LEMONADE Architecture - Supporting Open Mobile Alliance (OMA) Mobile Email (MEM) Using Internet Mail

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Abstract

   This document specifies the architecture for mobile email, as
   described by the Open Mobile Alliance (OMA), using Internet Mail
   protocols. This architecture was an important consideration for much
   of the work of the LEMONADE (Enhancements to Internet email to
   Support Diverse Service Environments) working group in the IETF.
   This document also describes how the LEMONADE architecture meets
   OMA's requirements for their Mobile Email (MEM) service.

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[1](#). **Introduction**

   This document describes the architecture of OMA Mobile Email (MEM)
   using Internet Mail protocols defined by the IETF. The LEMONADE
   working group has enhanced many of these protocols for use in the
   mobile environment. The LEMONADE profile [[PROFILE](#)] and its revision,
   [[PROFILE-bis](#)], summarize such protocols and protocol use. This
   document shows how the OMA MEM Requirements document [[MEM-req](#)], OMA
   MEM Architecture [[MEM-arch](#)], and OMA MEM Technical Specification
   [[MEM-ts](#)] relate to the work of LEMONADE in the IETF.

[2](#). **OMA Mobile Email (MEM)**

   The OMA Mobile Email (MEM) sub-working group has spent some time
   studying the requirements and architecture of mobile email. IETF
   LEMONADE has been liaising with them and has based much of its
   Internet Mail enhancements on their input. This section summarizes
   the output of the OMA.

[2.1](#). **OMA MEM Requirements**

   The OMA MEM activity collected a set of use cases and derived
   requirements for a Mobile Email (MEM) enabler. The OMA MEM
   Requirements document [[MEM-req](#)] summarizes this work. Some
   requirements relate to email protocols, some involve other OMA

technologies outside the scope of the IETF, and some relate to
implementations and normative interoperability statements for clients
and servers.

2.2. OMA MEM Architecture

This section introduces the OMA MEM Architecture.

2.2.1. OMA MEM Logical Architecture

The OMA MEM activity has derived a logical architecture from the
requirements and use cases described in [MEM-req]. A simplification
for illustrative purposes is shown in Figure 1, where arrows indicate
content flows.

```
                    _____
                   | Other     |
            +---|  Mobile   |<--+
            |   | Enablers  |    |
            |   |_____|    |
           |ME-4              |ME-3
         _v_____           ___v_____           _____
        |       |ME-1     |         |         |         |
        | MEM   |-------->|  MEM    | I2  | Email |
        |Client|     ME-2| Server  |<---->| Server  |
        |_____|<--------|_____|         |_____|
                            ^
                         |ME-5
                         |
```
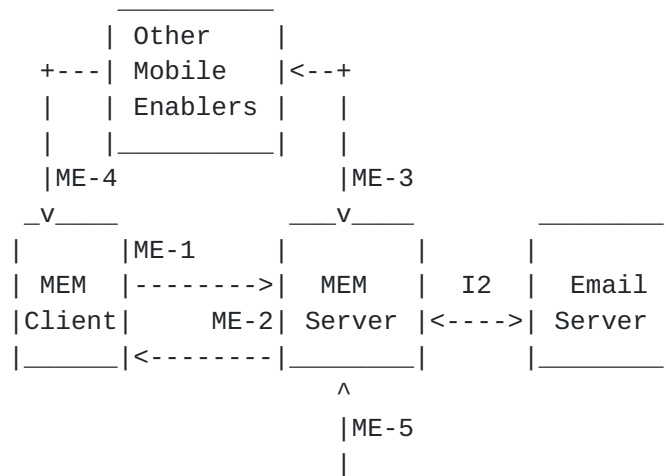
                Figure 1: Basic OMA MEM Logical Architecture

Figure 1 identifies the following elements:

o The MEM client that implements the client-side functionality of
   the OMA Mobile Email enabler. It is also responsible for
   providing the mobile email user experience and interface to the
   user and storing the email and data to be sent to the MEM server
   when not connected.

o The MEM server that implements the server-side functionality of
   the OMA Mobile Email (MEM) enabler.

o The MEM protocol between the MEM client and MEM server. It is
   responsible for all the in-band data exchanges that take place
   between the MEM client and server in order to update the MEM

client with email server changes and the email server with changes
in the MEM client, and in order to send new email from the email
server.

o Other OMA enablers that are needed to directly support the Mobile
   Email enabler. They are out of the scope of the IETF but may
   include support for:

   * Client provisioning and management for over-the-air
      installation of the MEM client on the device, provisioning of
      the client settings, and revocation of client privileges.

   * Messaging enablers for out-of-band notification, where out-of-
      band notifications that are server-to-client event exchanges
      are not transported by the MEM protocol but via other channels.

   * Billing, charging, and so on.

OMA identifies different interfaces:

o ME-1: MEM client interface to interact via the MEM protocol with
   the MEM server.

o ME-2: Corresponding interface of the MEM server.

o ME-3: Out-of-band MEM server interfaces; for example, to support
   generation of server-to-client notifications.

o ME-4: Out-of-band MEM client interfaces (e.g., to receive server-
   to-client notifications).

o ME-5: Interface for management of MEM enabler server settings,
   user preferences, and filters, globally and per account.

The MEM server enables an email server. In a particular
implementation, the email server may be packaged with (internal to
it) the MEM server or be a separate component. In such cases,
interfaces to the email server are out of scope of the OMA MEM
specifications. In the present document, we focus on the case where
the backend consists of IETF IMAP and SUBMIT servers. However, we
also discuss the relationship to other cases. The I2 interface is an
OMA notation to designate protocol / interfaces that are not
specified by the MEM enabler but may be standardized elsewhere.

2.2.2. OMA MEM Deployment Issues

The OMA MEM Architecture document [MEM-arch] further identifies
deployment models.

2.2.2.1. **OMA MEM Proxy**

   The OMA MEM Architecture document [MEM-arch] identifies OMA MEM
   server proxies as server components that may be deployed ahead of
   firewalls to facilitate firewall traversal.

2.2.2.2. **OMA MEM Deployment Cases**

   OMA MEM identifies that each component (MEM client, MEM servers,
   other enablers, and the email server) may be deployed in different
   domains, possibly separated by firewalls and other network
   intermediaries. MEM proxies may be involved in front of a firewall
   that protects the MEM server domain.

   OMA MEM targets support of configurations where:

   o All components are within the same domain, such as in a mobile
      operator.

   o The MEM client and other enablers are in the mobile operator
      domain, there is a MEM proxy, and the MEM server and email server
      are in the domain of the email service provider.

   o The MEM client and other enablers as well as a MEM proxy are in
      the mobile operator domain, and the MEM server and email server
      are in the domain of the email service provider.

   o The MEM client and other enablers are in the mobile operator
      domain, a MEM proxy is in a third-party service provider domain,
      and the MEM server and email server are in the domain of the email
      service provider.

   o The MEM client, other enabler, and MEM server are in the mobile
      operator domain, and the email server is in the domain of the
      email service provider.

   o The MEM client and other enablers are in the mobile operator
      domain, the MEM server is in a third-party service provider
      domain, and the email server is in the domain of the email service
      provider.

   The email service provider can be a third-party service provider, a
   network service provider, or an enterprise email service.

2.3. OMA MEM Technical Specification

The OMA MEM activity will conclude with a specification for a Mobile
Email (MEM) enabler. The ongoing work is in the OMA MEM Technical
Specification [MEM-ts]. LEMONADE is a basis for the mechanism.
However, some additional details that are outside the scope of the
IETF will also be included.

OMA provides ways to perform provisioning via OMA client provisioning
and device management. Other provisioning specifications are
available (e.g., SMS based).

OMA provides enablers to support out-of-band notification mechanisms,
filter specifications (such as XDM), and remote deactivate devices,
and to perform other non-Internet activities.

3. IETF LEMONADE Architecture

This section introduces the LEMONADE Architecture.

The IETF LEMONADE activity has derived a LEMONADE profile
[PROFILE-bis] with the logical architecture represented in Figure 2,
where arrows indicate content flows.

```
                            _____
                           |    |           |
               _____ |  Notification  |
              |          | |  Mechanism     |
              |          | |_____|
              |Notif.                ^
              |Protocol              |
              |                 ___|_____
              |           |    |          |         _____
            __v__    IMAP |    LEMONADE |    ESMTP       |    |
           |     |<----------->|  IMAP     |<---------------| MTA |
           | MUA |-           |  Store     |                |_____|
           |_____| \          |_____|
                    \              |
                     \             |URLAUTH
                 \SUBMIT           |
                   \          ____v_____
                    \     |          |
                     \    |  LEMONADE |     ESMTP       _____
                 ---->| Submit    |--------------->| MTA |
                           | Server    |                |_____|
                           |_____|
```
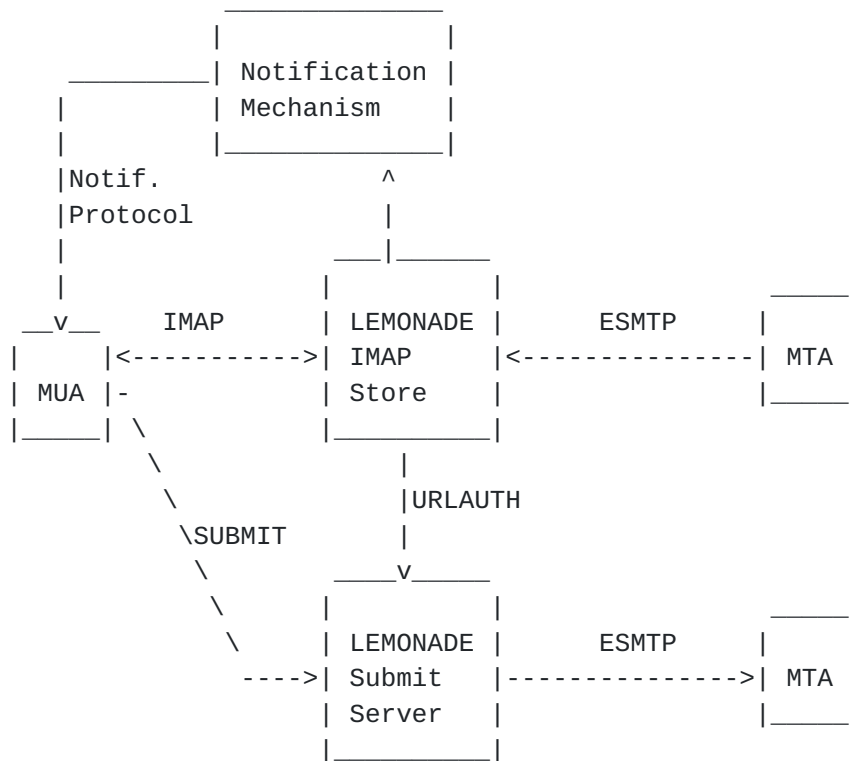
Figure 2: LEMONADE logical architecture

The LEMONADE profile [PROFILE] assumes:

o IMAP protocol [RFC3501], including LEMONADE profile extensions
   [PROFILE].

o SUBMIT protocol [RFC4409], including LEMONADE profile extensions.

o LEMONADE profile compliant IMAP store connected to an MTA (Mail
   Transfer Agent) via the ESMTP [EMAIL].

o LEMONADE profile compliant submit server connected to an MTA,
   often via the ESMTP.

o Out-of-band server-to-client notifications relying on external
   notification mechanisms (and notification protocols) that may be
   out of the scope of the LEMONADE profile.

o LEMONADE-aware MUA (Mail User Agent). While use of out-of-band
   notification is described in the LEMONADE profile, support for the
   underlying notifications mechanisms/protocols is out of the scope
   of the LEMONADE specifications.

Further details on the IETF email protocol stack and architecture can
be found in [MAIL].

3.1. Relationship between the OMA MEM and LEMONADE Logical Architectures

Figure 3 illustrates the mapping of the IETF LEMONADE logical
architecture on the OMA MEM logical architecture.

```
                        _____
                       | Other_Mob. Enablers |
                       | |-------------|     |
              _____| Notification |     |
             |         | | Mechanism   |     |
             |         | |_____|     |
             |Notif.   |_____^_____|
             |Protocol        _____|_____
       ME-4  |              |   ___|_ME-3_    |
        ___|____            | |           |   |         _____
       | __v__ |  IMAP      | | LEMONADE  |   | ESMTP  |     |
       ||     |<----------->| IMAP       |<-----------| MTA |
       || MUA ||   ME-2a    | | Store    |   |        |_____|
       ||_____||\ME-1       | |_____|   |
       | MEM   | \          |       |        |
       | Client|  \         |       |URLAUTH |
       |_____|   \SUBMIT  |       |        |
                    \   |   ____v_____     |
                     \  | |           |   |         _____
                      \ | | LEMONADE  |   | ESMTP  |     |
                  ---->| | Submit    |----------->| MTA |
             ME-2b |   | | Server   |   |        |_____|
                   |   |_____|   |
                   |MEM        Email |
                   |Server     Server|
                   |_____|
                            ^
                           |ME-5
                           |
```
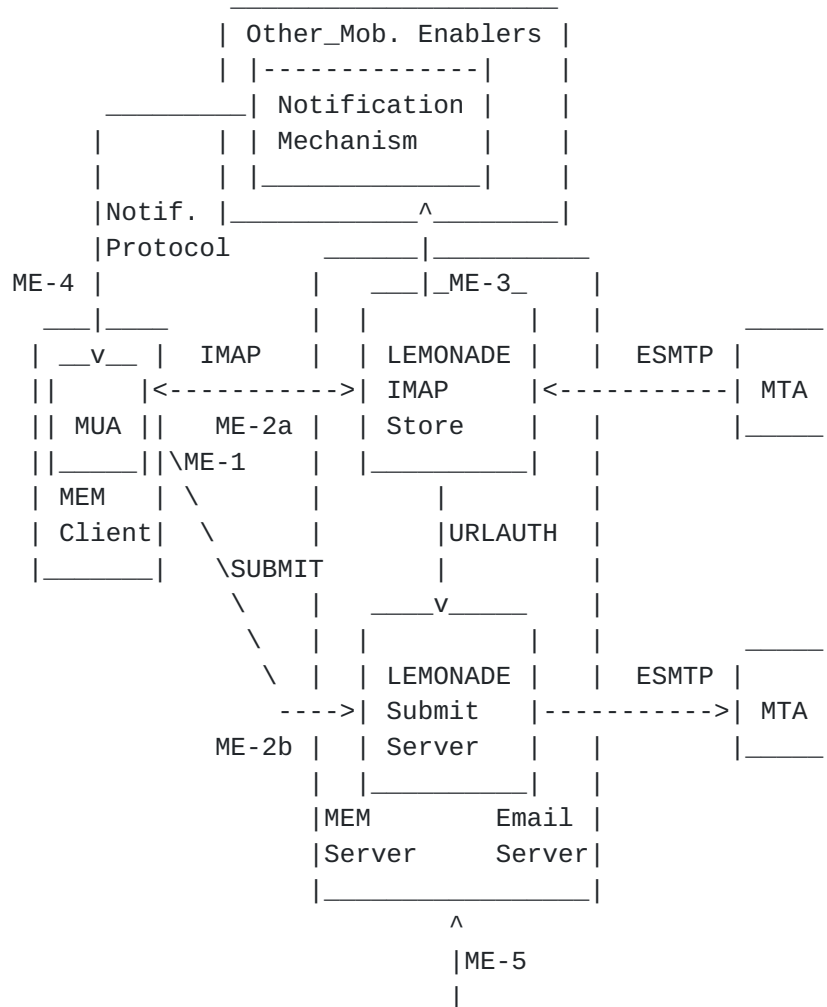
Figure 3: Mapping of LEMONADE Logical Architecture
          onto the OMA MEM Logical Architecture

As described in Section 3, the LEMONADE profile assumes LEMONADE
profile compliant IMAP stores and SUBMIT servers. Because the
LEMONADE profile extends the IMAP store and the SUBMIT server, the
mobile enablement of email provided by the LEMONADE profile is
directly provided in these servers. Mapping to the OMA MEM logical
architecture for the case considered and specified by the LEMONADE
profile, we logically combine the MEM server and email server.
However, in LEMONADE we split them logically into a distinct LEMONADE
message store and a LEMONADE SUBMIT server. ME-2 consists of two
interfaces. ME-2a is IMAP extended according to the LEMONADE
profile. ME-2b is SUBMIT extended according to the LEMONADE profile.

The MUA is part of the MEM client.

The external notifications mechanism is part of the OMA enablers
specified by the OMA.

3.2. LEMONADE Realization of OMA MEM with non-LEMONADE-Compliant Servers

The OMA MEM activity is not limited to enabling LEMONADE-compliant
servers. It explicitly identifies the need to support other
backends. This is, of course, outside the scope of the IETF LEMONADE
activity.

3.2.1. LEMONADE Realization of OMA MEM with non-LEMONADE IMAP Servers

Figure 4 illustrates the case of IMAP servers that are not LEMONADE-
compliant. In such case, the I2 interface between the MEM server
components and the IMAP store and SUBMIT server are IMAP and SUBMIT
without LEMONADE extensions.

It is important to note the realizations are of a schematic nature
and do not dictate actual implementation. For example, one could
envision collocating the LEMONADE MEM enabler server and the submit
server shown in Figure 4 in a single instantiation of the
implementation. Likewise, we consciously label the LEMONADE MEM
enabler as neither an IMAP proxy nor an IMAP back-to-back user agent.
LEMONADE leaves the actual implementation to the developer.

```
                 _____
                 |              |
      _____| Notification |
      |         | Mechanism    |
      |         |_____|
      |Notif.           ^
      |Protocol         |
      |             ___|_____         _____
      |            | LEMONADE |        |              |        _____
   __v__    IMAP   | MEM      | IMAP   |NON-LEMONADE | ESMTP |      |
   |      |<-------->|Enabler   |<------>|IMAP         |<----->| MTA |
   | MUA  |\  ME-2a | Server   |        |Store        |       |_____|
   |_____| \        |_____|        |_____|
        \   \            |
         \   \          |URLAUTH
          \SUBMIT       |
           \        ____v_____         _____
            \      |          |        |             |        _____
             \     | LEMONADE | SUBMIT |NON-LEMONADE | ESMTP |      |
           -->|    MEM      |        |Submit       |       |      |
              | Enabler  |------->|Server       |------>| MTA |
        ME-2b | Server   |        |             |       |_____|
              |_____|        |_____|
```

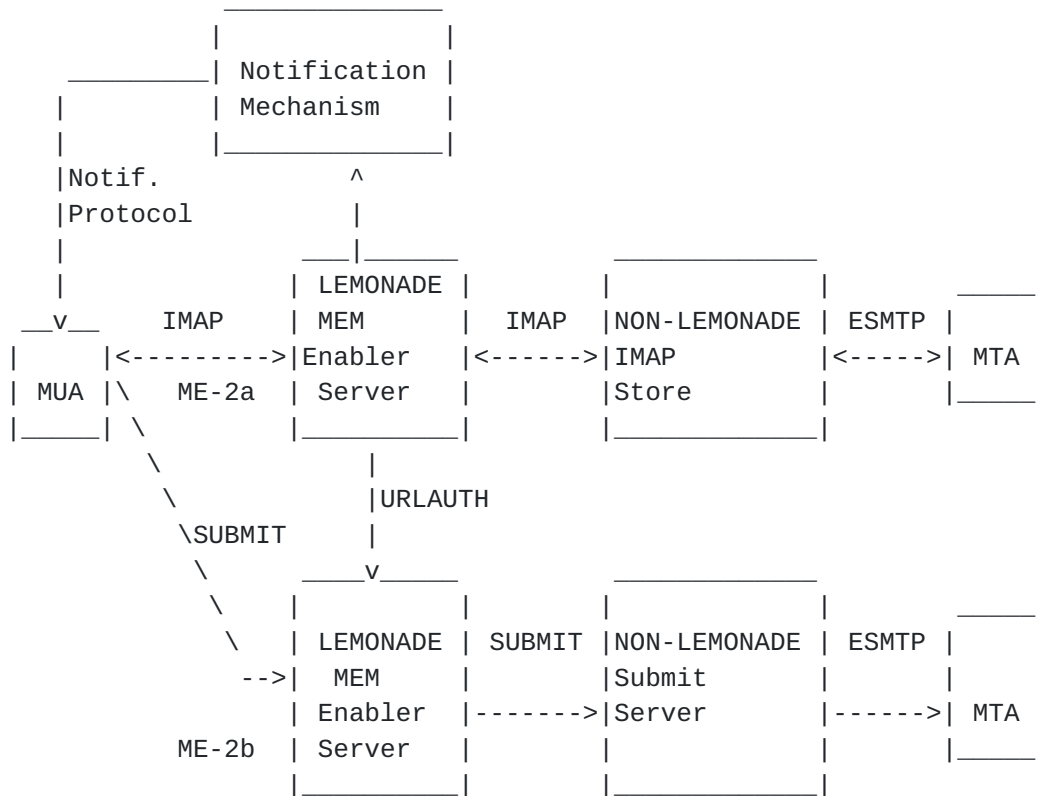   Figure 4: Architecture to Support Non-LEMONADE IMAP Servers
                  with a LEMONADE Realization of an OMA MEM Enabler

[3.2.2](#). **LEMONADE Realization of OMA MEM with non-IMAP Servers**

   Figure 5 illustrates the cases where the message store and submit
   servers are not IMAP store or submit servers. They may be Post
   Office Protocol (POP3) servers or other proprietary message stores.

```
                       _____
                      |              |
            _____| Notification |
           |          | Mechanism    |
           |          |_____|
           |Notif.           ^
           |Protocol         |
           |           ___|_____           _____
           |          | LEMONADE |         |              |        _____
   __v__      IMAP    | MEM      |   I2    |Proprietary |  | ESMTP |     |
  |     |<---------->|Enabler    |<------>|Message       |<----->| MTA |
  | MUA |\   ME-2a   | Server    |        |Store         |       |_____|
  |_____| \          |_____|         |_____|
       \   \              |
        \   \             |URLAUTH
         \SUBMIT          |
          \          ____v_____          _____
           \    |          |        |              |        _____
            \   | LEMONADE |   I2   |Proprietary |  | ESMTP |     |
          -->| MEM      |        |Submit         |       |     |
             | Enabler  |------->|Server         |------>| MTA |
       ME-2b | Server   |        |               |       |_____|
             |_____|        |_____|
```
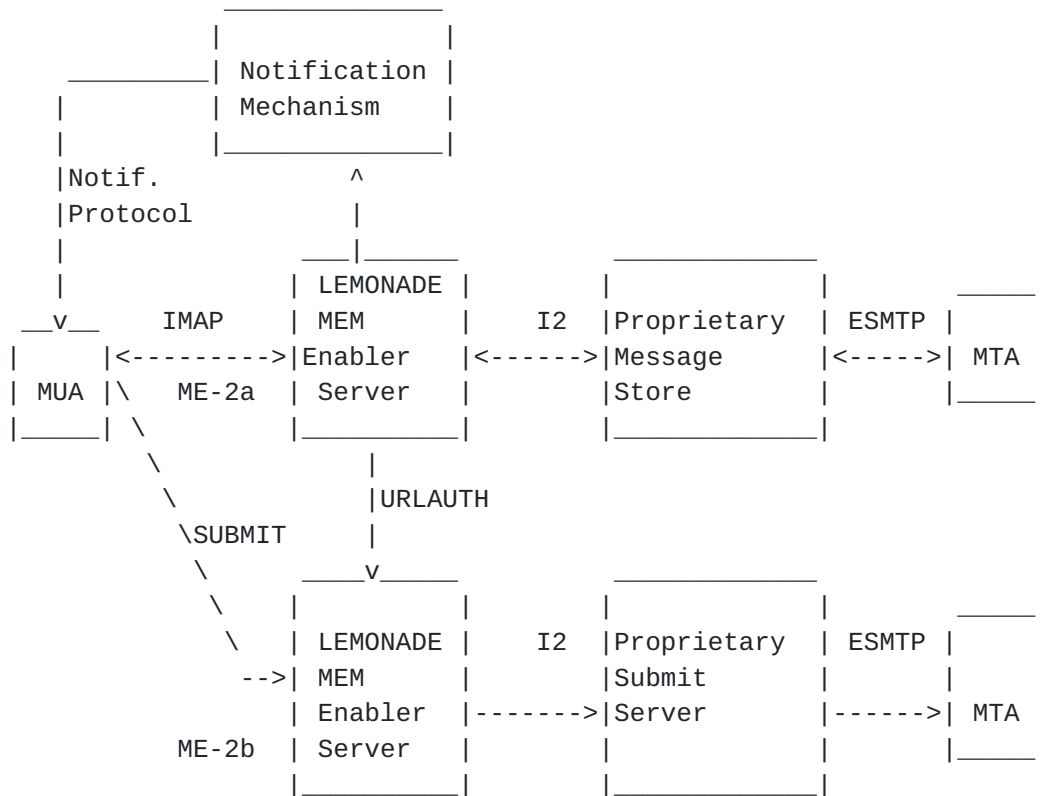
          Figure 5: Architecture to Support Non-IMAP Servers with a LEMONADE
                       Realization of OMA MEM Enabler

   I2 designates proprietary adapters to the backends.

4. Filters and Server-to-Client Notifications and LEMONADE

   OMA MEM Requirements [MEM-req] and Architecture [MEM-arch] emphasize
   the need to provide mechanisms for server-to-client notifications of
   email events and filtering. Figure 6 illustrates how notification
   and filtering works in the LEMONADE profile [PROFILE].

```
                   _____
                  |                |
       _____| Notification |
      |          | Mechanism    |
      |          |_____|
      |Notif.                  ^
      |Protocol -------\  _|__
      |    _____|    ___\>|NF|____
      |   |          |     ----    |                 _____
    __v__|   IMAP    |__  LEMONADE |___   ESMTP  __|     |
   |        |<-------->|VF| IMAP       |DF |<--------|AF| MTA |
   | MUA |\   ME-2a |--  Store   |---           --|_____|
   |_____| \         |_____| ^
        _____|_____|
           \                |URLAUTH
         \SUBMIT           |
          \          ____v_____
           \      |          |
            \     | LEMONADE |     ESMTP     |     |
          ---->| Submit   |-------------->| MTA |
        ME-2b   | Server   |                |_____|
                |_____|
```
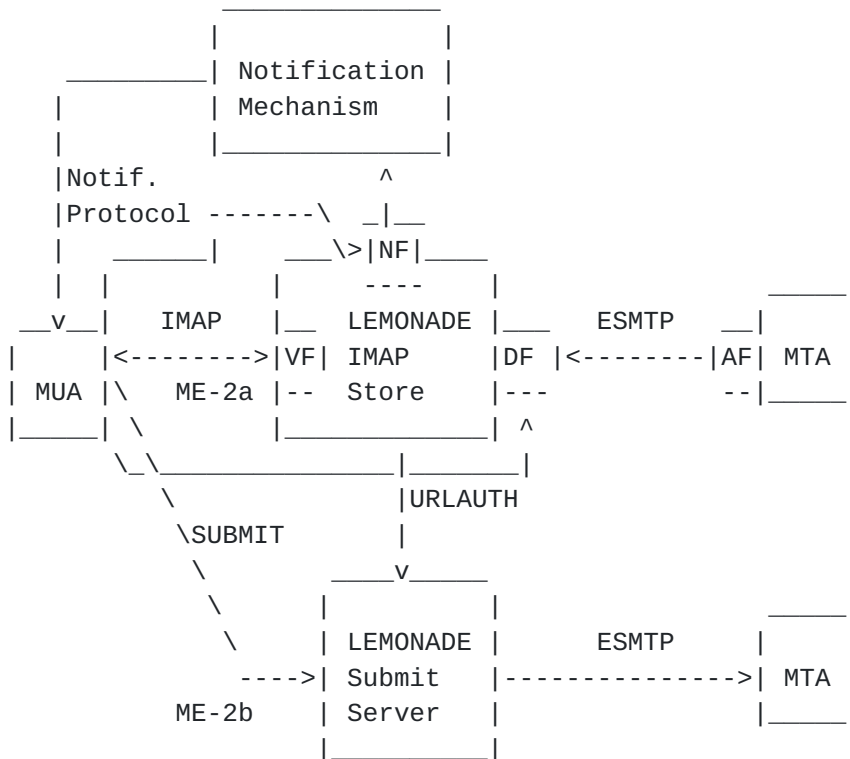
Figure 6: Filtering Mechanism Defined in LEMONADE Architecture

In Figure 6, we define four categories of filters:

o AF: Administrative Filters - The email service provider usually
   sets administrative filters. The user typically does not
   configure AF. AF applies policies covering content filtering,
   virus protection, spam filtering, etc.

o DF: Deposit Filters - Filters that are executed on deposit of new
   emails. They can be defined as SIEVE filters [SIEVE]. They can
   include vacation notices [RFC5230]. As SIEVE filters, one can
   administer them using the SIEVE management protocol [MANAGESIEVE].

o VF: View Filters - Filters that define which emails are visible to
   the MUA. View filters can be performed via IMAP using the
   facilities described in [NOTIFICATIONS].

o NF: Notification Filters - Filters that define for what email
   server event an out-of-band notification is sent to the client, as
   described in [NOTIFICATIONS].

Refer to the aforementioned references for implementation and
management of the respective filters.

5. Security Considerations

   We note there are security risks associated with:

   o Out-of-band notifications

   o Server configuration by client

   o Client configuration by server

   o Presence of MEM proxy servers

   o Presence of MEM servers as intermediaries

   o Measures to address the need to traverse firewalls

   We refer the reader to the relevant Internet Mail, IMAP, SUBMIT, and
   Lemonade documents for how we address these issues.

6. Acknowledgements

   The authors acknowledge and appreciate the work and comments of the
   IETF LEMONADE working group and the OMA MEM working group. We
   extracted the contents of this document from sections of
   [PROFILE-bis] by Stephane Maes, Alexey Melnikov, and Dave Cridland,
   as well as sections of [NOTIFICATIONS] by Stephane Maes and Ray
   Cromwell.

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Authors' Addresses

    Eric W. Burger
    Consultant
    New Hampshire
    USA

    Phone:
    Fax: +1 530-267-7447
    EMail: eburger@standardstrack.com
    URI: http://www.standardstrack.com

    Glenn Parsons
    Nortel Networks
    3500 Carling Avenue
    Ottawa, ON   K2H 8E9
    Canada

    Phone: +1 613 763 7582
    EMail: gparsons@nortel.com