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Referring to Multiple Resources in the Session Initiation Protocol (SIP)
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Abstract

This document defines extensions to the SIP REFER method so that this method can be used to refer servers to multiple resources. These extensions include the use of pointers to Uniform Resource Identifier

(URI)-lists in the Refer-To header field and the "multiple-refer" SIP option-tag.

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1. Introduction

The SIP [3] REFER method [5] allows a user agent to request a server to send a request to a third party. Still, a number of applications need to request a server to initiate transactions towards a set of destinations. In one example, the moderator of a conference may want the conference server to send BYE requests to a group of participants. In another example, the same moderator may want the conference server to INVITE a set of new participants.

We define an extension to REFER so that REFER can be used to refer servers to multiple destinations. In addition, we use the REFER extension defined in [7] which suppresses REFER's implicit subscription.

2. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in BCP 14, RFC 2119 [1] and indicate requirement levels for compliant implementations.

We define the following three new terms:

REFER-Issuer: the user agent issuing the REFER request.

REFER-Recipient: the user agent receiving the REFER request.

REFER-Target: the intended final recipient of the request to be generated by the REFER-Recipient.

3. Overview of operation

This document defines an extension to the SIP REFER method [5] that allows a SIP User Agent Client (UAC) to include a list of REFER-Targets in a REFER request and send it to a server. The server will create a new request for each entry in the list of REFER-Target URIs.

We represent the multiple REFER-Targets of a REFER using a URI-list. A UAC (User Agent Client) that wants to refer a server to a set of destinations creates a SIP REFER request. The Refer-To header contains a pointer to a URI-list, which is included in a body part, and an option-tag in the Required header field: "multiple-refer". This option-tag indicates the requirement to support the functionality described in this specification.

When the server receives such request it creates a new request per destination and sends them.

This document does not provide any mechanism for UACs to find out about the results of a REFER with multiple REFER-Targets. Furthermore, it does not provide support for the implicit subscription mechanism that is part of the SIP REFER method. The way UACs are kept informed about the results of a REFER is service specific. For example, a UAC sending a REFER to INVITE a set of participants to a conference may discover which participants were successfully brought into the conference by subscribing to the conference state event [9].

4. The multiple-refer SIP Option-Tag

We define a new SIP option-tag for the Require and Supported header fields: "multiple-refer".

A user agent including the "multiple-refer" option-tag in a Supported header indicates compliance with this specification.

A user agent generating a REFER with a pointer to a URI-list in its Refer-To header field MUST include the "multiple-refer" option-tag in the Require header field of the REFER.

5. Suppressing REFER's Implicit Subscription

REFER requests with a single REFER-Target establish implicitly a subscription to the refer event. The REFER-Issuer is informed about the result of the transaction towards the REFER-Target through this implicit subscription. As described in [RFC 3515](#) [5], NOTIFY requests sent as a result of an implicit subscription created by a REFER request contain a body of type "message/sipfrag" [4] that describes the status of the transaction initiated by the REFER-Recipient.

In the case of a REFER-Issuer that generates a REFER with multiple REFER-targets, the REFER-Issuer is typically already subscribed to other event package that can provide the information about the result of the transactions towards the REFER-Targets. For example, a moderator instructing a conference server to send a BYE request to a set of participants is usually subscribed to the conference state event package for the conference. Notifications to this event package will keep the moderator and the rest of the subscribers informed of the current list of conference participants.

Most of the applications using multiple REFER do not need its implicit subscription. Consequently, a SIP REFER-Issuer generating a REFER request with multiple REFER-Targets SHOULD include the "norefersub" option-tag in a Require header field to indicate that no notifications about the requests should be sent to the REFER-Issuer. The "norefersub" SIP option-tag is defined in [7] and suppresses the

REFER's implicit subscription.

At the time of writing, there is no extension that allows to report the status of several transactions over a REFER's implicit subscription. That is the motivation for this document to recommend the usage of the "norefersub" option-tag. If in the future such an extension is defined, REFER-Issuers using it could refrain from using the "norefersub" option-tag and use the new extension instead.

6. Behavior of SIP REFER-Issuers

As indicated in [Section 4](#) and [Section 5](#) a SIP REFER-Issuer that creates a REFER request with multiple REFER-Targets includes a "multiple-refer" and a "norefersub" option-tags in the Require header field.

The Refer-To header field of a REFER request with multiple REFER-Targets MUST contain a pointer (i.e., a Content-ID Uniform Resource Locator (URL) [[2](#)]) that points to the body part that carries the URI-list. The REFER-Issuer SHOULD NOT include any particular URI more than once in the URI-list.

7. Behavior of REFER-Recipients

The REFER-Recipient follows the rules in [Section 2.4.2 of RFC 3515](#) [[5](#)] to determine the status code of the response to the REFER.

If the URI-list contains a URI more than once, the REFER-Recipient MUST behave as if that URI appeared in the URI-list only once. The REFER-Recipient uses the comparison rules specific to the URI scheme of each of the URIs in the URI-list to determine if there is any URI which appears more than once.

The REFER-Recipient follows the rules in [RFC 3515](#) [[5](#)] to generate the necessary requests towards the REFER-Targets, acting as if it had received a regular (no URI-list) REFER per each URI in the URI-list.

8. Default URI-List Format

The default format for URI-list bodies used in a multiple REFER request is the resource list document specified in [[6](#)]. User agents able to generate or receive REFERS with multiple REFER-Targets MUST support this format as specified in [[6](#)] and MAY support other formats.

Nevertheless, the Extensible Markup Language (XML) Configuration Access Protocol (XCAP) resource list document provides features, such as hierarchical lists and the ability to include entries by reference

relative to the XCAP root URI, that are not needed by the multiplet REFER service defined in this document. Therefore, when using the default resource list document, SIP REFER-Issuers generating REFERS with multiple REFER-Targets SHOULD use flat lists (i.e., no hierarchical lists) and SHOULD NOT use <entry-ref> elements.

A REFER-Recipient receiving a URI-list with more information than what has just been described MAY discard all the extra information.

Figure 1 shows an example of a flat list that follows the resource list document.

```
<?xml version="1.0" encoding="UTF-8"?>
<resource-lists xmlns="urn:ietf:params:xml:ns:resource-lists"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <list>
    <entry uri="sip:bill@example.com" />
    <entry uri="sip:joe@example.org" />
    <entry uri="sip:ted@example.net" />
  </list>
</resource-lists>
```

Figure 1: URI List

9. Example

Figure 2 shows an example flow where a REFER-Issuer sends a multiple-REFER request to the focus of a conference, which acts as the REFER-Recipient. The REFER-Recipient generates a BYE request per REFER-Target. (How to use REFER to remove participants from a conference is specified in [\[10\]](#).)

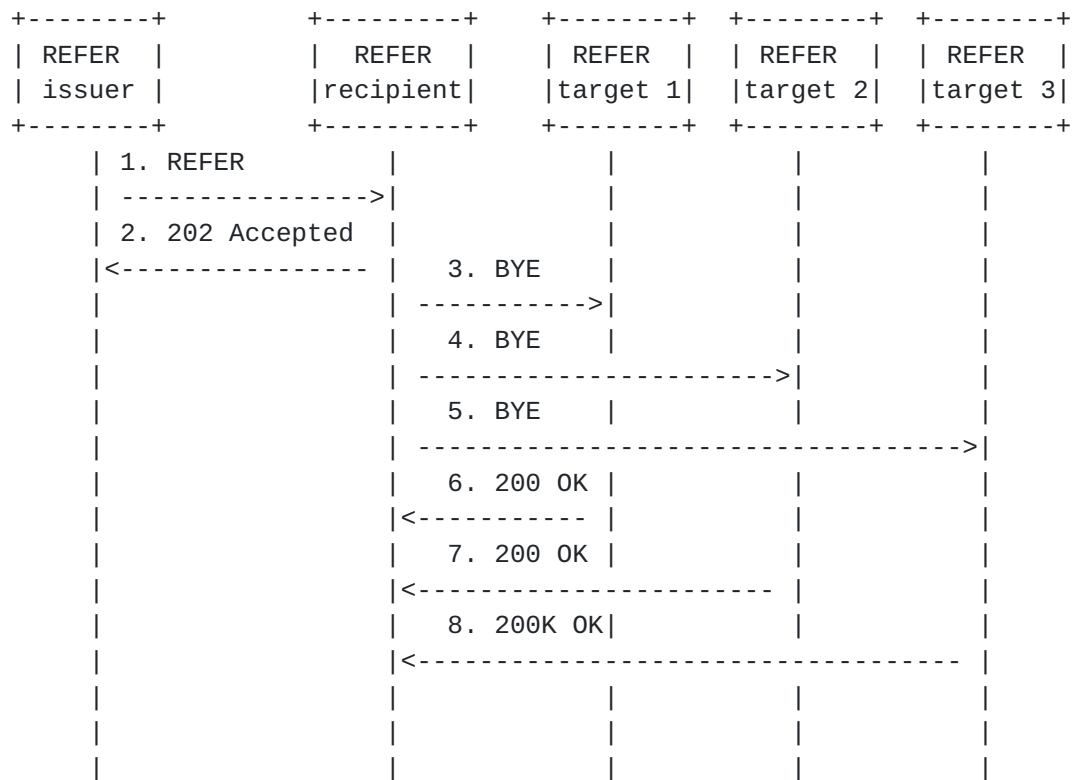


Figure 2: Example flow of a REFER request containing multiple REFER-Targets

The REFER request (1) contains a Refer-To header field that includes a pointer to the message body, which carries a list with the URIs of the REFER-Targets. The REFER's Require header field carries both the "multiple-refer" and the "norefersub" option-tags. Figure 3 shows an example of this REFER request. The resource list document contains the list of REFER-Target URIs along with the method of the SIP request that the REFER-Recipient generates.


```
REFER sip:conf-123@example.com SIP/2.0
Via: SIP/2.0/TCP client.chicago.example.com
    ;branch=z9hG4bKhjhs8ass83
Max-Forwards: 70
To: "Conference 123" <sip:conf-123@example.com>
From: Carol <sip:carol@chicago.example.com>;tag=32331
Call-ID: d432fa84b4c76e66710
CSeq: 2 REFER
Contact: <sip:carol@client.chicago.example.com>
Refer-To: <cid:cn35t8jf02@example.com>
Require: multiple-refer, norefersub
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, REFER, SUBSCRIBE, NOTIFY
Allow-Events: dialog
Accept: application/sdp, message/sipfrag
Content-Type: application/resource-lists+xml
Content-Disposition: uri-list
Content-Length: 307
Content-ID: <cn35t8jf02@example.com>

<?xml version="1.0" encoding="UTF-8"?>
<resource-lists xmlns="urn:ietf:params:xml:ns:resource-lists"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <list>
    <entry uri="sip:bill@example.com?method=BYE" />
    <entry uri="sip:joe@example.org?method=BYE" />
    <entry uri="sip:ted@example.net?method=BYE" />
  </list>
</resource-lists>
```

Figure 3: REFER request with multiple REFER-Targets

Figure 4 shows an example of the BYE request (3) that the REFER-Recipient sends to the first REFER-Target.

```
BYE sip:bill@example.com SIP/2.0
Via: SIP/2.0/TCP conference.example.com
    ;branch=z9hG4bKhjhs8assmm
Max-Forwards: 70
From: "Conference 123" <sip:conf-123@example.com>;tag=88734
To: <sip:bill@example.com>;tag=29872
Call-ID: d432fa84b4c34098s812
CSeq: 34 BYE
Content-Length: 0
```

Figure 4: BYE request

10. Security Considerations

The Framework and Security Considerations for SIP URI-List Services [8] discusses issues related to SIP URI-list services. Given that a server accepting REFERS with multiple REFER-targets acts as an URI-list service, implementations of this type of server MUST follow the security-related rules in [8]. These rules include mandatory authentication and authorization of clients, and opt-in lists.

Additionally, servers SHOULD only accept REFER requests within the context of an application the server understands (e.g., a conferencing application). This implies that servers MUST NOT accept REFERS for methods they do not understand. The idea behind these two rules is that servers are not used as dumb servers whose only function is to fan-out random messages they do not understand.

11. IANA Considerations

This document defines a new SIP option-tag: "multiple-refer". This option-tag should be registered in the SIP Parameters registry.

SIP user agents that place the "multiple-refer" option-tag in a Supported header field understand REFER requests that contain resource list document describing multiple REFER-Targets.

12. References

12.1 Normative References

- [1] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [2] Levinson, E., "Content-ID and Message-ID Uniform Resource Locators", [RFC 2392](#), August 1998.
- [3] 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.
- [4] Sparks, R., "Internet Media Type message/sipfrag", [RFC 3420](#), November 2002.
- [5] Sparks, R., "The Session Initiation Protocol (SIP) Refer Method", [RFC 3515](#), April 2003.
- [6] Rosenberg, J., "Extensible Markup Language (XML) Formats for Representing Resource Lists", [draft-ietf-simple-xcap-list-usage-05](#) (work in progress),

February 2005.

- [7] Levin, O., "Suppression of Session Initiation Protocol REFER Method Implicit Subscription", [draft-ietf-sip-refer-with-norefersub-01](#) (work in progress), February 2005.
- [8] Camarillo, G. and A. Roach, "Requirements and Framework for Session Initiation Protocol (SIP) Uniform Resource Identifier (URI)-List Services", [draft-ietf-sipping-uri-services-02](#) (work in progress), December 2004.

12.2 Informational References

- [9] Rosenberg, J., "A Session Initiation Protocol (SIP) Event Package for Conference State", [draft-ietf-sipping-conference-package-10](#) (work in progress), March 2005.
- [10] Johnston, A. and O. Levin, "Session Initiation Protocol Call Control - Conferencing for User Agents", [draft-ietf-sipping-cc-conferencing-06](#) (work in progress), November 2004.

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