

IMAP4 Mailbox Referrals

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

1. Abstract

When dealing with large amounts of users, messages and geographically dispersed IMAP4 [RFC-2060] servers, it is often desirable to distribute messages amongst different servers within an organization. For example an administrator may choose to store user's personal mailboxes on a local IMAP4 server, while storing shared mailboxes remotely on another server. This type of configuration is common when it is uneconomical to store all data centrally due to limited bandwidth or disk resources.

Mailbox referrals allow clients to seamlessly access mailboxes that are distributed across several IMAP4 servers.

A referral mechanism can provide efficiencies over the alternative "proxy method", in which the local IMAP4 server contacts the remote server on behalf of the client, and then transfers the data from the remote server to itself, and then on to the client. The referral mechanism's direct client connection to the remote server is often a more efficient use of bandwidth, and does not require the local server to impersonate the client when authenticating to the remote server.

2. Conventions used in this document

In examples, "C:" and "S:" indicate lines sent by the client and server respectively.

A home server, is an IMAP4 server that contains the user's inbox.

A remote mailbox is a mailbox that is not hosted on the user's home server.

A remote server is a server that contains remote mailboxes.

A shared mailbox, is a mailbox that multiple users have access to.

An IMAP mailbox referral is when the server directs the client to another IMAP mailbox.

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 [RFC-2119].

3. Introduction and Overview

IMAP4 servers that support this extension MUST list the keyword MAILBOX-REFERRALS in their CAPABILITY response. No client action is needed to invoke the MAILBOX-REFERRALS capability in a server.

A MAILBOX-REFERRALS capable IMAP4 server MUST NOT return referrals that result in a referrals loop.

A referral response consists of a tagged NO response and a REFERRAL response code. The REFERRAL response code MUST contain as an argument a one or more valid URLs separated by a space as defined in [RFC-1738]. If a server replies with multiple URLs for a particular object, they MUST all be of the same type. In this case, the URL MUST be an IMAP URL as defined in [RFC-2192]. A client that supports the REFERRALS extension MUST be prepared for a URL of any type, but it need only be able to process IMAP URLs.

A server MAY respond with multiple IMAP mailbox referrals if there is more than one replica of the mailbox. This allows the implementation of a load balancing or failover scheme. How a server keeps multiple replicas of a mailbox in sync is not addressed by this document.

If the server has a preferred order in which the client should attempt to access the URLs, the preferred URL SHOULD be listed in the first, with the remaining URLs presented in descending order of preference. If multiple referrals are given for a mailbox, a server should be aware that there are synchronization issues for a client if the UIDVALIDITY of the referred mailboxes are different.

An IMAP mailbox referral may be given in response to an IMAP command that specifies a mailbox as an argument.

Example:

```
A001 NO [REFERRAL IMAP://user;AUTH=*@SERVER2/REMOTE]Remote Mailbox
```

NOTE: user;AUTH=* is specified as required by [RFC-2192] to avoid a client falling back to anonymous login.

Remote mailboxes and their inferiors, that are accessible only via referrals SHOULD NOT appear in LIST and LSUB responses issued against the user's home server. They MUST appear in RLIST and RLSUB responses issued against the user's home server. Hierarchy referrals, in which a client would be required to connect to the remote server to issue a LIST to discover the inferiors of a mailbox are not addressed in this document.

For example, if shared mailboxes were only accessible via referrals on a remote server, a RLIST "" "#SHARED/%" command would return the same response if issued against the user's home server or the remote server.

Note: Mailboxes that are available on the user's home server do not need to be available on the remote server. In addition, there may be additional mailboxes available on the remote server, but they will not be accessible to the client via referrals unless they appear in the LIST response to the RLIST command against the user's home server.

A MAILBOX-REFERRALS capable client will issue the RLIST and RLSUB commands in lieu of LIST and LSUB. The RLIST and RLSUB commands behave identically to their LIST and LSUB counterparts, except remote mailboxes are returned in addition to local mailboxes in the LIST and LSUB responses. This avoids displaying to a non MAILBOX-REFERRALS enabled client inaccessible remote mailboxes.

4.1. SELECT, EXAMINE, DELETE, SUBSCRIBE, UNSUBSCRIBE, STATUS and APPEND Referrals

An IMAP4 server MAY respond to the SELECT, EXAMINE, DELETE, SUBSCRIBE, UNSUBSCRIBE, STATUS or APPEND command with one or more IMAP mailbox referrals to indicate to the client that the mailbox is hosted on a remote server.

When a client processes an IMAP mailbox referral, it will open a new connection or use an existing connection to the remote server so that it is able to issue the commands necessary to process the remote mailbox.

Example: <IMAP4 connection to home server>

```
C: A001 DELETE "SHARED/FOO"  
S: A001 NO [REFERRAL IMAP://user;AUTH=*@SERVER2/SHARED/FOO]  
      Remote mailbox. Try SERVER2.
```

<Client established a second connection to SERVER2 and issues the DELETE command on the referred mailbox>

```
S: * OK IMAP4rev1 server ready  
C: B001 AUTHENTICATE KERBEROS_V4  
<authentication exchange>  
S: B001 OK user is authenticated
```

```
C: B002 DELETE "SHARED/FOO"  
S: B002 OK DELETE completed
```

Example: <IMAP4 connection to home server>

```
C: A001 SELECT REMOTE  
S: A001 NO [REFERRAL IMAP://user;AUTH=*@SERVER2/REMOTE  
      IMAP://user;AUTH=*@SERVER3/REMOTE] Remote mailbox.  
      Try SERVER2 or SERVER3.
```

<Client opens second connection to remote server, and issues the commands needed to process the items in the remote mailbox>

```
S: * OK IMAP4rev1 server ready  
C: B001 AUTHENTICATE KERBEROS_V4  
<authentication exchange>  
S: B001 OK user is authenticated
```

```
C: B002 SELECT REMOTE  
S: * 12 EXISTS  
S: * 1 RECENT  
S: * OK [UNSEEN 10] Message 10 is first unseen  
S: * OK [UIDVALIDITY 123456789]  
S: * FLAGS (Answered Flagged Deleted Seen Draft)  
S: * OK [PERMANENTFLAGS (Answered Deleted Seen )]  
S: B002 OK [READ-WRITE] Selected completed
```

```
C: B003 FETCH 10:12 RFC822  
S: * 10 FETCH . . .  
S: * 11 FETCH . . .  
S: * 12 FETCH . . .  
S: B003 OK FETCH Completed
```

<Client is finished processing the REMOTE mailbox and
wants to process a mailbox on its home server>

```
C: B004 LOGOUT
S: * BYE IMAP4rev1 server logging out
S: B004 OK LOGOUT Completed
```

<Client continues with first connection>

```
C: A002 SELECT INBOX
S: * 16 EXISTS
S: * 2 RECENT
S: * OK [UNSEEN 10] Message 10 is first unseen
S: * OK [UIDVALIDITY 123456789]
S: * FLAGS (Answered Flagged Deleted Seen Draft)
S: * OK [PERMANENTFLAGS (Answered Deleted Seen )]
S: A002 OK [READ-WRITE] Selected completed
```

4.2. CREATE Referrals

An IMAP4 server MAY respond to the CREATE command with one or more IMAP mailbox referrals, if it wishes to direct the client to issue the CREATE against another server. The server can employ any means, such as examining the hierarchy of the specified mailbox name, in determining which server the mailbox should be created on.

Example:

```
C: A001 CREATE "SHARED/FOO"
S: A001 NO [REFERRAL IMAP://user;AUTH=*@SERVER2/SHARED/FOO]
    Mailbox should be created on remote server
```

Alternatively, because a home server is required to maintain a listing of referred remote mailboxes, a server MAY allow the creation of a mailbox that will ultimately reside on a remote server against the home server, and provide referrals on subsequent commands that manipulate the mailbox.

Example:

```
C: A001 CREATE "SHARED/FOO"
S: A001 OK CREATE succeeded

C: A002 SELECT "SHARED/FOO"
S: A002 NO [REFERRAL IMAP://user;AUTH=*@SERVER2/SHARED/FOO]
    Remote mailbox. Try SERVER2
```

4.3. RENAME Referrals

An IMAP4 server MAY respond to the RENAME command with one or more pairs of IMAP mailbox referrals. In each pair of IMAP mailbox referrals, the first one is an URL to the existing mailbox name and the second is an URL to the requested new mailbox name.

If within an IMAP mailbox referral pair, the existing and new mailbox URLs are on different servers, the remote servers are unable to perform the RENAME operation. To achieve the same behavior of server RENAME, the client MAY issue the constituent CREATE, FETCH, APPEND, and DELETE commands against both servers.

If within an IMAP mailbox referral pair, the existing and new mailbox URLs are on the same server it is an indication that the currently connected server is unable to perform the operation. The client can simply re-issue the RENAME command on the remote server.

Example:

```
C: A001 RENAME FOO BAR
S: A001 NO [REFERRAL IMAP://user;AUTH=*@SERVER1/FOO
      IMAP://user;AUTH=*@SERVER2/BAR] Unable to rename mailbox
      across servers
```

Since the existing and new mailbox names are on different servers, the client would be required to make a connection to both servers and issue the constituent commands require to achieve the RENAME.

Example:

```
C: A001 RENAME FOO BAR
S: A001 NO [REFERRAL IMAP://user;AUTH=*@SERVER2/FOO
      IMAP://user;AUTH=*@SERVER2/BAR] Unable to rename mailbox
      located on SERVER2
```

Since both the existing and new mailbox are on the same remote server, the client can simply make a connection to the remote server and re-issue the RENAME command.

4.4. COPY Referrals

An IMAP4 server MAY respond to the COPY command with one or more IMAP mailbox referrals. This indicates that the destination mailbox is on a remote server. To achieve the same behavior of a server COPY, the client MAY issue the constituent FETCH and APPEND commands against both servers.

Example:

```
C: A001 COPY 1 "SHARED/STUFF"
S: A001 NO [REFERRAL IMAP://user;AUTH=*@SERVER2/SHARED/STUFF]
    Unable to copy message(s) to SERVER2.
```

5.1 RLIST command

Arguments: reference name
 mailbox name with possible wildcards

Responses: untagged responses: LIST

Result: OK - RLIST Completed
 NO - RLIST Failure
 BAD - command unknown or arguments invalid

The RLIST command behaves identically to its LIST counterpart, except remote mailboxes are returned in addition to local mailboxes in the LIST responses.

5.2 RLSUB Command

Arguments: reference name
 mailbox name with possible wildcards

Responses: untagged responses: LSUB

Result: OK - RLSUB Completed
 NO - RLSUB Failure
 BAD - command unknown or arguments invalid

The RLSUB command behaves identically to its LSUB counterpart, except remote mailboxes are returned in addition to local mailboxes in the LSUB responses.

6. Formal Syntax

The following syntax specification uses the augmented Backus-Naur Form (BNF) as described in [ABNF].

list_mailbox = <list_mailbox> as defined in [RFC-2060]

mailbox = <mailbox> as defined in [RFC-2060]

mailbox_referral = <tag> SPACE "NO" SPACE
 <referral_response_code> (text / text_mime2)
 ; See [RFC-2060] for <tag>, text and text_mime2 definition

```
referral_response_code = "[" "REFERRAL" 1*(SPACE <url>) "]"  
; See [RFC-1738] for <url> definition
```

```
rlist = "RLIST" SPACE mailbox SPACE list_mailbox
```

```
rlsub = "RLSUB" SPACE mailbox SPACE list_mailbox
```

6. Security Considerations

The IMAP4 referral mechanism makes use of IMAP URLs, and as such, have the same security considerations as general internet URLs [RFC-1738], and in particular IMAP URLs [RFC-2192].

With the MAILBOX-REFERRALS capability, it is potentially easier to write a rogue server that injects a bogus referral response that directs a user to an incorrect mailbox. Although referrals reduce the effort to write such a server, the referral response makes detection of the intrusion easier.

7. References

[RFC-2060], Crispin, M., "Internet Message Access Protocol - Version 4rev1", RFC 2060, University of Washington, December 1996.

[RFC-2192], Newman, C., "IMAP URL Scheme", RFC 2192, Innosoft, September 1997.

[RFC-1738], Berners-Lee, T., Masinter, L., and M. McCahill, "Uniform Resource Locators (URL)", RFC 1738, CERN, Xerox Corporation, University of Minnesota, December 1994.

[RFC-2119], Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119, Harvard University, March 1997.

[ABNF], DRUMS working group, Dave Crocker Editor, "Augmented BNF for Syntax Specifications: ABNF", Work in Progress, Internet Mail Consortium, April 1997.

8. Acknowledgments

Many valuable suggestions were received from private discussions and the IMAP4 mailing list. In particular, Raymond Cheng, Mark Crispin, Mark Keasling, Chris Newman and Larry Osterman made significant contributions to this document.

9. Author's Address

Mike Gahrns
Microsoft
One Microsoft Way
Redmond, WA, 98072

Phone: (206) 936-9833
EMail: mikega@microsoft.com

