                   IMAP Extension for Object Identifiers

Abstract

   This document updates RFC 3501 (IMAP4rev1) with persistent
   identifiers on mailboxes and messages to allow clients to more
   efficiently reuse cached data when resources have changed location on
   the server.

Status of This Memo

   This is an Internet Standards Track document.

   This document is a product of the Internet Engineering Task Force
   (IETF). It represents the consensus of the IETF community. It has
   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 7841.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   https://www.rfc-editor.org/info/rfc8474.

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1. Introduction

   IMAP stores are often used by many clients. Each client may cache
   data from the server so that it doesn't need to redownload
   information. [RFC3501] states that a mailbox can be uniquely
   referenced by its name and UIDVALIDITY, and a message within that
   mailbox can be uniquely referenced by its mailbox (name +
   UIDVALIDITY) and unique identifier (UID). The triple of mailbox
   name, UIDVALIDITY, and UID is guaranteed to be immutable.

   [RFC4315] defines a COPYUID response that allows a client that copies
   messages to know the mapping between the UIDs in the source and
   destination mailboxes and, hence, update its local cache.

   If a mailbox is successfully renamed by a client, that client will
   know that the same messages exist in the destination mailbox name as
   previously existed in the source mailbox name.

The result is that the client that copies (or moves [RFC6851])
messages or renames a mailbox can update its local cache, but any
other client connected to the same store cannot know with certainty
that the messages are identical, so it will redownload everything.

This extension adds new properties to a message (EMAILID) and mailbox
(MAILBOXID). These properties allow a client to quickly identify
messages or mailboxes that have been renamed by another client.

This extension also adds an optional thread identifier (THREADID) to
messages, which can be used by the server to indicate messages that
it has identified to be related. A server that does not implement
threading will return NIL to all requests for THREADID.

2. Conventions Used in This Document

In examples, "C:" indicates lines sent by a client that is connected
to a server. "S:" indicates lines sent by the server to the client.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
"OPTIONAL" in this document are to be interpreted as described in
BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all
capitals, as shown here.

3. CAPABILITY Identification

IMAP servers that support this extension MUST include "OBJECTID" in
the response list to the CAPABILITY command.

4. MAILBOXID Object Identifier

The MAILBOXID is a server-allocated unique identifier for each
mailbox.

The server MUST return the same MAILBOXID for a mailbox with the same
name and UIDVALIDITY.

The server MUST NOT report the same MAILBOXID for two mailboxes at
the same time.

The server MUST NOT reuse the same MAILBOXID for a mailbox that does
not obey all the invariants that [RFC3501] defines for a mailbox that
does not change name or UIDVALIDITY.

The server MUST keep the same MAILBOXID for the source and
destination when renaming a mailbox in a way that keeps the same
messages (but see [RFC3501] for the special case regarding the
renaming of INBOX, which is treated as creating a new mailbox and
moving the messages).

4.1. New Response Code for CREATE

This document extends the CREATE command to have the response code
MAILBOXID on successful mailbox creation.

A server advertising the OBJECTID capability MUST include the
MAILBOXID response code in the tagged OK response to all successful
CREATE commands.

Syntax: "MAILBOXID" SP "(" objectid ")"

 Response code in tagged OK response for successful CREATE command.

Example:

```
  C: 3 create foo
  S: 3 OK [MAILBOXID (F2212ea87-6097-4256-9d51-71338625)] Completed
  C: 4 create bar
  S: 4 OK [MAILBOXID (F6352ae03-b7f5-463c-896f-d8b48ee3)] Completed
  C: 5 create foo
  S: 5 NO Mailbox already exists
```

4.2. New OK Untagged Response for SELECT and EXAMINE

This document adds a new untagged response code to the SELECT and
EXAMINE commands.

A server advertising the OBJECTID capability MUST return an untagged
OK response with the MAILBOXID response code on all successful SELECT
and EXAMINE commands.

Syntax: "OK" SP "[" "MAILBOXID" SP "(" objectid ")" "]" SP text

          Untagged OK response to SELECT or EXAMINE.

Example:

```
    C: 27 select "foo"
    [...]
    S: * OK [MAILBOXID (F2212ea87-6097-4256-9d51-71338625)] Ok
    [...]
    S: 27 OK [READ-WRITE] Completed
```

4.3. New Attribute for STATUS

   This document adds the MAILBOXID attribute to the STATUS command
   using the extended syntax defined in [RFC4466].

   A server that advertises the OBJECTID capability MUST support the
   MAILBOXID status attribute.

   Syntax: "MAILBOXID"

                 The attribute in the STATUS command.

   Syntax: "MAILBOXID" SP "(" objectid ")"

      The response item in the STATUS response contains the ObjectID
      assigned by the server for this mailbox.

   Example:

    C: 6 status foo (mailboxid)
    S: * STATUS foo (MAILBOXID (F2212ea87-6097-4256-9d51-71338625))
    S: 6 OK Completed
    C: 7 status bar (mailboxid)
    S: * STATUS bar (MAILBOXID (F6352ae03-b7f5-463c-896f-d8b48ee3))
    S: 7 OK Completed
    C: 8 rename foo renamed
    S: * OK rename foo renamed
    S: 8 OK Completed
    C: 9 status renamed (mailboxid)
    S: * STATUS renamed (MAILBOXID (F2212ea87-6097-4256-9d51-71338625))
    S: 9 OK Completed
    C: 10 status bar (mailboxid)
    S: * STATUS bar (MAILBOXID (F6352ae03-b7f5-463c-896f-d8b48ee3))
    S: 10 OK Completed

   When the LIST-STATUS IMAP capability defined in [RFC5819] is also
   available, the STATUS command can be combined with the LIST command.

   Example:

   C: 11 list "" "*" return (status (mailboxid))
   S: * LIST (\HasNoChildren) "." INBOX
   S: * STATUS INBOX (MAILBOXID (Ff8e3ead4-9389-4aff-adb1-d8d89efd8cbf))
   S: * LIST (\HasNoChildren) "." bar
   S: * STATUS bar (MAILBOXID (F6352ae03-b7f5-463c-896f-d8b48ee3))
   S: * LIST (\HasNoChildren) "." renamed
   S: * STATUS renamed (MAILBOXID (F2212ea87-6097-4256-9d51-71338625))
   S: 11 OK Completed (0.001 secs 3 calls)

5. EMAILID Object Identifier and THREADID Correlator

5.1. EMAILID Identifier for Identical Messages

   The EMAILID data item is an ObjectID that uniquely identifies the
   content of a single message. Anything that must remain immutable on
   a {name, uidvalidity, uid} triple must also be the same between
   messages with the same EMAILID.

   The server MUST return the same EMAILID for the same triple; hence,
   EMAILID is immutable.

   The server MUST return the same EMAILID as the source message for the
   matching destination message in the COPYUID pairing after a COPY or
   MOVE command [RFC6851].

   The server MAY assign the same EMAILID as an existing message upon
   APPEND (e.g., if it detects that the new message has exactly
   identical content to that of an existing message).

   NOTE: EMAILID only identifies the immutable content of the message.
   In particular, it is possible for different messages with the same
   EMAILID to have different keywords. This document does not specify a
   way to STORE by EMAILID.

5.2. THREADID Identifier for Related Messages

   The THREADID data item is an ObjectID that uniquely identifies a set
   of messages that the server believes should be grouped together when
   presented.

   THREADID calculation is generally based on some combination of
   References, In-Reply-To, and Subject, but the exact logic is left up
   to the server implementation. [RFC5256] describes some algorithms
   that could be used; however, this specification does not mandate any
   particular strategy.

   The server MUST return the same THREADID for all messages with the
   same EMAILID.

   The server SHOULD return the same THREADID for related messages, even
   if they are in different mailboxes; for example, messages that would
   appear in the same thread if they were in the same mailbox SHOULD
   have the same THREADID, even if they are in different mailboxes.

   The server MUST NOT change the THREADID of a message once reported.

THREADID is OPTIONAL; if the server doesn't support THREADID or is
unable to calculate relationships between messages, it MUST return
NIL to all FETCH responses for the THREADID data item, and a SEARCH
for THREADID MUST NOT match any messages.

The server MUST NOT use the same ObjectID value for both EMAILIDs and
THREADIDs. If they are stored with the same value internally, the
server can generate prefixed values (as shown in the examples below
with M and T prefixes) to avoid clashes.

5.3. New Message Data Items in FETCH and UID FETCH Commands

This document defines two FETCH items:

Syntax: "EMAILID"

  The EMAILID message data item causes the server to return EMAILID
  FETCH response data items.

Syntax: "THREADID"

 The THREADID message data item causes the server to return THREADID
 FETCH response data items.

This document defines the following responses:

Syntax: "EMAILID" SP "(" objectid ")"

The EMAILID response data item contains the server-assigned ObjectID
for each message.

Syntax: "THREADID" SP "(" objectid ")"

The THREADID response data item contains the server-assigned ObjectID
for the set of related messages to which this message belongs.

Syntax: "THREADID" SP nil

 The NIL value is returned for the THREADID response data item when
 the server mailbox does not support THREADID calculation.

   Example:

     C: 5 append inbox "20-Mar-2018 03:07:37 +1100" {733}
     [...]
     Subject: Message A
     Message-ID: <fake.1521475657.54797@example.com>
     [...]
     S: 5 OK [APPENDUID 1521475658 1] Completed

     C: 11 append inbox "20-Mar-2018 03:07:37 +1100" {793}
     [...]
     Subject: Re: Message A
     Message-ID: <fake.1521475657.21213@example.org>
     References: <fake.1521475657.54797@example.com>
     [...]
     S: 11 OK [APPENDUID 1521475658 2] Completed

     C: 17 append inbox "20-Mar-2018 03:07:37 +1100" {736}
     [...]
     Subject: Message C
     Message-ID: <fake.1521475657.60280@example.com>
     [...]
     S: 17 OK [APPENDUID 1521475658 3] Completed

     C: 22 fetch 1:* (emailid threadid)
     S: * 1 FETCH (EMAILID (M6d99ac3275bb4e) THREADID (T64b478a75b7ea9))
     S: * 2 FETCH (EMAILID (M288836c4c7a762) THREADID (T64b478a75b7ea9))
     S: * 3 FETCH (EMAILID (M5fdc09b49ea703) THREADID (T11863d02dd95b5))
     S: 22 OK Completed (0.000 sec)

     C: 23 move 2 foo
     S: * OK [COPYUID 1521475659 2 1] Completed
     S: * 2 EXPUNGE
     S: 23 OK Completed

     C: 24 fetch 1:* (emailid threadid)
     S: * 1 FETCH (EMAILID (M6d99ac3275bb4e) THREADID (T64b478a75b7ea9))
     S: * 2 FETCH (EMAILID (M5fdc09b49ea703) THREADID (T11863d02dd95b5))
     S: 24 OK Completed (0.000 sec)
     C: 25 select "foo"

     C: 25 select "foo"
     [...]
     S: 25 OK [READ-WRITE] Completed
     C: 26 fetch 1:* (emailid threadid)
     S: * 1 FETCH (EMAILID (M288836c4c7a762) THREADID (T64b478a75b7ea9))
     S: 26 OK Completed (0.000 sec)

Example: (no THREADID support)

```
        C: 26 fetch 1:* (emailid threadid)
        S: * 1 FETCH (EMAILID (M00000001) THREADID NIL)
        S: * 2 FETCH (EMAILID (M00000002) THREADID NIL)
        S: 26 OK Completed (0.000 sec)
```

6. New Filters on SEARCH Command

   This document defines the filters EMAILID and THREADID on the SEARCH
   command.

   Syntax: "EMAILID" SP objectid

       Messages whose EMAILID is exactly the specified ObjectID.

   Syntax: "THREADID" SP objectid

       Messages whose THREADID is exactly the specified ObjectID.

   Example: (as if run before the MOVE shown above when the mailbox had
   three messages)

```
        C: 27 search emailid M6d99ac3275bb4e
        S: * SEARCH 1
        S: 27 OK Completed (1 msgs in 0.000 secs)
        C: 28 search threadid T64b478a75b7ea9
        S: * SEARCH 1 2
        S: 28 OK Completed (2 msgs in 0.000 secs)
```

7. Formal Syntax

   The following syntax specification uses the Augmented Backus-Naur
   Form (ABNF) [RFC5234] notation. Elements not defined here can be
   found in the formal syntax of the ABNF [RFC5234], IMAP [RFC3501], and
   IMAP ABNF extensions [RFC4466] specifications.

   Except as noted otherwise, all alphabetic characters are case
   insensitive. The use of uppercase or lowercase characters to define
   token strings is for editorial clarity only. Implementations MUST
   accept these strings in a case-insensitive fashion.

   Please note specifically that ObjectID values are case sensitive.

```
     capability =/ "OBJECTID"

     fetch-att =/ "EMAILID" / "THREADID"

     fetch-emailid-resp = "EMAILID" SP "(" objectid ")"
             ; follows tagged-ext production from [RFC4466]

     fetch-threadid-resp = "THREADID" SP ( "(" objectid ")" / nil )
             ; follows tagged-ext production from [RFC4466]

     msg-att-static =/ fetch-emailid-resp / fetch-threadid-resp

     objectid = 1*255(ALPHA / DIGIT / "_" / "-")
             ; characters in object identifiers are case
             ; significant

     resp-text-code =/ "MAILBOXID" SP "(" objectid ")"
             ; incorporated before the expansion rule of
             ;  atom [SP 1*<any TEXT-CHAR except "]">]
             ; that appears in [RFC3501]

     search-key =/ "EMAILID" SP objectid / "THREADID" SP objectid

     status-att =/ "MAILBOXID"

     status-att-val =/ "MAILBOXID" SP "(" objectid ")"
             ; follows tagged-ext production from [RFC4466]
```

8. Implementation Considerations

8.1. Assigning Object Identifiers

   All ObjectID values are allocated by the server.

   In the interest of reducing the possibilities of encoding mistakes,
   ObjectIDs are restricted to a safe subset of possible byte values; in
   order to allow clients to allocate storage, they are restricted in
   length.

   An ObjectID is a string of 1 to 255 characters from the following set
   of 64 codepoints: a-z, A-Z, 0-9, _, -. These characters are safe to
   use in almost any context (e.g., filesystems, URIs, IMAP atoms).
   These are the same characters defined as base64url in [RFC4648].

For maximum safety, servers should also follow defensive allocation
strategies to avoid creating risks where glob completion or data type
detection may be present (e.g., on filesystems or in spreadsheets).
In particular, it is wise to avoid:

o IDs starting with a dash

o IDs starting with digits

o IDs that contain only digits

o IDs that differ only by ASCII case (for example, A vs. a)

o the specific sequence of three characters NIL in any case (because
   this sequence can be confused with the IMAP protocol expression of
   the null value)

A good solution to these issues is to prefix every ID with a single
alphabetical character.

8.2. Interaction with Special Cases

The case of RENAME INBOX may need special handling because it has
special behavior, as defined in [RFC3501], Section 6.3.5.

It is advisable (though not required) to have MAILBOXID be globally
unique, but it is only required to be unique within messages offered
to a single client login to a single server hostname. For example, a
proxy that aggregates multiple independent servers MUST NOT advertise
the OBJECTID capability unless it can guarantee that different
objects will never use the same identifiers, even if backend object
identifiers collide.

8.3. Client Usage

Servers that implement both RFC 6154 and this specification should
optimize their execution of commands like UID SEARCH OR EMAILID 1234
EMAILID 4321.

Clients can assume that searching the all-mail mailbox using OR/
EMAILID or OR/THREADID is a fast way to find messages again if some
other client has moved them out of the mailbox where they were
previously seen.

Clients that cache data offline should fetch the EMAILID of all new
messages to avoid redownloading already-cached message details.

Clients should fetch the MAILBOXID for any new mailboxes before
discarding cache data for any mailbox that is no longer present on
the server so that they can detect renames and avoid redownloading
data.

8.4. Advice to Client Implementers

In cases of server failure and disaster recovery, or misbehaving
servers, it is possible that a client will be sent invalid
information, e.g., identical ObjectIDs or ObjectIDs that have changed
where they MUST NOT change according to this document.

In a case where a client detects inconsistent ObjectID responses from
a server, it SHOULD fall back to relying on the guarantees of RFC
3501. For simplicity, a client MAY instead choose to discard its
entire cache and resync all state from the server.

Client authors protecting against server misbehavior MUST ensure that
their design cannot get into an infinite loop of discarding cache and
fetching the same data repeatedly without user interaction.

9. Future Considerations

This extension is intentionally defined to be compatible with the
data model in [JMAP-MAIL].

A future extension could be proposed to give a way to SELECT a
mailbox by MAILBOXID rather than name.

A future extension to [RFC5228] could allow fileinto by MAILBOXID
rather than name.

An extension to allow fetching message content directly via EMAILID
and message listings by THREADID could be proposed.

10. IANA Considerations

IANA has added "OBJECTID" to the "IMAP Capabilities" registry located
at <https://www.iana.org/assignments/imap-capabilities> with a
reference to this document.

IANA has added "MAILBOXID" to the "IMAP Response Codes" registry
located at <https://www.iana.org/assignments/imap-response-codes>
with a reference to this document.

11. Security Considerations

   It is strongly advised that servers generate ObjectIDs that are safe
   to use as filesystem names and unlikely to be autodetected as
   numbers. See implementation considerations.

   If a digest is used for ID generation, it must have a collision-
   resistant property, so server implementations are advised to monitor
   current security research and choose secure digests. As the IDs are
   generated by the server, it will be possible to migrate to a new hash
   by just using the new algorithm when creating new IDs. This is
   particularly true if a prefix is used on each ID, which can be
   changed when the algorithm changes.

   The use of a digest for ID generation may be used as proof that a
   particular sequence of bytes was seen by the server. However, this
   is only a risk if IDs are leaked to clients who don't have permission
   to fetch the data directly. Servers that are expected to handle
   highly sensitive data should consider this when choosing how to
   create IDs.

   See also the security considerations in [RFC3501], Section 11.

12. References

12.1. Normative References

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Appendix A. Ideas for Implementing Object Identifiers

   Ideas for calculating MAILBOXID:

   o Universally Unique Identifier (UUID) [RFC4122]

   o Server-assigned sequence number (guaranteed not to be reused)

   Ideas for implementing EMAILID:

   o Digest of message content (RFC822 bytes) -- expensive unless
      cached

   o UUID [RFC4122]

   o Server-assigned sequence number (guaranteed not to be reused)

   Ideas for implementing THREADID:

   o Derive from EMAILID of first seen message in the thread.

   o UUID [RFC4122]

   o Server-assigned sequence number (guaranteed not to be reused)

   There is a need to index and look up reference/in-reply-to data at
   message creation to efficiently find matching messages for threading.
   Threading may be either across mailboxes or within each mailbox only.
   The server has significant leeway here.

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   Chris Newman, and Josef Sipek.

   This document drew inspiration from the Gmail X-GM-THRID and X-GM-
   MSGID implementations as currently defined at
   <https://developers.google.com/gmail/imap/imap-extensions>, as well
   as the X-GUID implementation in the Dovecot server.

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