Network Working Group
Request for Comments: 3087
Category: Informational

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April 2001

Control of Service Context using SIP Request-URI

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Abstract

This memo provides information for the Internet community. It describes a useful way to conceptualize the use of the standard SIP (Session Initiation Protocol) Request-URI (Uniform Resource Identifier) that the authors and many members of the SIP community think is suitable as a convention. It does not define any new protocol with respect to RFC 2543.

In a conventional telephony environment, extended service applications often use call state information, such as calling party, called party, reason for forward, etc, to infer application context. In a SIP/2.0 call, much of this information may be either non-existent or unreliable. This document proposes a mechanism to communicate context information to an application. Under this proposal, a client or proxy can communicate context through the use of a distinctive Request-URI. This document continues with examples of how this mechanism could be used in a voice mail application.

Table of Contents

1. Introduction

A communication service should make use of the information it has at hand when being accessed. For example, in most current voice mail implementations, a subscriber retrieving messages from his own desk does not have to reenter his voice mailbox number - the service assumes that the store being accessed is the one associated with the endpoint being used to access the service. Some services allow the user to validate this assumption using IVR techniques before prompting for a PIN.

This concept of context-awareness can be captured in a voice mail service implementing SIP as defined in RFC 2543[1], without modification, through the standard use of that protocol's Request-URI. Furthermore, the concept is applicable to any SIP-based service where initial application state should be determined from context.

This concept is a usage convention of standard SIP as defined in RFC 2543[1] and does not modify or extend that protocol in any way.

2. Example Application

In this document, we use the example of voice mail to illustrate the technique. One motivation for applying this technique to this problem is allowing a proxy or location server to control the initial state of a voice service. For example, a voice client might register a contact list ending with the URL that would accept voice messages for the client.

2.1 Using URIs to Control Voice Mail Service Behavior

Many conventional voice mail systems use call state information, such as the calling party, called party, reason for forward, etc, to decide the initial application state. For example, it might play one outgoing message if the call reached voice mail because the called party did not answer and another if the line was busy. It decides whom the message is for based on the called party information. If the call originated from a subscriber's phone number, it might authenticate the caller and then go directly to the message retrieval and account maintenance menu.

When a new subscriber is added to a system, a set of identities could be generated, each given a unique sip URI. The following tables show some of the identities that might be generated (it is not exhaustive). The example schemes show that the URIs could, but don't necessarily have to, have mnemonic value.

In practical applications, it is important that an application does not apply semantic rules to the various URIs. Instead, it should allow any arbitrary string to be provisioned, and map the string to the desired behavior. The owner of the system may choose to provision mnemonic strings, but the application should not require it. In any large installation, the system owner is likely to have pre-existing rules for mnemonic URIs, and any attempt by an application to define its own rules may create a conflict. For our example, this means a voice mail system should allow an arbitrary mix of URLs from these schemes, or any other scheme that renders valid SIP URIs to be provisioned, rather than enforce one particular scheme.

```
URI Identity       Example Scheme 1
                        Example Scheme 2
                             Example Scheme 3

Deposit with       sip:sub-rjs-deposit@vm.wcom.com
standard greeting       sip:677283@vm.wcom.com
                             sip:rjs@vm.wcom.com;mode=deposit


Deposit with on    sip:sub-rjs-deposit-busy.vm.wcom.com
phone greeting          sip:677372@vm.wcom.com
                             sip:rjs@vm.wcom.com;mode=3991243

Deposit with       sip:sub-rjs-deposit-sg@vm.wcom.com
special greeting        sip:677384@vm.wcom.com
                             sip:rjs@vm.wcom.com;mode=sg

Retrieve - SIP     sip:sub-rjs-retrieve@vm.wcom.com
authentication          sip:677405@vm.wcom.com
                             sip:rjs@vm.wcom.com;mode=retrieve

Retrieve - prompt  sip:sub-rjs-retrieve-inpin.vm.wcom.com
for PIN in-band         sip:677415@vm.wcom.com
                             sip:rjs@vm.wcom.com;mode=inpin
```

When a service is first set up, identities such as the following could be created.

```
URI Identity       Example Scheme 1
                        Example Scheme 2
                             Example Scheme 3

Deposit -          sip:deposit@vm.wcom.com
identify target         sip:670001@vm.wcom.com
mailbox by To:               sip:deposit@vm.wcom.com
```

```
      Retrieve -         sip:retrieve@vm.wcom.com
      identify target         sip:670002@vm.wcom.com
      mailbox by SIP               sip:retrieve@vm.wcom.com
      authentication

      Deposit - prompt   sip:deposit-in@vm.wcom.com
      for target              sip:670003@vm.wcom.com
      mailbox in-band              sip:deposit@vm.wcom.com;mode=inband

      Retrieve - prompt  sip:retrieve-in@vm.wcom.com
      for target              sip:670004@vm.wcom.com
      mailbox and PIN              sip:retrieve@vm.wcom.com;mode=inband
      in-band
```

In addition to providing this set of URIs to the subscriber (to use as he sees fit), an integrated service provider could add these to the set of contacts in a find-me proxy. The proxy could then route calls to the appropriate URI based on the origin of the request, the subscriber's preferences and current state.

3. Voice Mail Scenario Descriptions

In each of these scenarios, the PSTN gateway is configured to communicate only with a particular proxy-registrar.

3.1 Deposits

3.1.1 Direct Request to Deposit to a particular mailbox

3.1.1.1 SIP source

A SIP client that knew the URI for a particular deposit mailbox (sip:sub-rjs-deposit@vm.wcom.com) could place a direct invitation to the voicemail service, or through a protecting proxy. The proxy could restrict access to deposit identities with special greetings by authenticating the requester.

3.1.1.2 Arbitrary PSTN source

The gateway's proxy would map a call from an unrecognized PSTN number to a number associated with a subscriber's mailbox into an invite to the deposit with standard greeting URI (sip:sub-rjs-deposit@vm.wcom.com).

3.1.1.3 Recognized PSTN source

The gateway's proxy would map a call from a recognized (exact or pattern match) PSTN number to a number associated with a subscriber's mailbox into an invite to the appropriate special greeting URI (sip:sub-rjs-deposit-sg@vm.wcom.com). The gateway's ability to identify the calling party (using calling party number) is trusted, so no further authentication of the requester is performed.

3.1.2 Direct Request to Deposit, mailbox to be determined

3.1.2.1 SIP source

A voice mail service or its protecting proxy could expose a generic deposit URL for use when a caller wished to go directly to voice mail. The service would likely play an IVR dialog to determine what message store to deposit a message into.

An application designer may be tempted to attempt to match the To: and From: headers on a call to infer information. However, this approach could cause complications when multiple proxy forwards occur in a call. For example, A calls B, who has all calls forwarded to C. C forwards the call to her voice mail service. If the voice mail service matches the To: header to determine the message store, it will get the information for B instead of C. But there is no reason to assume that C's voice mail service has any knowledge of B.

3.1.2.2 PSTN source

The gateway's proxy would map a call from an unrecognized PSTN number to the top level voice mail service access number to an invite to the Deposit - prompt for target mailbox in-band URI (sip:deposit-in@vm.wcom.com for example). Getting the call to the target mailbox would proceed as in the SIP source case.

3.1.2.3 Indirect Request to Deposit, due to find-me proxy decision

A find-me proxy could map an invitation to a subscriber (sip:rjs@wcom.com) to the appropriate voice mail service URI depending on the subscriber's current state. The normal deposit URI could be chosen if the subscriber's contact list has been otherwise exhausted with no answer. The busy-announcement URI would be chosen when a busy everywhere response is received from one of the contacts. A DND announcement URI could be selected if the subscriber had activated DND. Calls to sip:receptionist@wcom.com could be configured to roll to sip:deposit@wcom.com

3.2 Retrievals

3.2.1 Request to Retrieve from a particular mailbox

3.2.1.1 Trusted SIP source

A request to retrieve the contents of a particular mailbox (sip:sub-rjs-retrieve@vm.wcom.com) coming from a trusted source could be honored without further authentication checks. A trusted source is one with which the voice mail service has secure communications, and to which it is willing to delegate authentication. This could be the service's protecting proxy for example.

3.2.1.2 Authenticated SIP source

A service, or its protecting proxy, could choose to honor a retrieve request for a particular mailbox (sip:sub-rjs-retrieve@vm.wcom.com) based on SIP authentication. If SIP level authentication failed, the service or proxy could be configured to send the call to the in-band pin prompting URI (sip:sub-rjs-retrieve-inpin@vm.wcom.com).

3.2.1.3 Unauthenticated SIP source

A service, or its protecting proxy, receiving a retrieve request for a particular mailbox (sip:sub-rjs-retrieve@vm.wcom.com) with no other method of authenticating the requestor could send the request to the in-band pin prompting URI (sip:sub-rjs-retrieve-inpin@vm.wcom.com).

3.2.1.4 PSTN source

This scenario assumes that the service provider's network has been configured such that a PSTN number could be dialed explicitly for retrieving messages from a particular mailbox. Such services currently exist, but are not common. In such a network, the gateway's proxy would map the call to the in-band pin prompting URI (sip:sub-rjs-retrieve-inpin@vm.wcom.com).

3.2.2 Request to Retrieve, mailbox to be determined

3.2.2.1 SIP source

As in the Request to Deposit scenario, when a service receives a request for the top level retrieve URI it would most likely need to use in-band IVR techniques to determine the target mailbox and authenticate the caller.

3.2.2.2 Arbitrary PSTN source

This scenario assumes there is a single PSTN number that subscribers dial to access the voice mail service to retrieve messages. This is the most common access method provided by current voice mail services.

The gateway’s proxy would map a call to the top level PSTN number to the top level retrieve in-band prompting URI (sip:retrieve-in@vm.wcom.com). Once the system identifies the target mailbox, the call would be transferred to the appropriate in-band pin prompting URI (sip:sub-rjs-retrieve-inpin@vm.wcom.com).

3.2.2.3 Recognized PSTN source

This scenario also assumes there is a single PSTN number that subscribers dial to access the voice mail service to retrieve messages.

The gateway’s proxy would recognize the calling party number as a subscriber, and map the call to the subscriber’s in-band prompting URI (sip:sub-rjs-retrieve-inpin@vm.wcom.com)

4. Voice Mail Call Flow Examples

The following section describes some example call flows for a hypothetical voice mail service, with the host name of vm.wcom.com. All the call flows assume that a proxy protects the voice mail service and that a trust relationship exists between the voice mail service and the proxy.

4.1 Generic Scenario

4.1.1 Direct call to the voice mail system

User A calls the voice mail system directly. The voice mail system invokes the top-level menu, which might prompt the caller for an extension or the first few letters of a name.

```
           User A              Proxy              VM Service
             |                   |                       |
             |  INVITE F1        |                       |
             |------------------>|                       |
             |                   |  INVITE F2            |
             | (100 Trying) F3   |---------------------->|
             |<------------------|                       |
             |                   |  180 Ringing F4       |
             |  180 Ringing F5   |<----------------------|
             |<------------------|                       |
             |                   |  200 OK F6            |
             |  200 OK F6        |<----------------------|
             |<------------------|                       |
             |                   |                       |
             |  ACK F8           |                       |
             |------------------>|  ACK F9               |
             |                   |---------------------->|
             |                   |                       |
             |      RTP Established- Play top level menu |
             |<-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m->|
             |                   |                       |
             |  BYE F10          |                       |
             |------------------>|  BYE F11              |
             |                   |---------------------->|
             |                   |                       |
             |                   |  200 OK F12           |
             |                   |<----------------------|
             |  200 OK F13       |                       |
             |<------------------|                       |
             |                   |                       |
```

```
      Flow Id                            Comments

     INVITE F1     INVITE sip:VoiceMail@wcom.com SIP/2.0
     A->Proxy      Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Contact: TheBigGuy <sip:UserA@here.com>
                   Proxy-Authorization:Digest username="UserA",
                   realm="MCI WorldCom SIP",
                   nonce="ea9c8e88df84f1cc4e341ae6cbe5a359", opaque="",
                   uri="sip:VoiceMail@wcom.com", response=<appropriately
                   calculated hash goes here>
                   Content-Type: application/sdp
                   Content-Length: <appropriate value>
```

```
                   v=0
                   o=UserA 2890844526 2890844526 IN IP4 client.here.com
                   s=Session SDP
                   c=IN IP4 100.101.102.103
                   t=0 0
                   m=audio 49170 RTP/AVP 0
                   a=rtpmap:0 PCMU/8000

                   /*Client for A prepares to receive data on port 49170
                   from the network. */

    INVITE F2      INVITE sip:top@vm.wcom.com SIP/2.0
    Proxy->VM      Via: SIP/2.0/UDP wcom.com:5060; branch=1
                   Via: SIP/2.0/UDP here.com:5060
                   Record-Route: <sip:VoiceMail@wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Contact: TheBigGuy <sip:UserA@here.com>
                   Content-Type: application/sdp
                   Content-Length: <appropriate value>

                   v=0
                   o=UserA 2890844526 2890844526 IN IP4 client.here.com
                   s=Session SDP
                   c=IN IP4 100.101.102.103
                   t=0 0
                   m=audio 49170 RTP/AVP 0
                   a=rtpmap:0 PCMU/8000

    (100 Trying    SIP/2.0 100 Trying
    F3             Via: SIP/2.0/UDP here.com:5060
    Proxy->A)      From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Content-Length: 0

    180 Ringing    SIP/2.0 180 Ringing
    F4             Via: SIP/2.0/UDP wcom.com:5060; branch=1
    VM->Proxy      Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Content-Length: 0
```

```
   180 Ringing   SIP/2.0 180 Ringing
   F5            Via: SIP/2.0/UDP here.com:5060
   Proxy->A      From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq: 1 INVITE
                 Content-Length: 0

   200 OK F6     SIP/2.0 200 OK
   VM->Proxy     Via: SIP/2.0/UDP wcom.com:5060; branch=1
                 Via: SIP/2.0/UDP here.com:5060
                 Record-Route: <sip:VoiceMail@wcom.com>
                 From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq: 1 INVITE
                 Contact: VoiceMailSystem <sip:top@vm.wcom.com>
                 Content-Type: application/sdp
                 Content-Length: <appropriate value>

                 v=0
                 o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                 s=Session SDP
                 c=IN IP4 110.111.112.114
                 t=0 0
                 m=audio 3456 RTP/AVP 0
                 a=rtpmap:0 PCMU/8000


   200 OK F7     SIP/2.0 200 OK
   Proxy->A      Via: SIP/2.0/UDP here.com:5060
                 Record-Route: <sip:VoiceMail@wcom.com>
                 From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq: 1 INVITE
                 Contact VoiceMailSystem <sip:top@vm.wcom.com>
                 Content-Type: application/sdp
                 Content-Length: <appropriate value>

                 v=0
                 o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                 s=Session SDP
                 c=IN IP4 110.111.112.114
                 t=0 0
                 m=audio 3456 RTP/AVP 0
                 a=rtpmap:0 PCMU/8000
```

```
   ACK F8          ACK sip:VoiceMail@wcom.com SIP/2.0
   A->Proxy        Via: SIP/2.0/UDP here.com:5060
                   Route:<sip:top@vm.wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 1 ACK
                   Content-Length: 0

   ACK F9          ACK sip:top@vm.wcom.com SIP/2.0
   Proxy->VM       Via: SIP/2.0/UDP wcom.com:5060
                   Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>; tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 1 ACK
                   Content-Length: 0

                   /* RTP streams are established between A and VM.  VM
                   system starts IVR dialog for top level menu */

                   /* User A Hangs Up with VM system.  Alternatively, the
                   VM system could initiate the BYE*/

   BYE F10         BYE sip:VoiceMail@wcom.com SIP/2.0
   A->Proxy        Via: SIP/2.0/UDP here.com:5060
                   Route:<sip: top@vm.wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 2 BYE
                   Content-Length: 0

   BYE F11         BYE sip: top@vm.wcom.com SIP/2.0
   Proxy->VM       Via: SIP/2.0/UDP wcom.com:5060
                   Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 2 BYE
                   Content-Length: 0

   200 OK F12      SIP/2.0 200 OK
   VM->Proxy       Via: SIP/2.0/UDP wcom.com:5060
                   Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
```

```
                 CSeq: 2 BYE
                 Content-Length: 0

    200 OK F13    SIP/2.0 200 OK
    Proxy->A      Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq:  2 BYE
                  Content-Length: 0
```

4.2 Message Deposit Scenarios

4.2.1 Call to known subscriber forwarded on no answer

User A attempts to call UserB, who does not answer. The call is forwarded to UserB’s mailbox, and the voice mail system plays UserB’s outgoing message for a ring-no-answer. The flow assumes that the URL of "sip:UserB-dep-fna@vm.wcom.com maps" to the desired behavior for depositing a message on a forward-no-answer.

```
      User A            Proxy              User B         VM System
        |                 |                  |                |
        |  INVITE F1      |                  |                |
        |---------------->|  INVITE F2       |                |
        |                 |----------------->|                |
        | (100 Trying) F3 |                  |                |
        |<----------------| 180 Ringing F4   |                |
        |                 |<-----------------|                |
        |  180 Ringing F5 |                  |                |
        |<----------------| (Request Timeout)|                |
        |                 |                  |                |
        |                 | Cancel F6        |                |
        |                 |----------------->|                |
        |                 |                  |                |
        |                 | 200 OK F7        |                |
        |                 |<-----------------|                |
        |                 |                  |                |
        |                 |         INVITE F8                 |
        |                 |---------------------------------->|
        |                 |                  |                |
        |                 |         200 OK F9|                |
        |  200 OK F10     |<----------------------------------|
        |<----------------|                  |                |
        |                 |                  |                |
        |  ACK F11        |                  |                |
        |---------------->|         ACK F12  |                |
        |                 |---------------------------------->|
        |                 |                  |                |
        |    RTP Established Both Ways-Deposit Msg for B      |
        |<-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m->|
        |                 |                  |                |
        |  BYE F13        |                  |                |
        |---------------->|         BYE F14  |                |
        |                 |---------------------------------->|
        |                 |                  |                |
        |                 |         OK F15   |                |
        |  OK F16         |<----------------------------------|
        |<----------------|                  |                |
        |                 |                  |                |
```

```
     Flow Id                            Comments

    INVITE F1     INVITE sip:UserB@wcom.com SIP/2.0
    A->Proxy      Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>
                  Call-Id: 12345600@here.com
```

```
                   CSeq: 1 INVITE
                   Contact: TheBigGuy <sip:UserA@here.com>
                   Proxy-Authorization:Digest username="UserA",
                   realm="MCI WorldCom SIP",
                   nonce="ea9c8e88df84f1cec4341ae6cbe5a359", opaque="",
                   uri="sip:UserB@wcom.com", response=<appropriately
                   calculated hash goes here>
                   Content-Type: application/sdp
                   Content-Length: <appropriate value>

                   v=0
                   o=UserA 2890844526 2890844526 IN IP4 client.here.com
                   s=Session SDP
                   c=IN IP4 100.101.102.103
                   t=0 0
                   m=audio 49170 RTP/AVP 0
                   a=rtpmap:0 PCMU/8000

                   /*Client for A prepares to receive data on port 49170
                   from the network. */

   INVITE F2       INVITE sip:UserB1@somewhere.wcom.com SIP/2.0
   Proxy->B1       Via: SIP/2.0/UDP wcom.com:5060; branch=1
                   Via: SIP/2.0/UDP here.com:5060
                   Record-Route: <sip:UserB@wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: TheLittleGuy <sip:UserB@wcom.com>
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Contact: TheBigGuy <sip:UserA@here.com>
                   Content-Type: application/sdp
                   Content-Length: <appropriate value>

                   v=0
                   o=UserA 2890844526 2890844526 IN IP4 client.here.com
                   s=Session SDP
                   c=IN IP4 100.101.102.103
                   t=0 0
                   m=audio 49170 RTP/AVP 0
                   a=rtpmap:0 PCMU/8000

   (100 Trying     SIP/2.0 100 Trying
   F3              Via: SIP/2.0/UDP here.com:5060
   Proxy->A)       From: TheBigGuy <sip:UserA@here.com>
                   To: TheLittleGuy <sip:UserB@wcom.com>
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Content-Length: 0
```

```
180 Ringing   SIP/2.0 180 Ringing
F4            Via: SIP/2.0/UDP wcom.com:5060; branch=1
B1->Proxy     Via: SIP/2.0/UDP here.com:5060
              From: TheBigGuy <sip:UserA@here.com>
              To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
              Call-Id: 12345600@here.com
              CSeq: 1 INVITE
              Content-Length: 0

180 Ringing   SIP/2.0 180 Ringing
F5            Via: SIP/2.0/UDP here.com:5060
Proxy->A      From: TheBigGuy <sip:UserA@here.com>
              To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
              Call-Id: 12345600@here.com
              CSeq: 1 INVITE
              Content-Length: 0

              /* B1 rings for 9 seconds, this duration is a
              configurable parameter in the Proxy Server.  Proxy
              sends Cancel and proceeds down the list of routes,
              eventually hitting the voice mail URI for forward no
              answer */

CANCEL F6     CANCEL sip:UserB1@wcom.com SIP/2.0
Proxy->B1     Via: SIP/2.0/UDP wcom.com:5060; branch=1
              From: TheBigGuy <sip:UserA@here.com>
              To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
              Call-Id: 12345600@here.com
              CSeq: 1 CANCEL
              Content-Length: 0

200 OK F7     SIP/2.0 200 OK
B1->Proxy     Via: SIP/2.0/UDP wcom.com:5060; branch=1
              From: TheBigGuy <sip:UserA@here.com>
              To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
              Call-Id: 12345600@here.com
              CSeq: 1 CANCEL
              Content-Length: 0


INVITE F8     INVITE sip:UserB-dep-fna@vm.wcom.com SIP/2.0
Proxy->VM     Via: SIP/2.0/UDP wcom.com:5060;branch=2
              Via: SIP/2.0/UDP here.com:5060
              Record-Route: <sip:UserB@wcom.com>
              From: TheBigGuy <sip:UserA@here.com>
              To: TheLittleGuy <sip:UserB@wcom.com>
              Call-Id: 12345600@here.com
              CSeq: 1 INVITE
```

```
                 Contact: TheBigGuy <sip:UserA@here.com>
                 Content-Type: application/sdp
                 Content-Length: <appropriate value>

                 v=0
                 o=UserA 2890844526 2890844526 IN IP4 client.here.com
                 s=Session SDP
                 c=IN IP4 100.101.102.103
                 t=0 0
                 m=audio 49170 RTP/AVP 0
                 a=rtpmap:0 PCMU/8000

   200 OK F9     SIP/2.0 200 OK
   VM->Proxy     Via: SIP/2.0/UDP wcom.com:5060; branch=2
                 Via: SIP/2.0/UDP here.com:5060
                 Record-Route: <sip:UserB@wcom.com>
                 From: TheBigGuy <sip:UserA@here.com>
                 To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
                 Call-Id: 12345600@here.com
                 CSeq: 1 INVITE
                 Contact: TheLittleGuyVoiceMail <sip:UserB-dep-
                 fna@vm.wcom.com>
                 Content-Type: application/sdp
                 Content-Length: <appropriate value>

                 v=0
                 o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                 s=Session SDP
                 c=IN IP4 110.111.112.114
                 t=0 0
                 m=audio 3456 RTP/AVP 0
                 a=rtpmap:0 PCMU/8000


   200 OK F10    SIP/2.0 200 OK
   Proxy->A      Via: SIP/2.0/UDP here.com:5060
                 Record-Route: <sip:UserB@wcom.com>
                 From: TheBigGuy <sip:UserA@here.com>
                 To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
                 Call-Id: 12345600@here.com
                 CSeq: 1 INVITE
                 Contact: TheLittleGuyVoiceMail <sip:UserB-dep-
                 fna@vm.wcom.com>
                 Content-Type: application/sdp
                 Content-Length: <appropriate value>

                 v=0
                 o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
```

```
                     s=Session SDP
                     c=IN IP4 110.111.112.114
                     t=0 0
                     m=audio 3456 RTP/AVP 0
                     a=rtpmap:0 PCMU/8000

   ACK F11           ACK sip:UserB@wcom.com SIP/2.0
   A->Proxy          Via: SIP/2.0/UDP here.com:5060
                     Route:<sip: UserB-dep-fna@vm.wcom.com>
                     From: TheBigGuy <sip:UserA@here.com>
                     To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
                     Call-Id: 12345600@here.com
                     CSeq: 1 ACK
                     Content-Length: 0

   ACK F12           ACK sip:UserB-dep-fna@vm.wcom.com SIP/2.0
   Proxy->VM         Via: SIP/2.0/UDP wcom.com:5060
                     Via: SIP/2.0/UDP here.com:5060
                     From: TheBigGuy <sip:UserA@here.com>
                     To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
                     Call-Id: 12345600@here.com
                     CSeq: 1 ACK
                     Content-Length: 0

                     /* RTP streams are established between A and B2.  VM
                     system starts IVR dialog for message-deposit on no-
                     answer for UserB */

                     /* User A Hangs Up with VM system.  Alternatively, the
                     VM system could initiate the BYE*/

   BYE F13           BYE sip:UserB@wcom.com SIP/2.0
   A->Proxy          Via: SIP/2.0/UDP here.com:5060
                     Route:<sip: UserB-dep-fna@vm.wcom.com>
                     From: TheBigGuy <sip:UserA@here.com>
                     To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
                     Call-Id: 12345600@here.com
                     CSeq: 2 BYE
                     Content-Length: 0

   BYE F14           BYE sip: UserB-dep-fna@vm.wcom.com SIP/2.0
   Proxy->VM         Via: SIP/2.0/UDP wcom.com:5060
                     Via: SIP/2.0/UDP here.com:5060
                     From: TheBigGuy <sip:UserA@here.com>
                     To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
                     Call-Id: 12345600@here.com
                     CSeq: 2 BYE
                     Content-Length: 0
```

```
200 OK F15    SIP/2.0 200 OK
VM->Proxy     Via: SIP/2.0/UDP wcom.com:5060
              Via: SIP/2.0/UDP here.com:5060
              From: TheBigGuy <sip:UserA@here.com>
              To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
              Call-Id: 12345600@here.com
              CSeq: 2 BYE
              Content-Length: 0

200 OK F16    SIP/2.0 200 OK
Proxy->A      Via: SIP/2.0/UDP here.com:5060
              From: TheBigGuy <sip:UserA@here.com>
              To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
              Call-Id: 12345600@here.com
              CSeq:  2 BYE
              Content-Length: 0
```

4.2.2 Call to known subscriber forwarded on busy

User A attempts to call UserB, who is busy. The call is forwarded to UserB’s mailbox, and the voice mail system plays UserB’s outgoing message for a busy. This flow assumes that "sip:UserB-dep-fb@vm.wcom.com" maps to UserB’s mailbox and the behavior of "deposit message on busy."

```
      User A            Proxy             User B         VM System
        |                 |                  |                 |
        |  INVITE F1      |                  |                 |
        |---------------->|  INVITE F2       |                 |
        |                 |----------------->|                 |
        | (100 Trying) F3 |                  |                 |
        |<----------------| 486 Busy Here F4 |                 |
        |                 |<-----------------|                 |
        |                 |                  |                 |
        |                 |  ACK F5          |                 |
        |                 |----------------->|                 |
        |                 |                  |                 |
        |                 |         INVITE F6                  |
        |                 |----------------------------------->|
        |                 |                  |                 |
        |                 |         200 OK F7|                 |
        |  200 OK F8      |<-----------------------------------|
        |<----------------|                  |                 |
        |                 |                  |                 |
        |  ACK F9         |                  |                 |
        |---------------->|         ACK F10  |                 |
        |                 |----------------------------------->|
        |                 |                  |                 |
        |    RTP Established Both Ways-Deposit Msg for B       |
        |<-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-->|
        |                 |                  |                 |
        |  BYE F11        |                  |                 |
        |---------------->|         BYE F12  |                 |
        |                 |----------------------------------->|
        |                 |                  |                 |
        |                 |         OK F13   |                 |
        |  OK F14         |<-----------------------------------|
        |<----------------|                  |                 |
        |                 |                  |                 |
```

```
     Flow Id                               Comments

    INVITE F1     INVITE sip:UserB@wcom.com SIP/2.0
    A->Proxy      Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact: TheBigGuy <sip:UserA@here.com>
                  Proxy-Authorization:Digest username="UserA",
                  realm="MCI WorldCom SIP",
                  nonce="ea9c8e88df84f1cec4341ae6cbe5a359", opaque="",
                  uri="sip:UserB@wcom.com", response=<appropriately
```

```
                  calculated hash goes here>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserA 2890844526 2890844526 IN IP4 client.here.com
                  s=Session SDP
                  c=IN IP4 100.101.102.103
                  t=0 0
                  m=audio 49170 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000

                  /*Client for A prepares to receive data on port 49170
                  from the network. */

    INVITE F2     INVITE sip:UserB1@somewhere.wcom.com SIP/2.0
    Proxy->B1     Via: SIP/2.0/UDP wcom.com:5060; branch=1
                  Via: SIP/2.0/UDP here.com:5060
                  Record-Route: <sip:UserB@wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact: TheBigGuy <sip:UserA@here.com>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserA 2890844526 2890844526 IN IP4 client.here.com
                  s=Session SDP
                  c=IN IP4 100.101.102.103
                  t=0 0
                  m=audio 49170 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000

    (100 Trying   SIP/2.0 100 Trying
    F3            Via: SIP/2.0/UDP here.com:5060
    Proxy->A)     From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Content-Length: 0

    486 Busy      SIP/2.0 486 Busy Here
    Here F4       Via: SIP/2.0/UDP wcom.com:5060;branch=1
    B1->Proxy     Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
```

```
                     Call-Id: 12345600@here.com
                     CSeq: 1 INVITE
                     Content-Length: 0

   ACK F5            ACK sip: UserB1@wcom.com SIP/2.0
   Proxy->B          Via: SIP/2.0/UDP wcom.com:5060; branch=1
                     From: TheBigGuy <sip:UserA@here.com>
                     To: TheLittleGuy <sip:UserB@wcom.com>;tag=123456
                     Call-Id: 12345600@here.com
                     CSeq: 1 ACK
                     Content-Length: 0

   INVITE F6         INVITE sip:UserB-dep-fb@vm.wcom.com SIP/2.0
   Proxy->VM         Via: SIP/2.0/UDP wcom.com:5060;branch=2
                     Via: SIP/2.0/UDP here.com:5060
                     Record-Route: <sip:UserB@wcom.com>
                     From: TheBigGuy <sip:UserA@here.com>
                     To: TheLittleGuy <sip:UserB@wcom.com>
                     Call-Id: 12345600@here.com
                     CSeq: 1 INVITE
                     Contact: TheBigGuy <sip:UserA@here.com>
                     Content-Type: application/sdp
                     Content-Length: <appropriate value>

                     v=0
                     o=UserA 2890844526 2890844526 IN IP4 client.here.com
                     s=Session SDP
                     c=IN IP4 100.101.102.103
                     t=0 0
                     m=audio 49170 RTP/AVP 0
                     a=rtpmap:0 PCMU/8000

   200 OK F7         SIP/2.0 200 OK
   VM->Proxy         Via: SIP/2.0/UDP wcom.com:5060; branch=2
                     Via: SIP/2.0/UDP here.com:5060
                     Record-Route: <sip:UserB@wcom.com>
                     From: TheBigGuy <sip:UserA@here.com>
                     To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                     Call-Id: 12345600@here.com
                     CSeq: 1 INVITE
                     Contact: TheLittleGuyVoiceMail <sip:UserB-dep-
                     fb@vm.wcom.com>
                     Content-Type: application/sdp
                     Content-Length: <appropriate value>

                     v=0
                     o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                     s=Session SDP
```

```
                  c=IN IP4 110.111.112.114
                  t=0 0
                  m=audio 3456 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000

   200 OK F8      SIP/2.0 200 OK
   Proxy->A       Via: SIP/2.0/UDP here.com:5060
                  Record-Route: <sip:UserB@wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact TheLittleGuyVoiceMail <sip:UserB-dep-
                  fb@vm.wcom.com>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                  s=Session SDP
                  c=IN IP4 110.111.112.114
                  t=0 0
                  m=audio 3456 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000

   ACK F9         ACK sip:UserB@wcom.com SIP/2.0
   A->Proxy       Via: SIP/2.0/UDP here.com:5060
                  Route:<sip:UserB-dep-fb@vm.wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 1 ACK
                  Content-Length: 0

   ACK F10        ACK sip:UserB-dep-fb@vm.wcom.com SIP/2.0
   Proxy->VM      Via: SIP/2.0/UDP wcom.com:5060
                  Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 1 ACK
                  Content-Length: 0

                  /* RTP streams are established between A and B2.  VM
                  system starts IVR dialog for message-deposit on busy
                  for UserB */
```

```
                  /* User A Hangs Up with VM system.  Alternatively, the
                  VM system could initiate the BYE*/

    BYE F11       BYE sip:UserB@wcom.com SIP/2.0
    A->Proxy      Via: SIP/2.0/UDP here.com:5060
                  Route: <sip:UserB-dep-fnb@vm.wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 2 BYE
                  Content-Length: 0

    BYE F12       BYE sip: UserB-dep-fnb@vm.wcom.com SIP/2.0
    Proxy->VM     Via: SIP/2.0/UDP wcom.com:5060
                  Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 2 BYE
                  Content-Length: 0

    200 OK F13    SIP/2.0 200 OK
    VM->Proxy     Via: SIP/2.0/UDP wcom.com:5060
                  Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 2 BYE
                  Content-Length: 0

    200 OK F14    SIP/2.0 200 OK
    Proxy->A      Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuy <sip:UserB@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq:  2 BYE
                  Content-Length: 0
```

4.2.3 Direct call to a subscriber’s mailbox

User A calls UserB’s mailbox directly. This flow assumes that "sip:UserB-dep@vm.wcom.com" maps to UserB’s mailbox and the behavior of "generic message deposit"

```
            User A              Proxy                VM Service
              |                   |                        |
              |  INVITE F1        |                        |
              |------------------>|                        |
              |                   |  INVITE F2             |
              | (100 Trying) F3   |----------------------->|
              |<------------------|                        |
              |                   |  200 OK F4             |
              |  200 OK F5        |<-----------------------|
              |<------------------|                        |
              |                   |                        |
              |  ACK F6           |                        |
              |------------------>|  ACK F7                |
              |                   |----------------------->|
              |                   |                        |
              |      RTP Both Ways - Deposit Msg for B     |
              |<-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m->|
              |                   |                        |
              |  BYE F8           |                        |
              |------------------>|  BYE F9                |
              |                   |----------------------->|
              |                   |                        |
              |                   |  200 OK F10            |
              |                   |<-----------------------|
              |  200 OK F11       |                        |
              |<------------------|                        |
              |                   |                        |
```

```
     Flow Id                             Comments

    INVITE F1     INVITE sip:UserB-VM@vm.wcom.com SIP/2.0
    A->Proxy      Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuyVoiceMail <sip:UserB-VM@wcom.com>
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact: TheBigGuy <sip:UserA@here.com>
                  Proxy-Authorization:Digest username="UserA",
                  realm="MCI WorldCom SIP",
                  nonce="ea9c8e88df84f1cec4341ae6cbe5a359", opaque="",
                  uri="sip:UserB-VM@wcom.com", response=<appropriately
                  calculated hash goes here>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserA 2890844526 2890844526 IN IP4 client.here.com
                  s=Session SDP
```

```
                    c=IN IP4 100.101.102.103
                    t=0 0
                    m=audio 49170 RTP/AVP 0
                    a=rtpmap:0 PCMU/8000

                    /*Client for A prepares to receive data on port 49170
                    from the network. */

   INVITE F2        INVITE sip:UserB-dep@vm.wcom.com SIP/2.0
   Proxy->B1        Via: SIP/2.0/UDP wcom.com:5060; branch=1
                    Via: SIP/2.0/UDP here.com:5060
                    Record-Route: <sip:UserB-VM@wcom.com>
                    From: TheBigGuy <sip:UserA@here.com>
                    To: TheLittleGuyVoiceMail <sip:UserB-VM@vm.wcom.com>
                    Call-Id: 12345600@here.com
                    CSeq: 1 INVITE
                    Contact: TheBigGuy <sip:UserA@here.com>
                    Content-Type: application/sdp
                    Content-Length: <appropriate value>

                    v=0
                    o=UserA 2890844526 2890844526 IN IP4 client.here.com
                    s=Session SDP
                    c=IN IP4 100.101.102.103
                    t=0 0
                    m=audio 49170 RTP/AVP 0
                    a=rtpmap:0 PCMU/8000

   (100 Trying      SIP/2.0 100 Trying
   F3               Via: SIP/2.0/UDP here.com:5060
   Proxy->A)        From: TheBigGuy <sip:UserA@here.com>
                    To: TheLittleGuyVoiceMail <sip:UserB-VM@wcom.com>
                    Call-Id: 12345600@here.com
                    CSeq: 1 INVITE
                    Content-Length: 0

   200 OK F4        SIP/2.0 200 OK
   VM->Proxy        Via: SIP/2.0/UDP wcom.com:5060; branch=1
                    Via: SIP/2.0/UDP here.com:5060
                    Record-Route: <sip:UserB-VM@wcom.com>
                    From: TheBigGuy <sip:UserA@here.com>
                    To: TheLittleGuyVoiceMail <sip:UserB-
                    VM@wcom.com>;tag=3145678
                    Call-Id: 12345600@here.com
                    CSeq: 1 INVITE
                    Contact: TheLittleGuyVoiceMail <sip:UserB-
                    dep@vm.wcom.com>
                    Content-Type: application/sdp
```

```
                        Content-Length: <appropriate value>
                        v=0
                        o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                        s=Session SDP
                        c=IN IP4 110.111.112.114
                        t=0 0
                        m=audio 3456 RTP/AVP 0
                        a=rtpmap:0 PCMU/8000

    200 OK F5           SIP/2.0 200 OK
    Proxy->A            Via: SIP/2.0/UDP here.com:5060
                        Record-Route: <sip:UserB-VM@wcom.com>
                        From: TheBigGuy <sip:UserA@here.com>
                        To: TheLittleGuyVoiceMail <sip:UserB-
                        VM@wcom.com>;tag=3145678
                        Call-Id: 12345600@here.com
                        CSeq: 1 INVITE
                        Contact TheLittleGuyVoiceMail <sip:UserB-
                        dep@vm.wcom.com>
                        Content-Type: application/sdp
                        Content-Length: <appropriate value>

                        v=0
                        o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                        s=Session SDP
                        c=IN IP4 110.111.112.114
                        t=0 0
                        m=audio 3456 RTP/AVP 0
                        a=rtpmap:0 PCMU/8000

    ACK F6              ACK sip:UserB-VM@wcom.com SIP/2.0
    A->Proxy            Via: SIP/2.0/UDP here.com:5060
                        Route:<sip:UserB-dep@vm.wcom.com>
                        From: TheBigGuy <sip:UserA@here.com>
                        To: TheLittleGuyVoiceMail <sip:UserB-
                        VM@wcom.com>;tag=3145678
                        Call-Id: 12345600@here.com
                        CSeq: 1 ACK
                        Content-Length: 0

    ACK F7              ACK sip:UserB-dep@vm.wcom.com SIP/2.0
    Proxy->VM           Via: SIP/2.0/UDP wcom.com:5060
                        Via: SIP/2.0/UDP here.com:5060
                        From: TheBigGuy <sip:UserA@here.com>
                        To: TheLittleGuyVoiceMail <sip:UserB-
                        VM@wcom.com>;tag=3145678
                        Call-Id: 12345600@here.com
                        CSeq: 1 ACK
```

```
                  Content-Length: 0
                  /* RTP streams are established between A and VM.  VM
                  system starts IVR dialog for generic message-deposit
                  for UserB */

                  /* User A Hangs Up with VM system.  Alternatively, the
                  VM system could initiate the BYE*/

   BYE F8         BYE sip:UserB-VM@wcom.com SIP/2.0
   A->Proxy       Via: SIP/2.0/UDP here.com:5060
                  Route:<sip:UserB-dep@vm.wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuyVoiceMail <sip:UserB-
                  VM@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 2 BYE
                  Content-Length: 0

   BYE F9         BYE sip: UserB-dep@vm.wcom.com SIP/2.0
   Proxy->VM      Via: SIP/2.0/UDP wcom.com:5060
                  Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuyVoiceMail <sip:UserB-
                  VM@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 2 BYE
                  Content-Length: 0

   200 OK F10     SIP/2.0 200 OK
   VM->Proxy      Via: SIP/2.0/UDP wcom.com:5060
                  Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuyVoiceMail <sip:UserB-
                  VM@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 2 BYE
                  Content-Length: 0

   200 OK F11     SIP/2.0 200 OK
   Proxy->A       Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: TheLittleGuyVoiceMail <sip:UserB-
                  VM@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq:  2 BYE
                  Content-Length: 0
```

4.3 Message Retrieval Scenarios

4.3.1 Call to retrieve messages believed to be from a known subscriber

Some user uses a SIP client on UserA’s desk to call the voice mail system to retrieve messages. The SIP client has authenticated itself to the proxy using credentials assigned to the device. The proxy can make a weak assumption that the caller is the device owner. The URI of "sip:UserA-retrieve@vm.wcom.com" maps to UserA’s mailbox and the behavior of "retrieve messages after prompting for and verifying PIN." The VM System trusts the proxy, and will not accept calls from an untrusted source. The proxy will not allow direct calls to UserA-retrieve@vm.wcom.com. The proxy will forward calls placed to VoiceMail@wcom.com to UserA-retrieve@vm.wcom.com only for calls placed from a client device assigned to UserA.

```
User A              Proxy                VM Service
  |                   |                        |
  |  INVITE F1        |                        |
  |------------------>|                        |
  |                   |  INVITE F2             |
  | (100 Trying) F3   |----------------------->|
  |<------------------|                        |
  |                   |  200 OK F4             |
  |  200 OK F5        |<-----------------------|
  |<------------------|                        |
  |                   |                        |
  |  ACK F6           |                        |
  |------------------>|  ACK F7                |
  |                   |----------------------->|
  |                   |                        |
  |      RTP Both Ways - VM prompts for PIN    |
  |<-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m->|
  |                   |                        |
  |  BYE F8           |                        |
  |------------------>|  BYE F9                |
  |                   |----------------------->|
  |                   |                        |
  |                   |  200 OK F10            |
  |                   |<-----------------------|
  |  200 OK F11       |                        |
  |<------------------|                        |
  |                   |                        |
```

```
     Flow Id                            Comments

    INVITE F1     INVITE sip:VoiceMail@wcom.com SIP/2.0
    A->Proxy      Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: VoiceMail <sip:VoiceMail@wcom.com>
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact: TheBigGuy <sip:UserA@here.com>
                  Proxy-Authorization:Digest username="UserAPhone",
                  realm="MCI WorldCom SIP",
                  nonce="ea9c8e88df84f1cec4341ae6cbe5a359", opaque="",
                  uri="sip:VoiceMail@wcom.com", response=<appropriately
                  calculated hash goes here>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserA 2890844526 2890844526 IN IP4 client.here.com
                  s=Session SDP
                  c=IN IP4 100.101.102.103
                  t=0 0
                  m=audio 49170 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000

                  /*Client for A prepares to receive data on port 49170
                  from the network. */

    INVITE F2     INVITE sip:UserA-retrieve@vm.wcom.com SIP/2.0
    Proxy->B1     Via: SIP/2.0/UDP wcom.com:5060; branch=1
                  Via: SIP/2.0/UDP here.com:5060
                  Record-Route: <sip:VoiceMail@wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: VoiceMail <sip:VoiceMail@wcom.com>
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact: TheBigGuy <sip:UserA@here.com>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserA 2890844526 2890844526 IN IP4 client.here.com
                  s=Session SDP
                  c=IN IP4 100.101.102.103
                  t=0 0
                  m=audio 49170 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000
```

```
(100 Trying   SIP/2.0 100 Trying
F3            Via: SIP/2.0/UDP here.com:5060
Proxy->A)     From: TheBigGuy <sip:UserA@here.com>
              To: VoiceMail <sip:VoiceMail@wcom.com>
              Call-Id: 12345600@here.com
              CSeq: 1 INVITE
              Content-Length: 0

200 OK F4     SIP/2.0 200 OK
VM->Proxy     Via: SIP/2.0/UDP wcom.com:5060; branch=1
              Via: SIP/2.0/UDP here.com:5060
              Record-Route: <sip:VoiceMail@wcom.com>
              From: TheBigGuy <sip:UserA@here.com>
              To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
              Call-Id: 12345600@here.com
              CSeq: 1 INVITE
              Contact: VoiceMailSystem <sip:UserA-
              retrieve@vm.wcom.com>
              Content-Type: application/sdp
              Content-Length: <appropriate value>

              v=0
              o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
              s=Session SDP
              c=IN IP4 110.111.112.114
              t=0 0
              m=audio 3456 RTP/AVP 0
              a=rtpmap:0 PCMU/8000

200 OK F5     SIP/2.0 200 OK
Proxy->A      Via: SIP/2.0/UDP here.com:5060
              Record-Route: <sip:VoiceMail@wcom.com>
              From: TheBigGuy <sip:UserA@here.com>
              To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
              Call-Id: 12345600@here.com
              CSeq: 1 INVITE
              Contact VoiceMailSystem <sip: UserA-
              retrieve@vm.wcom.com>
              Content-Type: application/sdp
              Content-Length: <appropriate value>

              v=0
              o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
              s=Session SDP
              c=IN IP4 110.111.112.114
              t=0 0
              m=audio 3456 RTP/AVP 0
              a=rtpmap:0 PCMU/8000
```

```
   ACK F6          ACK sip:VoiceMail@wcom.com SIP/2.0
   A->Proxy        Via: SIP/2.0/UDP here.com:5060
                   Route:<sip:UserA-retrieve@vm.wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 1 ACK
                   Content-Length: 0

   ACK F7          ACK sip:UserA-retrieve@vm.wcom.com SIP/2.0
   Proxy->VM       Via: SIP/2.0/UDP wcom.com:5060
                   Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>; tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 1 ACK
                   Content-Length: 0

                   /* RTP streams are established between A and VM.  VM
                   determines that the call is likely from UserA, and
                   starts a message retrieval session, prompting for
                   PIN*/

                   /* User A Hangs Up with VM system.  Alternatively, the
                   VM system could initiate the BYE*/

   BYE F8          BYE sip: VoiceMail@wcom.com SIP/2.0
   A->Proxy        Via: SIP/2.0/UDP here.com:5060
                   Route:<sip:UserA-retrieve@vm.wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 2 BYE
                   Content-Length: 0

   BYE F9          BYE sip: UserA-retrieve@vm.wcom.com SIP/2.0
   Proxy->VM       Via: SIP/2.0/UDP wcom.com:5060
                   Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 2 BYE
                   Content-Length: 0

   200 OK F10      SIP/2.0 200 OK
   VM->Proxy       Via: SIP/2.0/UDP wcom.com:5060
                   Via: SIP/2.0/UDP here.com:5060
                   From: TheBigGuy <sip:UserA@here.com>
```

```
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq: 2 BYE
                 Content-Length: 0

    200 OK F11   SIP/2.0 200 OK
    Proxy->A     Via: SIP/2.0/UDP here.com:5060
                 From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq:  2 BYE
                 Content-Length: 0
```

4.3.2 Call to retrieve messages from an authenticated subscriber

UserA to call the voice mail system to retrieve messages. Assumptions: The caller is authenticated using UserA's credentials. "sip:UserA-retrieve-auth@vm.wcom.com" maps to UserA's mailbox and the behavior of "retrieve messages." The voice mail service trusts the proxy not to forward any calls to that URI unless the call is authenticated to be from UserA.

Given these assumptions, The VM service may choose not require a PIN for calls to this URI.

```
            User A              Proxy                VM Service
              |                   |                       |
              |  INVITE F1        |                       |
              |------------------>|                       |
              |                   |  INVITE F2            |
              | (100 Trying) F3   |---------------------->|
              |<------------------|                       |
              |                   |  200 OK F4            |
              |  200 OK F5        |<----------------------|
              |<------------------|                       |
              |                   |                       |
              |  ACK F6           |                       |
              |------------------>|  ACK F7               |
              |                   |---------------------->|
              |                   |                       |
              |      RTP Both Ways - Deposit Msg for B    |
              |<-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m-m->|
              |                   |                       |
              |  BYE F8           |                       |
              |------------------>|  BYE F9               |
              |                   |---------------------->|
              |                   |                       |
              |                   |  200 OK F10           |
              |                   |<----------------------|
              |  200 OK F11       |                       |
              |<------------------|                       |
              |                   |                       |
```

```
     Flow Id                             Comments

    INVITE F1     INVITE sip:VoiceMail@wcom.com SIP/2.0
    A->Proxy      Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: VoiceMail <sip:VoiceMail@wcom.com>
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact: TheBigGuy <sip:UserA@here.com>
                  Proxy-Authorization:Digest username="UserA",
                  realm="MCI WorldCom SIP",
                  nonce="ea9c8e88df84f1cec4341ae6cbe5a359", opaque="",
                  uri="sip:VoiceMail@wcom.com", response=<appropriately
                  calculated hash goes here>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserA 2890844526 2890844526 IN IP4 client.here.com
                  s=Session SDP
```

```
                   c=IN IP4 100.101.102.103
                   t=0 0
                   m=audio 49170 RTP/AVP 0
                   a=rtpmap:0 PCMU/8000

                   /*Client for A prepares to receive data on port 49170
                   from the network. */

   INVITE F2       INVITE sip:UserA-retrieve-auth@vm.wcom.com SIP/2.0
   Proxy->B1       Via: SIP/2.0/UDP wcom.com:5060; branch=1
                   Via: SIP/2.0/UDP here.com:5060
                   Record-Route: <sip:VoiceMail@wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Contact: TheBigGuy <sip:UserA@here.com>
                   Content-Type: application/sdp
                   Content-Length: <appropriate value>

                   v=0
                   o=UserA 2890844526 2890844526 IN IP4 client.here.com
                   s=Session SDP
                   c=IN IP4 100.101.102.103
                   t=0 0
                   m=audio 49170 RTP/AVP 0
                   a=rtpmap:0 PCMU/8000

   (100 Trying     SIP/2.0 100 Trying
   F3              Via: SIP/2.0/UDP here.com:5060
   Proxy->A)       From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Content-Length: 0

   200 OK F4       SIP/2.0 200 OK
   VM->Proxy       Via: SIP/2.0/UDP wcom.com:5060; branch=1
                   Via: SIP/2.0/UDP here.com:5060
                   Record-Route: <sip:VoiceMail@wcom.com>
                   From: TheBigGuy <sip:UserA@here.com>
                   To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                   Call-Id: 12345600@here.com
                   CSeq: 1 INVITE
                   Contact: VoiceMailSystem <sip:UserA-retrieve-
                   auth@vm.wcom.com>
                   Content-Type: application/sdp
                   Content-Length: <appropriate value>
```

```
                  v=0
                  o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                  s=Session SDP
                  c=IN IP4 110.111.112.114
                  t=0 0
                  m=audio 3456 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000

    200 OK F5     SIP/2.0 200 OK
    Proxy->A      Via: SIP/2.0/UDP here.com:5060
                  Record-Route: <sip:VoiceMail@wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 1 INVITE
                  Contact VoiceMailSystem <sip: UserA-retrieve-
                  auth@vm.wcom.com>
                  Content-Type: application/sdp
                  Content-Length: <appropriate value>

                  v=0
                  o=UserB 2890844527 2890844527 IN IP4 vm.wcom.com
                  s=Session SDP
                  c=IN IP4 110.111.112.114
                  t=0 0
                  m=audio 3456 RTP/AVP 0
                  a=rtpmap:0 PCMU/8000

    ACK F6        ACK sip:VoiceMail@wcom.com SIP/2.0
    A->Proxy      Via: SIP/2.0/UDP here.com:5060
                  Route: <sip:UserA-retrieve-auth@vm.wcom.com>
                  From: TheBigGuy <sip:UserA@here.com>
                  To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 1 ACK
                  Content-Length: 0

    ACK F7        ACK sip:UserA-retrieve-auth@vm.wcom.com SIP/2.0
    Proxy->VM     Via: SIP/2.0/UDP wcom.com:5060
                  Via: SIP/2.0/UDP here.com:5060
                  From: TheBigGuy <sip:UserA@here.com>
                  To: VoiceMail <sip:VoiceMail@wcom.com>; tag=3145678
                  Call-Id: 12345600@here.com
                  CSeq: 1 ACK
                  Content-Length: 0
```

```
                 /* RTP streams are established between A and VM.  VM
                 determines that the call is likely from UserA, and
                 starts a message retrieval session.  Since the proxy
                 has already authenticated the identity of UserA, the
                 VM does not need to prompt for PIN. */

                 /* User A Hangs Up with VM system.  Alternatively, the
                 VM system could initiate the BYE*/

   BYE F8        BYE sip:VoiceMail@wcom.com SIP/2.0
   A->Proxy      Via: SIP/2.0/UDP here.com:5060
                 Route:<sip:UserA-retrieve-auth@vm.wcom.com>
                 From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq: 2 BYE
                 Content-Length: 0

   BYE F9        BYE sip: UserA-retrieve-auth@vm.wcom.com SIP/2.0
   Proxy->VM     Via: SIP/2.0/UDP wcom.com:5060
                 Via: SIP/2.0/UDP here.com:5060
                 From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq: 2 BYE
                 Content-Length: 0

   200 OK F10    SIP/2.0 200 OK
   VM->Proxy     Via: SIP/2.0/UDP wcom.com:5060
                 Via: SIP/2.0/UDP here.com:5060
                 From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq: 2 BYE
                 Content-Length: 0

   200 OK F11    SIP/2.0 200 OK
   Proxy->A      Via: SIP/2.0/UDP here.com:5060
                 From: TheBigGuy <sip:UserA@here.com>
                 To: VoiceMail <sip:VoiceMail@wcom.com>;tag=3145678
                 Call-Id: 12345600@here.com
                 CSeq:  2 BYE
                 Content-Length: 0
```

5. Security Considerations

This document discusses a usage of SIP/2.0 as defined by RFC 2543[1]. It introduces no additions, modifications, or restrictions to the protocol defined therein. Any implementation of the concepts in this document is subject to the issues discussed there.

6. Acknowledgments

The authors would like to thank Chris Cunningham, Steve Donovan, Alan Johnston, Henry Sinnreich, Kevin Summers, John Truetken, and Dean Willis for their discussion of and contribution to this work.

References

[1] Handley, M., Schulzrinne, H., Schooler, E. and J. Rosenberg, "SIP: Session Initiation Protocol", RFC 2543, March 1999.

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Acknowledgement

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