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TOC

Implementing Call Park and Retrieve using the Session Initiation Protocol (SIP)
draft-procter-bliss-call-park-extension-01

Status of this Memo

Abstract

Call Park and Call Retrieve are useful telephony services that are familiar to many users. Existing implementations using the Session Initiation Protocol (SIP) show that a variety of approaches can be taken, with varying degrees of interoperability. This draft discusses a number of feature variations, and how they may be implemented.

Table of Contents

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1. Overview

TOC

Call Park is a feature that enables UAs to make a call inactive but not terminated, in such a way as to allow the call to be resumed by the UA that parked the call, or by a different UA.
This feature is typically used when User A wishes to transfer a call in progress to User B, but doesn't necessarily know how to reach User B's UA directly. In this situation, User A parks the call, and then tells User B where the call is parked. User B may then retrieve the call using a convenient UA.
Other uses include allowing multiple calls to be parked at the same 'location', and forming a queue. In this way, a simple 'ACD' system can be implemented that permits calls to be initially sorted and placed in one of a number of queues, ready to be handled when an appropriate agent becomes available (and retrieves the next call from the queue).
In all cases, the parked call is subsequently identifiable by a short (typically 3 or 4 digit) label known as an 'orbit'. This orbit is often allocated by the user parking the call, but some environments favour allocation of the orbit by a Park Server. Both approaches are described in this document.
Having a Park Server for parked calls is a useful approach, which secures parked calls against User Agent rebooting and other losses of service. However, being able to park and retrieve calls without a Park Server is also a useful model, both in terms of decentralised network design and also for smaller installations that don't necessarily merit a separate Park Server. Therefore, parking with and without a Park Server are discussed in this document.

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2. Parking a call

TOC

A basic call flow for Call Park is given in [se] (Johnston, A., "Session Initiation Protocol Service Examples," July 2007.) (section 2.15), and this forms the basis of the feature. This approach uses the SIP dialog ID between the parked endpoint and the park server itself as the unique parked call identifier. Using the dialog ID has a number of advantages since it is unique and allocated by both the parked user and the Park Server. However, it is also long, which can lead to problems when trying to identify parked calls by verbal or human-written mechanisms.

Traditional PBX users have become accustomed to parking a call against a short number (typically 3 or 4 digits), and then using this identifier to communicate to the retrieving party which call to retrieve. This information may be passed verbally, or by means of small paper notes. Whilst collisions may occur, they are generally avoided satisfactorily by administrative policies.

This draft attempts to reconcile these two models by allowing a short label to be attached to a parked call (the 'orbit'). The retrieving party can then use the same tag to locate the relevant dialog ID in order to retrieve the parked call.

2.1. Parking a call without an orbit

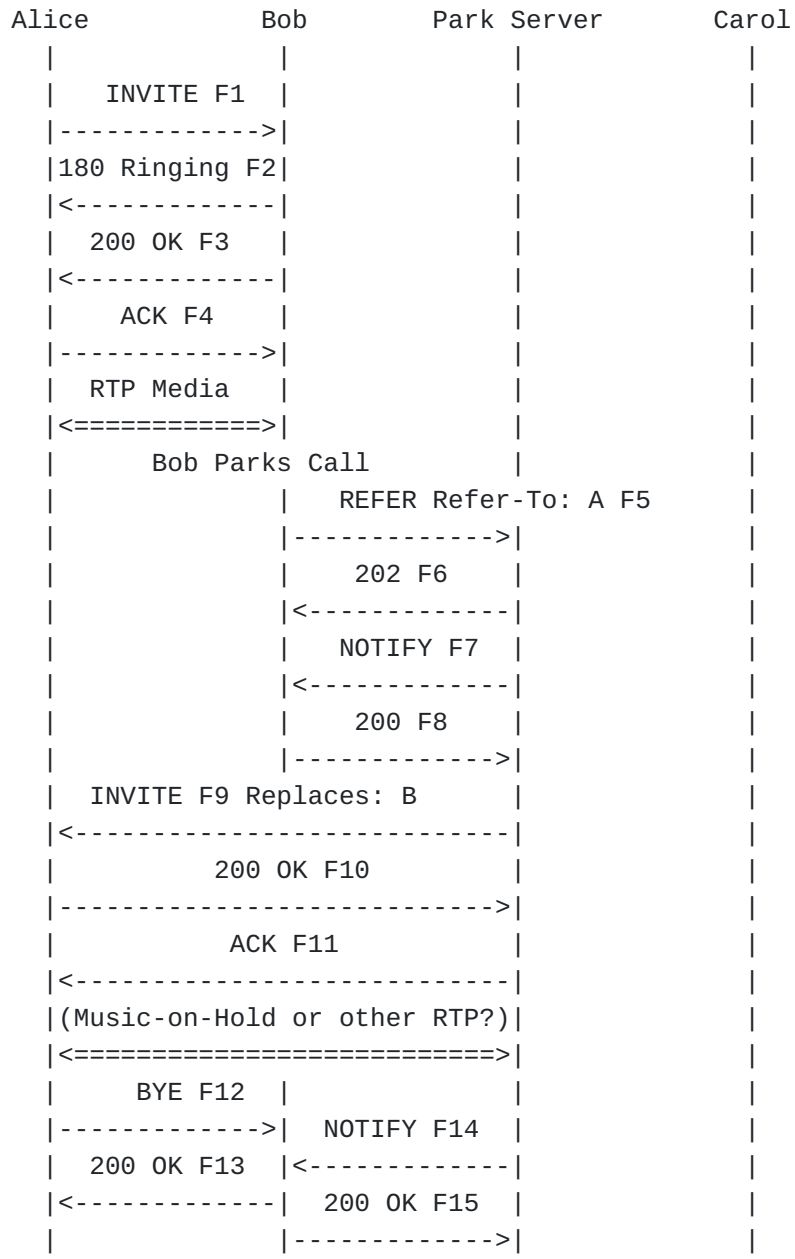
TOC

Certain environments do not require an 'orbit' to be used, either because calls are parked in a single queue, or the dialog identifiers are readily passed between concerned UAs. In this scenario, the flow described in [se] (Johnston, A., "Session Initiation Protocol Service Examples," July 2007.) is followed without deviation.

2.2. Parking a call with a specified orbit

TOC

The message flow of parking a call in this scenario is identical to that illustrated in [se] (Johnston, A., "Session Initiation Protocol Service Examples," July 2007.). The difference that this draft introduces is in the REFER message to the Park Server. The details of the REFER message changes are discussed below.



The URI <sips:park-server@example.com;orbit=1234> is used instead of directing the request to the URI <sips:park@server.example.com>. The addition of the orbit parameter effectively tags the parked call with a short memorable code entered by the user.

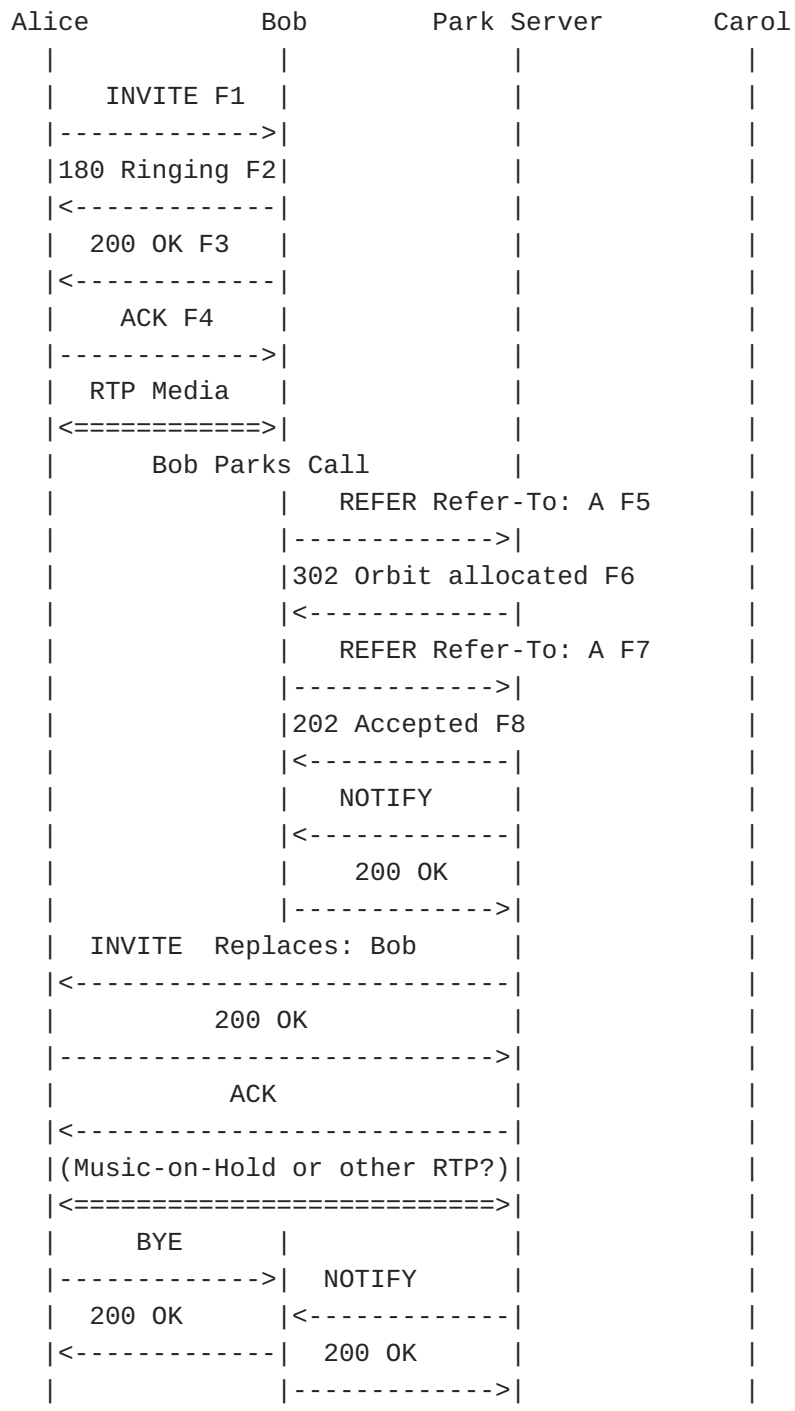
```
 F5 REFER Bob -> Park Server

 REFER sips:park-server@example.com;orbit=1234 SIP/2.0
 Via: SIP/2.0/TLS client.biloxi.example.com:5061
  ;branch=z9hG4bKnashds9
 Max-Forwards: 70
 From: Bob <sips:bob@biloxi.example.com>;tag=02134
 To: Park Server <sips:park-server@example.com;orbit=1234>
 Call-ID: 4802029847@biloxi.example.com
 CSeq: 1 REFER
<allOneLine>
 Refer-To: <sips:alice@client.atlanta.example.com?Replaces=
 12345601%40atlanta.example.com%3Bfrom-tag%3D314159
 %3Bto-tag%3D1234567>
</allOneLine>
 Referred-By: <sips:bob@biloxi.example.com>
 Contact: <sips:bob@client.biloxi.example.com>
 Content-Length: 0
```

2.3. Parking a call with a Park-Server allocated orbit

TOC

Sometimes an orbit number assignment policy needs to be implemented. This may be to ensure that all orbit numbers are a particular length, or have a form that means that they can be dialled directly (given suitable extensions to an Application Server). It may also be implemented to eliminate the problem of trying to park more than one call on the same orbit.

To enforce a policy, we ensure that the orbit number is not allocated by the UA (entered by the user, or by configuration etc.) but is instead allocated by the Park Server, and relayed to the UA. The approach taken here is analogous to the Conference Factory approach described in [RFC4579] (Johnston, A. and O. Levin, “Session Initiation Protocol (SIP) Call Control - Conferencing for User Agents,” August 2006.). Bob sends a REFER to the preconfigured Park Server URI, but without any 'orbit' parameter added. The Park Server then responds by redirecting Bob to the correct orbit by using a '302 Moved Temporarily' response. The orbit can then be found by inspecting this new target. Note that an intermediate proxy may recurse on this 302 response and Bob may never see the redirect. In this scenario, Bob can still extract the orbit from Contact of 2xx response to the original REFER.


Alice
Bob
Park Server
Carol
INVITE F1
180 Ringing F2
200 OK F3
ACK F4
RTP Media
Bob Parks Call
REFER Refer-To: A F5
302 Orbit allocated F6
REFER Refer-To: A F7
202 Accepted F8
NOTIFY
200 OK
INVITE Replaces: Bob
200 OK
ACK
(Music-on-Hold or other RTP?)
BYE
NOTIFY
200 OK
200 OK

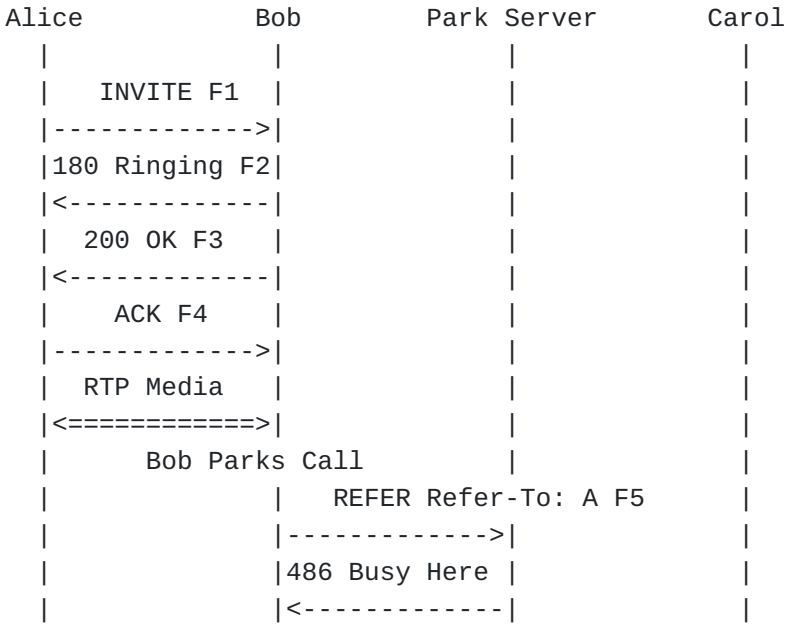
```
  F5 REFER Bob -> Park Server

  REFER sips:park-server@example.com SIP/2.0
  Via: SIP/2.0/TLS client.biloxi.example.com:5061
   ;branch=z9hG4bKnashdsB
  Max-Forwards: 70
  From: Bob <sips:bob@biloxi.example.com>;tag=22134
  To: Park Server <sips:park-server@example.com>
  Call-ID: 4802029847@biloxi.example.com
  CSeq: 1 REFER
<allOneLine>
  Refer-To: <sips:alice@client.atlanta.example.com?Replaces=
  12345601%40atlanta.example.com%3Bfrom-tag%3D314159
  %3Bto-tag%3D1234567>
</allOneLine>
  Referred-By: <sips:bob@biloxi.example.com>
  Contact: <sips:bob@client.biloxi.example.com>
  Content-Length: 0


  F6 302 Orbit Allocated Park Server -> Bob

  SIP/2.0 202 Orbit Allocated
  Via: SIP/2.0/TLS client.biloxi.example.com:5061
   ;branch=z9hG4bKnashdsB
   ;received=192.0.2.105
  From: Bob <sips:bob@biloxi.example.com>;tag=22134
  To: Park Server <sips:park-server@example.com>;tag=56324
  Call-ID: 4802029848@biloxi.example.com
  CSeq: 1 REFER
  Contact: <sips:park-server@example.com;orbit=1234>
  Content-Length: 0
```

Once Bob's UA learns of the allocated orbit (either by finding it in the 302 response, or by finding it in the Contact of the 202 response to the REFER), it can be passed to the user (Bob) in an appropriate manner.

2.4. A failed attempt to park a call

TOC

A Park Server may choose to reject a park attempt for many reasons, including prohibiting multiple calls being parked against the same orbit, or prohibiting certain users from parking calls on certain orbits. Whatever the reason, the response sent to Bob will enable Bob to take appropriate action. The following example shows the Park Server rejecting a call due to the orbit already being in use.



When Bob's parking attempt is rejected, Bob may choose to attempt to park the call again, but using a different orbit number. The ability for Bob to recover from failed parking attempts such as this without dropping the call to Alice is an important consequence of Bob sending the REFER to the Park Server, rather than sending the REFER to Alice so that she can park herself.

2.5. Parking a call without a Park Server

TOC

Sometimes, it is useful to be able to park a call without using a Park Server. The original dialog between Alice and Bob is maintained, even though Bob has notionally parked the call. As a consequence, the only changes that occur may be within Bob's UA, and will not necessarily involve any SIP signalling.

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3. Retrieving a Parked Call

TOC

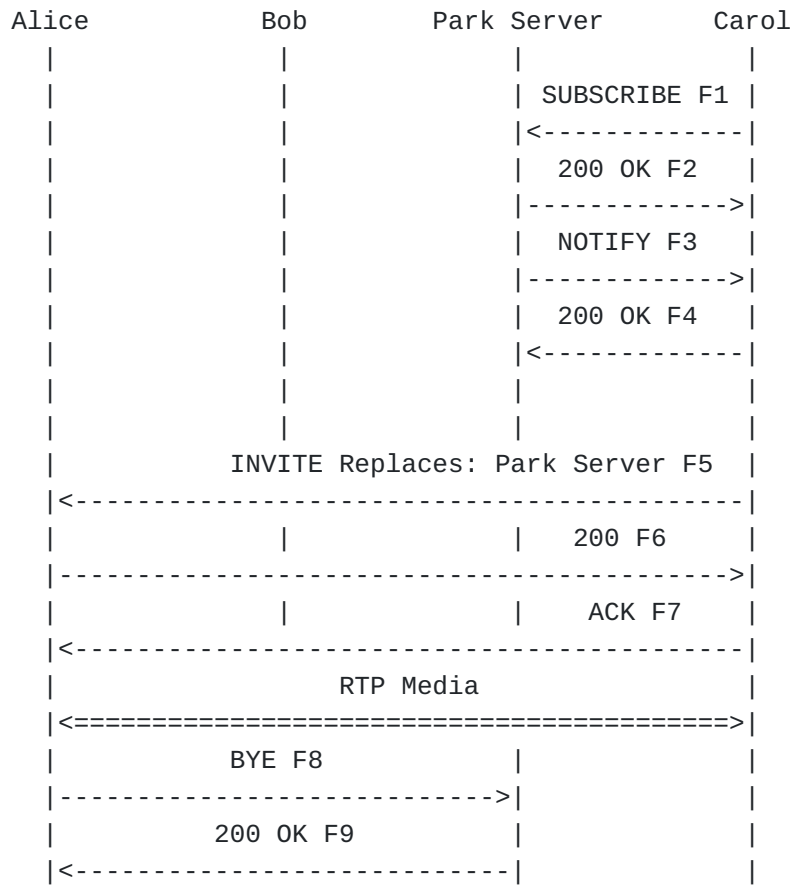
In order to retrieve a parked call, Carol needs to obtain the dialog identifiers for the dialog between Alice and wherever Alice is parked. The dialog identifiers can be obtained by issuing a SUBSCRIBE for the dialog event package [RFC4235] (Rosenberg, J., Schulzrinne, H., and R. Mahy, “An INVITE-Initiated Dialog Event Package for the Session Initiation Protocol (SIP),” November 2005.). The resulting NOTIFY will contain details of all pertinent calls, including the dialog identifiers. Carol may (if presented with multiple dialogs) choose

which call to retrieve. Many implementations choose the first dialog listed, although some use the <duration> element to identify which call has been parked for the longest time.
Once Carol has the necessary dialog identifiers, she can retrieve the parked call using the flow descibed in [se] (Johnston, A., "Session Initiation Protocol Service Examples," July 2007.).

3.1. Retrieving a call from a Park Server

TOC

By subscribing to the dialog event package [RFC4235] (Rosenberg, J., Schulzrinne, H., and R. Mahy, "An INVITE-Initiated Dialog Event Package for the Session Initiation Protocol (SIP)," November 2005.) at the same URI used for parking the call, i.e. <sips:park-server@example.com;orbit=1234>, all the information that is required for the call to be retrieved by C is delivered in the corresponding NOTIFY.
Similarly, if the call was parked in an environment that does not require 'orbit' parameters, subscribing to the URI used for parking the call, i.e. <sips:park-server@example.com>, will still result in the necessary information being provided for the call to be retrieved.



F1 SUBSCRIBE Carol -> Park Server

```
SUBSCRIBE sips:park-server@example.com;orbit=1234 SIP/2.0
Via: SIP/2.0/TLS chicago.example.com:5061;branch=z9hG4bK92bz
Max-Forwards: 70
From: Carol <sips:carol@chicago.example.com>;tag=8672349
To: <sips:park-server@example.com;orbit=1234>
Call-ID: xt4653gs2ham@chicago.example.com
CSeq: 1 SUBSCRIBE
Contact: <sips:carol@client.chicago.example.com>
Event: dialog
Subscription-State: active;expires=0
Accept: application/dialog-info+xml
Content-Length: 0
```

F2 200 OK Park Server -> Carol

```
SIP/2.0 200 OK
Via: SIP/2.0/TLS chicago.example.com:5061;branch=z9hG4bK92bz
 ;received=192.0.2.114
Max-Forwards: 70
From: Carol <sips:carol@chicago.example.com>;tag=8672349
To: <sips:park-server@example.com;orbit=1234>;tag=1234567
Call-ID: xt4653gs2ham@chicago.example.com
CSeq: 1 SUBSCRIBE
Content-Length: 0
```

```
F3 NOTIFY  Park Server -> Carol

NOTIFY sips:carol@client.chicago.example.com SIP/2.0
Via: SIP/2.0/TLS chicago.example.com:5061;branch=z9hG4bK93ca
Max-Forwards: 70
To: Carol <sips:carol@chicago.example.com>;tag=8672349
From: <sips:park-server@example.com;orbit=1234>;tag=1234567
Call-ID: xt4653gs2ham@chicago.example.com
CSeq: 2 NOTIFY
Contact: <sips:park-server@example.com;orbit=1234>
Event: dialog
Subscription-State: terminated
Content-Type: application/dialog-info+xml
Content-Length: ...

<?xml version="1.0"?>
<dialog-info xmlns="urn:ietf:params:xml:ns:dialog-info"
   version="0" state="full"
   entity="sips:park@park.server.example.com;orbit=1234">
<dialog id="94992014524" call-id="12345600@atlanta.example.com"
   local-tag="3145678" remote-tag="1234567" direction="recipient"
   remote-uri="alice@atlanta.example.com"
   remote-target="alice@client.atlanta.example.com">
<state>confirmed</state>
</dialog>
</dialog-info>


F4 200 OK  Carol -> Park Server

SIP/2.0 200 OK
Via: SIP/2.0/TLS chicago.example.com:5061;branch=z9hG4bK93ca
To: Carol <sips:carol@chicago.example.com>;tag=8672349
From: <sips:park@server.example.com;orbit=1234>;tag=1234567
Call-ID: xt4653gs2ham@chicago.example.com
CSeq: 2 NOTIFY
Contact: <sips:carol@client.chicago.example.com>
Content-Length: 0
```

The remainder of the frames are the same as the corresponding frames from [se] (Johnston, A., “Session Initiation Protocol Service Examples,” July 2007.), since the required dialog ID has been obtained through the SUBSCRIBE / NOTIFY cycle from the Park Server.

TOC

3.2. Retrieving a call from a User Agent

Retrieving a parked call from a User Agent is very similar to retrieving a call from a Park Server. The main difference is identifying which URI should be used for the initial subscription, in order to find the dialog identifiers for the parked call.

The URI most likely to be known for a particular User Agent is the AoR. But this may correspond to multiple UAs. Therefore, if Carol subscribes to the AoR, she should be prepared for multple NOTIFY responses, should her SUBSCRIBE fork.

It is tempting to state that Carol should subscribe to the GRUU of the UA with the parked call. This will work well if the GRUU is known in advance (possibly by Carol having a long-lived subscription to Bob's UA). If the GRUU is not known in advance, then it may prove too onerous to expect it to be typed in on Carol's UA, just to retrieve a parked call.

Open issue: Is subscribing to the AoR the best we can offer?

Using the 'orbit' parameter in conjunction with parking calls on User Agents can lead to difficulties in ensuring that the 'orbit' parameter is delivered to the User Agent. See [loose-route] (Rosenberg, J., "Applying Loose Routing to Session Initiation Protocol (SIP) User Agents (UA)," January 2008.) and [uri-delivery] (Holmberg, C. and H. Elburg, "Target URI delivery in the Session Initiation Protocol (SIP)," January 2008.) for the currently debated approaches.

Open issue: I think either approach will serve our purposes here. Presumably we can just wait and see which one is favoured.

If the 'orbit' parameter is not used, then Carol will eventually find out about all the dialogs currently in progress at Bob's UA. Distinguishing the parked call from other dialogs may prove challenging (assuming that all calls marked as held is not acceptable). There may be an opportunity to reuse some BLISS-MLA work here, which permits dialogs to be marked as 'exclusive', which indicates that other UAs should not attempt to pick them up.

Open issue: How should a parked call be identified when parked on a UA with other (potentially non-parked) dialogs in progress? Does this problem only exist when an orbit is not used?

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4. User Agent Configuration

TOC

For Bob and Carol to be able to park and retrieve calls using a Park Server, both need to be configured with the URI of the Park Server. In addition, Bob and Carol should be configured to understand whether or not an orbit will be required for park and retrieve. Finally, Bob also needs to be configured to determine whether Bob should provide the orbit or whether the orbit will be allocated by the Park Server.

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5. Acknowledgements

TOC

The following individuals were part of the Call Park Design Team, and have helped to shape this document:

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>
> Jason Fischl
>
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>
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>
> Theo Zourzouvillys

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6. Security Considerations

TOC

None.

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7. IANA Considerations

TOC

Open issue: presumably need to define the new uri-parameter 'orbit'.

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8. References

TOC

8.1. Normative References

TOC

[se]	Johnston, A., “Session Initiation Protocol Service Examples,” draft-ietf-sipping-service-examples-13 (work in progress), July 2007.
[RFC4235]	Rosenberg, J., Schulzrinne, H., and R. Mahy, “An INVITE-Initiated Dialog Event Package for the Session Initiation Protocol (SIP),” RFC 4235, November 2005.

8.2. Informative References

TOC

[RFC4579]	Johnston, A. and O. Levin, “Session Initiation Protocol (SIP) Call Control - Conferencing for User Agents,” BCP 119, RFC 4579, August 2006.
[loose-route]	Rosenberg, J., “Applying Loose Routing to Session Initiation Protocol (SIP) User Agents (UA),” draft-rosenberg-sip-ua-loose-route-02 (work in progress), January 2008.
[uri-delivery]	Holmberg, C. and H. Elburg, “Target URI delivery in the Session Initiation Protocol (SIP),” draft-holmberg-sip-target-uri-delivery-01 (work in progress), January 2008.

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TOC

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TOC

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