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OZ+: Object Oriented Open Distributed System¹

— Object Oriented Multi-media Electronic Mail —

塚本 亨治 (電総研)² Petit Bertrand (EC 滞在研究員)³ 篠原 弘樹 (松下電器)⁴
 水谷 功 (住友電工)⁵ 梶浦 広行 (シャープ)⁶

1 Introduction

It is a well know fact that the number of workstations networks is increasing quikly, leading to the development of more and more software applications adapted to these networks. The *electronic mail* is one of these basic applications (see for example [3]).

In this project, we extend the principle of the electronic text mail to transfer data like images and executable codes under the shape of objects. This application is done over the OZ Object Oriented Distributed System. The communication part is structured like it is proposed by the MHS OSI model. The user interface is developed with the MOTIF widgets.

2 The OZ Open Distributed System

The OZ system [1, 2], using the notion of object, allows to develop and run distributed applications as if they were developed and ran on a single computer. An object is an entity which includes data and the operations called *methods* in OZ, which manipulate these data. All the data in OZ are seen and manipulated as objects.

The OZ objects are transfered between *Virtual Machines*. A Virtual Machine (VM) can be seen as an abstract machine able to: interpret codes included in objects, receive objects from other VMs and send objects to other VMs.

The ozmail system is implemented as a group of VMs that executes parts of the processing and exchanges object data using the MHS structure.

3 The Message Handling System Structure (MHS)

A MHS mail system is composed of three parts, the user agent, the message store and the message transfer agent:

- The *user agent* (UA) "directly interfaces with the end user for preparing, submitting and receiving messages. It also provide text editing and presentation services for the end user".
- "The *message transfer agent*(MTA) provides the routing and relaying of electronic mail. This function is responsible primarily for the store-and-forward path, channel security, and the actual mail routing through the communication media".
- The message store (MS) stores locally the messages acting like mailboxes. The messages are delivered to the UA by the MS.

4 The OZ mail implementation

The mail developed with OZ has a structure very close to the MHS one. The MTA, MS and UA are implemented as Virtual Machines. We introduce in the structure a "mail supervisor" which can control the status of the MS and MTA. This mail supervisor works as a UA allowed to acces the users list and the mails.

The main specificity of the OZmail system is to allow the tansfer of data as objects. It means that the message could be of several types such as text, image, complex object composed of text, image and other data. When delivering a message, the mail system processes the mail body according to its type, displaying the text or executing a specific application.

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²Michiharu TUKAMOTO (Electrotechnical Laboratory)

³Petit BERTRAND (EC Guest Researcher)

⁴Hiroki SHINOHARA (MATSUSHITA Electric Industrial Co., Ltd.)

⁵Isao MIZUTANI (SUMITOMO Electric Industries, Ltd.)

⁶Hiroyuki KAZIURA (SHARP Corporation)

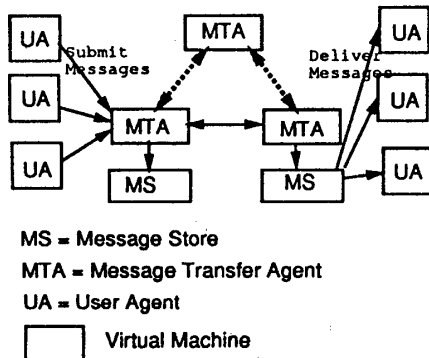


Figure 1: OZ mail structure.

An application to be send has to follow specific rules: firstly it has to include *standard* methods which are used as entry point by the receiving UA, and secondly the messages has to remain as *persistant object* in specific servers of the OZ system, in order to be availaible at any time on a user request. The application can be graphical and ran as a part of the UA graphic application. The application sent are based on two parts, one to prepare the mail content (if necessary) and one to get the mail content. This allows to extend the use of mail to new uses, like remote data base access or hyperText transfer for example.

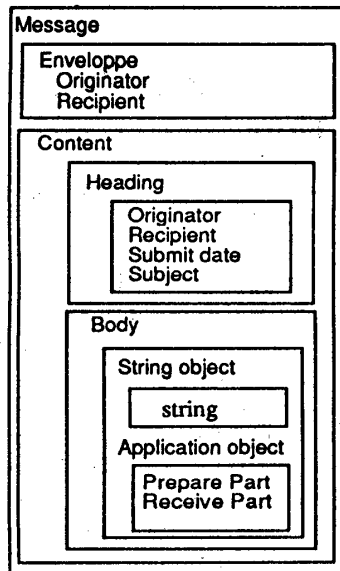


Figure 2: OZ mail Message structure.

The UAs and manager are developped using MOTIF as graphic user interface. The UA main

window is based on the list of the user's mails, which after login the mail, is periodically renewed by an automatic polling on the MS server. When "clicking" an element of the list a window is displayed according to the type of the mail. In case of application, the executable functions are listed and the user can choose what he wants to run.

Concerning the emission of messages the mail system offers the text transfer as a basic function . The other messages, like image or other data, are seen as applications. For an application, the preparation part of the message runs through a method with a specific name. This method is activated by the user before submitting the message.

5 Conclusion

The use of objects as *body* of the mail leads to a mail system much more powerful than the transfer of text only. The users can send data with standard application supplied by the mail application for example, but they can also send their own OZ applications. Thus, we have an concrete example of the "inheritance of standard" proposed as a basic function of OZ. Indeed we see that without modifying the MHS mail structure we can defined a *standard* for the body of the message allowing to transfer not only text but also applications.

References

- [1] M.Tsukamoto et al.: *The Architecture of OZ :Object Oriented Open Distributed System*, proceeding of ISIIS'88 (November 1988).
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