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## 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.

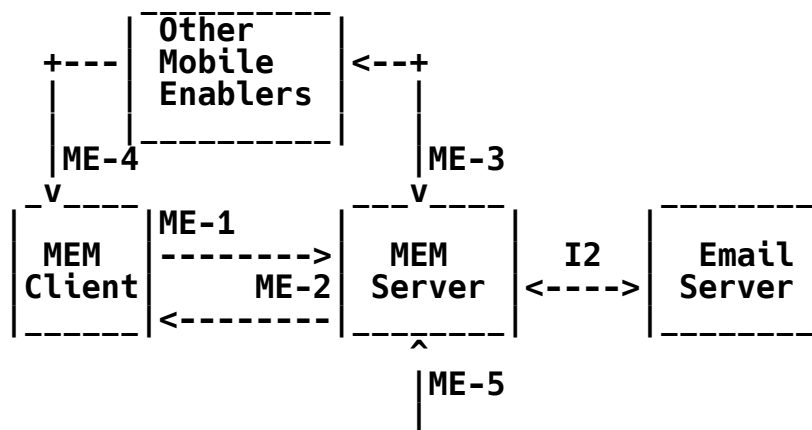


Figure 1: Basic OMA MEM Logical Architecture

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.

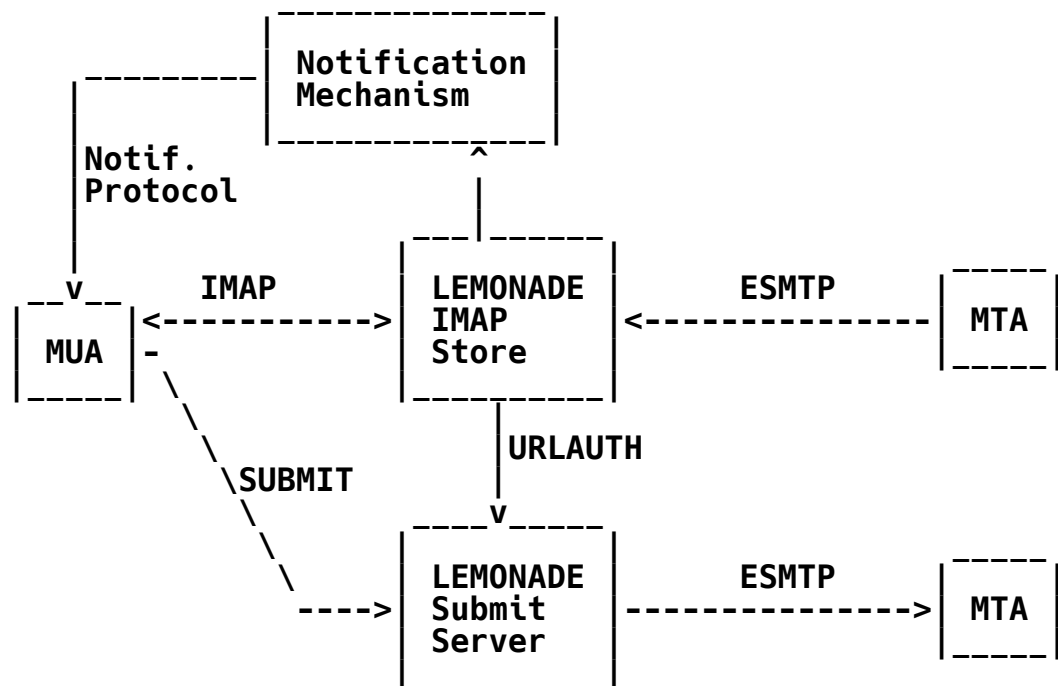


Figure 2: LEMONADE logical architecture

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.

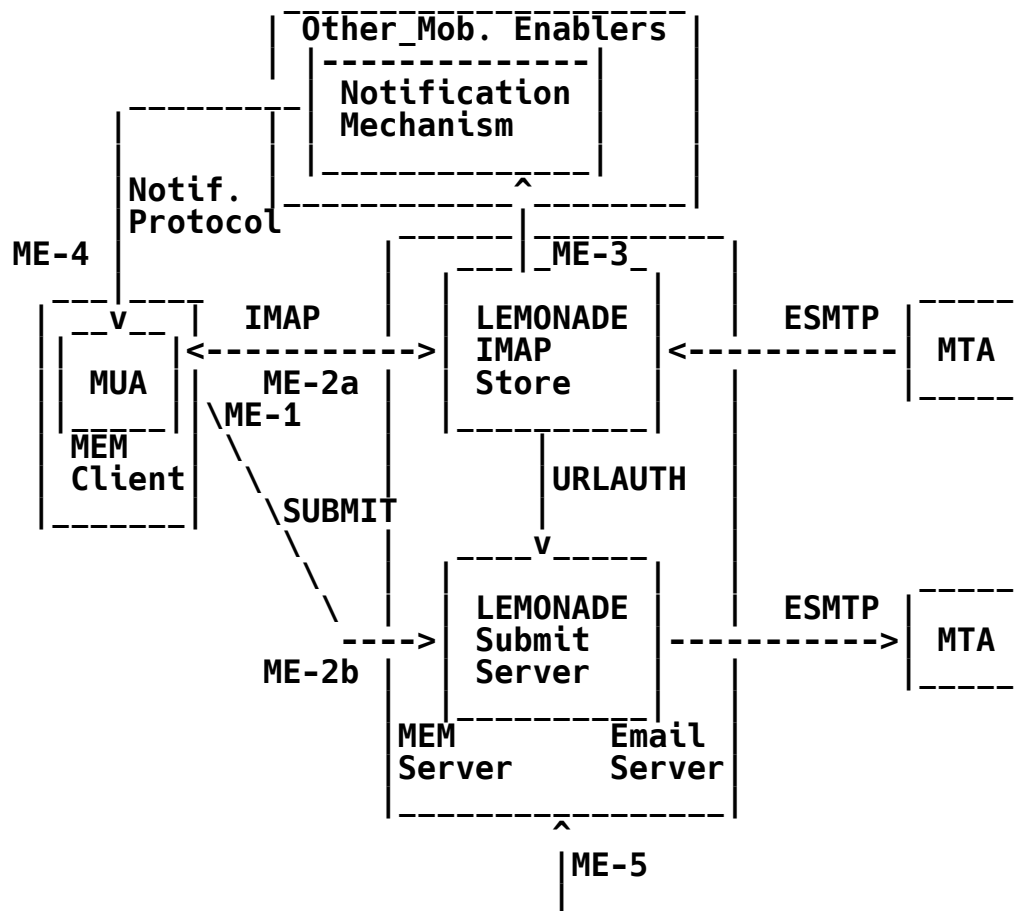


Figure 3: Mapping of LEMONADE Logical Architecture onto the OMA MEM Logical Architecture

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.

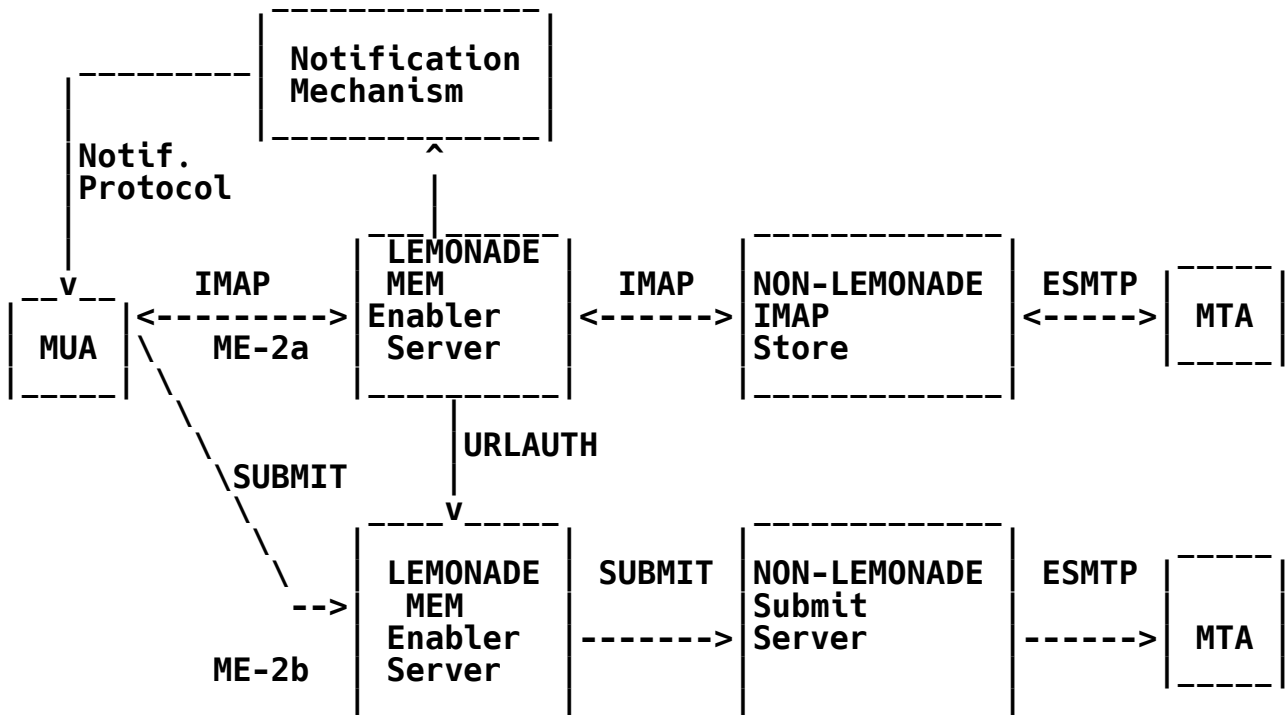


Figure 4: Architecture to Support Non-LEMONADE IMAP Servers with a LEMONADE Realization of an OMA MEM Enabler

### 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.

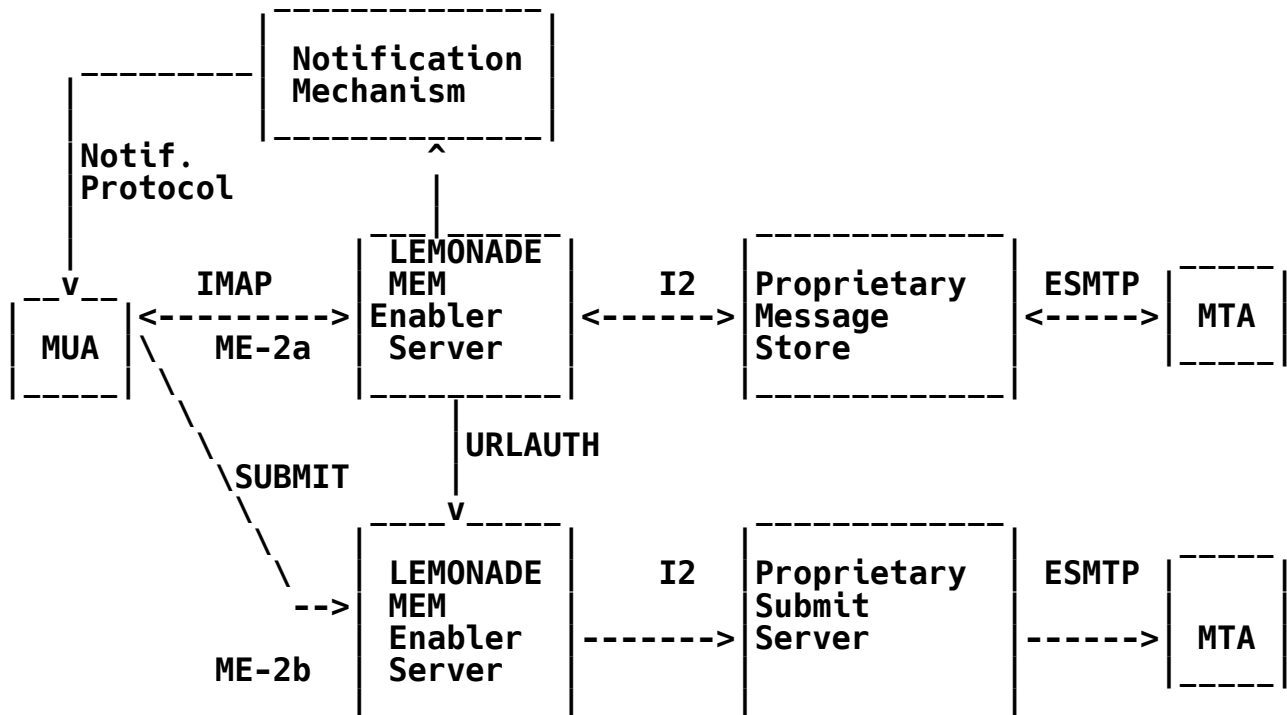


Figure 5: Architecture to Support Non-IMAP Servers with a LEMONADE Realization of OMA MEM Enabler

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].

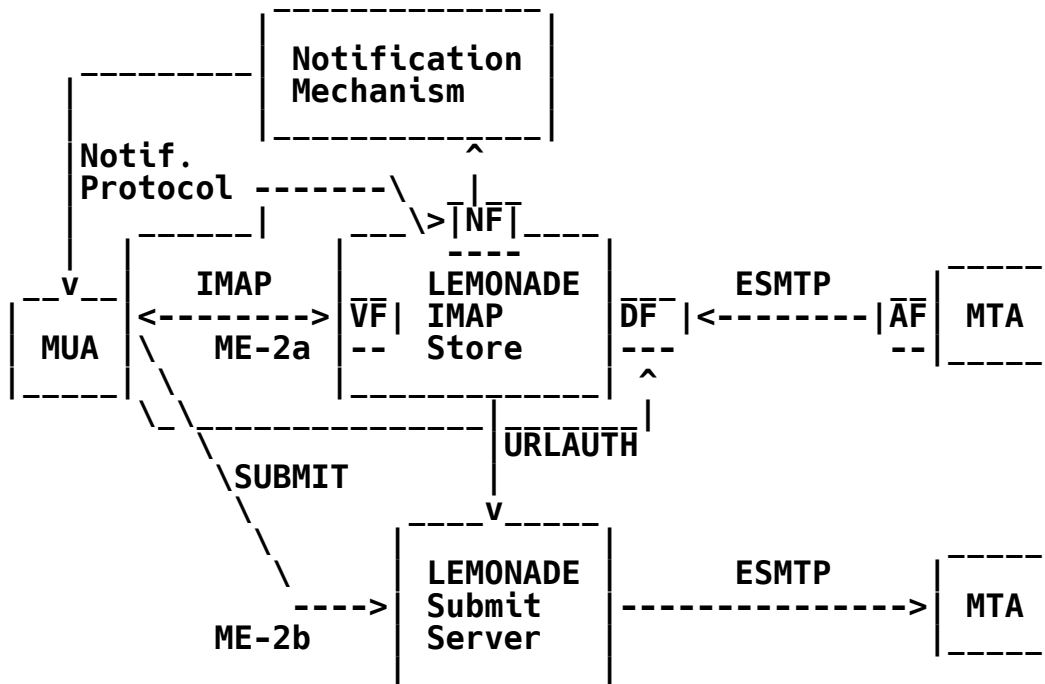


Figure 6: Filtering Mechanism Defined in LEMONADE Architecture

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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