conversation.