# DEVELOPMENT OF DYNAMIC ALLOCATION SYSTEM OF MAIL SERVER MEMORY AMONG USERS OF CORPORATE NETWORK

**Rasim Alguliyev[1], Aytan Huseynova[2]**

Institute of Information Technology of ANAS, Baku, Azerbaijan
[1]*rasim@science.az*, [2]*ayten@lan.ab.az*

Information is becoming the key factor of world politics, economics (trade, production), it is a product of scientific and research activity. Demand of structuring, generation, storage, search and transfer of information devices is growing; meeting these demands is the objective of creation and development of information networks. In this regard, special attention must be paid to transfer of information. There are many methods of information transfer, carried out through activity of a large amount of software, working in this field. One of the most widespread methods is the method of information transfer through electronic mail. Relevance of the topic is defined by the fact that one of the most effective communication devices in Internet is electronic mail. A letter sent via internet, reaches the receiver on the other end of the planet in several moments, which is one of the advantage of electronic mail compared to surface mail. Besides, expenses for such mailing are minimal. That's why, in many organizations electronic mail becomes an irreplaceable instrument during correspondence of users [1].

It is difficult to imagine an organization, employees of which do not use advantages of communication through electronic mail. In order to send a message to another user, it is necessary to launch a special mail program, with assistance of which message will reach the mailbox of the recipient. Then, another user also launches the mail program, which checks for messages on his mailbox.

A local mailbox is considered for each user, which stores all messages for him. There are special programs for working with mailbox which are called Mail User Agent, in abbreviated form MUA. Mail user agents do not receive messages from remote computers, they only reflect the contents of user mail box [2].

Electronic mail, as well as surface mail, works with a system of electronic "post offices" – mail servers, which provide transfer of letters to global networks. They interact through mail protocols providing transfer and identification of information transferred in network. Computer-clients of mail servers provide service of users of electronic mail.

Each user has his login and password for using electronic mail. Through mail client, for example Outlook Express, user passes through authentification on mail service through SMTP (Simple Mail Transfer Protocol) while sending, and through POP (Post Office Protocol) or IMAP (internet message access protocol) while receiving mail. Upon successful authentification, prepared mail is sent to the server. Then, servers connect to mail recipient's using DNS addresses and send it there. Then, client program loads the mail into its "Inbox" folder. Usually by default, 25 Port is used for SMTP and 110 port used for POP and IMAP.

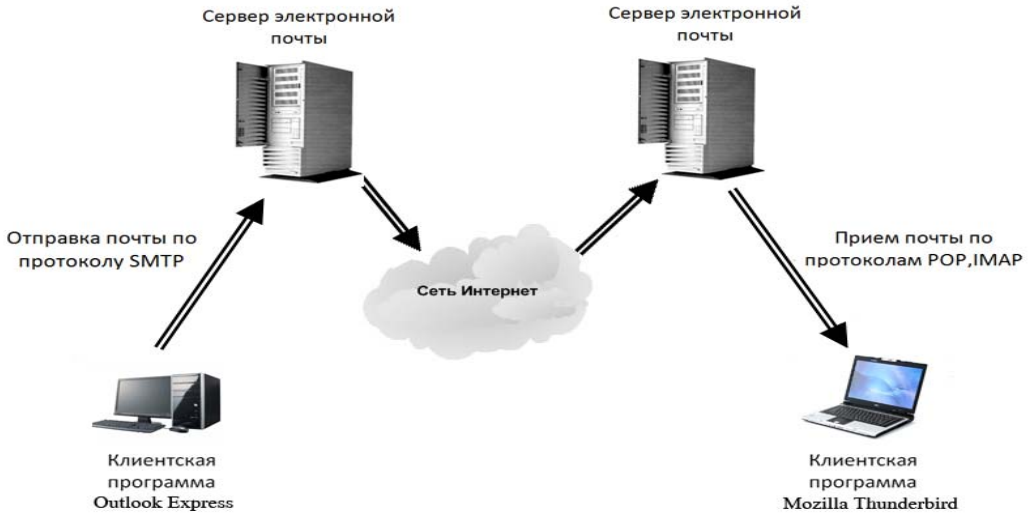
Following are widely used electronic mail servers: HMailserver, Communigate Pro, Hula, Sendmail, Postfix, MDaemon, Microsoft Exchange Server.

Out of abovementioned servers, MDaemon and Microsoft Exchange Server can work only on Windows operating systems, others work on Unix and Windows systems.

Operation principle of electronic mail is depicted on Picture 1.

Messages (electronic letters), recorded in a special format are transferred through electronic mail. Currently, widely accepted format is MIME. Any message in this format consists of a title and body of the message [3]. Title necessarily contains four main fields:

- Sender's address (From:)
- Recipient's address (To:)
- Subject of the message (Subject:)
- Date (Date:)




Picture.1 Operation principle of electronic mail

Second and third fields are indicated by the sender of the message. First field (analogue of return address) and fourth field (analogue of postmark) are filled automatically by mail program. Body of the message consists of the content of the message. Ordinary text can be used as the body. Besides, one or several files can be attached to the text (for example graphic, audio or text). Content of electronic mail affect its size, but not the message sending process. Any user working with electronic mail must be registered on corporate mail server. Being registered on mail server, user receives an electronic mail address and a mail box which will accumulate incoming mail is created on the servers. Electronic mail is generally constructed in following way: user_name@host_name.

For example, secretary@science.az

host_name – address where mail server is located; user_name – registered name of a certain user on mail server. Operation of electronic mail consists of two interrelated processes: acceptance of incoming mail and sending out outgoing mail. Mail program is responsible for both of the tasks on user's behalf. The task of the mail program is exchange of information with mail server.

Upon projecting of corporate mail system, one of the main tasks is selection of equipment and correct distribution of memory among users of corporate network. It is necessary to choose such equipment that can process current flow of electronic mails in the organization. Also, this equipment must have a backup, for production and processing of electronic mails in case of increase of correspondence volume [4]. Main problem upon selection of equipment is lack of its conformity with server's technical characteristics related to productivity. This way, mail administrator has to rely on previous experience of corporate mail system exploitation and manufacturers recommendations on mail software. Frequently, given information is not sufficient for construction of a corporate system meeting all set requirements.

Following parameters could be units of mail server production measurement: intensiveness of processing of electronic letters and intensiveness of processing of electronic letter packages. Intensiveness of processing of electronic letters is the more frequently used. But we must note that, there's a special productivity for different lengths of electronic mail, measured in electronic mails. Another unit of measure is intensiveness of processing of packages of electronic letters by the mail server. Given unit of measure of mail server productivity does not depend on the length of the electronic letter. Technical characteristics of

mail server include parameters such as clock frequency of central processor (CP), volume of RAM memory, size of hard disk etc. Sometimes an excessive amount of electronic mails can accumulate. If many users in the organization store a large amount of electronic messages, then a large volume of storage server memory is necessary. In order to increase reliability, efficiency and exclusion of "blockings" in operation of corporate electronic mail, following modes of user operation are determined:

1.Volume of user mail box memory – for example 20 Mb. Allocation of a large volume of memory is carried out in reasonable cases. Memory limit is determined by the administrator.

2.Revision of mail box must be carried out on a daily basis.

3.Outgoing (incoming) messages (attachments) must be transferred to hard magnetic disk after their sending (receiving)

4.Date and time of sending and receiving of each message must be approved with notifications, for which mail program of each user's computer must be configured to notification (receipt) request.

5.Storage life of messages in mail server memory (mail box) must not exceed 5 days. Storage life of messages is configured by the user. Upon lengthy absence of the user, deletion date of messages can be prolonged until the return of the user, but for no longer than 30 days.

6.Total volume of sent messages with attachments must not exceed 1 Mb. Attachments of larger volume must be archived using WinRaR program. If even after archivation the volume of attachment exceeds 1 Mb, then attachments must be sent piece-by-piece.

Large volume of mail box storage results in increase of the server's copying and restoration time, which affects accessibility and reliability of the system. For this system it is recommended to control the size of mail boxes in order to prevent filling of entire memory space.

In given article, we propose a dynamic distribution of memory among users of corporate network in order to prevent the necessity of increasing the memory size of mail server.

That said, initially each user of *i* electronic mail is allocated to equal volumes of memory $Q/n = Q_i^0, i = 1,....,n$ of the mail box.

Then,

$$Q_1^0 + Q_2^0 + ....Q_n^0 = Q$$

where $Q$ is general volume of mail server memory.

Volume of used memory of mail box changes depending on intensiveness ($\alpha$) of user reference to server memory.

Let's suppose $q_i^j$ is the volume of e-mail that is accepted by $i^{th}$ user at *j* time. Let $V_i^j$ indicate the volume of e-mail saved by $i^{th}$ user until $j^{th}$ time. Then, at *j* time, $i^{th}$ user occupies the volume of

$$Q_i^j = V_i^j + q_i^j . \quad (1)$$

User deletes some of the data from received e-mail, and saves the e-mail in $\overline{Q}_i^j$ volume. Then, at $i^{th}$ moment of time, following volume will be stored in its memory

$$\overline{V}_i^j = V_i^j + \overline{Q}_i^j \quad (2)$$

Let's mark the fraction of memory used from the *i* mail box from the overall memory of mail box at *j* time as $\alpha_i^j$

$$\alpha_i^j = \frac{\overline{V}_i^j}{Q}, \quad (3)$$

In $[j-1, j]$ time interval, and after

$$\overline{k}_i^j = \frac{\overline{V}_i^j - \overline{V}_i^{j-1}}{Q}\ , \tag{4}$$

Dynamics of change of coefficient of memory use in $[j-1, j]$ time interval.
It is clear that, any moment of *j* time, must meet following condition:

$$k_i^0 = 0\ , \quad \sum_{i=1}^{n} \alpha_i^j = 1 \tag{5}$$

Let's assume that in $j+1$ moment of time, user accepts $Q_i^{j+1}$ volume of e-mail.
Our task consists of the following:
It is required to find a new value of $\alpha_i^{j+1}$, which meets following conditions:

Providing,

$$\sum_{i=1}^{n}\left(\alpha_i^{j+1} - \frac{1}{j}\sum_{k=0}^{j}\alpha_i^j\right)^2 \to \min$$

$$\frac{1}{j}\sum_{k=0}\alpha_i^k < \alpha_i^{j+1} < \frac{1}{j}\sum_{k=0}^{j}\alpha_i^k + k_i^j V_i^{j+1}$$

$$\sum_{i=1}^{n}\alpha_i^{j+1} = 1$$

The task is solved for each discrete moment of time *j* [5].

**References**

1. R. Blum . Administration of mail servers sendmail http://www.intuit.ru/department/internet/sendmail/1/ (In Russian)
2. http://www.intuit.ru/department/internet/sendmail/1/
3. http://www.kgtu.runnet.ru/WD/TUTOR/int/e-mail.htm
4. Kalashnikov S. G. Determination of mail service production dependence from technical characteristics http://network-journal.mpei.ac.ru/cgi-bin (In Russian)
5. Ashmanov S.A. Linear programming. - M: Science, 1981, 340 p. (In Russian)