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Session Initiation Protocol (SIP) Basic Call Flow Examples

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Abstract

This document gives examples of Session Initiation Protocol (SIP) call flows. Elements in these call flows include SIP User Agents and Clients, SIP Proxy and Redirect Servers. Scenarios include SIP Registration and SIP session establishment. Call flow diagrams and message details are shown.

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1. Overview

The call flows shown in this document were developed in the design of a SIP IP communications network. They represent an example minimum set of functionality.

It is the hope of the authors that this document will be useful for SIP implementers, designers, and protocol researchers alike and will help further the goal of a standard implementation of RFC 3261 [1]. These flows represent carefully checked and working group reviewed scenarios of the most basic examples as a companion to the specifications.

These call flows are based on the current version 2.0 of SIP in RFC 3261 [1] with SDP usage described in RFC 3264 [2]. Other RFCs also comprise the SIP standard but are not used in this set of basic call flows.

Call flow examples of SIP interworking with the PSTN through gateways are contained in a companion document, RFC 3666 [5].

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14, RFC 2119 [4].

1.1. General Assumptions

A number of architecture, network, and protocol assumptions underlie the call flows in this document. Note that these assumptions are not requirements. They are outlined in this section so that they may be taken into consideration and to aid in the understanding of the call flow examples.

The authentication of SIP User Agents in these example call flows is performed using HTTP Digest as defined in [1] and [3].

Some Proxy Servers in these call flows insert Record-Route headers into requests to ensure that they are in the signaling path for future message exchanges.

These flows show TCP, TLS, and UDP for transport. See the discussion in RFC 3261 for details on the transport issues for SIP.

1.2. Legend for Message Flows

Dashed lines (---) represent signaling messages that are mandatory to the call scenario. These messages can be SIP or PSTN signaling. The arrow indicates the direction of message flow.

Double dashed lines (===) represent media paths between network elements.

Messages with parentheses around their name represent optional messages.

Messages are identified in the Figures as F1, F2, etc. This references the message details in the list that follows the Figure. Comments in the message details are shown in the following form:

```
 /* Comments. */
```

1.3. SIP Protocol Assumptions

This document does not prescribe the flows precisely as they are shown, but rather the flows illustrate the principles for best practice. They are best practices usages (orderings, syntax, selection of features for the purpose, handling of error) of SIP methods, headers and parameters. IMPORTANT: The exact flows here must not be copied as is by an implementer due to specific incorrect characteristics that were introduced into the document for convenience and are listed below. To sum up, the basic flows represent well-reviewed examples of SIP usage, which are best common practice according to IETF consensus.

For simplicity in reading and editing the document, there are a number of differences between some of the examples and actual SIP messages. For example, the HTTP Digest responses are not actual MD5 encodings. Call-IDs are often repeated, and CSeq counts often begin at 1. Header fields are usually shown in the same order. Usually only the minimum required header field set is shown, others that would normally be present such as Accept, Supported, Allow, etc are not shown.

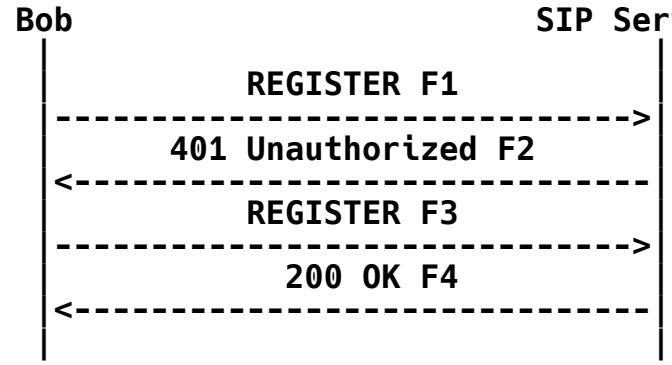
Actors:

Element	Display Name	URI	IP Address
User Agent	Alice	alice@atlanta.example.com	192.0.2.101
User Agent	Bob	bob@biloxi.example.com	192.0.2.201
User Agent		bob@chicago.example.com	192.0.2.100
Proxy Server		ss1.atlanta.example.com	192.0.2.111
Proxy/Registrar		ss2.biloxi.example.com	192.0.2.222
Proxy Server		ss3.chicago.example.com	192.0.2.233
ALG		alg1.atlanta.example.com	192.0.2.128

2. SIP Registration

Registration binds a particular device Contact URI with a SIP user Address of Record (AOR).

2.1. Successful New Registration



Bob sends a SIP REGISTER request to the SIP server. The request includes the user's contact list. This flow shows the use of HTTP Digest for authentication using TLS transport. TLS transport is used due to the lack of integrity protection in HTTP Digest and the danger of registration hijacking without it, as described in RFC 3261 [1]. The SIP server provides a challenge to Bob. Bob enters her/his valid user ID and password. Bob's SIP client encrypts the user information according to the challenge issued by the SIP server and sends the response to the SIP server. The SIP server validates the user's credentials. It registers the user in its contact database and returns a response (200 OK) to Bob's SIP client. The response includes the user's current contact list in Contact headers. The format of the authentication shown is HTTP digest. It is assumed that Bob has not previously registered with this Server.

Message Details

F1 REGISTER Bob -> SIP Server

```
REGISTER sips:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
Max-Forwards: 70
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Contact: <sips:bob@client.biloxi.example.com>
Content-Length: 0
```

F2 401 Unauthorized SIP Server -> Bob

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>;tag=1410948204
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
WWW-Authenticate: Digest realm="atlanta.example.com", qop="auth",
 nonce="ea9c8e88df84f1cec4341ae6cbe5a359",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

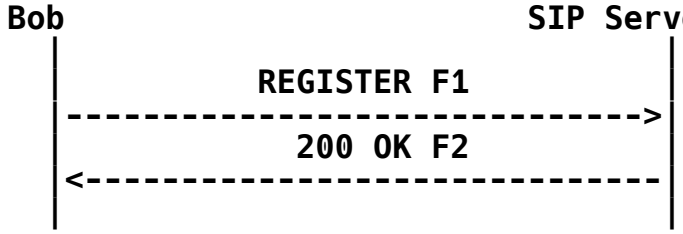
F3 REGISTER Bob -> SIP Server

```
REGISTER sips:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashd92
Max-Forwards: 70
From: Bob <sips:bob@biloxi.example.com>;tag=ja743ks76zlflH
To: Bob <sips:bob@biloxi.example.com>
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 2 REGISTER
Contact: <sips:bob@client.biloxi.example.com>
Authorization: Digest username="bob", realm="atlanta.example.com"
 nonce="ea9c8e88df84f1cec4341ae6cbe5a359", opaque="",
 uri="sips:ss2.biloxi.example.com",
 response="dfe56131d1958046689d83306477ecc"
Content-Length: 0
```

F4 200 OK SIP Server -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashd92
 ;received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=ja743ks76zlflH
To: Bob <sips:bob@biloxi.example.com>;tag=37GkEhwl6
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 2 REGISTER
Contact: <sips:bob@client.biloxi.example.com>;expires=3600
Content-Length: 0
```

2.2. Update of Contact List



Bob wishes to update the list of addresses where the SIP server will redirect or forward INVITE requests.

Bob sends a SIP REGISTER request to the SIP server. Bob's request includes an updated contact list. Since the user already has authenticated with the server, the user supplies authentication credentials with the request and is not challenged by the server. The SIP server validates the user's credentials. It registers the user in its contact database, updates the user's contact list, and returns a response (200 OK) to Bob's SIP client. The response includes the user's current contact list in Contact headers.

Message Details

F1 REGISTER Bob -> SIP Server

```
REGISTER sips:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
Max-Forwards: 70
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Contact: mailto:bob@biloxi.example.com
Authorization: Digest username="bob", realm="atlanta.example.com",
 qop="auth", nonce="1cec4341ae6cbe5a359ea9c8e88df84f", opaque="",
 uri="sips:ss2.biloxi.example.com",
 response="71ba27c64bd01de719686aa4590d5824"
Content-Length: 0
```

F2 200 OK SIP Server -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>;tag=34095828jh
```

```
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Contact: <sips:bob@client.biloxi.example.com>;expires=3600
Contact: <mailto:bob@biloxi.example.com>;expires=4294967295
Content-Length: 0
```

2.3. Request for Current Contact List

Bob sends a register request to the Proxy Server containing no Contact headers, indicating the user wishes to query the server for the user's current contact list. Since the user already has authenticated with the server, the user supplies authentication credentials with the request and is not challenged by the server. The SIP server validates the user's credentials. The server returns a response (200 OK) which includes the user's current registration list in Contact headers.

Message Details

F1 REGISTER Bob -> SIP Server

```
REGISTER sips:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
Max-Forwards: 70
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Authorization: Digest username="bob", realm="atlanta.example.com",
 nonce="df84f1cec4341ae6cbe5ap359a9c8e88", opaque="",
 uri="sips:ss2.biloxi.example.com",
 response="aa7ab4678258377c6f7d4be6087e2f60"
Content-Length: 0
```

F2 200 OK SIP Server -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
 ;received=192.0.2.201
```

```
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>;tag=jqoiweu75
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Contact: <sips:bob@client.biloxi.example.com>;expires=3600
Contact: <mailto:bob@biloxi.example.com>;expires=4294967295
Content-Length: 0
```

2.4. Cancellation of Registration

Bob wishes to cancel their registration with the SIP server. Bob sends a SIP REGISTER request to the SIP server. The request has an expiration period of 0 and applies to all existing contact locations. Since the user already has authenticated with the server, the user supplies authentication credentials with the request and is not challenged by the server. The SIP server validates the user's credentials. It clears the user's contact list, and returns a response (200 OK) to Bob's SIP client.

Message Details

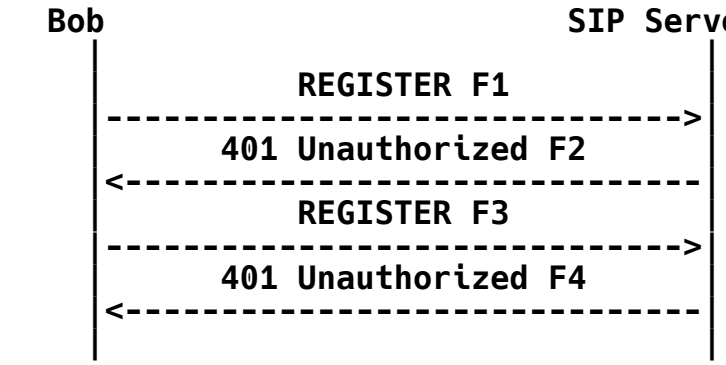
F1 REGISTER Bob -> SIP Server

```
REGISTER sips:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
Max-Forwards: 70
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Expires: 0
Contact: *
Authorization: Digest username="bob", realm="atlanta.example.com",
 nonce="88df84f1cac4341aea9c8ee6cbe5a359", opaque="",
 uri="sips:ss2.biloxi.example.com",
 response="ff0437c51696f9a76244f0cf1dbabbea"
Content-Length: 0
```

F2 200 OK SIP Server -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>;tag=1418nmdsrf
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Content-Length: 0
```

2.5. Unsuccessful Registration



Bob sends a SIP REGISTER request to the SIP Server. The SIP server provides a challenge to Bob. Bob enters her/his user ID and password. Bob's SIP client encrypts the user information according to the challenge issued by the SIP server and sends the response to the SIP server. The SIP server attempts to validate the user's credentials, but they are not valid (the user's password does not match the password established for the user's account). The server returns a response (401 Unauthorized) to Bob's SIP client.

Message Details

F1 REGISTER Bob -> SIP Server

```
REGISTER sips:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
Contact: <sips:bob@client.biloxi.example.com>
Content-Length: 0
```

F2 Unauthorized SIP Server -> Bob

```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=a73kszlfl
To: Bob <sips:bob@biloxi.example.com>;tag=1410948204
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 1 REGISTER
WWW-Authenticate: Digest realm="atlanta.example.com", qop="auth",
 nonce="f1cec4341ae6ca9c8e88df84be55a359",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

F3 REGISTER Bob -> SIP Server

```
REGISTER sips:ss2.biloxi.example.com SIP/2.0
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashd92
Max-Forwards: 70
From: Bob <sips:bob@biloxi.example.com>;tag=JueHGuidj28dfga
To: Bob <sips:bob@biloxi.example.com>
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 2 REGISTER
Contact: <sips:bob@client.biloxi.example.com>
Authorization: Digest username="bob", realm="atlanta.example.com",
 nonce="f1cec4341ae6ca9c8e88df84be55a359", opaque="",
 uri="sips:ss2.biloxi.example.com",
 response="61f8470ceb87d7ebf508220214ed438b"
Content-Length: 0

/*  The response above encodes the incorrect password */
```

F4 401 Unauthorized SIP Server -> Bob

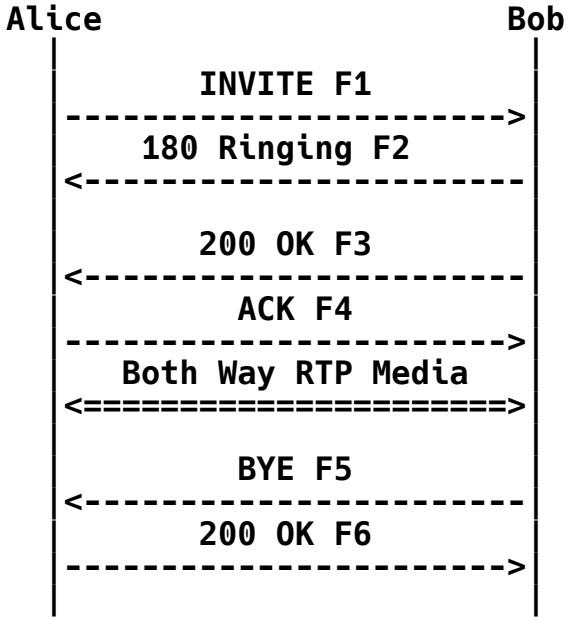
```
SIP/2.0 401 Unauthorized
Via: SIP/2.0/TLS client.biloxi.example.com:5061;branch=z9hG4bKnashd92
 ;received=192.0.2.201
From: Bob <sips:bob@biloxi.example.com>;tag=JueHGuidj28dfga
To: Bob <sips:bob@biloxi.example.com>;tag=1410948204
Call-ID: 1j9FpLxk3uxtm8tn@biloxi.example.com
CSeq: 2 REGISTER
WWW-Authenticate: Digest realm="atlanta.example.com", qop="auth",
 nonce="84f1c1ae6cbe5ua9c8e88dfa3ecm3459",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

3. SIP Session Establishment

This section details session establishment between two SIP User Agents (UAs): Alice and Bob. Alice (sip:alice@atlanta.example.com) and Bob (sip:bob@biloxi.example.com) are assumed to be SIP phones or SIP-enabled devices. The successful calls show the initial signaling, the exchange of media information in the form of SDP payloads, the establishment of the media session, then finally the termination of the call.

HTTP Digest authentication is used by Proxy Servers to authenticate the caller Alice. It is assumed that Bob has registered with Proxy Server Proxy 2 as per Section 2 to be able to receive the calls via the Proxy.

3.1. Successful Session Establishment



In this scenario, Alice completes a call to Bob directly.

Message Details

F1 INVITE Alice -> Bob

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
```

```
Call-ID: 384827629822018851l@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F2 180 Ringing Bob -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=8321234356
Call-ID: 384827629822018851l@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
Content-Length: 0
```

F3 200 OK Bob -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=8321234356
Call-ID: 384827629822018851l@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F4 ACK Alice -> Bob

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bd5
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=8321234356
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0

/* RTP streams are established between Alice and Bob */

/* Bob Hangs Up with Alice. Note that the CSeq is NOT 2, since
   Alice and Bob maintain their own independent CSeq counts.
   (The INVITE was request 1 generated by Alice, and the BYE is
   request 1 generated by Bob) */
```

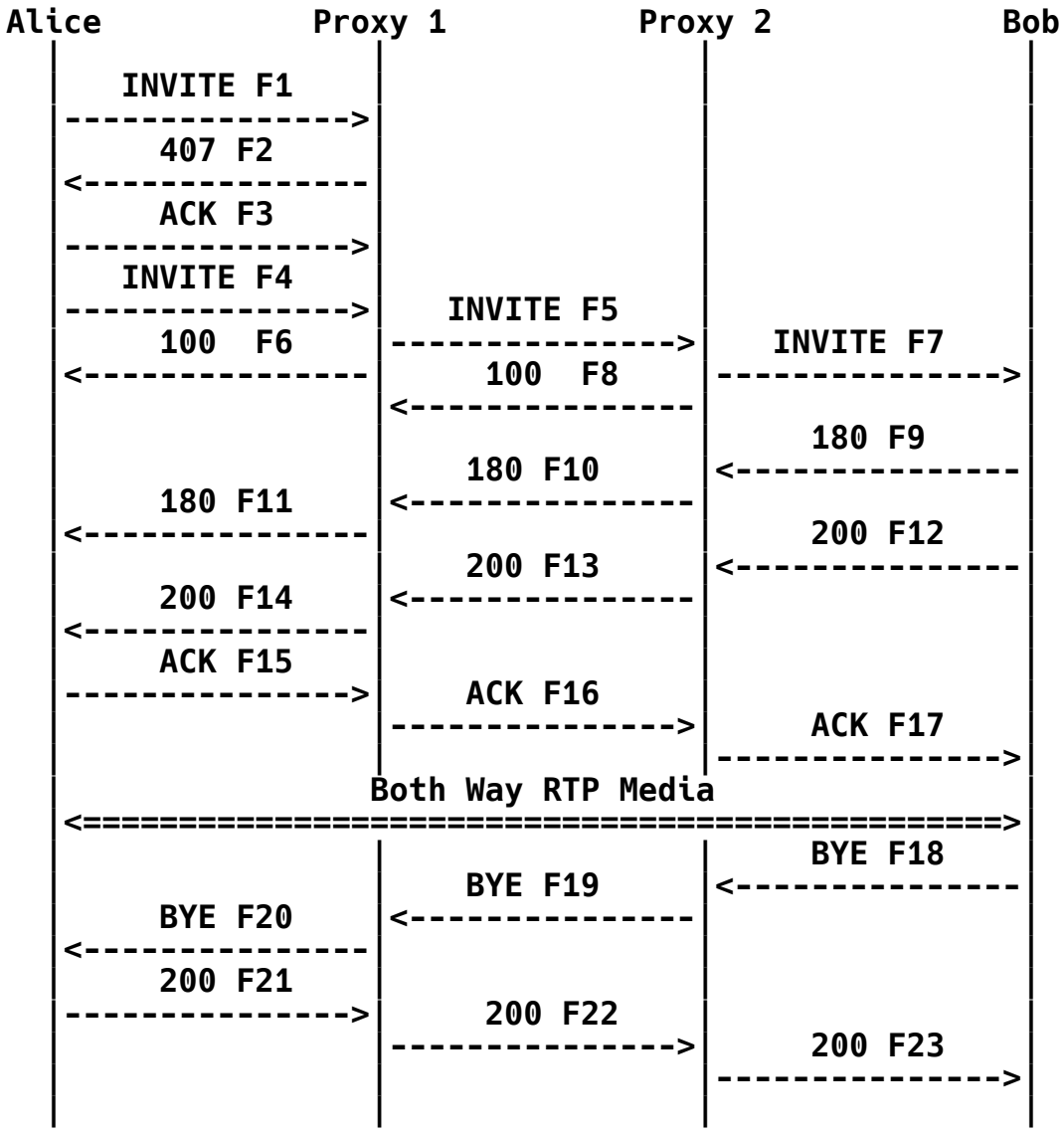
F5 BYE Bob -> Alice

```
BYE sip:alice@client.atlanta.example.com SIP/2.0
Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
Max-Forwards: 70
From: Bob <sip:bob@biloxi.example.com>;tag=8321234356
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

F6 200 OK Alice -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sip:bob@biloxi.example.com>;tag=8321234356
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

3.2. Session Establishment Through Two Proxies



In this scenario, Alice completes a call to Bob using two proxies Proxy 1 and Proxy 2. The initial INVITE (F1) contains a pre-loaded Route header with the address of Proxy 1 (Proxy 1 is configured as a default outbound proxy for Alice). The request does not contain the Authorization credentials Proxy 1 requires, so a 407 Proxy Authorization response is sent containing the challenge information. A new INVITE (F4) is then sent containing the correct credentials and the call proceeds. The call terminates when Bob disconnects by initiating a BYE message.

Proxy 1 inserts a Record-Route header into the INVITE message to ensure that it is present in all subsequent message exchanges. Proxy 2 also inserts itself into the Record-Route header. The ACK (F15) and BYE (F18) both have a Route header.

Message Details

F1 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74b43
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Proxy 1 challenges Alice for authentication */
```

F2 407 Proxy Authorization Required Proxy 1 -> Alice

```
SIP/2.0 407 Proxy Authorization Required
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74b43
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=3flal12sf
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 INVITE
Proxy-Authenticate: Digest realm="atlanta.example.com", qop="auth",
 nonce="f84f1cec41e6cbe5aea9c8e88d359",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

F3 ACK Alice -> Proxy 1

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74b43
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=3flal12sf
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0

/* Alice responds be re-sending the INVITE with authentication
   credentials in it. */
```

F4 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="wf84f1ceczx41ae6cbe5aea9c8e88d359", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="42ce3cef44b22f50c6a6071bc8"
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Proxy 1 accepts the credentials and forwards the INVITE to Proxy
2.  Client for Alice prepares to receive data on port 49172 from the
network. */
```

F5 INVITE Proxy 1 -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 69
Record-Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F6 100 Trying Proxy 1 -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 2 INVITE
Content-Length: 0
```

F7 INVITE Proxy 2 -> Bob

```
INVITE sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 68
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
```

```
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F8 100 Trying Proxy 2 -> Proxy 1

```
SIP/2.0 100 Trying
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 2 INVITE
Content-Length: 0
```

F9 180 Ringing Bob -> Proxy 2

```
SIP/2.0 180 Ringing
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 3848276298220188511@atlanta.example.com
Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
CSeq: 2 INVITE
Content-Length: 0
```

F10 180 Ringing Proxy 2 -> Proxy 1

```
SIP/2.0 180 Ringing
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 3848276298220188511@atlanta.example.com
Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
CSeq: 2 INVITE
Content-Length: 0
```

F11 180 Ringing Proxy 1 -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 3848276298220188511@atlanta.example.com
Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
CSeq: 2 INVITE
Content-Length: 0
```

F12 200 OK Bob -> Proxy 2

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 2 INVITE
```

```
   Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
   Content-Type: application/sdp
   Content-Length: 147

   v=0
   o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
   s=-
   c=IN IP4 192.0.2.201
   t=0 0
   m=audio 3456 RTP/AVP 0
   a=rtpmap:0 PCMU/8000
```

F13 200 OK Proxy 2 -> Proxy 1

```
   SIP/2.0 200 OK
   Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
    ;received=192.0.2.111
   Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Record-Route: <sip:ss2.biloxi.example.com;lr>,
    <sip:ss1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=314159
   Call-ID: 3848276298220188511@atlanta.example.com
   CSeq: 2 INVITE
   Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
   Content-Type: application/sdp
   Content-Length: 147

   v=0
   o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
   s=-
   c=IN IP4 192.0.2.201
   t=0 0
   m=audio 3456 RTP/AVP 0
   a=rtpmap:0 PCMU/8000
```

F14 200 OK Proxy 1 -> Alice

```
   SIP/2.0 200 OK
   Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Record-Route: <sip:ss2.biloxi.example.com;lr>,
    <sip:ss1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=314159
```

```
Call-ID: 384827629822018851l@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.biloxi.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F15 ACK Alice -> Proxy 1

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74b76
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>,
 <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 384827629822018851l@atlanta.example.com
CSeq: 2 ACK
Content-Length: 0
```

F16 ACK Proxy 1 -> Proxy 2

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74b76
 ;received=192.0.2.101
Max-Forwards: 69
Route: <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 384827629822018851l@atlanta.example.com
CSeq: 2 ACK
Content-Length: 0
```

F17 ACK Proxy 2 -> Bob

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
```

```
   Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
    ;received=192.0.2.111
   Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74b76
    ;received=192.0.2.101
   Max-Forwards: 68
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=314159
   Call-ID: 3848276298220188511@atlanta.example.com
   CSeq: 2 ACK
   Content-Length: 0

   /* RTP streams are established between Alice and Bob */

   /* Bob Hangs Up with Alice. */

   /* Again, note that the CSeq is NOT 3.  Alice and Bob maintain
      their own separate CSeq counts */


   F18 BYE Bob -> Proxy 2

   BYE sip:alice@client.atlanta.example.com SIP/2.0
   Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
   Max-Forwards: 70
   Route: <sip:ss2.biloxi.example.com;lr>,
    <sip:ss1.atlanta.example.com;lr>
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 3848276298220188511@atlanta.example.com
   CSeq: 1 BYE
   Content-Length: 0


   F19 BYE Proxy 2 -> Proxy 1

   BYE sip:alice@client.atlanta.example.com SIP/2.0
   Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
   Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
    ;received=192.0.2.201
   Max-Forwards: 69
   Route: <sip:ss1.atlanta.example.com;lr>
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 3848276298220188511@atlanta.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

F20 BYE Proxy 1 -> Alice

```
BYE sip:alice@client.atlanta.example.com SIP/2.0
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
 ;received=192.0.2.201
Max-Forwards: 68
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

F21 200 OK Alice -> Proxy 1

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

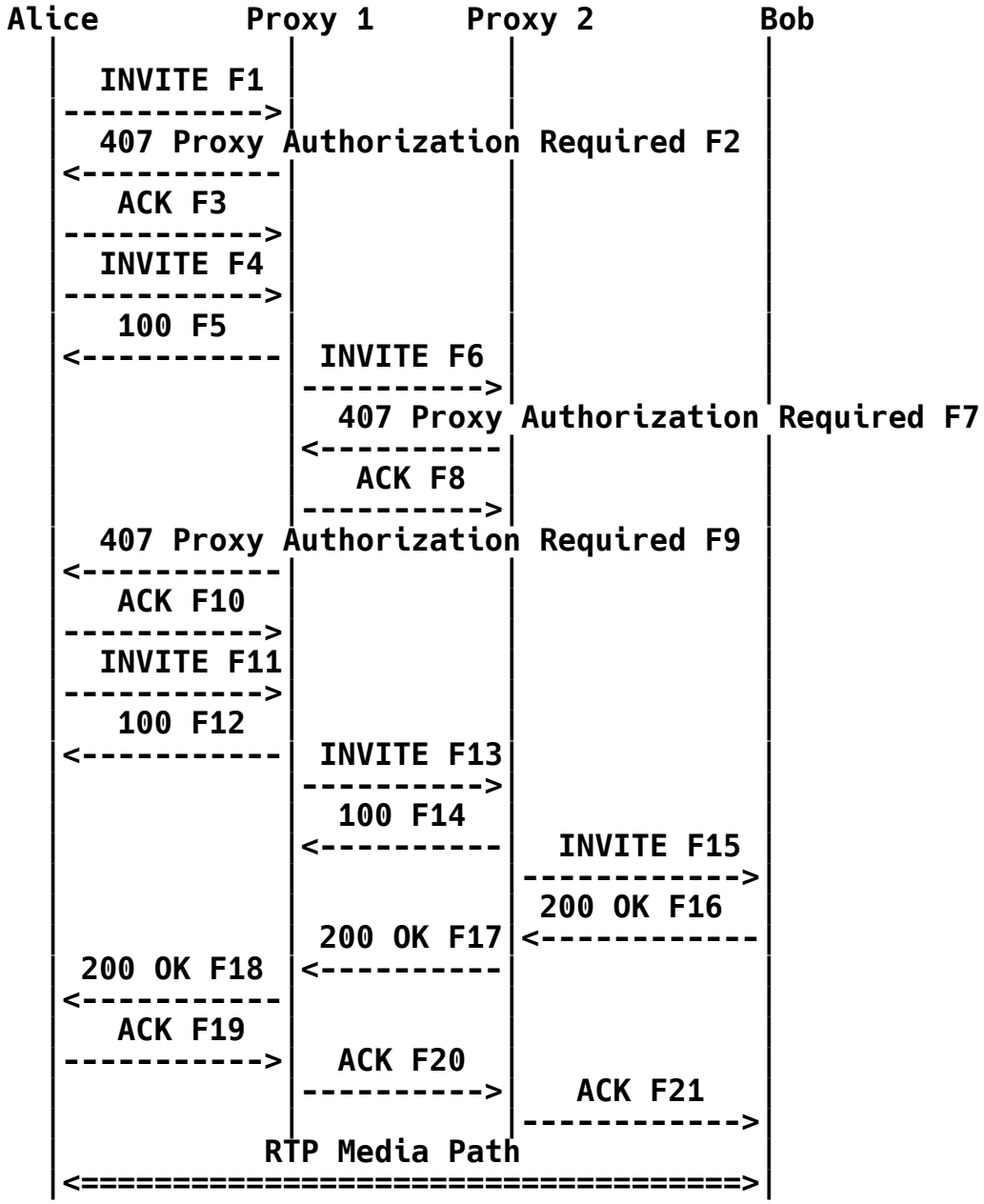
F22 200 OK Proxy 1 -> Proxy 2

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
 ;received=192.0.2.101
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

F23 200 OK Proxy 2 -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

3.3. Session with Multiple Proxy Authentication



In this scenario, Alice completes a call to Bob using two proxies Proxy 1 and Proxy 2. Alice has valid credentials in both domains. Since the initial INVITE (F1) does not contain the Authorization credentials Proxy 1 requires, so a 407 Proxy Authorization response is sent containing the challenge information. A new INVITE (F4) is

then sent containing the correct credentials and the call proceeds after Proxy 2 challenges and receives valid credentials. The call terminates when Bob disconnects by initiating a BYE message.

Proxy 1 inserts a Record-Route header into the INVITE message to ensure that it is present in all subsequent message exchanges. Proxy 2 also inserts itself into the Record-Route header.

Message Details

F1 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b03
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Proxy 1 challenges Alice for authentication */
```

F2 407 Proxy Authorization Required Proxy 1 -> Alice

```
SIP/2.0 407 Proxy Authorization Required
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b03
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=876321
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Proxy-Authenticate: Digest realm="atlanta.example.com", qop="auth",
 nonce="wf84f1cczx41ae6cbeaea9ce88d359",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

F3 ACK Alice -> Proxy 1

```
ACK sip:bob@biloxi.example.com SIP/2.0
Max-Forwards: 70
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b03
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=876321
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0

/* Alice responds be re-sending the INVITE with authentication
   credentials in it.  The same Call-ID is used, so the CSeq is
   increased. */
```

F4 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b21
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="wf84f1ceczx41ae6cbe5aea9c8e88d359", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="42ce3cef44b22f50c6a6071bc8"
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Proxy 1 accepts the credentials and forwards the INVITE to Proxy
2.  Client for Alice prepares to receive data on port 49172 from the
network. */
```

F5 100 Trying Proxy 1 -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b21
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Content-Length: 0
```

F6 INVITE Proxy 1 -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b21
 ;received=192.0.2.101
Max-Forwards: 69
Record-Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Proxy 2 challenges Alice for authentication */
```

F7 407 Proxy Authorization Required Proxy 2 -> Proxy 1

```
SIP/2.0 407 Proxy Authorization Required
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b21
 ;received=192.0.2.101
```

```
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=838209
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Proxy-Authenticate: Digest realm="biloxi.example.com", qop="auth",
 nonce="c1e22c41ae6cbe5ae983a9c8e88d359",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

F8 ACK Proxy 1 -> Proxy 2

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b21
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=838209
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 ACK
Content-Length: 0

/* Proxy 1 forwards the challenge to Alice for authentication from
Proxy 2 */
```

F9 407 Proxy Authorization Required Proxy 1 -> Alice

```
SIP/2.0 407 Proxy Authorization Required
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b21
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=838209
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Proxy-Authenticate: Digest realm="biloxi.example.com", qop="auth",
 nonce="c1e22c41ae6cbe5ae983a9c8e88d359",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

F10 ACK Alice -> Proxy 1

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b21
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=838209
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
```

```
   CSeq: 2 ACK
   Proxy-Authorization: Digest username="alice",
    realm="atlanta.example.com",
    nonce="wf84f1ceczx41ae6cbe5aea9c8e88d359", opaque="",
    uri="sip:bob@biloxi.example.com",
    response="42ce3cef44b22f50c6a6071bc8"
   Content-Length: 0

   /* Alice responds be re-sending the INVITE with authentication
   credentials for Proxy 1 AND Proxy 2.  */


   F11 INVITE Alice -> Proxy 1

   INVITE sip:bob@biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
   Max-Forwards: 70
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 3 INVITE
   Contact: <sip:alice@client.atlanta.example.com>
   Proxy-Authorization: Digest username="alice",
    realm="atlanta.example.com",
    nonce="wf84f1ceczx41ae6cbe5aea9c8e88d359", opaque="",
    uri="sip:bob@biloxi.example.com",
    response="42ce3cef44b22f50c6a6071bc8"
   Proxy-Authorization: Digest username="alice",
    realm="biloxi.example.com",
    nonce="c1e22c41ae6cbe5ae983a9c8e88d359", opaque="",
    uri="sip:bob@biloxi.example.com", response="f44ab22f150c6a56071bce8"
   Content-Type: application/sdp
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000

   /* Proxy 1 finds its credentials and authorizes Alice, forwarding the
   INVITE to Proxy.  */
```

F12 100 Trying Proxy 1 -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 INVITE
Content-Length: 0
```

F13 INVITE Proxy 1 -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 69
Record-Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Proxy-Authorization: Digest username="alice",
 realm="biloxi.example.com",
 nonce="c1e22c41ae6cbe5ae983a9c8e88d359", opaque="",
 uri="sip:bob@biloxi.example.com", response="f44ab22f150c6a56071bce8"
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Proxy 2 finds its credentials and authorizes Alice, forwarding the
INVITE to Bob.  */
```

F14 100 Trying Proxy 2 -> Proxy 1

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 INVITE
Content-Length: 0
```

F15 INVITE Proxy 2 -> Bob

```
INVITE sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK31972.1
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 68
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Bob answers the call immediately */
```

F16 200 OK Bob -> Proxy 2

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK31972.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=9103874
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F17 200 OK Proxy 2 -> Proxy 1

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=9103874
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
```

```
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F18 200 OK Proxy 1 -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=9103874
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F19 ACK Alice -> Proxy 1

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b44
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>,
 <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=9103874
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 3 ACK
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="wf84f1ceczx41ae6cbe5aea9c8e88d359", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="42ce3cef44b22f50c6a6071bc8"
Proxy-Authorization: Digest username="alice",
 realm="biloxi.example.com",
```

```
    nonce="c1e22c41ae6cbe5ae983a9c8e88d359", opaque="",
    uri="sip:bob@biloxi.example.com", response="f44ab22f150c6a56071bce8"
   Content-Length: 0
```

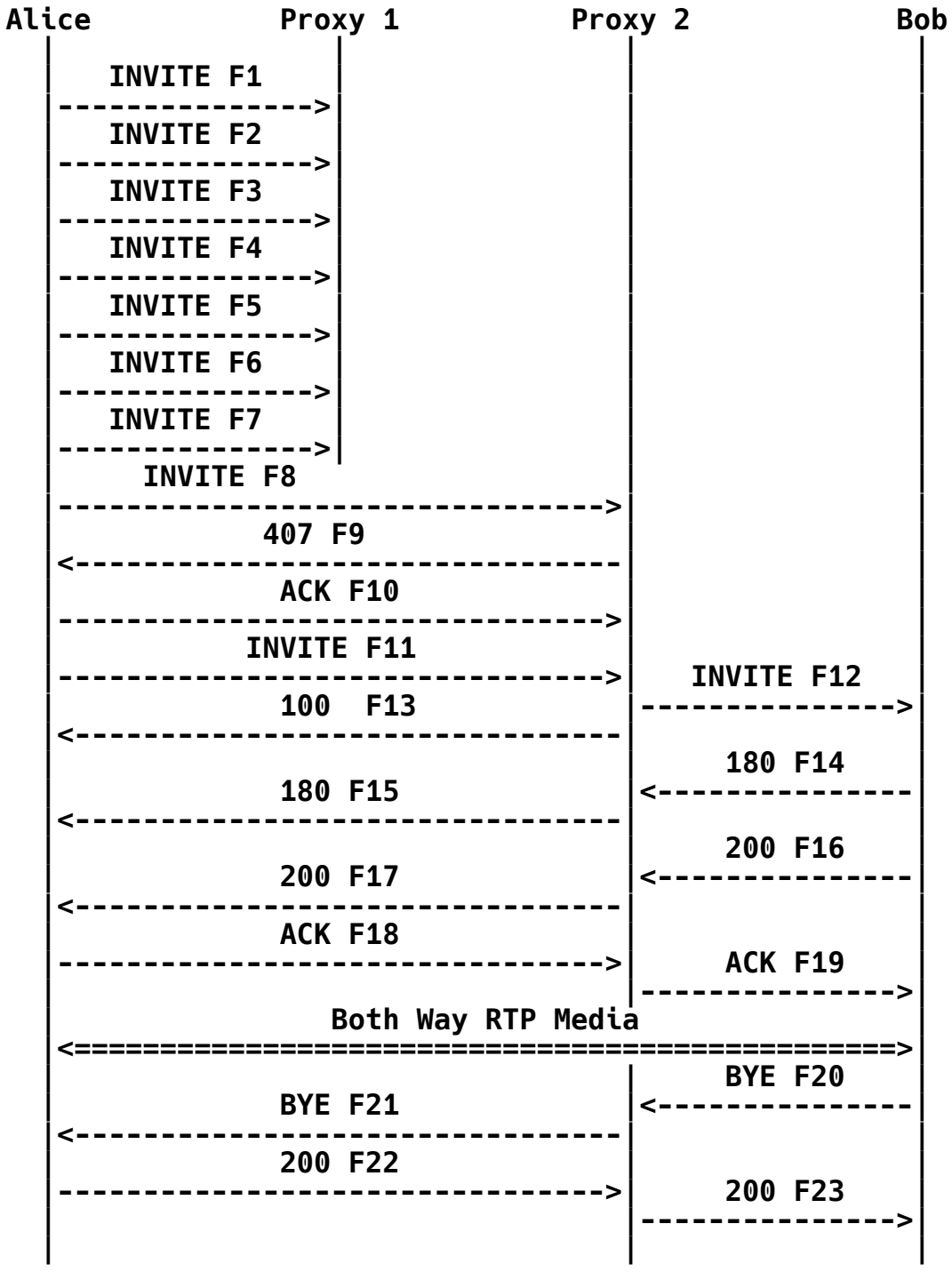
F20 ACK Proxy 1 -> Proxy 2

```
   ACK sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b44
    ;received=192.0.2.101
   Max-Forwards: 69
   Route: <sip:ss2.biloxi.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=9103874
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 3 ACK
   Contact: <sip:bob@client.biloxi.example.com>
   Proxy-Authorization: Digest username="alice",
    realm="biloxi.example.com",
    nonce="c1e22c41ae6cbe5ae983a9c8e88d359", opaque="",
    uri="sip:bob@biloxi.example.com", response="f44ab22f150c6a56071bce8"
   Content-Length: 0
```

F21 ACK Proxy 2 -> Bob

```
   ACK sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK31972.1
   Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK230f2.1
    ;received=192.0.2.111
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b44
    ;received=192.0.2.101
   Max-Forwards: 68
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=9103874
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 3 ACK
   Contact: <sip:bob@client.biloxi.example.com>
   Content-Length: 0
```

3.4. Successful Session with Proxy Failure



In this scenario, Alice completes a call to Bob via a Proxy Server. Alice is configured for a primary SIP Proxy Server Proxy 1 and a secondary SIP Proxy Server Proxy 2 (Or is able to use DNS SRV records to locate Proxy 1 and Proxy 2). Alice has valid credentials for both domains. Proxy 1 is out of service and does not respond to INVITEs (it is reachable, but unresponsive). Alice then completes the call to Bob using Proxy 2.

Message Details

F1 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK465b6d
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F2 INVITE Alice -> Proxy 1

Same as Message F1

F3 INVITE Alice -> Proxy 1

Same as Message F1

F4 INVITE Alice -> Proxy 1

Same as Message F1

F5 INVITE Alice -> Proxy 1

Same as Message F1

F6 INVITE Alice -> Proxy 1

Same as Message F1

F7 INVITE Alice -> Proxy 1

Same as Message F1

/* Alice gives up on the unresponsive proxy */

F8 INVITE Alice -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b8a
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

/* Proxy 2 challenges Alice for authentication */

F9 407 Proxy Authorization Required Proxy 2 -> Alice

```
SIP/2.0 407 Proxy Authorization Required
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b8a
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=2421452
```

```
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 1 INVITE
Proxy-Authenticate: Digest realm="biloxi.example.com", qop="auth",
 nonce="1ae6cbe5ea9c8e8df84fqnlec434a359",
 opaque="", stale=FALSE, algorithm=MD5
Content-Length: 0
```

F10 ACK Alice -> Proxy 2

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b8a
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=2421452
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0

/* Alice responds by re-sending the INVITE with authentication
credentials in it.  */
```

F11 INVITE Alice -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Proxy-Authorization: Digest username="alice",
 realm="biloxi.example.com",
 nonce="1ae6cbe5ea9c8e8df84fqnlec434a359", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="8a880c919d1a52f20a1593e228adf599"
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

```
   /* Proxy 2 accepts the credentials and forwards the INVITE to Bob.
   Client for Alice prepares to receive data on port 49172 from the
   network.
   */


   F12 INVITE Proxy 2 -> Bob

   INVITE sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Max-Forwards: 69
   Record-Route: <sip:ss2.biloxi.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
   CSeq: 2 INVITE
   Contact: <sip:alice@client.atlanta.example.com>
   Content-Type: application/sdp
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000


   F13 100 Trying Proxy 2 -> Alice

   SIP/2.0 100 Trying
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
   CSeq: 2 INVITE
   Content-Length: 0


   F14 180 Ringing Bob -> Proxy 2

   SIP/2.0 180 Ringing
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
    ;received=192.0.2.222
```

```
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F15 180 Ringing Proxy 2 -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F16 200 OK Bob -> Proxy 2

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F17 200 OK Proxy 2 -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F18 ACK Alice -> Proxy 2

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b8g
Max-Forwards: 70
Route: <sip:ss2.biloxi.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 2 ACK
Content-Length: 0
```

F19 ACK Proxy 2 -> Bob

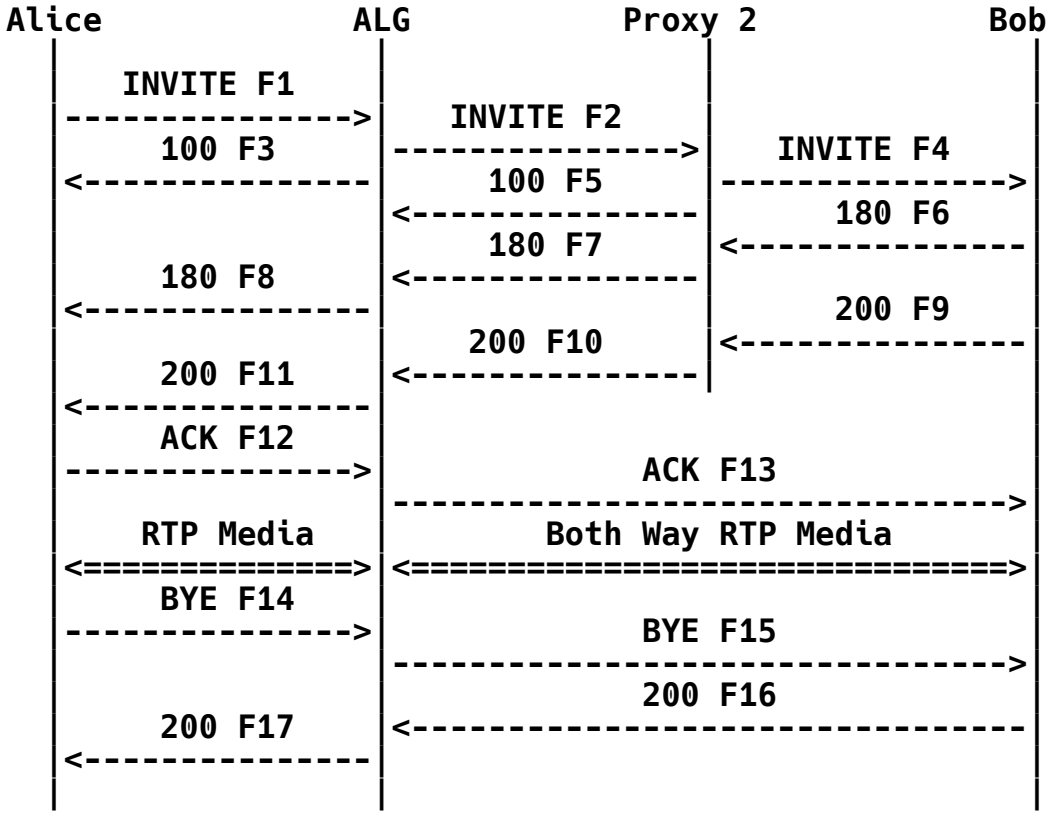
```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b8g
 ;received=192.0.2.101
Max-Forwards: 69
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
```

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

   /* RTP streams are established between Alice and Bob */

   /* Bob Hangs Up with Alice. */


   F20 BYE Bob -> Proxy 2

   BYE sip:alice@client.atlanta.example.com SIP/2.0
   Via: SIP/2.0/UDP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
   Max-Forwards: 70
   Route: <sip:ss2.biloxi.example.com;lr>
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
   CSeq: 1 BYE
   Content-Length: 0


   F21 BYE Proxy 2 -> Alice

   BYE sip:alice@client.atlanta.example.com SIP/2.0
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
   Via: SIP/2.0/UDP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
    ;received=192.0.2.201
   Max-Forwards: 69
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
   CSeq: 1 BYE
   Content-Length: 0


   F22 200 OK Alice -> Proxy 2

   SIP/2.0 200 OK
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
    ;received=192.0.2.222
   Via: SIP/2.0/UDP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
    ;received=192.0.2.201
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
   CSeq: 1 BYE
   Content-Length: 0
```

F23 200 OK Proxy 2 -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.biloxi.example.com:5060;branch=z9hG4bKnashds7
 ;received=192.0.2.201
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 4Fde34wkd11wsGFDs3@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

3.5. Session Through a SIP ALG



Alice completes a call to Bob through a ALG (Application Layer Gateway) and a SIP Proxy. The routing through the ALG is accomplished using a pre-loaded Route header in the INVITE F1. Note that the media stream setup is not end-to-end - the ALG terminates both media streams and bridges them. This is done by the ALG modifying the SDP in the INVITE (F1) and 200 OK (F10) messages, and possibly any 18x or ACK messages containing SDP.

In addition to firewall traversal, this Back-to-Back User Agent (B2BUA) could be used as part of an anonymizer service (in which all identifying information on Alice would be removed), or to perform codec media conversion, such as mu-law to A-law conversion of PCM on an international call.

Also note that Proxy 2 does not Record-Route in this call flow.

Message Details

F1 INVITE Alice -> SIP ALG

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Route: <sip:alg1.atlanta.example.com;lr>
Proxy-Authorization: Digest username="alice",
 realm="biloxi.example.com",
 nonce="85b4f1cen4341ae6cbe5a3a9c8e88df9", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="b3f392f9218a328b9294076d708e6815"
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* Client for Alice prepares to receive data on port 49172 from the
network. */
```

F2 INVITE SIP ALG -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 69
Record-Route: <sip:alg1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Proxy-Authorization: Digest username="alice",
 realm="biloxi.example.com",
```

```
    nonce="85b4f1cen4341ae6cbe5a3a9c8e88df9", opaque="",
    uri="sip:bob@biloxi.example.com",
    response="b3f392f9218a328b9294076d708e6815"
   Content-Type: application/sdp
   Content-Length: 150

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.128
   t=0 0
   m=audio 2000 RTP/AVP 0
   a=rtpmap:0 PCMU/8000


   F3 100 Trying SIP ALG -> Alice

   SIP/2.0 100 Trying
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Content-Length: 0

   /* SIP ALG prepares to proxy data from port 192.0.2.128/2000 to
   192.0.2.101/49172.   Proxy 2 uses a Location Service function to
   determine where Bob is located. Based upon location analysis the call
   is forwarded to Bob */


   F4 INVITE Proxy 2 -> Bob

   INVITE sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK2d4790.1
   Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
    ;received=192.0.2.128
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Max-Forwards: 68
   Record-Route: <sip:alg1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Contact: <sip:alice@client.atlanta.example.com>
   Content-Type: application/sdp
```

```
   Content-Length: 150

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.128
   t=0 0
   m=audio 2000 RTP/AVP 0
   a=rtpmap:0 PCMU/8000


   F5 100 Trying Proxy 2 -> SIP ALG

   SIP/2.0 100 Trying
   Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
    ;received=192.0.2.128
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Content-Length: 0


   F6 180 Ringing Bob -> Proxy 2

   SIP/2.0 180 Ringing
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK2d4790.1
    ;received=192.0.2.222
   Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
    ;received=192.0.2.128
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Record-Route: <sip:alg1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=314159
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Contact: <sip:bob@client.biloxi.example.com>
   Content-Length: 0


   F7 180 Ringing Proxy 2 -> SIP ALG

   SIP/2.0 180 Ringing
   Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
    ;received=192.0.2.128
```

```
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:alg1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F8 180 Ringing SIP ALG -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:alg1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F9 200 OK Bob -> Proxy 2

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
 ;received=192.0.2.128
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:alg1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
```

```
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F10 200 OK Proxy 2 -> SIP ALG

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
 ;received=192.0.2.128
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:alg1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F11 200 OK SIP ALG -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:alg1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.128
t=0 0
```

```
   m=audio 1734 RTP/AVP 0
   a=rtpmap:0 PCMU/8000

   /* The ALG prepares to proxy packets from 192.0.2.128/
      1734 to 192.0.2.201/3456 */
```

F12 ACK Alice -> SIP ALG

```
   ACK sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bhh
   Max-Forwards: 70
   Route: <sip:alg1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=314159
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 ACK
   Content-Length: 0
```

F13 ACK SIP ALG -> Bob

```
   ACK sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bhh
    ;received=192.0.2.101
   Max-Forwards: 69
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=314159
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 ACK
   Content-Length: 0

   /* RTP streams are established between Alice and the ALG and
   between the ALG and B*/

   /* Alice Hangs Up with Bob. */
```

F14 BYE Alice -> SIP ALG

```
   BYE sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74be5
   Max-Forwards: 70
   Route: <sip:alg1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>;tag=314159
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
```

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

F15 BYE SIP ALG -> Bob

```
BYE sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74be5
 ;received=192.0.2.101
Max-Forwards: 69
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 BYE
Content-Length: 0
```

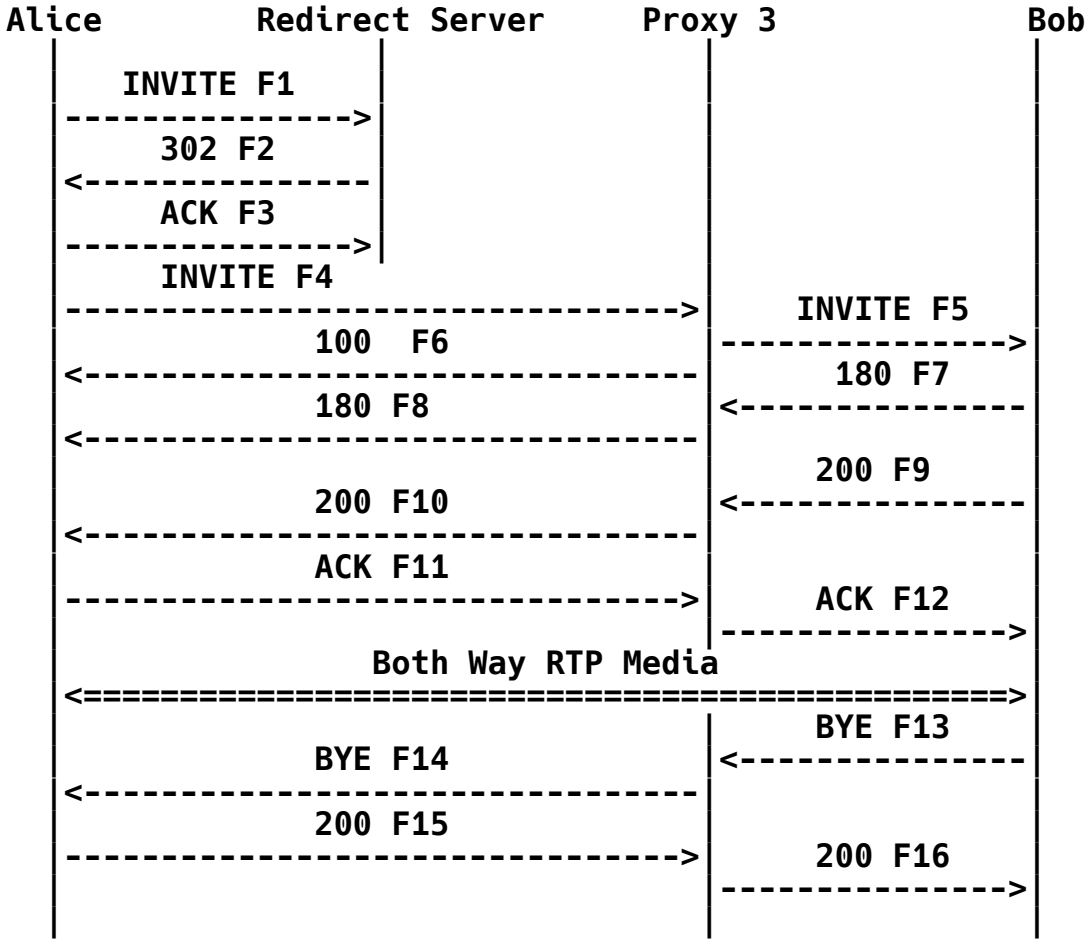
F16 200 OK Bob -> SIP ALG

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP alg1.atlanta.example.com:5060;branch=z9hG4bK739578.1
 ;received=192.0.2.128
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74be5
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 BYE
Content-Length: 0
```

F17 200 OK SIP ALG -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74be5
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 BYE
Content-Length: 0
```

3.6. Session via Redirect and Proxy Servers with SDP in ACK



In this scenario, Alice places a call to Bob using first a Redirect server then a Proxy Server. The INVITE message is first sent to the Redirect Server. The Server returns a 302 Moved Temporarily response (F2) containing a Contact header with Bob's current SIP address. Alice then generates a new INVITE and sends to Bob via the Proxy Server and the call proceeds normally. In this example, no SDP is present in the INVITE, so the SDP is carried in the ACK message.

The call is terminated when Bob sends a BYE message.

Message Details

F1 INVITE Alice -> Redirect Server

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bKbf9f44
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Length: 0
```

F2 302 Moved Temporarily Redirect Proxy -> Alice

```
SIP/2.0 302 Moved Temporarily
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bKbf9f44
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=53fHlqlQ2
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@chicago.example.com;transport=tcp>
Content-Length: 0
```

F3 ACK Alice -> Redirect Server

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bKbf9f44
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=53fHlqlQ2
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

F4 INVITE Alice -> Proxy 3

```
INVITE sip:bob@chicago.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
```

```
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Length: 0
```

F5 INVITE Proxy 3 -> Bob

```
INVITE sip:bob@client.chicago.example.com SIP/2.0
Via: SIP/2.0/TCP ss3.chicago.example.com:5060;branch=z9hG4bK721e.1
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 69
Record-Route: <sip:ss3.chicago.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Length: 0
```

F6 100 Trying Proxy 3 -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Content-Length: 0
```

F7 180 Ringing Bob -> Proxy 3

```
SIP/2.0 180 Ringing
Via: SIP/2.0/TCP ss3.chicago.example.com:5060;branch=z9hG4bK721e.1
 ;received=192.0.2.233
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss3.chicago.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.chicago.example.com;transport=tcp>
Content-Length: 0
```

F8 180 Ringing Proxy 3 -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss3.chicago.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.chicago.example.com;transport=tcp>
Content-Length: 0
```

F9 200 OK Bob -> Proxy 3

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP ss3.chicago.example.com:5060;branch=z9hG4bK721e.1
 ;received=192.0.2.233
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss3.chicago.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.chicago.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 148

v=0
o=bob 2890844527 2890844527 IN IP4 client.chicago.example.com
s=-
c=IN IP4 192.0.2.100
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F10 200 OK Proxy -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss3.chicago.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
```

```
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 INVITE
Contact: <sip:bob@client.chicago.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 148

v=0
o=bob 2890844527 2890844527 IN IP4 client.chicago.example.com
s=-
c=IN IP4 192.0.2.100
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/* ACK contains SDP of Alice since none present in INVITE */
```

F11 ACK Alice -> Proxy 3

```
ACK sip:bob@client.chicago.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bq9
Max-Forwards: 70
Route: <sip:ss3.chicago.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 ACK
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F12 ACK Proxy 3 -> Bob

```
ACK sip:bob@client.chicago.example.com SIP/2.0
Via: SIP/2.0/TCP ss3.chicago.example.com:5060;branch=z9hG4bK721e.1
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bq9
 ;received=192.0.2.101
Max-Forwards: 69
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
```

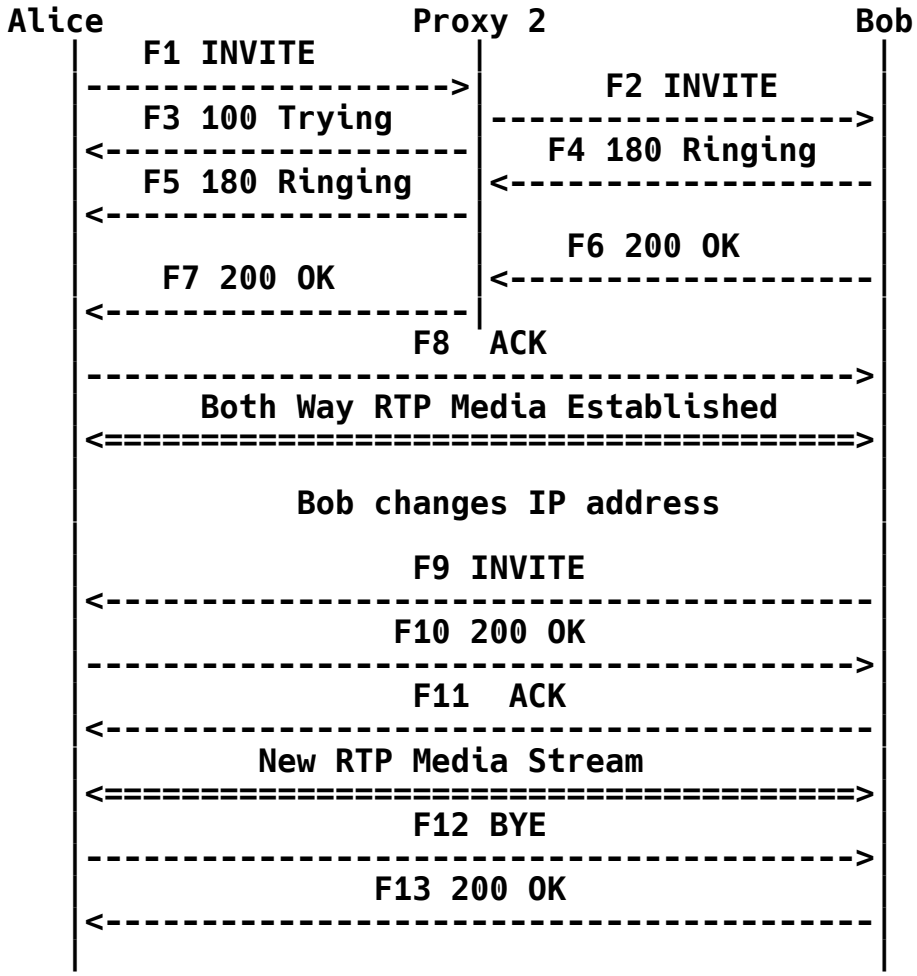
```
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 2 ACK
   Content-Type: application/sdp
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000

   /* RTP streams are established between Alice and Bob */

   /* Bob Hangs Up with Alice. */


   F13 BYE Bob -> Proxy 3

   BYE sip:alice@client.atlanta.example.com SIP/2.0
   Via: SIP/2.0/TCP client.chicago.example.com:5060;branch=z9hG4bKfgaw2
   Max-Forwards: 70
   Route: <sip:ss3.chicago.example.com;lr>
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 BYE
   Content-Length: 0


   F14 BYE Proxy 3 -> Alice

   BYE sip:alice@client.atlanta.example.com SIP/2.0
   Via: SIP/2.0/TCP ss3.chicago.example.com:5060;branch=z9hG4bK721e.1
    ;received=192.0.2.100
   Via: SIP/2.0/TCP client.chicago.example.com:5060;branch=z9hG4bKfgaw2
   Max-Forwards: 69
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 BYE
   Content-Length: 0


   F15 200 OK Alice -> Proxy 3

   SIP/2.0 200 OK
```

```
Via: SIP/2.0/TCP ss3.chicago.example.com:5060;branch=z9hG4bK721e.1
 ;received=192.0.2.233
Via: SIP/2.0/TCP client.chicago.example.com:5060;branch=z9hG4bKfgaw2
 ;received=192.0.2.100
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

F16 200 OK Proxy 3 -> Bob

```
SIP/2.0 200 OK
Via: SIP/2.0/TCP client.chicago.example.com:5060;branch=z9hG4bKfgaw2
 ;received=192.0.2.100
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 BYE
Content-Length: 0
```

3.7. Session with re-INVITE (IP Address Change)



This example shows a session in which the media changes midway through the session. When Bob's IP address changes during the session, Bob sends a re-INVITE containing a new Contact and SDP (version number incremented) information to A. In this flow, the proxy does not Record-Route so is not in the SIP messaging path after the initial exchange.

Message Details

F1 INVITE Alice -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F2 INVITE Proxy 2 -> Bob

```
INVITE sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK2d4790.1
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 69
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F3 100 Trying Proxy 2 -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F4 180 Ringing Bob -> Proxy 2

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F5 180 Ringing Proxy 2 -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F6 200 OK Bob -> Proxy 2

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
```

```
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F7 200 OK Proxy 2 -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Type: application/sdp
Content-Length: 147

v=0
o=bob 2890844527 2890844527 IN IP4 client.biloxi.example.com
s=-
c=IN IP4 192.0.2.201
t=0 0
m=audio 3456 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F8 ACK Alice -> Bob

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74b7b
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

```
   /* RTP streams are established between Alice and Bob */

   /* Bob changes IP address and re-INVITEs Alice with new Contact and
   SDP */


   F9 INVITE Bob -> Alice

   INVITE sip:alice@client.atlanta.example.com SIP/2.0
   Via: SIP/2.0/UDP client.chicago.example.com:5060;branch=z9hG4bKlkld5l
   Max-Forwards: 70
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 14 INVITE
   Contact: <sip:bob@client.chicago.example.com>
   Content-Type: application/sdp
   Content-Length: 149

   v=0
   o=bob 2890844527 2890844528 IN IP4 client.chicago.example.com
   s=-
   c=IN IP4 192.0.2.100
   t=0 0
   m=audio 47172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000


   F10 200 OK Alice -> Bob

   SIP/2.0 200 OK
   Via: SIP/2.0/UDP client.chicago.example.com:5060;branch=z9hG4bKlkld5l
    ;received=192.0.2.100
   Max-Forwards: 70
   From: Bob <sip:bob@biloxi.example.com>;tag=314159
   To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 14 INVITE
   Contact: <sip:alice@client.atlanta.example.com>
   Content-Type: application/sdp
   Content-Length: 150

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
```

```
m=audio 1000 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F11 ACK Bob -> Alice

```
ACK sip:alice@client.atlanta.example.com SIP/2.0
Via: SIP/2.0/UDP client.chicago.example.com:5060;branch=z9hG4bKlkldcc
Max-Forwards: 70
From: Bob <sip:bob@biloxi.example.com>;tag=314159
To: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 14 ACK
Content-Length: 0

/* New RTP stream established between Alice and Bob */

/* Alice hangs up with Bob */
```

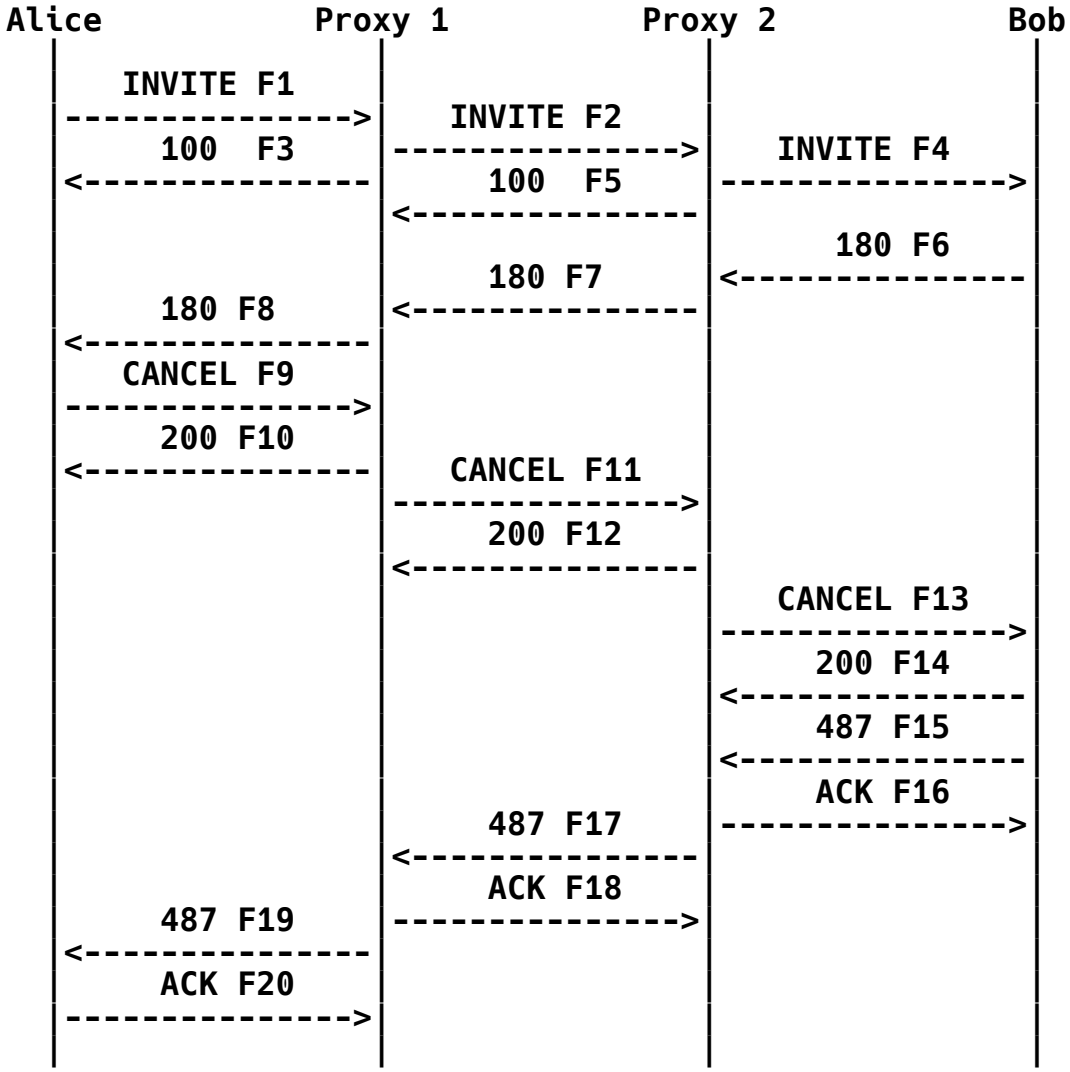
F12 BYE Alice -> Bob

```
BYE sip:bob@client.chicago.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bo4
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 BYE
Content-Length: 0
```

F13 200 OK Bob -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bo4
 ;received=192.0.2.101
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 2 BYE
Content-Length: 0
```

3.8. Unsuccessful No Answer



In this scenario, Alice gives up on the call before Bob answers (sends a 200 OK response). Alice sends a CANCEL (F9) since no final response had been received from Bob. If a 200 OK to the INVITE had crossed with the CANCEL, Alice would have sent an ACK then a BYE to Bob in order to properly terminate the call.

Note that the CANCEL message is acknowledged with a 200 OK on a hop by hop basis, rather than end to end.

Message Details

F1 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="ze7k1ee88df84f1cec431ae6cbe5a359", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="b00b416324679d7e243f55708d44be7b"
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/*Client for Alice prepares to receive data on port 49172 from the
network.*/
```

F2 INVITE Proxy 1 -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 69
Record-Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151
```

```
v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F3 100 Trying Proxy 1 -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F4 INVITE Proxy 2 -> Bob

```
INVITE sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
Max-Forwards: 68
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F5 100 Trying Proxy 2 -> Proxy 1

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F6 180 Ringing Bob -> Proxy 2

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F7 180 Ringing Proxy 2 -> Proxy 1

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
```

```
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F8 180 Ringing Proxy 1 -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F9 CANCEL Alice -> Proxy 1

```
CANCEL sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Route: <sip:ss1.atlanta.example.com;lr>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 CANCEL
Content-Length: 0
```

F10 200 OK Proxy 1 -> Alice

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 CANCEL
Content-Length: 0
```

F11 CANCEL Proxy 1 -> Proxy 2

```
CANCEL sip:alice@atlanta.example.com SIP/2.0
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 CANCEL
Content-Length: 0
```

F12 200 OK Proxy 2 -> Proxy 1

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 CANCEL
Content-Length: 0
```

F13 CANCEL Proxy 2 -> Bob

```
CANCEL sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 CANCEL
Content-Length: 0
```

F14 200 OK Bob -> Proxy 2

```
SIP/2.0 200 OK
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 CANCEL
Content-Length: 0
```

F15 487 Request Terminated Bob -> Proxy 2

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F16 ACK Proxy 2 -> Bob

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

F17 487 Request Terminated Proxy 2 -> Proxy 1

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F18 ACK Proxy 1 -> Proxy 2

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

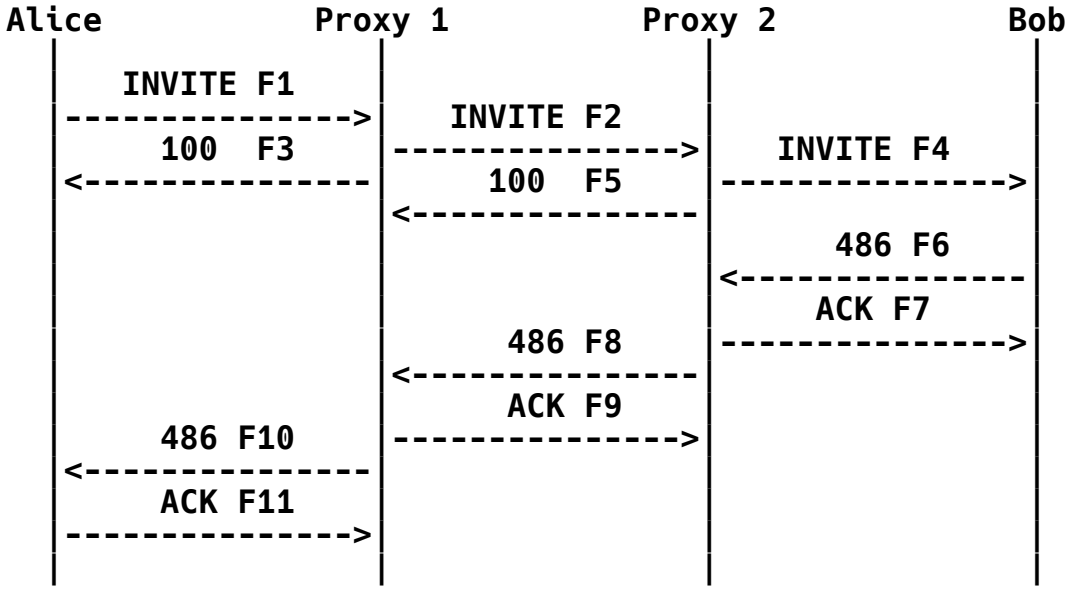
F19 487 Request Terminated Proxy 1 -> Alice

```
SIP/2.0 487 Request Terminated
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
```

F20 ACK Alice -> Proxy 1

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="ze7k1ee88df84f1cec431ae6cbe5a359", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="b00b416324679d7e243f55708d44be7b"
CSeq: 1 ACK
Content-Length: 0
```

3.9. Unsuccessful Busy



In this scenario, Bob is busy and sends a 486 Busy Here response to Alice's INVITE. Note that the non-2xx response is acknowledged on a hop-by-hop basis instead of end-to-end. Also note that many SIP UAs will not return a 486 response, as they have multiple line and other features.

Message Details

F1 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="dc3a5ab2530aa93112cf5904ba7d88fa", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="702138b27d869ac8741e10ec643d55be"
Content-Type: application/sdp
Content-Length: 151
```

```
v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000

/*Client for Alice prepares to receive data on port 49172 from the
network.*/
```

F2 INVITE Proxy 1 -> Proxy 2

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 69
Record-Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F3 100 Trying Proxy 1 -> Alice

```
SIP/2.0 100 Trying
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F4 INVITE Proxy 2 -> Bob

```
INVITE sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 68
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com;transport=tcp>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F5 100 Trying Proxy 2 -> Proxy 1

```
SIP/2.0 100 Trying
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F6 486 Busy Here Bob -> Proxy 2

```
SIP/2.0  486 Busy Here
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
```

```
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F7 ACK Proxy 2 -> Bob

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

F8 486 Busy Here Proxy 2 -> Proxy 1

```
SIP/2.0  486 Busy Here
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F9 ACK Proxy 1 -> Proxy 2

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

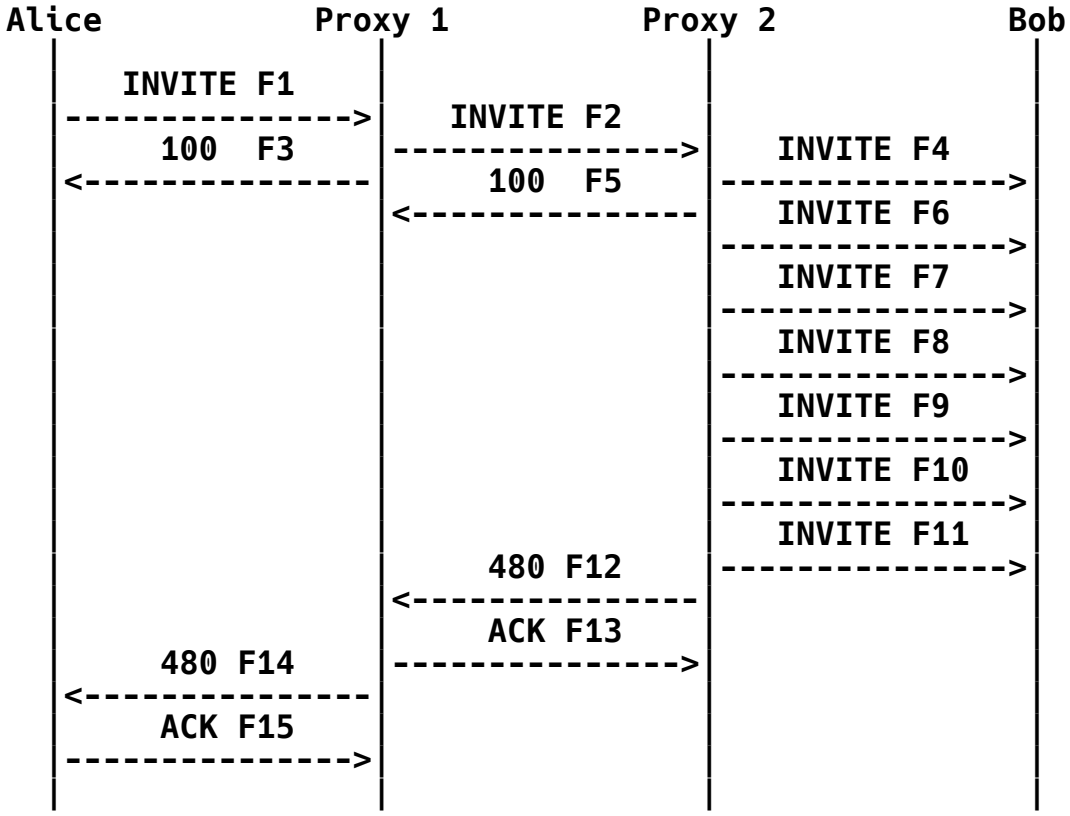
F10 486 Busy Here Proxy 1 -> Alice

```
SIP/2.0  486 Busy Here
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F11 ACK Alice -> Proxy 1

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/TCP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="dc3a5ab2530aa93112cf5904ba7d88fa", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="702138b27d869ac8741e10ec643d55be"
Content-Length: 0
```

3.10. Unsuccessful No Response from User Agent



In this example, there is no response from Bob to Alice's INVITE messages being re-transmitted by Proxy 2. After the sixth re-transmission, Proxy 2 gives up and sends a 480 No Response to Alice.

Message Details

F1 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
```

```
    nonce="cf5904ba7d8dc3a5ab2530aa931128fa", opaque="",
    uri="sip:bob@biloxi.example.com",
    response="7afc04be7961f053c24f80e7dbaf888f"
   Content-Type: application/sdp
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000

   /*Client for Alice prepares to receive data on port 49172 from the
   network.*/


   F2 INVITE Proxy 1 -> Proxy 2

   INVITE sip:bob@biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Max-Forwards: 69
   Record-Route: <sip:ss1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Contact: <sip:alice@client.atlanta.example.com>
   Content-Type: application/sdp
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000


   F3 100 Trying Proxy 1 -> Alice

   SIP/2.0 100 Trying
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
```

```
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F4 INVITE Proxy 2 -> Bob

```
INVITE sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Max-Forwards: 68
Record-Route: <sip:ss2.biloxi.example.com;lr>,
<sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Content-Type: application/sdp
Content-Length: 151

v=0
o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
s=-
c=IN IP4 192.0.2.101
t=0 0
m=audio 49172 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

F5 100 Trying Proxy 2 -> Proxy 1

```
SIP/2.0 100 Trying
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F6 INVITE Proxy 2 -> Bob

Resend of Message F4

F7 INVITE Proxy 2 -> Bob

Resend of Message F4

F8 INVITE Proxy 2 -> Bob

Resend of Message F4

F9 INVITE Proxy 2 -> Bob

Resend of Message F4

F10 INVITE Proxy 2 -> Bob

Resend of Message F4

F11 INVITE Proxy 2 -> Bob

Resend of Message F4

/* Proxy 2 gives up */

F12 480 No Response Proxy 2 -> Proxy 1

```
SIP/2.0 480 No Response
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F13 ACK Proxy 1 -> Proxy 2

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

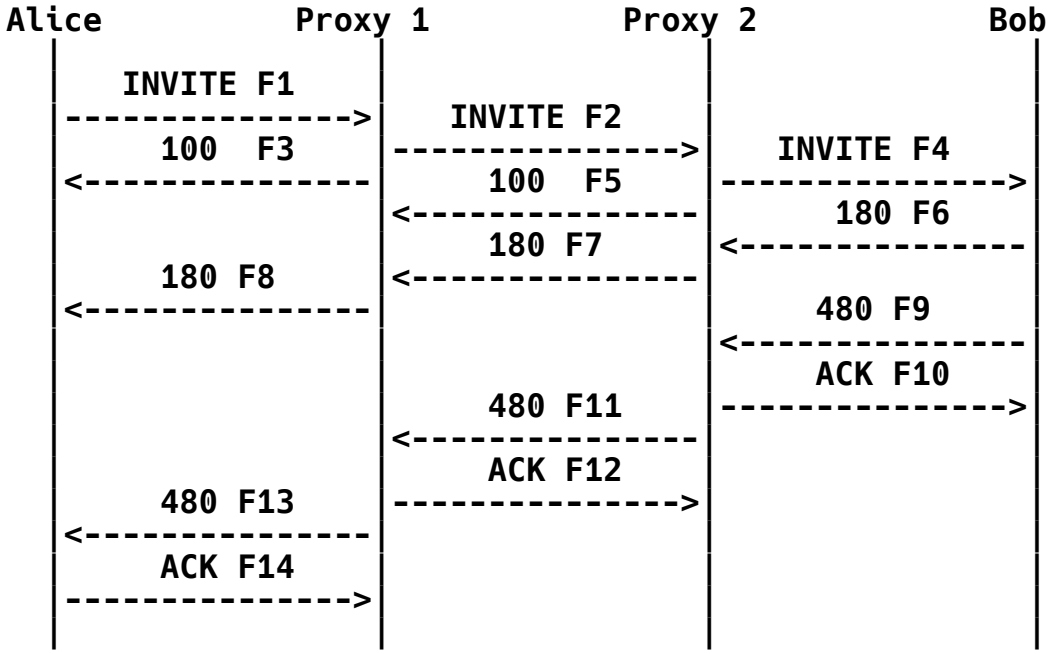
F14 480 No Response Proxy 1 -> Alice

```
SIP/2.0 480 No Response
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F15 ACK Alice -> Proxy 1

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="cf5904ba7d8dc3a5ab2530aa931128fa", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="7afc04be7961f053c24f80e7dbaf888f"
Content-Length: 0
```

3.11. Unsuccessful Temporarily Unavailable



In this scenario, Bob initially sends a 180 Ringing response to Alice, indicating that alerting is taking place. However, then a 480 Unavailable is then sent to Alice. This response is acknowledged then proxied back to Alice.

Message Details

F1 INVITE Alice -> Proxy 1

```
INVITE sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
Route: <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:alice@client.atlanta.example.com>
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="aa9311cf5904ba7d8dc3a5ab253028fa", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="59a46a91bf1646562a4d486c84b399db"
Content-Type: application/sdp
```

```
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000

   /*Client for Alice prepares to receive data on port 49172 from the
   network.*/


   F2 INVITE Proxy 1 -> Proxy 2

   INVITE sip:bob@biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Max-Forwards: 69
   Record-Route: <sip:ss1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Contact: <sip:alice@client.atlanta.example.com>
   Content-Type: application/sdp
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000


   F3 100 Trying Proxy 1 -> Alice

   SIP/2.0 100 Trying
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
```

```
   Content-Length: 0


   F4 INVITE Proxy 2 -> Bob

   INVITE sip:bob@client.biloxi.example.com SIP/2.0
   Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
   Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
    ;received=192.0.2.111
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   Max-Forwards: 68
   Record-Route: <sip:ss2.biloxi.example.com;lr>,
    <sip:ss1.atlanta.example.com;lr>
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Contact: <sip:alice@client.atlanta.example.com>
   Content-Type: application/sdp
   Content-Length: 151

   v=0
   o=alice 2890844526 2890844526 IN IP4 client.atlanta.example.com
   s=-
   c=IN IP4 192.0.2.101
   t=0 0
   m=audio 49172 RTP/AVP 0
   a=rtpmap:0 PCMU/8000


   F5 100 Trying Proxy 2 -> Proxy 1

   SIP/2.0 100 Trying
   Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
    ;received=192.0.2.111
   Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
    ;received=192.0.2.101
   From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
   To: Bob <sip:bob@biloxi.example.com>
   Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
   CSeq: 1 INVITE
   Content-Length: 0
```

F6 180 Ringing Bob -> Proxy 2

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F7 180 Ringing Proxy 2 -> Proxy 1

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
Content-Length: 0
```

F8 180 Ringing Proxy 1 -> Alice

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
Record-Route: <sip:ss2.biloxi.example.com;lr>,
 <sip:ss1.atlanta.example.com;lr>
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Contact: <sip:bob@client.biloxi.example.com>
```

```
Content-Length: 0
```

F9 480 Temporarily Unavailable Bob -> Proxy 2

```
SIP/2.0 480 Temporarily Unavailable
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
 ;received=192.0.2.222
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F10 ACK Proxy 2 -> Bob

```
ACK sip:bob@client.biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss2.biloxi.example.com:5060;branch=z9hG4bK721e4.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

F11 480 Temporarily Unavailable Proxy 2 -> Proxy 1

```
SIP/2.0 480 Temporarily Unavailable
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
 ;received=192.0.2.111
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F12 ACK Proxy 1 -> Proxy 2

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP ss1.atlanta.example.com:5060;branch=z9hG4bK2d4790.1
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 ACK
Content-Length: 0
```

F13 480 Temporarily Unavailable Proxy 1 -> Alice

```
SIP/2.0 480 Temporarily Unavailable
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
 ;received=192.0.2.101
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
CSeq: 1 INVITE
Content-Length: 0
```

F14 ACK Alice -> Proxy 1

```
ACK sip:bob@biloxi.example.com SIP/2.0
Via: SIP/2.0/UDP client.atlanta.example.com:5060;branch=z9hG4bK74bf9
Max-Forwards: 70
From: Alice <sip:alice@atlanta.example.com>;tag=9fxced76sl
To: Bob <sip:bob@biloxi.example.com>;tag=314159
Call-ID: 2xTb9vxSit55XU7p8@atlanta.example.com
Proxy-Authorization: Digest username="alice",
 realm="atlanta.example.com",
 nonce="aa9311cf5904ba7d8dc3a5ab253028fa", opaque="",
 uri="sip:bob@biloxi.example.com",
 response="59a46a91bf1646562a4d486c84b399db"
CSeq: 1 ACK
Content-Length: 0
```

4. Security Considerations

Since this document contains examples of SIP session establishment, the security considerations in RFC 3261 [1] apply. RFC 3261 describes the basic threats including registration hijacking, server impersonation, message body tampering, session modifying or teardown, and denial of service and amplification attacks. The use of HTTP Digest as shown in this document provides one-way authentication and protection against replay attacks. TLS transport is used in registration scenarios due to the lack of integrity protection in HTTP Digest and the danger of registration hijacking without it, as described in RFC 3261 [1]. A full discussion of the weaknesses of HTTP Digest is provided in RFC 3261 [1]. The use of TLS and the Secure SIP (sips) URI scheme provides a better level of security including two-way authentication. S/MIME can provide end-to-end confidentiality and integrity protection of message bodies, as described in RFC 3261.

5. References

5.1. Normative References

[1] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M. and E. Schooler, "SIP: Session Initiation Protocol", RFC 3261, June 2002.

[2] Rosenberg, J. and H. Schulzrinne, "An Offer/Answer Model with SDP", RFC 3264, April 2002.

[3] Franks, J., Hallam-Baker, P., Hostetler, J., Lawrence, S., Leach, P., Luotonen, A. and L. Stewart, "HTTP authentication: Basic and Digest Access Authentication", RFC 2617, June 1999.

[4] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

5.2. Informative References

[5] Johnston, A., Donovan, S., Sparks, R., Cunningham, C. and K. Summers, "Session Initiation Protocol (SIP) Public Switched Telephone Network (PSTN) Call Flows", BCP 76, RFC 3666, December 2003.

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