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

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Abstract

This document describes use cases and documents call flows which 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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Table of Contents

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 [I-D.ietf-sipcore-rfc4244bis] for example applications and common scenarios. The optional "rc" and "mp" header field parameters defined in [I-D.ietf-sipcore-rfc4244bis] 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 [I-D.ietf-sipcore-rfc4244bis]. The terms "location service", "redirect" and "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 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 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 "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-Forward: 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-Forward: 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-Forward: 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-Forward: 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-Forward: 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-Forward: 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-Forward: 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 example provides a basic call scenario without forking. Alice has indicated that she wants Privacy associated with the History-Info header field entries. In addition, sip:biloxi.example.com adds Privacy header fields indicating that the History-Info header field information is anonymized outside the biloxi.example.com domain. Note, that if the atlanta.example.com proxy had added privacy header fields to all its hi-entries, then all the hi-entries in the response would be anonymous.

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

 |                |                |                |
 |   INVITE F1    |                |                |
 |--------------->|                |                |
 |                |                |                |
 |                |   INVITE F2    |                |
 |                |--------------->|                |
 |                |                |                |
 |                |                | INVITE F3      |
 |                |                |--------------->|
 |                |                |                |
 |                |                |     200 F4     |
 |                |                |<---------------|
 |                |                |                |
 |                |     200 F5     |                |
 |                |<---------------|                |
 |                |                |                |
 |     200 F6     |                |                |
 |<---------------|                |                |
 |                |                |                |
```

```
   |                |       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-Forward: 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-Forward: 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:anonymous@anonymous.invalid>;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

```
INVITE sip:bob@192.0.1.11 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-Forward: 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:anonymous@anonymous.invalid>;index=1
History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
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=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
   Supported: histinfo
   Call-Id: 12345600@atlanta.example.com
   CSeq: 1 INVITE
   History-Info: <sip:anonymous@anonymous.invalid>;index=1
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
   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:anonymous@anonymous.invalid>;index=1
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
   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:anonymous@anonymous.invalid>;index=1
   History-Info: <sip:bob@biloxi.example.com;p=x>;index=1.1
   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 -->
```

3.3. 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-Forward: 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-Forward: 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-Forward: 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 an 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 by the agent - 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 is not addressing 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                         |
   |------------------------------------------------------->|
```

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-Forward: 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-Forward: 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-Forward: 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-Forward: 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-Forward: 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]
```

Figure 4: Example for Automatic Call Distribution

The first hi-entry with the "mp" header field parameter contains a "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 user agents are associated with an address-of-record (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 Internet 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 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 a "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 *
```

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]
```


Figure 5: Alias Example

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 in terms of how and why the call arrived at the VMS.

Furthermore it is the proxy forwarding the call to 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 RFC4244bis to find the target which 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                       |
|------------------------------------------------->|
```

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-Forward: 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-Forward: 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-Forward: 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-Forward: 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]
```

Figure 6: Enterprise Voivemail Example

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 environment 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 the Bob but Bob has temporarily forwarded his phone to Carol because she is his wife. 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 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                          |
   |----------------------------------------------------->|
```

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-Forward: 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-Forward: 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-Forward: 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-Forward: 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]
```

Figure 7: Consumer Voivemail Example

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 which 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.

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 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 *
```

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 a 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-Forward: 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-Forward: 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]
```

Figure 8: GRUU Example

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) remote correspondent. 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, will 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 *
```

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 a 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-Forward: 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-Forward: 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>
```

Figure 9: Limited Use Address Example

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 which 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 which first introduced the concept, [RFC3087], control of network announcements and 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 which decides to forward the request in some way, and does so by rewriting the Request-URI.

Section on voicemail (Section 3.6) shows how History-Info can be used to invocate a service.

3.11. Toll Free Number

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

In the telephone network, toll free numbers are just aliases to actual numbers which 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 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. ENUM, for example [RFC6117] has already been proposed as a mechanism for performing Local Number Portability (LNP) queries [RFC4769], and recently been proposed for performing calling name queries [I-D.ietf-enum-cnam]. Using it for 8xx number translations is a logical next-step.

Once such a translation has been performed, the call needs to be routed towards the target of the request. Normally, this would happen by selecting a PSTN gateway which is a good route towards the translated number. However, one can imagine all-IP systems where the 8xx numbers are SIP endpoints on an IP network, in which case the translation of the 8xx number would actually be a SIP URI and not a phone number. Assuming for the moment it is a PSTN connected entity, the call would be routed towards a PSTN gateway. Proper treatment of the call in the PSTN (and in particular, correct reconciliation of billing records) requires that the call be marked with both the

original 8xx number AND the target number for the call. However, in our example here, since the translation was performed by a SIP proxy upstream from the gateway, the original 8xx number would have been lost, and the call will not interwork properly with the PSTN. History-info would come in play here to assure original 8xx number is not lost.

Furthermore, even if the translation of the 8xx number was a SIP URI, the enterprise or user who utilize the 8xx service would like to know whether the call came in via 8xx number in order to treat the call differently (for example to play a special announcement..) but if the original R-URI is lost through translation, there is no way to tell if the call came in via 8xx number.

Similar problems arise with other "special" numbers and services used in the PSTN, such as operator services, pay/premium numbers (9xx numbers in the U.S), 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 an 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 *
```

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]
```

Figure 10: Service Number Example

4. Security Considerations

The security considerations for the History-Info header field are specified in [I-D.ietf-sipcore-rfc4244bis].

5. IANA Considerations

This document has no IANA considerations.

5.1. Acknowledgements

Jonathan Rosenberg et al produced the document that provided additional use cases precipitating the requirement for the new "target" parameter in the History-Info header field and the new SIP/SIPS URI parameter. Hadriel Kaplan provided some comments.

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