

Network Working Group  
Internet-Draft  
Expires: January 16, 2002

R. Sparks  
dynamicsoft  
July 18, 2001

SIP Call Control - Transfer  
draft-ietf-sip-cc-transfer-05

Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC2026](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/lid-abstracts.txt>.

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

This Internet-Draft will expire on January 16, 2002.

Copyright Notice

Copyright (C) The Internet Society (2001). All Rights Reserved.

Abstract

This document describes providing Call Transfer capabilities in SIP. Transfer capabilities. This work is part of the Call Control Framework.

Internet-Draft

SIP Call Control - Transfer

July 2001

## Table of Contents

<a href="#">1.</a>	Overview . . . . .	<a href="#">3</a>
<a href="#">2.</a>	Changes from <a href="#">draft-sparks-sip-cc-transfer-04</a> . . . . .	<a href="#">3</a>
<a href="#">3.</a>	Actors and Roles . . . . .	<a href="#">3</a>
<a href="#">4.</a>	Requirements . . . . .	<a href="#">4</a>
<a href="#">5.</a>	Using REFER to achieve Call Transfer . . . . .	<a href="#">4</a>
<a href="#">6.</a>	Basic Transfer . . . . .	<a href="#">5</a>
<a href="#">6.1</a>	Successful Transfer . . . . .	<a href="#">6</a>
<a href="#">6.2</a>	Failed Transfer . . . . .	<a href="#">7</a>
<a href="#">6.2.1</a>	Target Busy . . . . .	<a href="#">7</a>
<a href="#">6.2.2</a>	Transfer Target does not answer . . . . .	<a href="#">8</a>
<a href="#">7.</a>	Transfer with Consultation Hold . . . . .	<a href="#">9</a>
<a href="#">7.1</a>	Exposing transfer target . . . . .	<a href="#">9</a>
<a href="#">7.2</a>	Protecting transfer target . . . . .	<a href="#">10</a>
<a href="#">7.3</a>	Recovery when one party does not support REFER . . . . .	<a href="#">10</a>
<a href="#">7.4</a>	Consultation Hold in the presence of forking proxies . . . . .	<a href="#">11</a>
<a href="#">7.5</a>	Using the Replaces header to improve the Consultation Hold experience . . . . .	<a href="#">12</a>
<a href="#">7.5.1</a>	Consultation Hold protecting transfer target . . . . .	<a href="#">12</a>
<a href="#">7.5.2</a>	Recovering from one party not supporting the Replaces header	13
<a href="#">7.6</a>	Aborting a Consultation Hold . . . . .	<a href="#">14</a>
<a href="#">8.</a>	Transfer with multiple parties . . . . .	<a href="#">14</a>
<a href="#">9.</a>	Open Issues . . . . .	<a href="#">15</a>
<a href="#">10.</a>	Acknowledgments . . . . .	<a href="#">15</a>
	References . . . . .	<a href="#">15</a>
	Author's Address . . . . .	<a href="#">16</a>
	Full Copyright Statement . . . . .	<a href="#">17</a>

## 1. Overview

This document describes providing Call Transfer capabilities in SIP. Transfer capabilities. This work is part of the Call Control Framework.

The mechanisms discussed here are most closely related to traditional basic and consultation hold transfers. This document does not discuss transfer scenarios involving ad-hoc conferences (where all parties involved are briefly in a conference until this transferor drops out).

Editor's note: Per working group consensus, [draft-ietf-sip-cc-transfer-04](#) was split into two drafts. This document details the use of REFER to achieve call transfer. The definition of REFER itself was removed to [draft-ietf-sip-refer-00](#)

## 2. Changes from [draft-sparks-sip-cc-transfer-04](#)

- o Split the draft
- o Removed the contested distinction between attended and unattended transfer (involving an ad-hoc conference).
- o Added new failure and recovery flows
- o Added flow demonstrating the use of the Replaces header to affect user experience

## 3. Actors and Roles

There are three actors in a given transfer event, each playing one of the following roles:

Transferee - the party being transferred to the Transfer Target.

Transferor - the party initiating the transfer

Transfer Target - the new party being introduced into a call with the Transferee.

The following roles are used to describe transfer requirements and scenarios:

Sparks	Expires January 16, 2002	[Page 3]
--------	--------------------------	----------

---

Internet-Draft	SIP Call Control - Transfer	July 2001
----------------	-----------------------------	-----------

Originator - wishes to place a call to the Recipient. This actor is the source of the first INVITE in a session, to either a Facilitator or a Screener.

Facilitator - receives a call or out-of-band request from the Originator, establishes a call to the Recipient through the Screener, and connects the Originator to the Recipient.

Screener - receives a call ultimately intended for the Recipient and transfers the calling party to the Recipient if appropriate.

Recipient - the party the Originator is ultimately connected to.

#### [4.](#) Requirements

1. Any party in a SIP session MUST be able to transfer any other party in that session at any point in that session.
2. The Transferor and the Transferee MUST NOT be removed from a session as part of a transfer transaction.

At first glance, requirement 2 may seem to indicate that the user experience in a transfer must be significantly different from what a current PBX or Centrex user expects. As the call-flows in this document show, this is not the case. A client MAY

preserve the current experience. In fact, without this requirement, some forms of the current experience (ringback on transfer failure for instance) will be lost.

3. The Transferor MUST know whether or not the transfer was successful (this is significantly different from the requirements of the earlier BYE-Also approach to transfer).

## 5. Using REFER to achieve Call Transfer

A REFER [[3](#)] can be issued by the Transferor to cause the Transferee to issue an INVITE to the Transfer-Target. Note that a successful REFER transaction does not terminate the session between the Transferor and the Transferee. If those parties wish to terminate their session, they must do so with a subsequent BYE request. The media negotiated between the transferee and the transfer target is not affected by the media that had been negotiated between the transferor and the transferee. In particular, the INVITE issued by the Transferee will have the same SDP body it would have if he

Sparks

Expires January 16, 2002

[Page 4]

---

Internet-Draft

SIP Call Control - Transfer

July 2001

Transferee had initiated that INVITE on its own. Further, the disposition of the media streams between the Transferor and the Transferee is not altered by the REFER method. Agents may alter a session's media through additional signaling. For example, they may make use of the SIP hold re-INVITE [[1](#)] or the conferencing extensions provided by this framework.

## 6. Basic Transfer

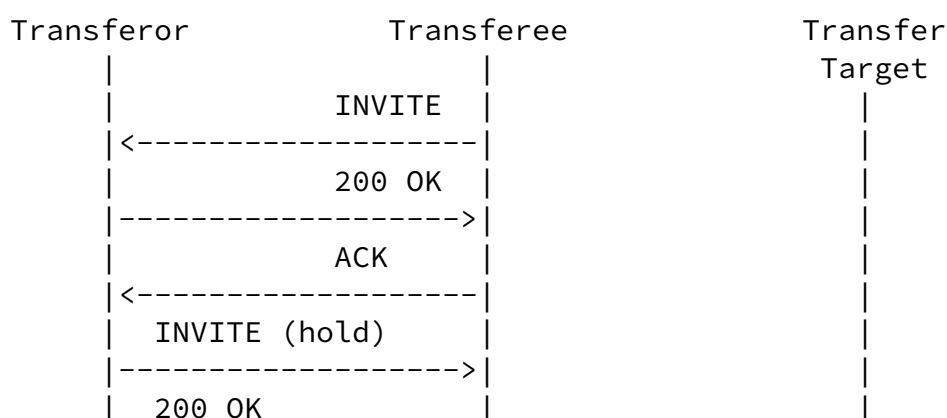
Basic Transfer consists of the Transferor providing the Transfer Target's contact to the Transferee. The Transferee attempts to establish a session using that contact and reports the results of that attempt to the Transferor. The signaling relationship between the Transferor and Transferee is not terminated, so the call is recoverable if the Transfer Target cannot be reached. Note that the Transfer Target's contact information has been exposed to the Transferee. The provided contact can be used to make new calls in the future.

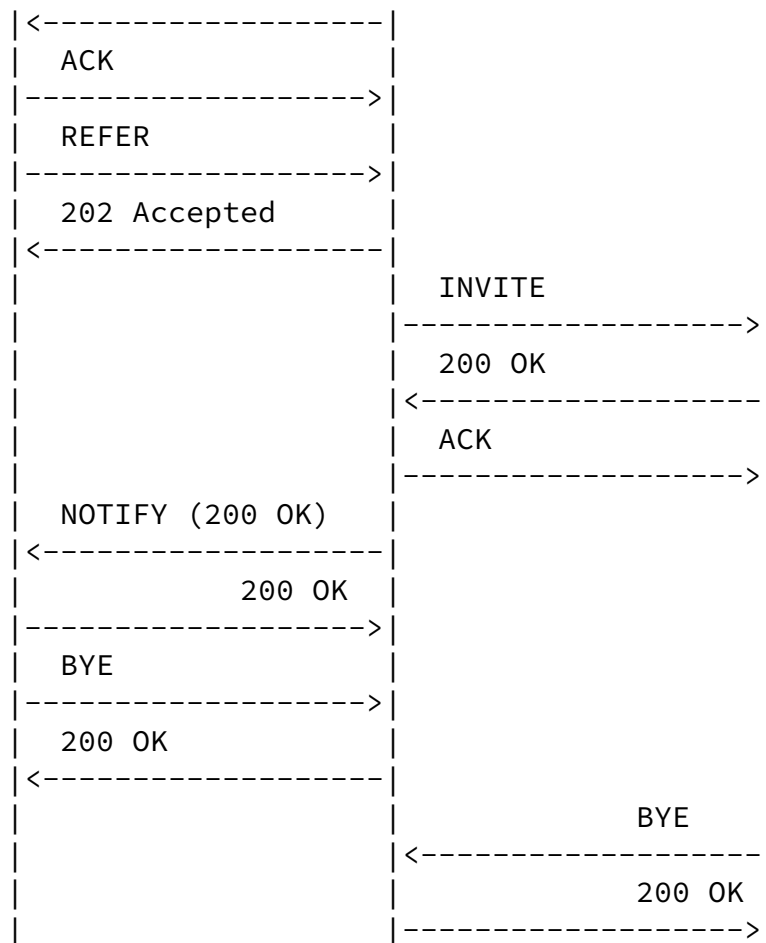
The diagrams below show indicate the first line of each message. All messages in a particular diagram share the same Call-ID. In these

diagrams, media is managed through reINVITE holds, but other mechanisms (mixing multiple media streams at the UA or using the conferencing extensions for example) are valid.

Each of the flows below shows the call-leg between the Transferor and the Transferee remaining connected (on hold) during the REFER process. While this provides the greatest flexibility for recovery from failure, it is not necessary. If the Transferor's agent does not wish to participate in the remainder of the REFER process and has no intention of assisting with recovery from transfer failure, it could emit a BYE to the Transferee as soon as the REFER transaction completes.

### [6.1](#) Successful Transfer





## [6.2](#) Failed Transfer

### [6.2.1](#) Target Busy

Transferor

|

Transferee

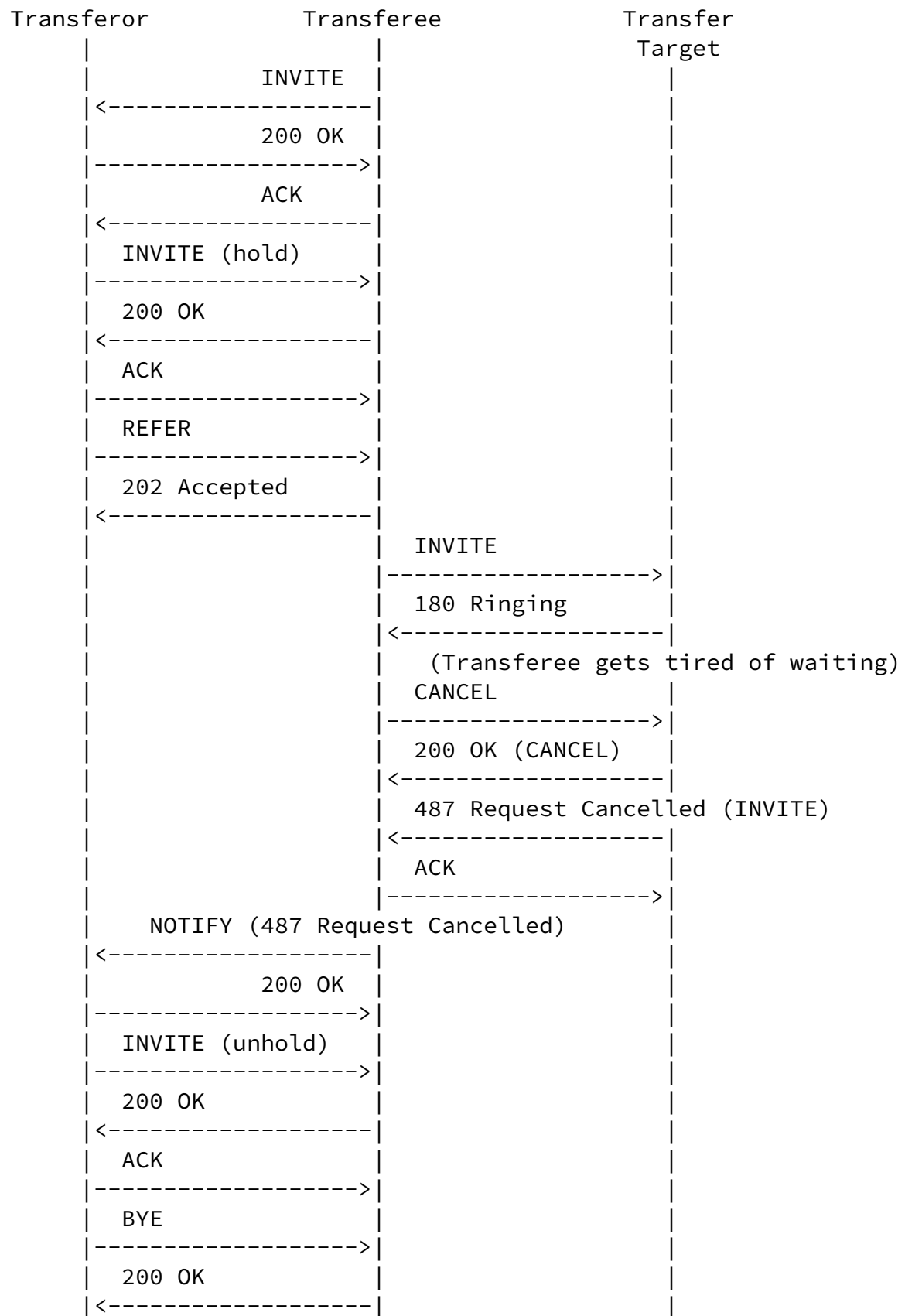
|

Transfer  
Target

INVITE	
<-----	
200 OK	
----->	
ACK	
<-----	
INVITE (hold)	
----->	
200 OK	
<-----	
ACK	
----->	
REFER	
----->	
202 Accepted	
<-----	
	INVITE
	----->
	486 Busy Here
	<-----
	ACK
	----->
NOTIFY (503 Service Unavailable)	
or NOTIFY (486 Busy Here)	
<-----	
200 OK	
----->	
INVITE (unhold)	
----->	
200 OK	
<-----	
ACK	
----->	
BYE	
----->	
200 OK	
<-----	



### 6.2.2 Transfer Target does not answer



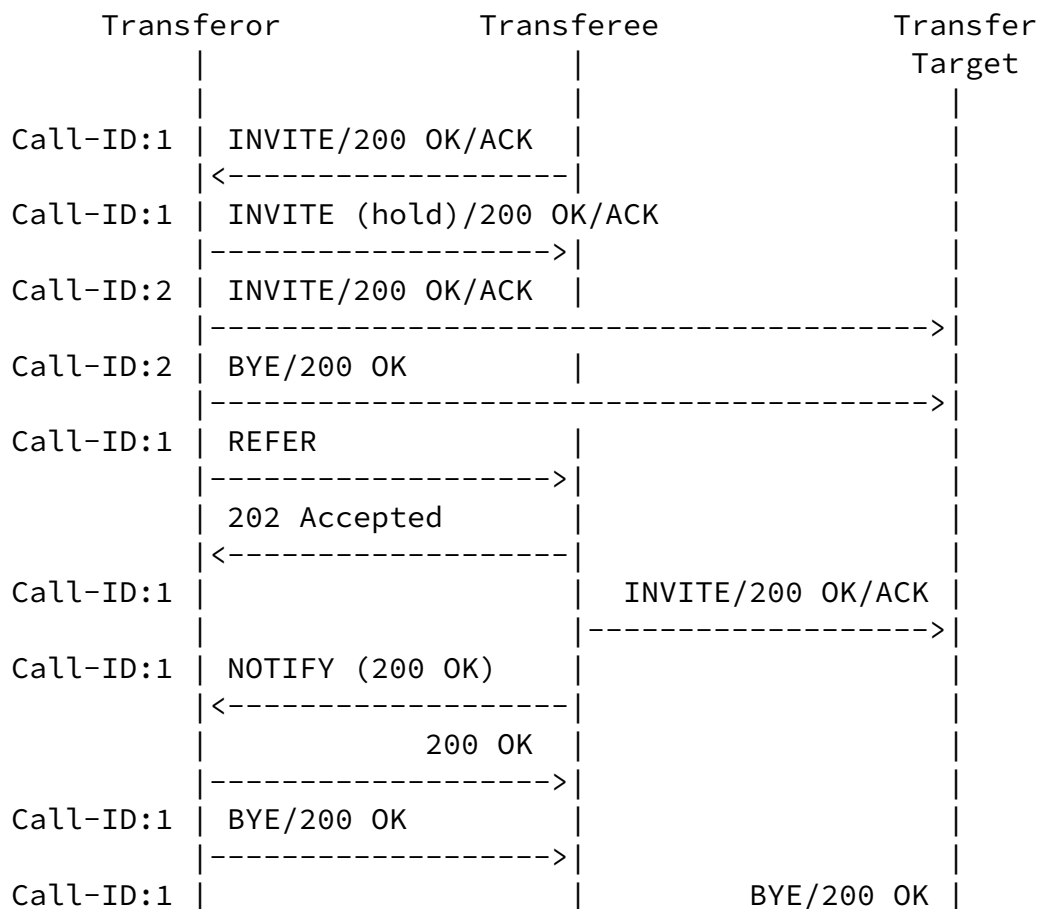
## 7. Transfer with Consultation Hold

Transfer with Consultation Hold involves a session between the transferor and the transfer target before the transfer actually takes place. This is implemented with SIP Hold and Transfer as described above.

### 7.1 Exposing transfer target

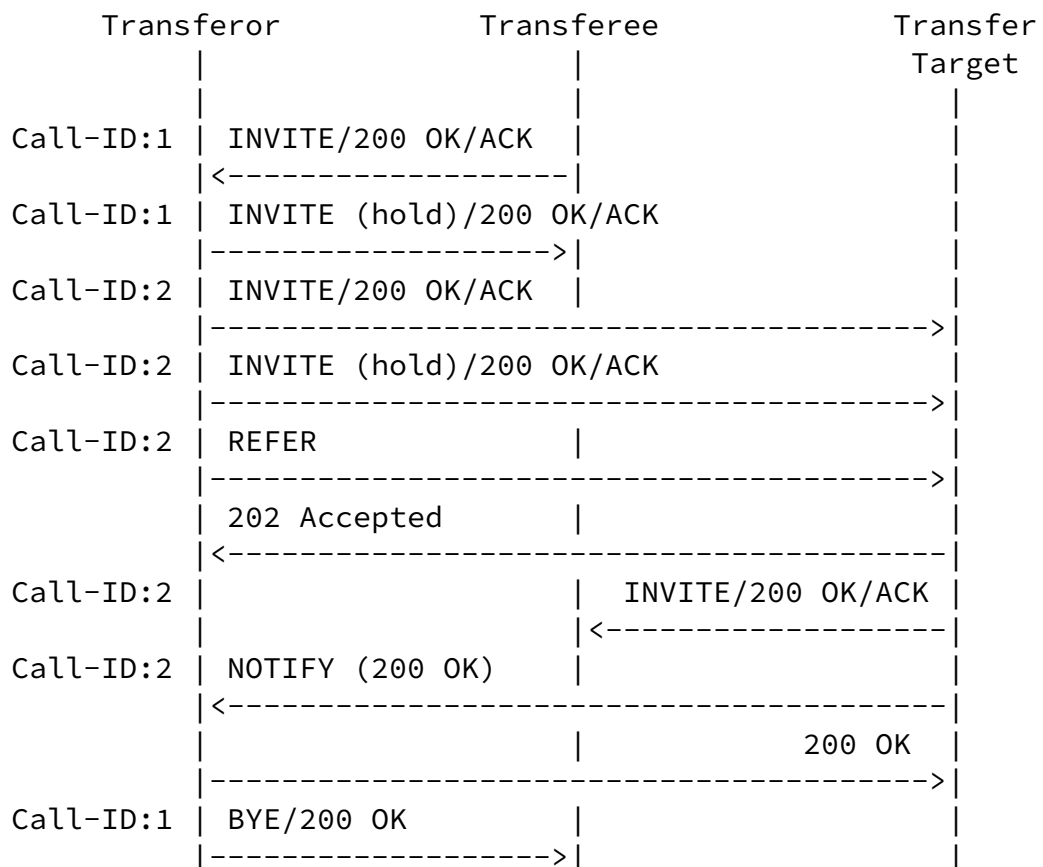
The transferor places the transferee on hold, establishes a call with the transfer target to alert them to the impending transfer, terminates the connection with the transfer target, then proceeds with transfer as above. This variation can be used to provide an experience similar to that expected by current PBX and Centrex users.

To (hopefully) improve clarity, non-REFER transactions have been collapsed into one indicator with the arrow showing the direction of the request.



## [7.2](#) Protecting transfer target

The transferor places the transferee on hold, establishes a call with the transfer target and then reverses their roles, transferring the original transfer target to the original transferee. This has the advantage of hiding information about the original transfer target from the original transferee. On the other hand, the Transferee's experience is different that in current systems. The Transferee is effectively "called back" by the Transfer Target. If supported, use of the Replaces header can help improve this experience. Examples of this usage appear later in this document.



Call-ID:2	BYE/200 OK	
		----->
Call-ID:2		BYE/200 OK
		----->

### 7.3 Recovery when one party does not support REFER

If protecting or exposing the transfer target is not a concern, it is possible to complete a transfer with consultation hold when only the transferor and one other party support REFER.

Sparks

Expires January 16, 2002

[Page 10]

Internet-Draft

SIP Call Control - Transfer

July 2001

	Transferor	Transferee	Transfer Target
Call-ID:1	INVITE/200 OK/ACK		
	<-----		
Call-ID:1	INVITE (hold)/200 OK/ACK		
	----->		
Call-ID:2	INVITE/200 OK/ACK		
			----->
Call-ID:2	INVITE (hold)/200 OK/ACK		
			----->
Call-ID:1	REFER		
	----->		
Call-ID:1	501 Not Implemented		
	<-----		
Call-ID:2	REFER		
			----->
	202 Accepted		
	<-----		
Call-ID:2		INVITE/200 OK/ACK	
		<-----	
Call-ID:2	NOTIFY (200 OK)		
	<-----		
			200 OK
			----->
Call-ID:1	BYE/200 OK		
	----->		
Call-ID:2	BYE/200 OK		
			----->

Call-ID:2			BYE/200 OK	
			----->	

#### [7.4](#) Consultation Hold in the presence of forking proxies

It is worth noting that the examples given above abstract away any proxies that might be between the three parties. In 4.5.1 for example, the URL used to reach the Transfer Target may go through a forking proxy. There is no guarantee that the Transferee's and Transferor's invitations to the Transfer Target will reach the same endpoint. If the proxy forked in parallel, both invitations could cause multiple endpoints to ring. To increase the probability of the desired behavior of having the referred invite reach and ring only the same endpoint as the consultation invite, the Transferor SHOULD issue the REFER request with the Refer-To: header containing the Contact the Transfer Target provided in its 200 OK to the Transferor's INVITE. If that REFER fails, the Transferor SHOULD issue another REFER with the Refer-To: header containing the URL it

Sparks	Expires January 16, 2002	[Page 11]
--------	--------------------------	-----------

---

Internet-Draft	SIP Call Control - Transfer	July 2001
----------------	-----------------------------	-----------

used to reach the Transfer Target, augmented with an Accept-Contact header containing the Contact the Transfer Target provided.

#### [7.5](#) Using the Replaces header to improve the Consultation Hold experience

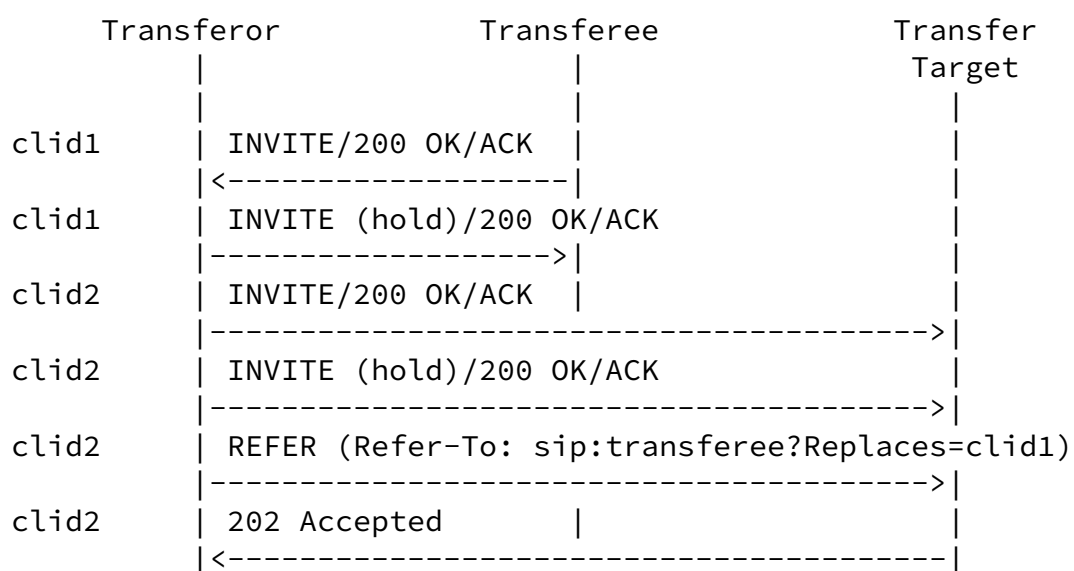
##### [7.5.1](#) Consultation Hold protecting transfer target

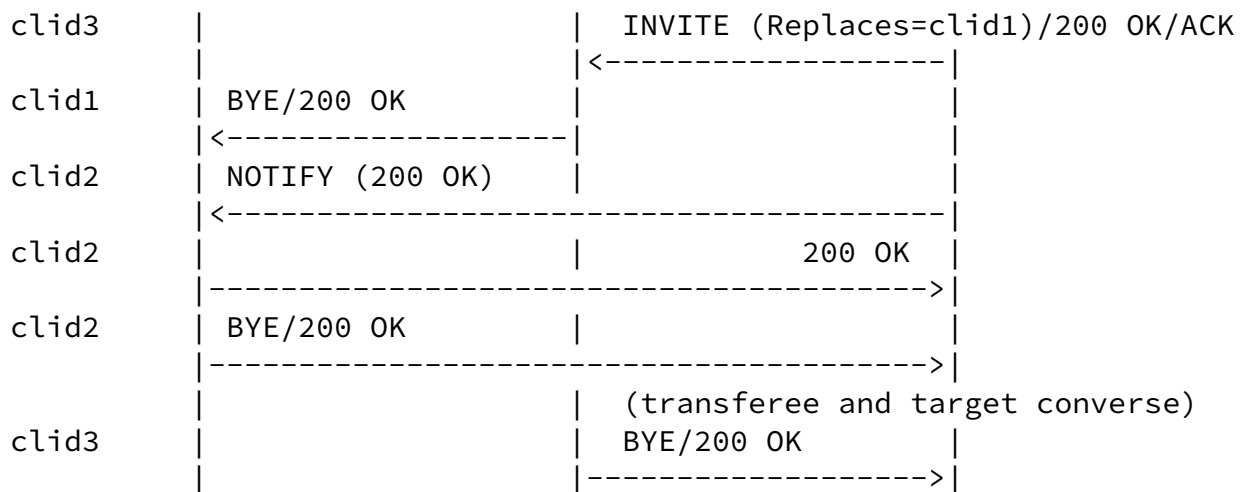
One of the problems with the simplest implementation of a target protecting transfer is that the transferee is receiving a new call from the transfer-target. Unless the transferee's agent has a reliable way to associate this new call with the call it already has with the transferor, it will have to alert the new call on another appearance. If this, or some other call-waiting-like UI were not available, the transferee might be stuck returning a Busy-Here to the transfer target, effectively preventing the transfer. There are many ways that that correlation could be provided. The call leg parameters could be provided directly as header parameters in the Refer-To: URL for example. The Replaces mechanism [\[4\]](#) uses this approach and solves this problem nicely.

For the flow below, clid1 means Call Leg Identifier 1, and consists

of the parameters to the Replaces header for call-leg 1. In [4] this is the Call-ID, To-tag and From-tag.

Note that the transferee's agent emits a BYE to the transferor's agent as an immediate consequence of processing the Replaces header.





### [7.5.2](#) Recovering from one party not supporting the Replaces header

Similar to the case of recovering from a party not supporting REFER, the transferor can recover from a party not supporting the Replaces header, at the potential cost of not protecting the transfer target and reverting to the non-Replaces user experience.

In the above flow, if all of the following are true:

- o The Transferee's agent does not support the Replaces header
- o The Transferee's agent does not support multiple appearances or call-waiting and returns Busy-Here to all new INVITEs when engaged in a call.
- o The Transfer-Target's agent is configured to expose the cause of a REFERenced action failure in its NOTIFY (see the security issues associated with this choice in [\[3\]](#)).
- o The Transferor is willing to expose the Transfer-Target.

then the Transferor can retry the transfer by sending a new REFER to the Transferee.

### [7.6](#) Aborting a Consultation Hold

In any of the consultation hold flows above, the Transferor may decide to terminate its attempt to contact the Transfer target before that session is established. Most frequently, that will be the end of the scenario, but in some circumstances, the transferor may wish to proceed with the transfer action. For example, he may wish to complete the transfer knowing that the transferee will end up

eventually talking to the transfer-target's voice-mail service.

For flows that expose the transfer target, this simply becomes a basic transfer.

This scenario is far more complicated for flows that protect the transfer target. Since no session is established between the transferor and the transfer target, the transfer target's agent would have to honor out-of-session REFERS, and somehow indicate what's happening via its user interface (this scenario is most likely to occur when the transfer-target is away from his agent).

## 8. Transfer with multiple parties

In this example the Originator places call to the Facilitator who reaches the Recipient through the Screener. The Recipient's contact information is exposed to the Facilitator and the Originator. This example is provided for clarification of the semantics of the REFER method only and should not be used as the design of an implementation.

Call-ID	Originator	Facilitator	Screener	Recipient
1	INVITE/200 OK/ACK			"Get Fred for me!"
	----->			"Right away!"
1	INVITE (hold)/200 OK/ACK			
	<-----			
2		INVITE/200 OK/ACK		"I have a call
		----->		from Mary for Fred"
2		INVITE (hold)/200 OK/ACK		"Hold please"
		<-----		
3			INVITE/200 OK/ACK	
			----->	"You have a call
				from Mary"
				"Put her through"
3			INVITE (hold)/200 OK/ACK	
			----->	
2		REFER		
		<-----		
		202 Accepted		



2		INVITE/200 OK/ACK		
		----->		"This is Fred"
2		NOTIFY (200 OK)		"Please hold for Mary"
		----->		
		200 OK		
		<-----		
2		BYE/200 OK		
		<-----		
3			BYE/200 OK	
			----->	
2		INVITE (hold)/200 OK/ACK		
		----->		
1	REFER			
	<-----			
	202 Accepted			
	----->			
1	INVITE/200 OK/ACK			
	----->			"Hey Fred"
1	NOTIFY (200 OK)			"Hello Mary"
	----->			
	200 OK			
	<-----			
1	BYE/200 OK			
	<-----			
2		BYE/200 OK		
		----->		
1	BYE/200 OK			
	<-----			"See you later"

## 9. Open Issues

## 10. Acknowledgments

This draft is a collaborative product of the SIP working group. Thanks to Alan Johnston for providing the starting point for the new error and recovery flows.

## References

- [1] Handley, M., Schulzrinne, H., Schooler, E. and J. Rosenberg, "SIP: Session Initiation Protocol", [RFC 2543](#), March 1999.
- [2] Campbell, B., "Framework for SIP Call Control Extensions", [draft-ietf-sip-cc-framework-00](#) (work in progress), March 2000.
- [3] Sparks, R., "The REFER Method", [draft-ietf-sip-refer-00](#) (work in progress), March 2000.

progress), July 2001.

- [4] Biggs, B. and R. Dean, "The SIP Replaces Header", [draft-biggs-sip-replaces-00](#) (work in progress), November 2000.

#### Author's Address

Robert J. Sparks  
dynamicsoft  
5100 Tennyson Parkway  
Suite 1200  
Plano, TX 75024

EMail: [rsparks@dynamicsoft.com](mailto:rsparks@dynamicsoft.com)

---

Internet-Draft

SIP Call Control - Transfer

July 2001

## Full Copyright Statement

Copyright (C) The Internet Society (2001). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

## Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

Sparks

Expires January 16, 2002

[Page 17]