Session Initiation Protocol (SIP) History-Info Header Call Flow Examples

Abstract

   This document describes use cases and documents call flows that
   require the History-Info header field to capture the Request-URIs as
   a Session Initiation Protocol (SIP) Request is retargeted. The use
   cases are described along with the corresponding call flow diagrams
   and messaging details.

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1. Overview

   Many services that use SIP require the ability to determine why and
   how the call arrived at a specific application. The use cases
   provided in this document illustrate the use of the History-Info
   header [RFC7044], for example, applications and common scenarios.
   The optional "rc" and "mp" header field parameters defined in
   [RFC7044] are required for several of the use cases. Descriptions of
   the example use cases, call flow diagrams, and messaging details are
   provided.

2. Conventions and Terminology

   The term "retarget" is used as defined in [RFC7044]. The terms
   "location service", "redirect", and "address-of-record (AOR)" are
   used consistent with the terminology in [RFC3261].

3. Detailed Call Flows

   The scenarios in this section provide sample use cases for the
   History-Info header for informational purposes only. They are not
   intended to be normative. In many cases, only the relevant messaging
   details are included in the body of the call flow.

3.1. Sequentially Forking (History-Info in Response)

   This scenario highlights an example where the History-Info in the
   response is useful to an application or user that originated the
   request.

   Alice sends a call to Bob via sip:example.com. The proxy
   sip:example.com sequentially tries Bob on a SIP User Agent (UA) that
   has bound a contact with the sip:bob@example.com AOR, and then
   several alternate addresses (Office and Home) unsuccessfully before
   sending a response to Alice. The hi-entry containing the initial
   contact is the hi-entry just prior to the first hi-entry tagged with
   an "rc" header field parameter. In this example, the Office and Home
   are not the same AOR as sip:bob@example.com, but rather different
   AORs that have been configured as alternate addresses for Bob in the
   proxy. In other words, Office and Home are not bound through SIP
   Registration with Bob's AOR. This type of arrangement is common, for
   example, when a "routing" rule to a Public Switched Telephone Network
   (PSTN) number is manually configured in a proxy. These hi-entries
   are identified by the index contained in the hi-target-param "mp"
   header field parameter in the hi-entries.

   This scenario illustrates that by providing the History-Info to
   Alice, the end-user, or an application at Alice could make a decision
   on how best to attempt finding Bob without sending multiple requests
   to the same destination. Upon receipt of the response containing the
   History-Info entries, the Request-URIs for the History-Info entries
   tagged with an "mp" header field parameter are extracted. Those
   Request-URIs can be compared to other URIs (if any) that might be
   attempted in order to establish the session with Bob. This results
   in avoiding the sending of another INVITE to Bob's home phone.
   Without this mechanism, Alice might well attempt to reach Bob at his
   office phone, which would then retarget the request to Bob's home
   phone. When that attempt failed, then Alice might attempt to reach
   Bob directly at his home phone, unknowingly for a third time.

```
        Alice    example.com            Bob     Office    Home

        |           |                   |         |         |
        | INVITE F1 |                   |         |         |
        |---------->|     INVITE F2     |         |         |
        |           |------------------>|         |         |
        | 100 Trying F3                 |         |         |
        |<----------| 302 Move Temporarily F4     |         |
        |           |<------------------|         |         |
        |           |      ACK F5       |         |         |
        |           |------------------>|         |         |
        |           |            INVITE F6        |         |
        |           |---------------------------->|         |
        |           |           180 Ringing F7    |         |
        |           |<----------------------------|         |
        | 180 Ringing F8                |         |         |
        |<----------|  retransmit INVITE          |         |
        |           |---------------------------->|         |
        |           |            ( timeout )      |         |
        |           |               INVITE F9     |         |
        |           |-------------------------------------->|
        |           |             100 Trying F10  |         |
        |           |<--------------------------------------|
        |           |             486 Busy Here F11         |
        |           |<--------------------------------------|
        | 486 Busy Here F12             |         |         |
        |<----------|               ACK F13       |         |
        |           |-------------------------------------->|
        | ACK F14   |                   |         |         |
        |---------->|                   |         |         |
```
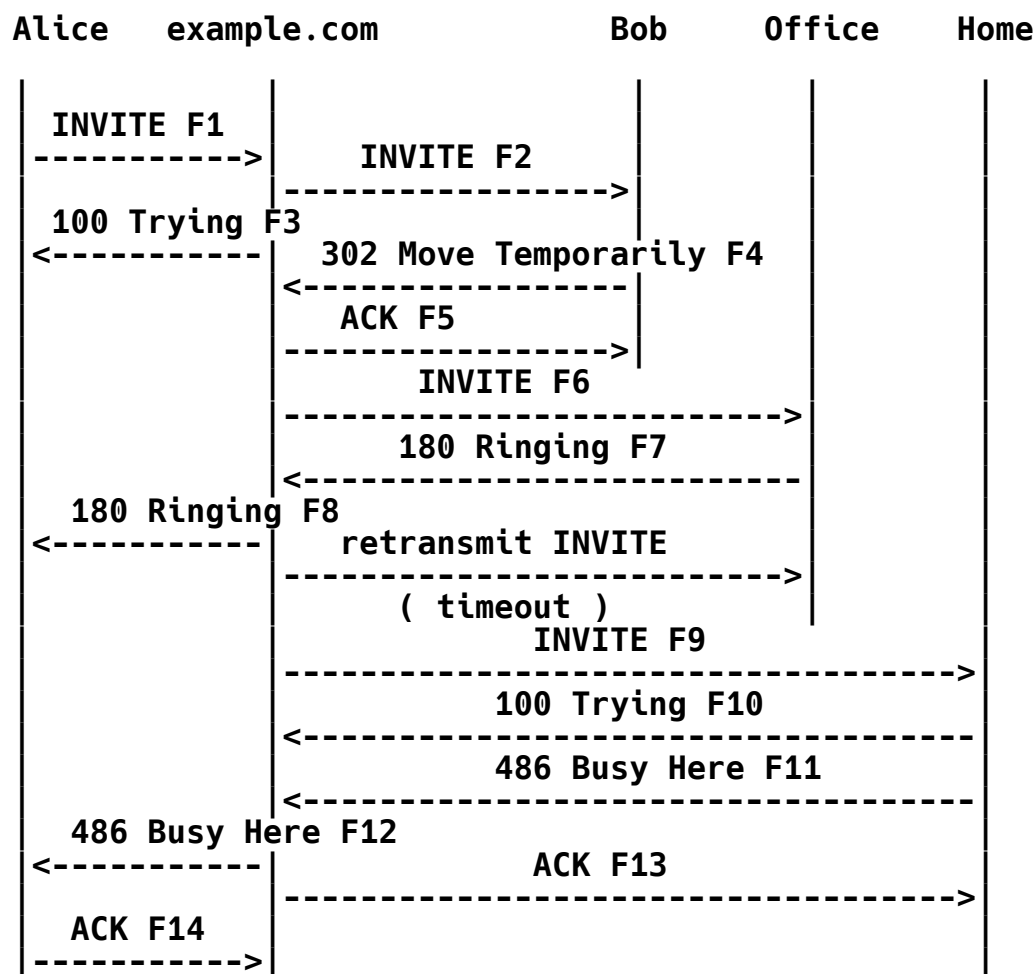
                Figure 1: Example with Sequential Forking

Message Details

F1 INVITE Alice -> example.com

INVITE sip:bob@example.com SIP/2.0
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
Max-Forwards: 70
From: Alice <sip:alice@example.com>;tag=sr3dds
To: Bob <sip:bob@example.com>
Supported: histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
History-Info: <sip:bob@example.com>;index=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>

[SDP Not Shown]

F2 INVITE example.com -> Bob

INVITE sip:bob@192.0.2.4 SIP/2.0
Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx3st
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
Max-Forwards: 69
From: Alice <sip:alice@example.com>;tag=sr3dds
To: Bob <sip:bob@example.com>
Supported: histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
Record-Route: <sip:proxy.example.com;lr>
History-Info: <sip:bob@example.com>;index=1
History-Info: <sip:bob@192.0.2.4>;index=1.1;rc=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>

[SDP Not Shown]

F3 100 Trying example.com -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
From: Alice <sip:alice@example.com>;tag=sr3dds
To: Bob <sip:bob@example.com>
Supported: histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
Content-Length: 0
```

F4 302 Moved Temporarily Bob -> example.com

```
SIP/2.0 302 Moved Temporarily
Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx3st
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
From: Alice <sip:alice@example.com>;tag=sr3dds
To: Bob <sip:bob@example.com>;tag=es43sd
Supported: histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
History-Info: <sip:bob@example.com>;index=1
History-Info: <sip:bob@192.0.2.4>;index=1.1;rc=1
Contact: <sip:office@example.com>;mp=1
Content-Length: 0
```

F5 ACK example.com -> Bob

```
ACK sip:bob@example.com SIP/2.0
Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx3st
Max-Forwards: 70
From: Alice <sip:alice@example.com>;tag=sr3dds
To: Bob <sip:bob@example.com>;tag=es43sd
Call-ID: 12345600@example.com
CSeq: 1 ACK
Content-Length: 0
```

```
   F6 INVITE example.com -> office

   INVITE sip:office@192.0.2.5 SIP/2.0
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx4st
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   Max-Forwards: 69
   From: Alice <sip:alice@example.com>;tag=sr3dds
   To: Bob <sip:bob@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   Record-Route: <sip:proxy.example.com;lr>
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.4?Reason=SIP%3Bcause%3D302>;\
                 index=1.1;rc=1
   History-Info: <sip:office@example.com>;index=1.2;mp=1
   History-Info: <sip:office@192.0.2.5>;index=1.2.1;rc=1.2
   CSeq: 1 INVITE
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]


   F7 180 Ringing office -> example.com

   SIP/2.0 180 Ringing
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx4st
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@example.com>;tag=sr3dds
   To: Bob <sip:bob@example.com>;tag=53rdds
   Supported: histinfo
   Call-ID: 12345600@example.com
   Record-Route: <sip:proxy.example.com;lr>
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.4?Reason=SIP%3Bcause%3D302>;\
                 index=1.1;rc=1
   History-Info: <sip:office@example.com>;index=1.2;mp=1
   History-Info: <sip:office@192.0.2.5>;index=1.2.1;rc=1.2
   CSeq: 1 INVITE
   Contact: Office <sip:office@192.0.2.5>
   Content-Length: 0
```

    F8 180 Ringing example.com -> Alice

    SIP/2.0 180 Ringing
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
    From: Alice <sip:alice@example.com>;tag=sr3dds
    To: Bob <sip:bob@example.com>;tag=53rdds
    Supported: histinfo
    Call-ID: 12345600@example.com
    Record-Route: <sip:proxy.example.com;lr>
    History-Info: <sip:bob@example.com>;index=1
    History-Info: <sip:bob@192.0.2.4?Reason=SIP%3Bcause%3D302>;\
                  index=1.1;rc=1
    History-Info: <sip:office@example.com>;index=1.2;mp=1
    History-Info: <sip:office@192.0.2.5>;index=1.2.1;rc=1.2
    CSeq: 1 INVITE
    Contact: Office <sip:office@192.0.2.5>
    Content-Length: 0

    F9 INVITE example.com -> home

    INVITE sip:home@192.0.2.6 SIP/2.0
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx5st
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
    Max-Forwards: 69
    From: Alice <sip:alice@example.com>;tag=sr3dds
    To: Bob <sip:bob@example.com>
    Supported: histinfo
    Call-ID: 12345600@example.com
    Record-Route: <sip:proxy.example.com;lr>
    History-Info: <sip:bob@example.com>;index=1
    History-Info: <sip:bob@192.0.2.4?Reason=SIP%3Bcause%3D302>;\
                  index=1.1;rc=1
    History-Info: <sip:office@example.com?Reason=SIP%3Bcause%3D408>;\
                  index=1.2;mp=1
    History-Info: <sip:office@192.0.2.5?Reason=SIP%3Bcause%3D408>;\
                  index=1.2.1;rc=1.2
    History-Info: <sip:home@example.com>;index=1.3;mp=1
    History-Info: <sip:home@192.0.2.6>;index=1.3.1;rc=1.3
    CSeq: 1 INVITE
    Contact: Alice <sip:alice@192.0.2.3>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

```
   F10 100 Trying home -> example.com

   SIP/2.0 100 Trying
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx5st
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@example.com>;tag=sr3dds
   To: Bob <sip:bob@example.com>
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   Content-Length: 0


   F11 486 Busy Here home -> example.com

   SIP/2.0  486 Busy Here
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx5st
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@example.com>;tag=sr3dds
   To: Bob <sip:bob@example.com>;tag=55rdds
   Call-ID: 12345600@example.com
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.4?Reason=SIP%3Bcause%3D302>;\
                 index=1.1;rc=1
   History-Info: <sip:office@example.com?Reason=SIP%3Bcause%3D408>;\
                 index=1.2;mp=1
   History-Info: <sip:office@192.0.2.5?Reason=SIP%3Bcause%3D408>;\
                 index=1.2.1;rc=1.2
   History-Info: <sip:home@example.com>;index=1.3;mp=1
   History-Info: <sip:home@192.0.2.6>;index=1.3.1;rc=1.3
   CSeq: 1 INVITE
   Content-Length: 0
```

```
   F12 486 Busy Here example.com -> Alice

   SIP/2.0  486 Busy Here
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@example.com>;tag=sr3dds
   To: Bob <sip:bob@example.com>;tag=55rdds
   Call-ID: 12345600@example.com
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.4?Reason=SIP%3Bcause%3D302>;\
                 index=1.1;rc=1
   History-Info: <sip:office@example.com?Reason=SIP%3Bcause%3D408>;\
                 index=1.2;mp=1
   History-Info: <sip:office@192.0.2.5?Reason=SIP%3Bcause%3D408>;\
                 index=1.2.1;rc=1.2
   History-Info: <sip:home@example.com>;index=1.3;mp=1
   History-Info: <sip:home@192.0.2.6>;index=1.3.1;rc=1.3
   CSeq: 1 INVITE
   Content-Length: 0


   F13 ACK example.com -> home

   ACK sip:home@192.0.2.6 SIP/2.0
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKx5st
   Max-Forwards: 70
   From: Alice <sip:alice@example.com>;tag=sr3dds
   To: Bob <sip:bob@example.com>;tag=55rdds
   Call-ID: 12345600@example.com
   CSeq: 1 ACK
   Content-Length: 0


   F14 ACK Alice -> example.com

   ACK sip:bob@example.com SIP/2.0
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   Max-Forwards: 70
   From: Alice <sip:alice@example.com>;tag=sr3dds
   To: Bob <sip:bob@example.com>;tag=55rdds
   Call-ID: 12345600@example.com
   Route: <sip:proxy.example.com;lr>
   CSeq: 1 ACK
   Content-Length: 0
```

3.2. History-Info with Privacy Header Field

   This is an example of the use of the Privacy header field with a
   value of "history" added by an intermediary. The intermediary
   responsible for the biloxi.example.com domain adds a Privacy header
   field with a value of "history" indicating that all the History-Info
   header field information is anonymized outside the biloxi.example.com
   domain.

```
      Alice   atlanta.example.com  biloxi.example.com  Bob Work  Bob Home

        |                   |                   |             |           |
        |   INVITE F1       |                   |             |           |
        |------------------>|                   |             |           |
        |                   |                   |             |           |
        |                   |   INVITE F2       |             |           |
        |                   |------------------>|             |           |
        |                   |                   |             |           |
        |                   |                   |  INVITE F3  |           |
        |                   |                   |------------>|           |
        |                   |                   | 302 Move Temporarily F4 |
        |                   |                   |<------------|           |
        |                   |                   |    ACK F5   |           |
        |                   |                   |------------>|           |
        |                   |                   |             |           |
        |                   |                   |  INVITE F6  |           |
        |                   |                   |----------------------->|
        |                   |                   |    200 F7   |           |
        |                   |                   |<-----------------------|
        |                   |                   |             |           |
        |                   |      200 F8       |             |           |
        |                   |<------------------|             |           |
        |                   |                   |             |           |
        |      200 F9       |                   |             |           |
        |<------------------|                   |             |           |
        |                   |                   |             |           |
        |                   |         ACK       |             |           |
        |------------------------------------------------------------->|
        |                   |                   |             |           |
```
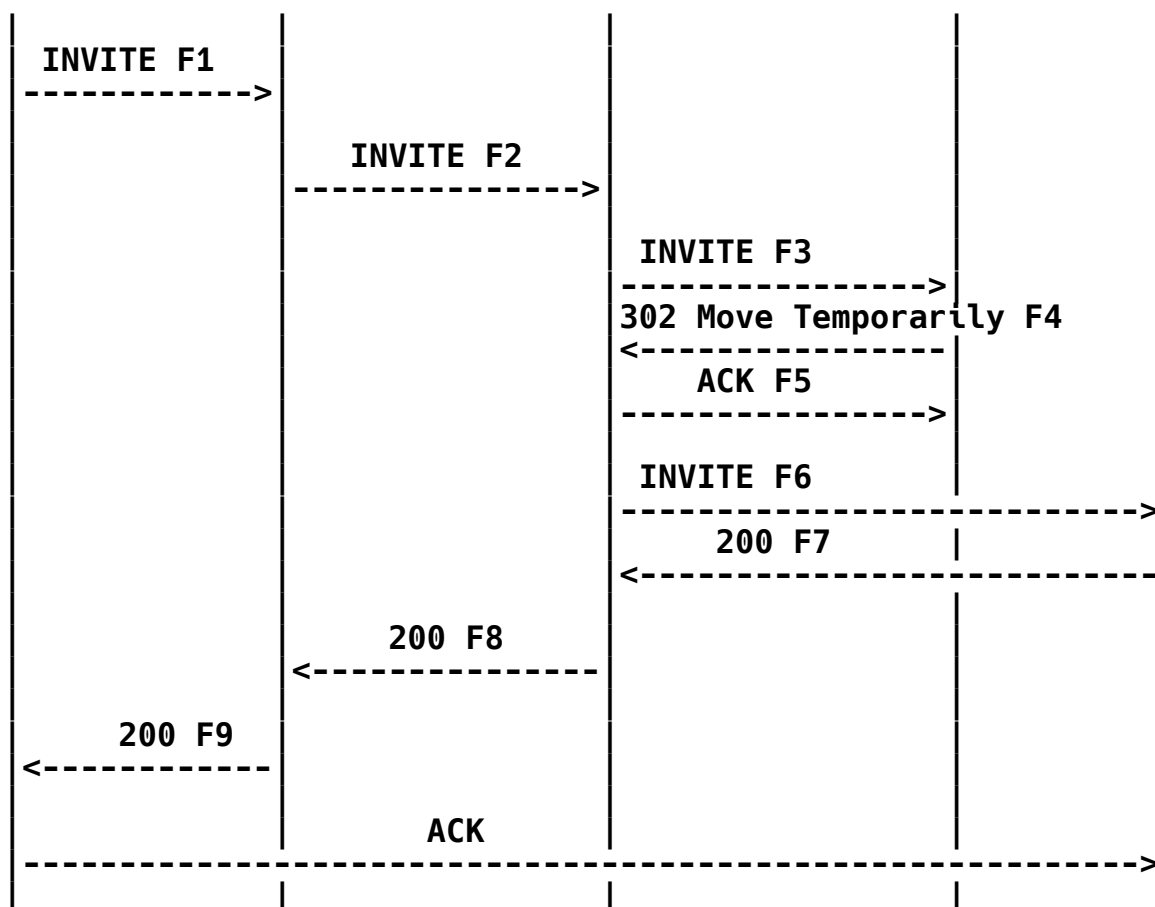
                 Figure 2: Example with Privacy Header Fields

Message Details

F1 INVITE Alice -> atlanta.example.com

```
INVITE sip:bob@biloxi.example.com;p=x SIP/2.0
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=22
To: Bob <sip:bob@biloxi.example.com>
Supported: histinfo
Privacy: history
Call-ID: 12345600@atlanta.example.com
CSeq: 1 INVITE
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>
```

[SDP Not Shown]

F2 INVITE atlanta.example.com -> biloxi.example.com

```
INVITE sip:bob@biloxi.example.com;p=x SIP/2.0
Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
Max-Forwards: 69
From: Alice <sip:alice@atlanta.example.com>;tag=22
To: Bob <sip:bob@biloxi.example.com>
Supported: histinfo
Call-ID: 12345600@atlanta.example.com
CSeq: 1 INVITE
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>
```

[SDP Not Shown]

    F3 INVITE biloxi.example.com -> Bob Work

    INVITE sip:bob@192.0.1.11 SIP/2.0
    Via: SIP/2.0/TCP proxy.biloxi.example.com:5060;branch=z9hG4bKgs33
    Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                     received=192.0.2.3
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
    Max-Forwards: 68
    From: Alice <sip:alice@atlanta.example.com>;tag=22
    To: Bob <sip:bob@biloxi.example.com>
    Privacy: history
    Supported: histinfo
    Call-ID: 12345600@atlanta.example.com
    CSeq: 1 INVITE
    History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
    History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
    History-Info: <sip:bob@192.0.1.11>;index=1.1.1;rc=1.1
    Contact: Alice <sip:alice@192.0.2.3>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

    F4 302 Moved Temporarily Bob Work -> biloxi.example.com

    SIP/2.0 302 Moved Temporarily
    Via: SIP/2.0/TCP proxy.biloxi.example.com:5060;branch=z9hG4bKgs33;\
                     received=192.0.2.102
    Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                     received=192.0.2.3
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
    From: Alice <sip:alice@atlanta.example.com>;tag=22
    To: Bob <sip:bob@biloxi.example.com>;tag=11
    Privacy: history
    Supported: histinfo
    Call-ID: 12345600@atlanta.example.com
    CSeq: 1 INVITE
    History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
    History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
    History-Info: <sip:bob@192.0.1.11>;index=1.1.1;rc=1.1
    Contact: Bob Home <sip:bob@192.0.1.15>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

```
   F5 ACK  biloxi.example.com -> Bob Work

   ACK sip:bob@192.0.1.11 SIP/2.0
   Via: SIP/2.0/TCP proxy.biloxi.example.com:5060;branch=z9hG4bKgs33
   Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                 received=192.0.2.3
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   Max-Forwards: 68
   From: Alice <sip:alice@atlanta.example.com>;tag=22
   To: Bob <sip:bob@biloxi.example.com>;tag=11
   Call-ID: 12345600@atlanta.example.com
   CSeq: 1 ACK
   Content-Length: <appropriate value>

   [SDP Not Shown]


   F6 INVITE  biloxi.example.com -> Bob Home

   INVITE sip:bob@192.0.1.15 SIP/2.0
   Via: SIP/2.0/TCP proxy.biloxi.example.com:5060;branch=z9hG4bKgs32
   Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                 received=192.0.2.3
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   Max-Forwards: 68
   From: Alice <sip:alice@atlanta.example.com>;tag=22
   To: Bob <sip:bob@biloxi.example.com>
   Privacy: history
   Supported: histinfo
   Call-ID: 12345600@atlanta.example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
   History-Info: <sip:bob@192.0.1.11?Reason=SIP%3Bcause%3D302>;\
                 index=1.1.1;rc=1
   History-Info: <sip:bob@192.0.1.15>;index=1.1.2
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]
```

```
   F7 200 OK  Bob -> biloxi.example.com

   SIP/2.0 200 OK
   Via: SIP/2.0/TCP proxy.biloxi.example.com:5060;branch=z9hG4bKgs32;\
                   received=192.0.2.101
   Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                   received=192.0.2.3
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@atlanta.example.com>;tag=22
   To: Bob <sip:bob@biloxi.example.com>;tag=33
   Privacy: history
   Supported: histinfo
   Call-ID: 12345600@atlanta.example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
   History-Info: <sip:bob@192.0.1.11?Reason=SIP%3Bcause%3D302>;\
                   index=1.1.1;rc=1
   History-Info: <sip:bob@192.0.1.15>;index=1.1.2;rc=1.1
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]


   F8 200 OK  biloxi.example.com -> atlanta.example.com

   SIP/2.0 200 OK
   Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                   received=192.0.2.3
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@atlanta.example.com>;tag=22
   To: Bob <sip:bob@biloxi.example.com>;tag=33
   Privacy: history
   Supported: histinfo
   Call-ID: 12345600@atlanta.example.com
   CSeq: 1 INVITE
   History-Info: <sip:anonymous@anonymous.invalid>;index=1
   History-Info: <sip:anonymous@anonymous.invalid>;index=1.1
   History-Info: <sip:anonymous@anonymous.invalid>;index=1.1.1;rc=1
   History-Info: <sip:anonymous@anonymous.invalid>;index=1.1.2;rc=1.1
   Contact: Bob <sip:bob@192.0.1.11>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]
```

    F9 200 OK atlanta.example.com -> Alice

    SIP/2.0 200 OK
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
    From: Alice <sip:alice@atlanta.example.com>;tag=22
    To: Bob <sip:bob@biloxi.example.com>;tag=33
    Privacy: history
    Supported: histinfo
    Call-ID: 12345600@atlanta.example.com
    CSeq: 1 INVITE
    History-Info: <sip:anonymous@anonymous.invalid>;index=1
    History-Info: <sip:anonymous@anonymous.invalid>;index=1.1
    History-Info: <sip:anonymous@anonymous.invalid>;index=1.1.1;rc=1
    History-Info: <sip:anonymous@anonymous.invalid>;index=1.1.2;rc=1.1
    Contact: Bob <sip:bob@192.0.1.11>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

3.3. Privacy for a Specific History-Info Entry

    This example provides a basic call scenario similar to Section 3.2;
    however, due to local policy at sip:biloxi.example.com, only the
    final hi-entry in the History-Info, which is Bob's local URI,
    contains a privacy header field with a priv-value of "history", thus
    providing Alice with some information about the history of the
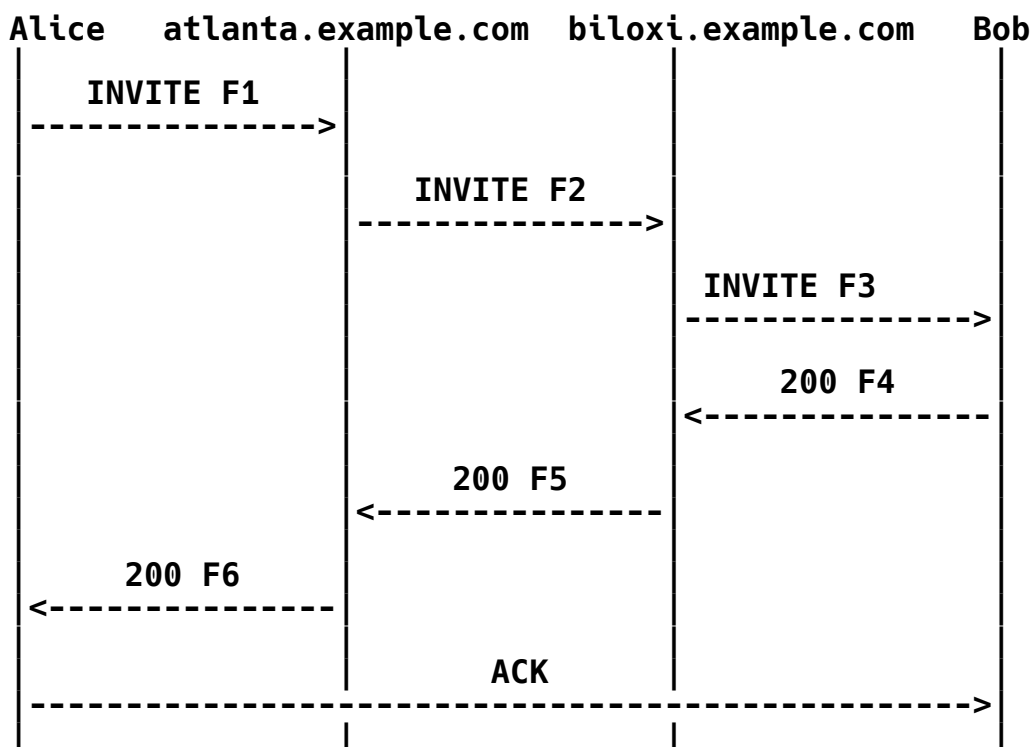   request, but anonymizing Bob's local URI.

```
        Alice    atlanta.example.com  biloxi.example.com    Bob
         |            |                    |                 |
         |   INVITE F1 |                    |                 |
         |--------------->|                 |                 |
         |            |                    |                 |
         |            |   INVITE F2        |                 |
         |            |--------------->|                     |
         |            |                    |                 |
         |            |                    |   INVITE F3     |
         |            |                    |--------------->|
         |            |                    |                 |
         |            |                    |   200 F4        |
         |            |                    |<---------------|
         |            |                    |                 |
         |            |   200 F5           |                 |
         |            |<---------------|                     |
         |            |                    |                 |
         |   200 F6   |                    |                 |
         |<---------------|                 |                 |
         |            |                    |                 |
         |            |   ACK              |                 |
         |------------------------------------------------->|
         |            |                    |                 |
```

                Figure 3: Example with Privacy Header Field for Specific URI

   Message Details

   F1 INVITE Alice -> atlanta.example.com

   INVITE sip:bob@biloxi.example.com;p=x SIP/2.0
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   Max-Forwards: 70
   From: Alice <sip:alice@atlanta.example.com>;tag=22
   To: Bob <sip:bob@biloxi.example.com>
   Supported: histinfo
   Call-ID: 12345600@atlanta.example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

```
F2 INVITE   atlanta.example.com -> biloxi.example.com

INVITE sip:bob@biloxi.example.com;p=x SIP/2.0
Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
Max-Forwards: 69
From: Alice <sip:alice@atlanta.example.com>;tag=22
To: Bob <sip:bob@biloxi.example.com>
Supported: histinfo
Call-ID: 12345600@atlanta.example.com
CSeq: 1 INVITE
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1;np=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>

[SDP Not Shown]


F3 INVITE   biloxi.example.com -> Bob

INVITE sip:bob@192.0.1.11 SIP/2.0
Via: SIP/2.0/TCP proxy.biloxi.example.com:5060;branch=z9hG4bKeset
Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                received=192.0.2.101
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
Max-Forwards: 68
From: Alice <sip:alice@atlanta.example.com>;tag=22
To: Bob <sip:bob@biloxi.example.com>
Supported: histinfo
Call-ID: 12345600@atlanta.example.com
CSeq: 1 INVITE
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1;np=1
History-Info: <sip:bob@192.0.1.11?Privacy=history>;index=1.1.1;rc=1.1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>

[SDP Not Shown]
```

```
   F4 200 OK  Bob -> biloxi.example.com

   SIP/2.0 200 OK
   Via: SIP/2.0/TCP proxy.biloxi.example.com:5060;branch=z9hG4bKeset;\
                  received=192.0.2.5
   Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                  received=192.0.2.101
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@atlanta.example.com>;tag=22
   To: Bob <sip:bob@biloxi.example.com>;tag=33
   Supported: histinfo
   Call-ID: 12345600@atlanta.example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1;np=1
   History-Info: <sip:bob@192.0.1.11?Privacy=history>;index=1.1.1;rc=1.1
   Contact: Bob <sip:bob@192.0.1.11>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]


   F5 200 OK  biloxi.example.com -> atlanta.example.com

   SIP/2.0 200 OK
   Via: SIP/2.0/TCP proxy.atlanta.example.com:5060;branch=z9hG4bKbst2;\
                  received=192.0.2.101
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
   From: Alice <sip:alice@atlanta.example.com>;tag=22
   To: Bob <sip:bob@biloxi.example.com>;tag=33
   Supported: histinfo
   Call-ID: 12345600@atlanta.example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1;np=1
   History-Info: <sip:anonymous@anonymous.invalid>;index=1.1.1;rc=1.1
   Contact: Bob <sip:bob@192.0.1.11>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]
```

F6 200 OK atlanta.example.com -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK4321
From: Alice <sip:alice@atlanta.example.com>;tag=22
To: Bob <sip:bob@biloxi.example.com>;tag=33
Supported: histinfo
Call-ID: 12345600@atlanta.example.com
CSeq: 1 INVITE
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1;np=1
History-Info: <sip:anonymous@anonymous.invalid>;index=1.1.1;rc=1.1
Contact: Bob <sip:bob@192.0.1.11>
Content-Type: application/sdp
Content-Length: <appropriate value>
```

[SDP Not Shown]

3.4. Automatic Call Distribution

This scenario highlights an example of an Automatic Call Distribution
service, where the agents are divided into groups based upon the type
of customers they handle. In this example, the Gold customers are
given higher priority than Silver customers, so a Gold call would get
serviced even if all the agents servicing the Gold group were busy,
by retargeting the request to the Silver Group for delivery to an
agent. Upon receipt of the call at the agent assigned to handle the
incoming call, based upon the History-Info header in the message, the
application at the agent can provide an indication that this is a
Gold call by extracting the hi-entry associated with the incoming
request, which is determined by locating the hi-entry whose index is
reflected in the first hi-entry with a hi-target of "mp". In the
example, this would be the hi-entry referenced by the value of the
first "mp" header field parameter, i.e., the hi-entry containing an
index of "1". An application can also determine how many groups from
which the call may have overflowed before reaching the agent, etc.,
and present the information to the agent so that the call can be
handled appropriately, i.e., "I'm so sorry for the delay, blah, blah,
blah..."

For scenarios whereby calls might overflow from the Silver to the
Gold, clearly the alternate group identification, internal routing,
or actual agent that handles the call should not be sent to UA1.
Thus, for this scenario, one would expect that the proxy would not
support the sending of the History-Info in the response, even if
requested by Alice or the proxy could anonymize the Silver related
hi-entries by adding privacy in the Silver hi-entries.

As with the other examples, this is not a complete prescription of
how one would do this type of service but an example of a subset of
processing that might be associated with such a service. In
addition, this example does not address any aspects of agent
availability resulting in the call being sent to an agent in another
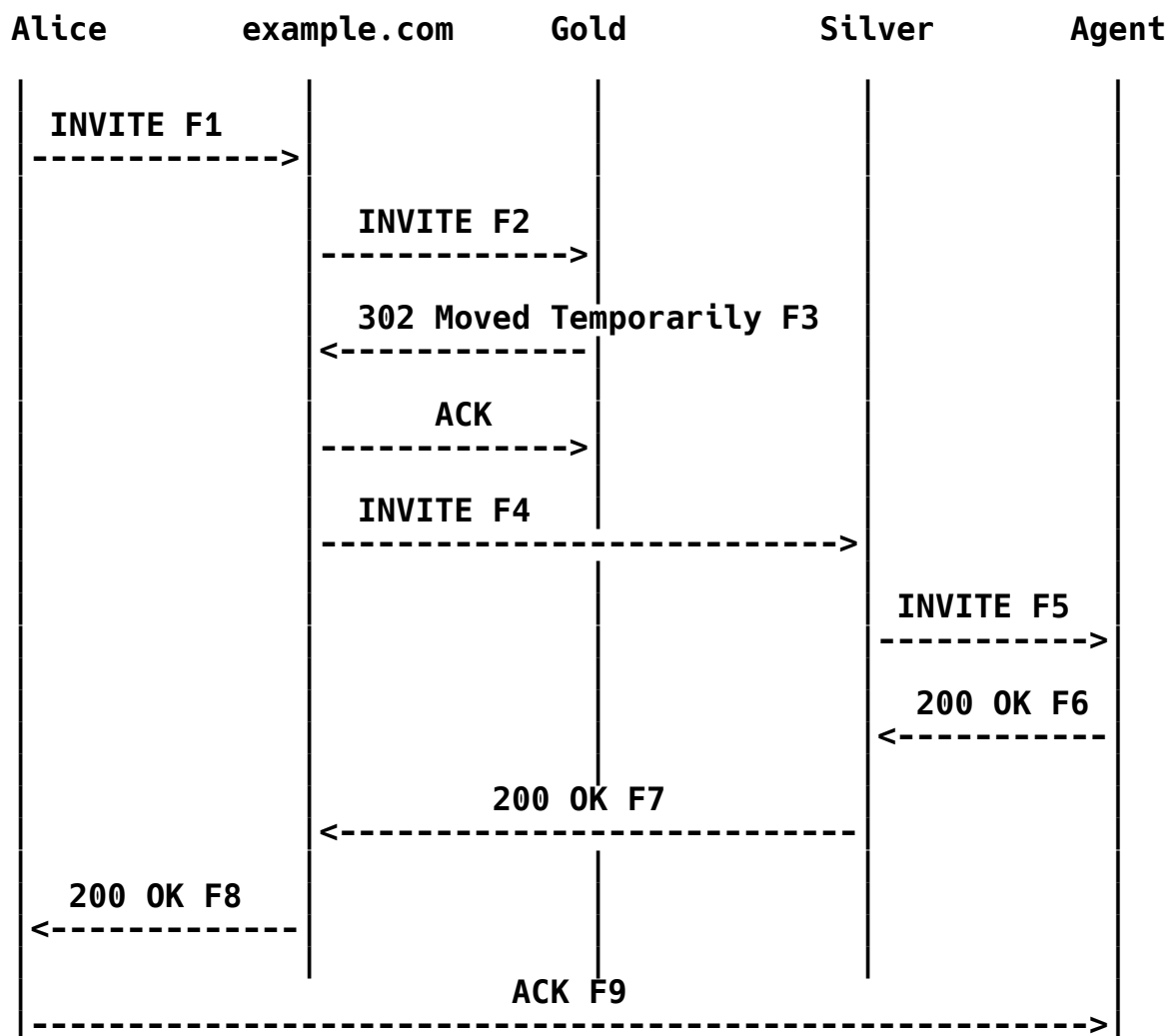group, which might also be done via a SIP interface.

```
   Alice        example.com       Gold          Silver         Agent

    |              |               |              |              |
    | INVITE F1    |               |              |              |
    |------------->|               |              |              |
    |              |               |              |              |
    |              | INVITE F2     |              |              |
    |              |------------->|               |              |
    |              |               |              |              |
    |              | 302 Moved Temporarily F3     |              |
    |              |<-------------|                |              |
    |              |               |              |              |
    |              |     ACK       |              |              |
    |              |------------->|               |              |
    |              | INVITE F4     |              |              |
    |              |----------------------------->|              |
    |              |               |              |              |
    |              |               |              | INVITE F5    |
    |              |               |              |------------->|
    |              |               |              |              |
    |              |               |              | 200 OK F6    |
    |              |               |              |<-------------|
    |              |               |              |              |
    |              |      200 OK F7               |              |
    |              |<-----------------------------|              |
    |              |               |              |              |
    |  200 OK F8   |               |              |              |
    |<-------------|               |              |              |
    |              |               |              |              |
    |                     ACK F9                                 |
    |----------------------------------------------------------->|
    |              |               |              |              |
```

               Figure 4: Example for Automatic Call Distribution

Message Details

F1 INVITE Alice -> example.com

```
INVITE sip:Gold@example.com SIP/2.0
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
Max-Forwards: 70
From: Alice <sip:alice@example.com>;tag=1235
To: Gold Member Assistance <sip:Gold@example.com>
Supported: histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
History-Info: <sip:Gold@example.com>;index=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>
```

[SDP Not Shown]

F2 INVITE example.com -> Gold.example.com

```
INVITE sip:Gold@gold.example.com SIP/2.0
Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
Max-Forwards: 69
From: Alice <sip:alice@example.com>;tag=1235
To: Gold Member Assistance <sip:Gold@example.com>
Supported: histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
History-Info: <sip:Gold@example.com>;index=1
History-Info: <sip:Gold@gold.example.com>;rc=1;index=1.1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>
```

[SDP Not Shown]

   F3 302 Moved Temporarily Gold.example.com -> example.com

   SIP/2.0 302 Moved Temporarily
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4;\
                    received=192.0.2.101
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   From: Alice <sip:alice@example.com>;tag=1235
   To: Gold Member Assistance <sip:Gold@example.com>;tag=kkaz-
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:Gold@example.com>;index=1
   History-Info: <sip:Gold@gold.example.com>;rc=1;index=1.1
   Contact: <sip:Silver@example.com>;mp=1
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F4 INVITE example.com -> Silver.example.com

   INVITE sip:Silver@example.com SIP/2.0
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK45q2
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 69
   From: Alice <sip:alice@example.com>;tag=1235
   To: Gold Member Assistance <sip:Gold@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:Gold@example.com>;index=1
   History-Info: <sip:Gold@gold.example.com?Reason=SIP%3Bcause%3D302>;\
                    rc=1;index=1.1
   History-Info: <sip:Silver@example.com>;index=1.2;mp=1
   History-Info: <sip:Silver@silver.example.com>;index=1.2.1;rc=1.2
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

      F5 INVITE Silver.example.com -> Agent

      INVITE sip:Silver@192.0.2.7 SIP/2.0
      Via: SIP/2.0/TCP silver.example.com:5060;branch=z9hG4bKerxs
      Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK45q2;\
                  received=192.0.2.101
      Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
      Max-Forwards: 68
      From: Alice <sip:alice@example.com>;tag=1235
      To: Gold Member Assistance <sip:Gold@example.com>
      Supported: histinfo
      Call-ID: 12345600@example.com
      CSeq: 1 INVITE
      History-Info: <sip:Gold@example.com>;index=1
      History-Info: <sip:Gold@gold.example.com?Reason=SIP%3Bcause%3D302>;\
                  rc=1;index=1.1
      History-Info: <sip:Silver@example.com>;index=1.2;mp=1
      History-Info: <sip:Silver@silver.example.com>;index=1.2.1;rc=1.2
      History-Info: <sip:Silver@192.0.2.7>;index=1.2.1.1;rc=1.2.1
      Contact: Alice <sip:alice@192.0.2.3>
      Content-Type: application/sdp
      Content-Length: <appropriate value>

      [SDP Not Shown]

    F6 200 OK Agent -> Silver.example.com

    SIP/2.0 200 OK
    Via: SIP/2.0/TCP silver.example.com:5060;branch=z9hG4bKerxs;\
                    received=192.0.2.5
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK45q2;\
                    received=192.0.2.101
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
    From: Alice <sip:alice@example.com>;tag=1235
    To: Gold Member Assistance <sip:Gold@example.com>;tag=2325
    Supported: histinfo
    Call-ID: 12345600@example.com
    CSeq: 1 INVITE
    History-Info: <sip:Gold@example.com>;index=1
    History-Info: <sip:Gold@gold.example.com?Reason=SIP%3Bcause%3D302>;\
                    rc=1;index=1.1
    History-Info: <sip:Silver@example.com>;index=1.2;mp=1
    History-Info: <sip:Silver@silver.example.com>;index=1.2.1;rc=1.2
    History-Info: <sip:Silver@192.0.2.7>;index=1.2.1.1;rc=1.2.1
    Contact: Agent <sip:Silver@192.0.2.7>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

    F7 200 OK Silver.example.com -> example.com

    SIP/2.0 200 OK
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK45q2;\
                    received=192.0.2.101
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
    From: Alice <sip:alice@example.com>;tag=1235
    To: Gold Member Assistance <sip:Gold@example.com>;tag=2325
    Supported: histinfo
    Call-ID: 12345600@example.com
    CSeq: 1 INVITE
    History-Info: <sip:Gold@example.com>;index=1
    History-Info: <sip:Gold@gold.example.com?Reason=SIP%3Bcause%3D302>;\
                    rc=1;index=1.1
    History-Info: <sip:Silver@example.com>;index=1.2;mp=1
    History-Info: <sip:Silver@silver.example.com>;index=1.2.1;rc=1.2
    History-Info: <sip:Silver@192.0.2.7>;index=1.2.1.1;rc=1.2.1
    Contact: Agent <sip:Silver@192.0.2.7>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

   F8 200 OK example.com -> Alice

   SIP/2.0 200 OK
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   From: Alice <sip:alice@example.com>;tag=1235
   To: Gold Member Assistance <sip:Gold@example.com>;tag=2325
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:Gold@example.com>;index=1
   History-Info: <sip:Gold@gold.example.com?Reason=SIP%3Bcause%3D302>;\
                  rc=1;index=1.1
   History-Info: <sip:Silver@example.com>;index=1.2;mp=1
   History-Info: <sip:Silver@silver.example.com>;index=1.2.1;rc=1.2
   History-Info: <sip:Silver@192.0.2.7>;index=1.2.1.1;rc=1.2.1
   Contact: Agent <sip:Silver@192.0.2.7>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F9 ACK Alice -> Agent

   ACK sip:Silver@192.0.2.7 SIP/2.0
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t3
   Max-Forwards: 70
   From: Alice <sip:alice@example.com>;tag=1235
   To: Gold Member Assistance <sip:Gold@example.com>;tag=2325
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 ACK
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   The first hi-entry with the "mp" header field parameter contains an
   "mp" header field parameter value of 1, which points to the original-
   target, which allows the operator to identify that the call was from
   the Gold customer.

3.5. Determining the Alias Used

SIP UAs are associated with an AOR. It is possible for a single UA
to actually have multiple AORs associated with it. One common usage
for this is aliases. For example, a user might have an AOR of
sip:john@example.com but also have the AORs
sip:john.smith@example.com and sip:jsmith@example.com. Rather than
registering against each of these AORs individually, the user would
register against just one of them, and the home proxy would
automatically accept incoming calls for any of the aliases, treating
them identically and ultimately forwarding them towards the UA. This
is common practice in the IP Multimedia Subsystem (IMS), where it is
called "implicit registration" and each alias is called a "public
user identity (PUID)".

It is a common requirement for a User Agent Server (UAS), on receipt
of a call, to know which of its aliases was used to reach it. This
knowledge can be used to choose ringtones to play, determine call
treatment, and so on. For example, a user might give out one alias
to friends and family only, resulting in a special ring that alerts
the user to the importance of the call.

The following call flow and example messages show how History-Info
can be used to find out the alias used to reach the callee. The
alias for the call is determined by hi-entry with the index that
matches the value of the last hi-entry with an "rc" header field
parameter in the Request received.

```
          Alice               example.com            John
            |                       | REGISTER F1       |
            |                       |<--------------------|
            |                       | 200 OK F2         |
            |                       |-------------------->|
            |  INVITE F3            |                     |
            |--------------------->|                      |
            |                       | INVITE F4         |
            |                       |-------------------->|
            |                       |                     |
                   * Rest of flow not shown *
```
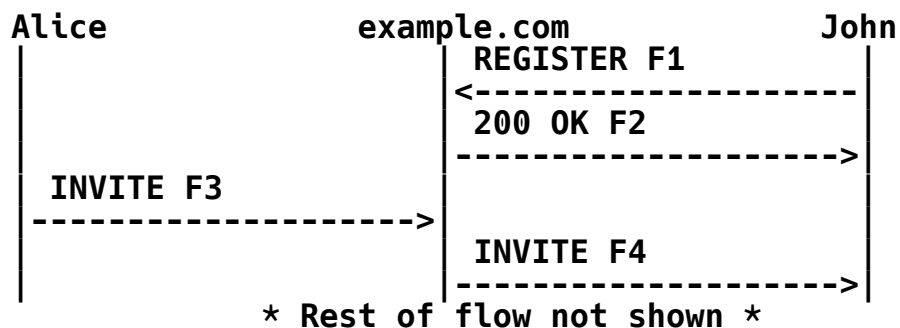
Figure 5: Alias Example

Message Details

F1 REGISTER John -> example.com

REGISTER sip:example.com SIP/2.0
Via: SIP/2.0/TCP 192.0.2.1;branch=z9hG4bKnashds7
Max-Forwards: 70
From: John <sip:john@example.com>;tag=a73kszlfl
To: John <sip:john@example.com>
Supported: histinfo
Call-ID: 1j9FpLxk3uxtm8tn@192.0.2.1
CSeq: 1 REGISTER
Contact: <sip:john@192.0.2.1>
Content-Length: 0

F2 200 OK example.com -> John

SIP/2.0 200 OK
Via: SIP/2.0/TCP 192.0.2.1;branch=z9hG4bKnashds7
From: John <sip:john@example.com>;tag=a73kszlfl
To: John <sip:john@example.com>;tag=d2dstee2
Call-ID: 1j9FpLxk3uxtm8tn@192.0.2.1
CSeq: 1 REGISTER
Contact: <sip:john@192.0.2.1>;expires=3600
Content-Length: 0

F3 INVITE Alice -> example.com

INVITE sip:john.smith@example.com SIP/2.0
Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
Max-Forwards: 70
From: Alice <sip:alice@example.com>;tag=a73kszlfl
To: John <sip:john.smith@example.com>
Supported: histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
History-Info: <sip:john.smith@example.com>;index=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Type: application/sdp
Content-Length: <appropriate value>

[SDP Not Shown]

    F4 INVITE example.com -> John

    INVITE sip:john@192.0.2.1 SIP/2.0
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
    Max-Forwards: 69
    From: Alice <sip:alice@example.com>;tag=a73kszlfl
    To: John <sip:john.smith@example.com>
    Supported: histinfo
    Call-ID: 12345600@example.com
    CSeq: 1 INVITE
    Record-Route: <sip:proxy.example.com;lr>
    History-Info: <sip:john.smith@example.com>;index=1
    History-Info: <sip:john@192.0.2.1>;index=1.1;rc=1
    Contact: Alice <sip:alice@192.0.2.3>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

    The last hi-entry with the "rc" header field parameter references the
    source of retargeting pointing at the alias AOR, which in the example
    is "john.smith@example.com".

3.6. PBX Voicemail Example

    A typical use case for voicemail is one whereby the original called
    party is not reachable and the call arrives at a voicemail system.
    In some cases, multiple alternate destinations may be tried without
    success. The voicemail system typically requires the original called
    party information to determine the appropriate mailbox so an
    appropriate greeting can be provided and the appropriate party
    notified of the message.

    In this example, Alice calls Bob, whose SIP client is forwarded to
    Carol. Carol does not answer the call; thus, it is forwarded to a VM
    (voicemail) server (VMS). In order to determine the appropriate
    mailbox to use for this call, the VMS needs the original target for
    the request. The original target is determined by finding the first
    hi-entry tagged with "rc" or "mp" and using the hi-entry referenced
    by the index of "rc" or "mp" header field parameter as the target for
    determining the appropriate mailbox. This hi-entry is used to
    populate the "target" URI parameter as defined in [RFC4458]. The
    reason associated with the first hi-entry tagged with "rc" or "mp"
    (i.e., 302) could be used to provide a customized voicemail greeting
    and is used to populate the "cause" URI parameter as defined in
    [RFC4458]. Note that some VMSs may also (or instead) use the

information available in the History-Info headers for custom handling
of the VM based on how and why the call arrived at the VMS.

Furthermore, it is the proxy forwarding the call to the VMS that
determines the target of the voicemail; it is the proxy that sets the
target of voicemail, which is also the entity that utilizes [RFC7044]
to find the target that is usually based on local policy installed by
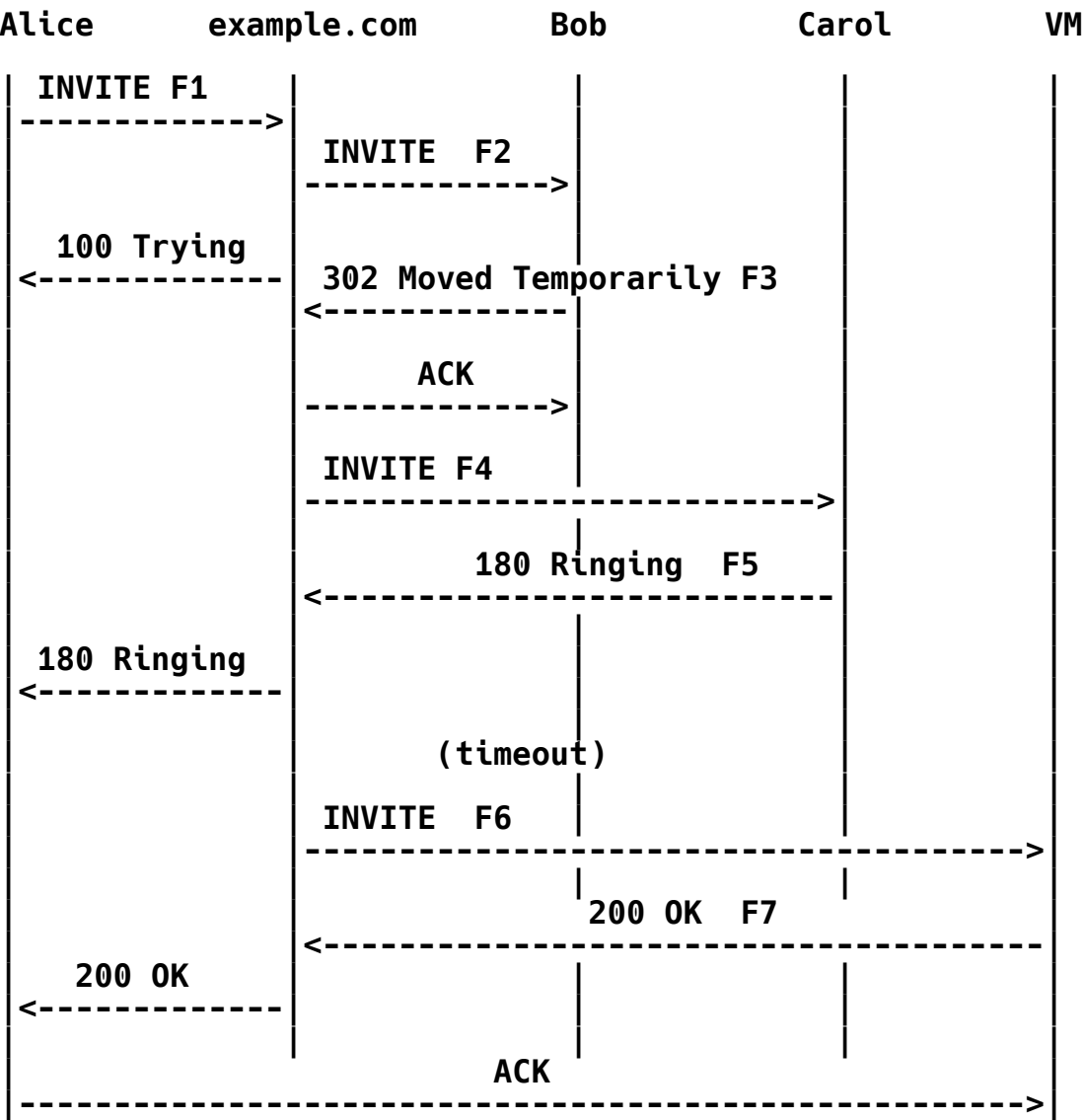the user or an administrator.

```
  Alice        example.com        Bob          Carol          VM
    |             |                |             |             |
    |  INVITE F1  |                |             |             |
    |------------->|               |             |             |
    |             |  INVITE  F2    |             |             |
    |             |--------------->|             |             |
    |             |                |             |             |
    | 100 Trying  |                |             |             |
    |<------------| 302 Moved Temporarily F3     |             |
    |             |<---------------|             |             |
    |             |                |             |             |
    |             |     ACK        |             |             |
    |             |--------------->|             |             |
    |             |                |             |             |
    |             | INVITE F4      |             |             |
    |             |----------------------------->|             |
    |             |                |             |             |
    |             |       180 Ringing  F5        |             |
    |             |<-----------------------------|             |
    |             |                |             |             |
    | 180 Ringing |                |             |             |
    |<------------|                |             |             |
    |             |                |             |             |
    |             |            (timeout)         |             |
    |             |                |             |             |
    |             | INVITE  F6     |             |             |
    |             |------------------------------------------->|
    |             |                |             |             |
    |             |            200 OK  F7        |             |
    |             |<-------------------------------------------|
    | 200 OK      |                |             |             |
    |<------------|                |             |             |
    |             |                |             |             |
    |             |            ACK               |             |
    |------------------------------------------------------->|
```

              Figure 6: Enterprise Voicemail Example

   Message Details

   F1 INVITE Alice -> example.com

   INVITE sip:bob@example.com SIP/2.0
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 70
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F2 INVITE example.com -> Bob

   INVITE sip:bob@192.0.2.5 SIP/2.0
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 69
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5>;index=1.1;rc=1
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F3 302 Moved Temporarily Bob -> example.com

   SIP/2.0 302 Moved Temporarily
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4;\
                     received=192.0.2.101
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>;tag=2g22d-lnf
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5>;index=1.1;rc=1
   Contact: <sip:carol@example.com>;mp=1
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F4 INVITE example.com -> Carol

   INVITE sip:carol@192.0.2.4 SIP/2.0
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK4522
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 69
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302>;\
                     index=1.1;rc=1
   History-Info: <sip:carol@example.com;cause=480>;index=1.2;mp=1
   History-Info: <sip:carol@192.0.2.4;cause=480>;index=1.2.1;rc=1.2
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F5 180 Ringing Carol -> example.com

   SIP/2.0 180 Ringing
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK4522;\
                    received=192.0.2.101
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>;tag=setss3x
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302>;\
                    index=1.1;rc=1
   History-Info: <sip:carol@example.com;cause=480>;index=1.2;mp=1
   History-Info: <sip:carol@192.0.2.4;cause=480>;index=1.2.1;rc=1.2
   Contact: <sip:carol@192.0.2.4>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

    F6 INVITE example.com -> VM

    INVITE sip:vm@192.0.2.6;target=sip:bob%40example.com;cause=480\
                       SIP/2.0
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK4523
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
    Max-Forwards: 69
    From: Alice <sip:alice@example.com>;tag=kkaz-
    To: Bob <sip:bob@example.com>
    Supported: histinfo
    Call-ID: 12345600@example.com
    CSeq: 1 INVITE
    History-Info: <sip:bob@example.com>;index=1
    History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302>;\
                    index=1.1;rc=1
    History-Info: <sip:carol@example.com;cause=480?Reason=SIP%3Bcause%3D\
                    408>;index=1.2;mp=1
    History-Info: <sip:carol@192.0.2.4;cause=480?Reason=SIP%3Bcause%3D\
                    408>;index=1.2.1;rc=1.2
    History-Info: <sip:vm@example.com;\
                    target=sip:bob%40example.com;cause=480>;\
                    index=1.3;mp=1
    History-Info: <sip:vm@192.0.2.6;\
                    target=sip:bob%40example.com;cause=480>;\
                    index=1.3.1;rc=1.3
    Contact: Alice <sip:alice@192.0.2.3>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

```
   F7 200 OK VM -> example.com

   SIP/2.0 200 OK
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK4523;\
                     received=192.0.2.101
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>;tag=3dweggs
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302>;\
                     index=1.1;rc=1
   History-Info: <sip:carol@example.com;cause=480?Reason=SIP%3Bcause%3D\
                     408>;index=1.2;mp=1
   History-Info: <sip:carol@192.0.2.4;cause=480?Reason=SIP%3Bcause%3D\
                     408>;index=1.2.1;rc=1.2
   History-Info: <sip:vm@example.com;\
                     target=sip:bob%40example.com;cause=480>;\
                     index=1.3;mp=1
   History-Info: <sip:vm@192.0.2.6;\
                     target=sip:bob%40example.com;cause=480>;\
                     index=1.3.1;rc=1.3
   Contact: <sip:vm@192.0.2.6>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]
```

   The VMS can look at the last hi-entry and find the target of the
   mailbox by looking at the URI entry in the "target" URI parameter in
   the hi-entry.

3.7. Consumer Voicemail Example

   In the case of a consumer, when the call is retargeted, it is usually
   to another administrative domain. The voicemail system in these
   environments typically requires the last-called-party information to
   determine the appropriate mailbox so an appropriate greeting can be
   provided and the appropriate party notified of the message.

   In this example, Alice calls Bob, but Bob has temporarily forwarded
   his phone to Carol (she is his wife). Carol does not answer the
   call; thus, it is forwarded to a VMS. In order to determine the
   appropriate mailbox to use for this call, the VMS needs the
   appropriate target for the request. The last target is determined by
   finding the hi-entry referenced by the index of last hi-entry tagged

with "mp" for determining the appropriate mailbox. This hi-entry is
used to populate the "target" URI parameter as defined in [RFC4458].
Note that some VMSs may also (or instead) use the information
available in the History-Info headers for custom handling of the VM
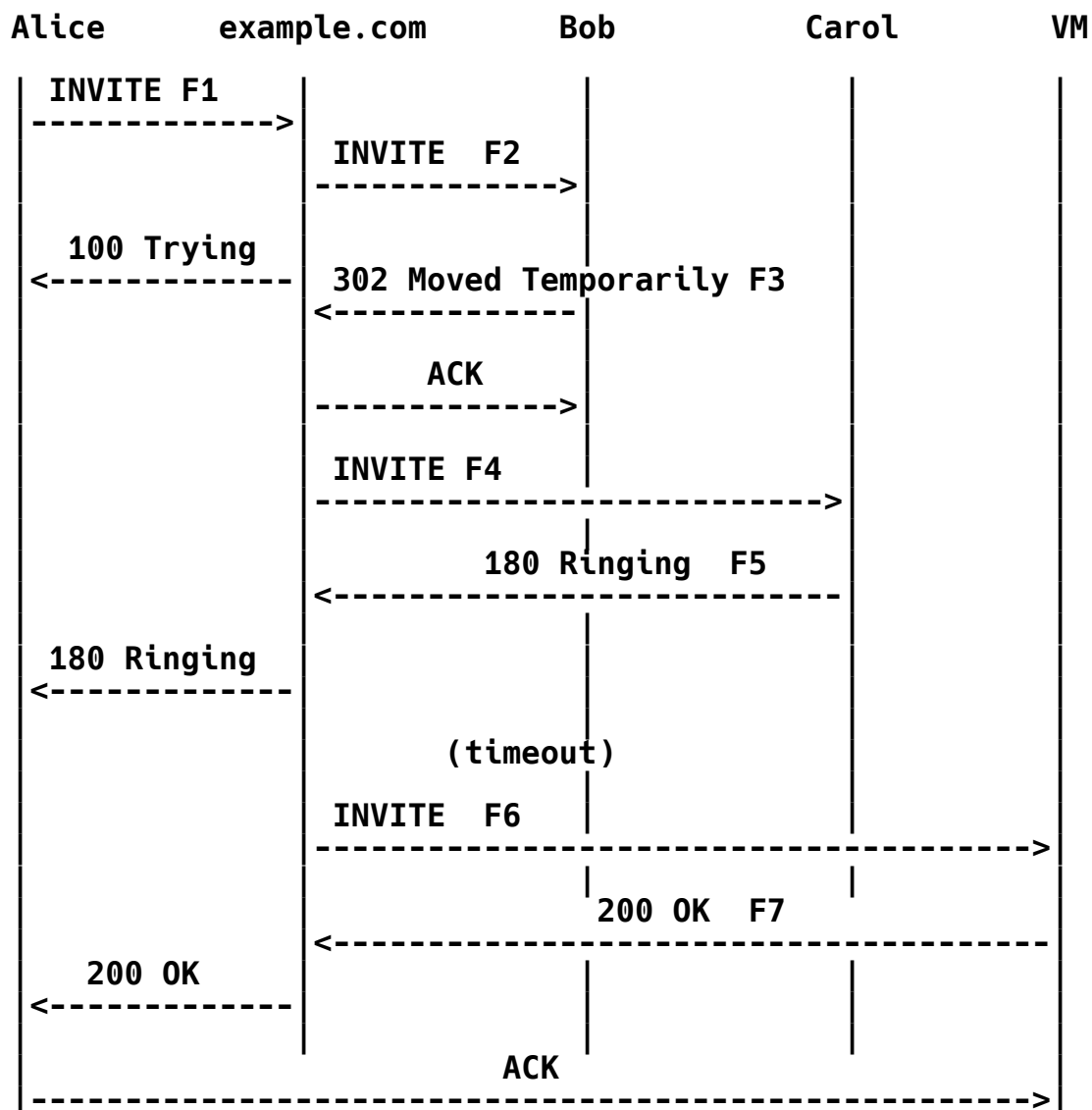in terms of how and why the called arrived at the VMS.

```
     Alice         example.com           Bob           Carol          VM
       |  INVITE F1   |                   |              |            |
       |------------->|                   |              |            |
       |              |    INVITE  F2     |              |            |
       |              |------------------>|              |            |
       |  100 Trying  |                   |              |            |
       |<-------------| 302 Moved Temporarily F3         |            |
       |              |<------------------|              |            |
       |              |       ACK         |              |            |
       |              |------------------>|              |            |
       |              |  INVITE F4        |              |            |
       |              |--------------------------------->|            |
       |              |                   |              |            |
       |              |       180 Ringing  F5            |            |
       |              |<---------------------------------|            |
       |              |                   |              |            |
       | 180 Ringing  |                   |              |            |
       |<-------------|                   |              |            |
       |              |                   |              |            |
       |              |     (timeout)     |              |            |
       |              |  INVITE  F6       |              |            |
       |              |-------------------------------------------->|
       |              |                   |              |            |
       |              |                   | 200 OK  F7   |            |
       |              |<--------------------------------------------|
       |   200 OK     |                   |              |            |
       |<-------------|                   |              |            |
       |              |                   |              |            |
       |              |          ACK      |              |            |
       |--------------------------------------------------------->|
```

                    Figure 7: Consumer Voicemail Example

   Message Details

   F1 INVITE Alice -> example.com

   INVITE sip:bob@example.com SIP/2.0
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 70
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F2 INVITE example.com -> Bob

   INVITE sip:bob@192.0.2.5 SIP/2.0
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 69
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5>;index=1.1;rc=1
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

    F3 302 Moved Temporarily Bob -> example.com

    SIP/2.0 302 Moved Temporarily
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4;\
            received=192.0.2.101
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
    From: Alice <sip:alice@example.com>;tag=kkaz-
    To: Bob <sip:bob@example.com>;tag=224ls3s-t
    Supported: histinfo
    Call-ID: 12345600@example.com
    CSeq: 1 INVITE
    History-Info: <sip:bob@example.com>;index=1
    History-Info: <sip:bob@192.0.2.5>;index=1.1;rc=1
    Contact: <sip:carol@example.com>;mp=1
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

    F4 INVITE example.com -> Carol

    INVITE sip:carol@192.0.2.4 SIP/2.0
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK24s5
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
    Max-Forwards: 69
    From: Alice <sip:alice@example.com>;tag=kkaz-
    To: Bob <sip:bob@example.com>
    Supported: histinfo
    Call-ID: 12345600@example.com
    CSeq: 1 INVITE
    History-Info: <sip:bob@example.com>;index=1
    History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302\
                %3Btext%3D%22Moved%20Temporarily%22>\
                ;index=1.1;rc=1
    History-Info: <sip:carol@example.com>;index=1.2;mp=1
    History-Info: <sip:carol@192.0.2.4>;index=1.2.1;rc=1.2
    Contact: Alice <sip:alice@192.0.2.3>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

```
   F5 180 Ringing Carol -> example.com

   SIP/2.0 180 Ringing
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK24s5;\
           received=192.0.2.101
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>;tag=setss3x
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302\
               %3Btext%3D%22Moved%20Temporarily%22>;\
               index=1.1;rc=1
   History-Info: <sip:carol@example.com>;index=1.2;mp=1
   History-Info: <sip:carol@192.0.2.4>;index=1.2.1;rc=1.2
   Contact: <sip:carol@192.0.2.4>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]
```

```
   F6 INVITE example.com -> VM

   INVITE sip:vm@192.0.2.6;target=sip:carol%40example.com SIP/2.0
   Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKbbg4
   Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 69
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: Bob <sip:bob@example.com>
   Supported: histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   History-Info: <sip:bob@example.com>;index=1
   History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302\
                 %3Btext%3D%22Moved%20Temporarily%22>;\
                 index=1.1;rc=1
   History-Info: <sip:carol@example.com>;\
                 index=1.2;mp=1
   History-Info: <sip:carol@192.0.2.4?Reason=SIP%3Bcause%3D408>;\
                 index=1.2.1;rc=1.2
   History-Info: <sip:vm@example.com;target=sip:carol%40example.com;\
                 cause=408>;index=1.2.2;mp=1.2
   History-Info: <sip:vm@192.0.2.5;target=sip:carol%40example.com;\
                 cause=408>;index=1.2.2.1;rc=1.2.2
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]
```

       F7 200 OK VM -> example.com

       SIP/2.0 200 OK
       Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bKbbg4
       Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
       From: Alice <sip:alice@example.com>;tag=kkaz-
       To: Bob <sip:bob@example.com>;tag=3dweggs
       Supported: histinfo
       Call-ID: 12345600@example.com
       CSeq: 1 INVITE
       History-Info: <sip:bob@example.com>;index=1
       History-Info: <sip:bob@192.0.2.5?Reason=SIP%3Bcause%3D302\
                   %3Btext%3D%22Moved%20Temporarily%22>;\
                   index=1.1;rc=1
       History-Info: <sip:carol@example.com>;\
                   index=1.2;mp=1
       History-Info: <sip:carol@192.0.2.4?Reason=SIP%3Bcause%3D408>;\
                   index=1.2.1;rc=1.2
       History-Info: <sip:vm@example.com;target=sip:carol%40example.com;\
                   cause=408>;index=1.2.2;mp=1.2
       History-Info: <sip:vm@192.0.2.5;target=sip:carol%40example.com;\
                   cause=408>;index=1.2.2.1;rc=1.2.2
       Contact: <sip:carol@192.0.2.5>
       Content-Type: application/sdp
       Content-Length: <appropriate value>

       [SDP Not Shown]

       The VMS can look at the last hi-entry and find the target of the
       mailbox by looking for the "target" URI parameter in the hi-entry and
       the reason by the "cause" URI parameter in the same hi-entry.

3.8. GRUU

       A variation on the problem in Section 3.5 occurs with Globally
       Routable User Agent URI (GRUU) [RFC5627]. A GRUU is a URI assigned
       to a UA instance that has many of the same properties as the AOR but
       causes requests to be routed only to that specific instance. It is
       desirable for a UA to know whether it was reached because a
       correspondent sent a request to its GRUU or to its AOR. This can be
       used to drive differing authorization policies on whether the request
       should be accepted or rejected, for example. However, like the AOR
       itself, the GRUU is lost in translation at the home proxy. Thus, the
       UAS cannot know whether it was contacted via the GRUU or its AOR.

The following call flow and example messages show how History-Info
can be used to find out the GRUU used to reach the callee.

While a GRUU is comprised of an AOR with a URI parameter, as defined
in [RFC5627], the GRUU construct itself is not an AOR. Thus, the
retargeting of a request based on a GRUU does not result in the
addition of an "rc" header field parameter to the hi-entry containing
the GRUU. The lack of an "rc" header field parameter in the hi-
entries can be a hint that the source of retargeting is a GRUU.
However, to ensure this is the case, the UAS needs to search for a
"gr" parameter in the hi-entry prior to the last hi-entry. If there
is a GRUU, the URI will always be prior to the last hi-entry as the
GRUU does not allow multiple instance to be mapped to a contact
address.

```
            Alice              example.com              John
              |                     | REGISTER F1       |
              |                     |<----------------------
              |                     | 200 OK F2         |
              |                     |-------------------->|
              |   INVITE F3         |                   |
              |-------------------->|                   |
              |                     |   INVITE F4       |
              |                     |-------------------->|
              |                     |                   |
                       * Rest of flow not shown *
```
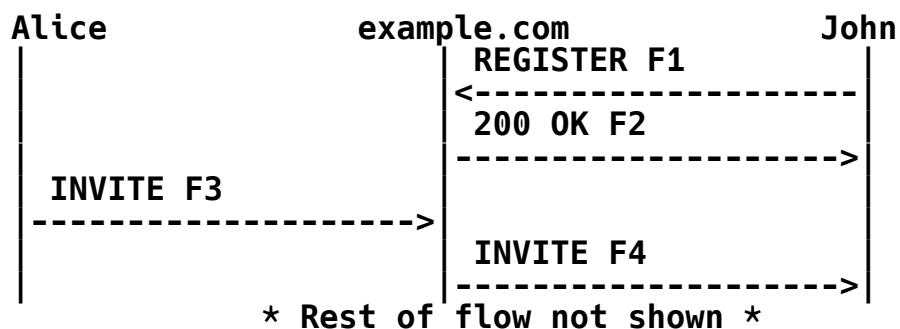
Figure 8: GRUU Example

Message Details

F1 REGISTER John -> example.com

REGISTER sip:example.com SIP/2.0
Via: SIP/2.0/UDP 192.0.2.1;branch=z9hG4bKnashds7
Max-Forwards: 70
From: John <sip:John@example.com>;tag=a73kszlfl
Supported: gruu
To: John <sip:john@example.com>
Call-ID: 1j9FpLxk3uxtm8tn@192.0.2.1
CSeq: 1 REGISTER
Contact: <sip:john@192.0.2.1>;+sip.instance=\
    <urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>
Content-Length: 0

[SDP Not Shown]

F2 200 OK example.com -> John

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP 192.0.2.1;branch=z9hG4bKnashds7
From: John <sip:john@example.com>;tag=a73kszlfl
To: John <sip:john@example.com> ;tag=b88sn
Call-ID: 1j9FpLxk3uxtm8tn@192.0.2.1
CSeq: 1 REGISTER
Contact: <sip:john@192.0.2.1>;\
    pub-gruu="sip:john@example.com;\
    gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6";\
    temp-gruu=\
    "sip:tgruu.7hs==jd7vnzga5w7fajsc7-ajd6fabz0f8g5@example.com;\
  gr";+sip.instance=\
    "<urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>";\
    expires=3600
  Content-Length: 0
```

[SDP Not Shown]

Assuming Alice has knowledge of a GRUU either through
prior communication or through other means such as presence
places a call to John's GRUU.

F3 INVITE Alice -> example.com

```
INVITE sip:john@example.com;\
    gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6 SIP/2.0
Via: SIP/2.0/TCP  192.0.2.3:5060;branch=z9hG4bK42t2
Max-Forwards: 70
From: Alice <sip:alice@example.com>;tag=kkaz-
To: <sip:john@example.com;\
    gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>
Supported: gruu, histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
History-Info: <sip:john@example.com;\
    gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>;index=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Length: <appropriate value>
```

[SDP Not Shown]

    F4 INVITE example.com -> John

    INVITE sip:john@192.0.2.1 SIP/2.0
    Via: SIP/2.0/TCP proxy.example.com:5060;branch=z9hG4bK12s4
    Via: SIP/2.0/TCP 192.0.2.3:5060;branch=z9hG4bK42t2
    Max-Forwards: 69
    From: Alice <sip:alice@example.com>;tag=kkaz-
    To: <sip:john@example.com;\
        gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>
    Supported: gruu, histinfo
    Call-ID: 12345600@example.com
    CSeq: 1 INVITE
    Record-Route: <sip:proxy.example.com;lr>
    History-Info: <sip:john@example.com;\
        gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>;index=1
    History-Info: <sip:john@192.0.2.1>;index=1.1;rc=1
    Contact: Alice <sip:alice@192.0.2.3>
    Content-Type: application/sdp
    Content-Length: <appropriate value>

    [SDP Not Shown]

    By analyzing the entry referenced by the entry with the last "rc",
    one can realize that the URI used to reach the device was GRUU by
    finding the "gr" parameter.

3.9. Limited-Use Address

    A limited-use address is a SIP URI that is minted on-demand, and
    passed out to a small number (usually one) of remote correspondents.
    Incoming calls targeted to that limited-use address are accepted as
    long as the UA still desires communications from the remote target.
    Should they no longer wish to be bothered by that remote
    correspondent, the URI is invalidated so that future requests
    targeted to it are rejected.

    Limited-use addresses are used in battling voice spam [RFC5039]. The
    easiest way to provide them would be for a UA to be able to take its
    AOR and "mint" a limited-use address by appending additional
    parameters to the URI. It could then give out the URI to a
    particular correspondent and remember that URI locally. When an
    incoming call arrives, the UAS would examine the parameter in the URI
    and determine whether or not the call should be accepted.
    Alternatively, the UA could push authorization rules into the
    network, so that it need not even see incoming requests that are to
    be rejected.

This approach, especially when executed on the UA, requires that
parameters attached to the AOR, but not used by the home proxy in
processing the request, survive the translation at the home proxy and
be presented to the UA. This will not be the case with the logic in
RFC 3261, since the Request-URI is replaced by the registered
contact, and any such parameters are lost.

Using the History-Info, John's UA can easily see if the call was
addressed to its AOR, GRUU, or a temp-GRUU and treat the call
accordingly by looking for a "gr" tag in the hi-entry prior to the
last hi-entry.

```
         Alice              example.com                John
           |                     | REGISTER F1          |
           |                     |<--------------------- |
           |                     | 200 OK F2            |
           |                     |--------------------->|
           |   INVITE F3         |                      |
           |-------------------->|                      |
           |                     | INVITE F4            |
           |                     |--------------------->|
           |                     |                      |
                       * Rest of flow not shown *
```
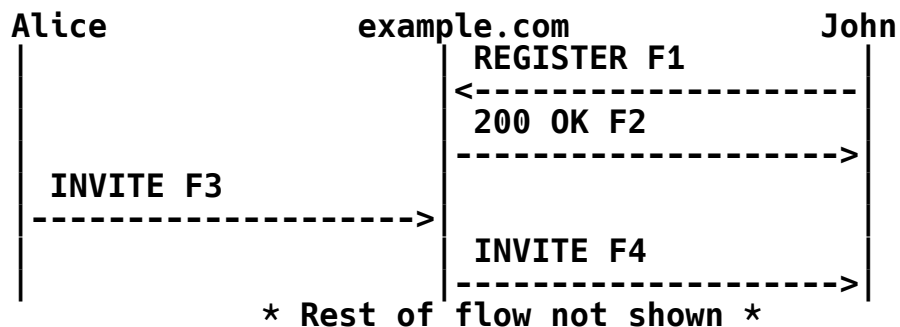
                 Figure 9: Limited-Use Address Example

Message Details

F1 REGISTER John -> example.com

REGISTER sip:example.com SIP/2.0
Via: SIP/2.0/UDP 192.0.2.1;branch=z9hG4bKnashds7
Max-Forwards: 70
From: John <sip:John@example.com>;tag=a73kszlfl
Supported: gruu
To: John <sip:john@example.com>
Call-ID: 1j9FpLxk3uxtm8tn@192.0.2.1
CSeq: 1 REGISTER
Contact: <sip:john@192.0.2.1>;\
   +sip.instance="<urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>"
Content-Length: 0

```
F2 200 OK example.com -> John

SIP/2.0 200 OK
Via: SIP/2.0/UDP 192.0.2.1;branch=z9hG4bKnashds7
From: John <sip:john@example.com>;tag=a73kszlfl
To: John <sip:john@example.com> ;tag=b88sn
Call-ID: 1j9FpLxk3uxtm8tn@192.0.2.1
CSeq: 1 REGISTER
Contact: <sip:john@192.0.2.1>;\
   pub-gruu="sip:john@example.com;\
   gr=urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6";\
   temp-gruu=\
   "sip:tgruu.7hs==jd7vnzga5w7fajsc7-ajd6fabz0f8g5@example.com;gr";\
   +sip.instance="<urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6>";\
   expires=3600
Content-Length: 0

  Assuming Alice has knowledge of a temp-GRUU, she places a
  call to the temp-GRUU.


F3 INVITE Alice -> example.com

INVITE sip:tgruu.7hs==jd7vnzga5w7fajsc7-ajd6fabz0f8g5@example.com;\
      gr SIP/2.0
Via: SIP/2.0/UDP 192.0.2.3:5060;branch=z9hG4bK42t2
Max-Forwards: 70
From: Alice <sip:alice@example.com>;tag=kkaz-
To: <sip:tgruu.7hs==jd7vnzga5w7fajsc7-ajd6fabz0f8g5@example.com\
  ;gr>
Supported: gruu, histinfo
Call-ID: 12345600@example.com
CSeq: 1 INVITE
History-Info: \
 <sip:tgruu.7hs==jd7vnzga5w7fajsc7-ajd6fabz0f8g5@example.com;gr>\
 ;index=1
Contact: Alice <sip:alice@192.0.2.3>
Content-Length: <appropriate value>
```

```
   F4 INVITE example.com -> John

   INVITE sip:john@192.0.2.1 SIP/2.0
   Via: SIP/2.0/UDP proxy.example.com:5060;branch=z9hG4bK12s4
   Via: SIP/2.0/UDP 192.0.2.3:5060;branch=z9hG4bK42t2
   Max-Forwards: 69
   From: Alice <sip:alice@example.com>;tag=kkaz-
   To: <sip:tgruu.7hs==jd7vnzga5w7fajsc7-ajd6fabz0f8g5@example.com\
     ;gr>
   Supported: gruu, histinfo
   Call-ID: 12345600@example.com
   CSeq: 1 INVITE
   Record-Route: <sip:proxy.example.com;lr>
   History-Info: \
    <sip:tgruu.7hs==jd7vnzga5w7fajsc7-ajd6fabz0f8g5@example.com;gr>\
     ;index=1
   History-Info: <sip:john@192.0.2.1>;index=1.1;rc=1
   Contact: Alice <sip:alice@192.0.2.3>
   Content-Type: application/sdp
   Content-Length: <appropriate value>
```

   By analyzing the entry referenced by the entry with the last "rc",
   one can realize that the URI used to reach the device was GRUU by
   finding the "gr" parameter.

3.10. Service Invocation

   Several SIP specifications have been developed that make use of
   complex URIs to address services within the network rather than
   subscribers. The URIs are complex because they contain numerous
   parameters that control the behavior of the service. Examples of
   this include the specification that first introduced the concept,
   [RFC3087], control of network announcements and Interactive Voice
   Response (IVR) with SIP URI [RFC4240], and control of voicemail
   access with SIP URI [RFC4458].

   A common problem with all of these mechanisms is that once a proxy
   has decided to rewrite the Request-URI to point to the service, it
   cannot be sure that the Request-URI will not be destroyed by a
   downstream proxy that decides to forward the request in some way, and
   does so by rewriting the Request-URI.

   Section 3.6 shows how History-Info can be used to invoke a service.

3.11. Toll-Free Number

   Toll-free numbers, also known in the United States as 800 or 8xx
   numbers, are telephone numbers that are free for users to call.

   In the telephone network, toll-free numbers are just aliases to
   actual numbers that are used for routing of the call. In order to
   process the call in the PSTN, a switch will perform a query (using a
   protocol called Transaction Capabilities Application Part (TCAP)),
   which will return either a phone number or the identity of a carrier
   which can handle the call.

   There has been recent work on allowing such PSTN translation services
   to be accessed by SIP proxy servers through IP querying mechanisms.
   For example, ENUM [RFC6117] has already been proposed as a mechanism
   for performing Number Portability (NP) queries [RFC4769]. Using it
   for 8xx number translations is a logical next step.

   The new target from translating the 8xx number may be in the PSTN or
   in the SIP network. If the new target is an entity in the PSTN, the
   proper treatment in the PSTN (and in particular, correct
   reconciliation of billing records) requires that the call be marked
   with both the originating number (8xx number) and the new target
   number, History-info would come in play here to assure original 8xx
   number is not lost.

   Although not required to have both the originating number (8xx
   number) and the new target in the SIP network, an enterprise or user
   who utilize the 8xx service can benefit by knowing whether the call
   came in via an 8xx number in order to treat the call differently (for
   example, to play a special announcement), but if the original
   Request-URI is lost through translation, there is no way to tell if
   the call came in via 8xx number. History-Info again would come in
   play here.

   Similar problems arise with other "special" numbers and services used
   in the PSTN, such as operator services, pay/premium numbers (9xx
   numbers in the United States), and short service codes such as 311.

   To find the service number, the UAS can extract the hi-entry whose
   index matches the value of the first hi-entry with an "mp" tag.
   Technically, the call can be forwarded to these "special" numbers
   from non-special numbers; however, that is uncommon based on the way
   these services authorize translations.

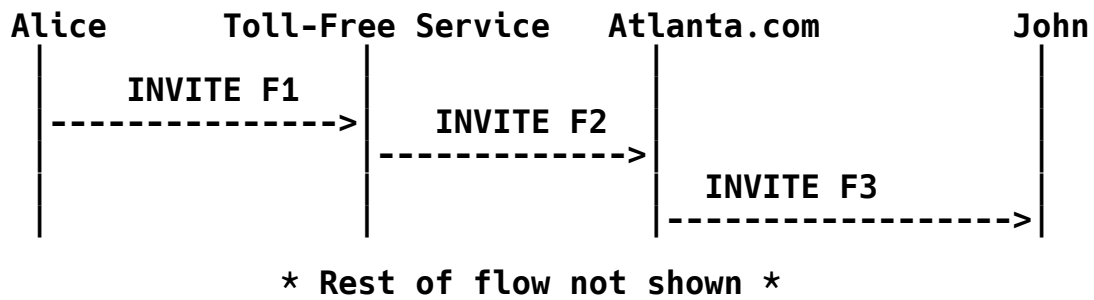   This example call flow shows a UAC that does not support History-
   Info.

```
            Alice        Toll-Free Service   Atlanta.com        John
              |               |               |                  |
              |   INVITE F1   |               |                  |
              |-------------->|   INVITE F2   |                  |
              |               |-------------->|                  |
              |               |               |    INVITE F3     |
              |               |               |----------------->|
              |               |               |                  |
```

              * Rest of flow not shown *

              Figure 10: Service Number Example

   Message Details

   F1 INVITE 192.0.2.1 -> Toll-Free Service

   INVITE sip:+18005551002@example.com;user=phone SIP/2.0
   Via: SIP/2.0/TCP 192.0.2.1:5060;branch=z9hG4bK74bf
   From: Alice <sip:+15551001@example.com;user=phone>;tag=9fxced76sl
   To: <sip:+18005551002@example.com;user=phone>
   Call-ID: c3x842276298220188511
   CSeq: 1 INVITE
   Max-Forwards: 70
   Contact: <sip:alice@192.0.2.1>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F2 INVITE Toll-Free Service -> Atlanta.com

   INVITE sip:+15555551002@atlanta.com SIP/2.0
   Via: SIP/2.0/TCP 192.0.2.4:5060;branch=z9hG4bK-ik8
   Via: SIP/2.0/TCP 192.0.2.1:5060;branch=z9hG4bK74bf
   From: Alice <sip:+15551001@example.com;user=phone>;tag=9fxced76sl
   To: <sip:+18005551002@example.com;user=phone>
   Call-ID: c3x842276298220188511
   CSeq: 1 INVITE
   Max-Forwards: 69
   Supported: histinfo
   History-Info: <sip:+18005551002@example.com;user=phone>;index=1
   History-Info: <sip:+15555551002@atlanta.com>;index=1.1;mp=1
   Contact: <sip:alice@192.0.2.1>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

   F3 INVITE Atlanta.com -> John

   INVITE sip:john@198.51.100.2 SIP/2.0
   Via: SIP/2.0/TCP 198.51.100.1:5060;branch=z9hG4bKpxk7g
   Via: SIP/2.0/TCP 192.0.2.4:5060;branch=z9hG4bK-ik8
   Via: SIP/2.0/TCP 192.0.2.1:5060;branch=z9hG4bK74bf
   From: Alice <sip:+15551001@example.com;user=phone>;tag=9fxced76sl
   To: <sip:+18005551002@example.com;user=phone>
   Call-ID: c3x842276298220188511
   CSeq: 1 INVITE
   Max-Forwards: 68
   Supported: histinfo
   History-Info: <sip:+18005551002@example.com;user=phone>;index=1
   History-Info: <sip:+15555551002@atlanta.com>;index=1.1;mp=1
   History-Info: <sip:john@atlanta.com>;index=1.1.1;rc=1.1
   History-Info: <sip:john@198.51.100.2>;index=1.1.1.1;rc=1.1.1
   Contact: <sip:alice@192.0.2.1>
   Content-Type: application/sdp
   Content-Length: <appropriate value>

   [SDP Not Shown]

4. Security Considerations

The security considerations for the History-Info header field are
specified in [RFC7044].

5. Acknowledgements

Jonathan Rosenberg, et al produced the document that provided
additional use cases precipitating the requirement for the new
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