

EXERCISE 2: E-MAIL PROTOCOLS

INTRODUCTION

Electronic mail represents a typical store-and-forward communication system which operates asynchronously. The term »store-and-forward« means that electronic mail, that is to be conveyed between different users is temporarily stored and relayed by mail servers. Asynchronism means that mail transfer between mail sender and server is not simultaneous and not carried out with the same speed as between server and mail recipient. Here, we will consider a simple mail system consisting of a:

- sending client,
- mail server and
- receiving client.

To transfer a mail from a client to a mailbox on a server, the SMTP (Simple Mail Transfer Protocol) application layer protocol is used over a TCP connection that uses the port number 25 at the server side.

To transfer a mail from a mailbox on a server to a client, the POP3 (Post Office Protocol version 3) application layer protocol can be used over a TCP connection that uses the port number 110 at the server side. A mail box on a server is indicated by an address of the form user@server.

The electronic message (email) must be composed in the standardised way, as specified in the standard RFC 822. Here, only a very simple description of the format will be given. The message consists of two parts, namely the message header and the message body, the two of them being separated by an empty line. The header itself consists of several lines, defining the date/time the message was sent, the sender and receiver of the message and the subject; while the above specifications are mandatory, according to the standard (although many servers do not check the validity or even the presence of header), other optional lines can be added. The message body consists of one or more lines of text. Although the electronic message was originally strictly character-oriented, non-alphanumeric contents can also be encoded into character-like contents and sent as a mail according to newer standards.

Example (which includes the DATA keyword and the terminating period):

```
DATA
Date: 04 Nov 11 18:07 +0100
From: name.surname@fe.uni-lj.si
To: protokoli@protokoli.fe.uni-lj.si
Subject: Message subject
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Message.

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+0100 stands for time zone (+1 hour and 0 minutes in the example) and allows the universal time to be specified.

YOUR TASK

Transfer mail from one client to the server and from the server to another client. The two different clients will be implemented by two different students who will manually type SMTP and POP3 protocol data units (both these protocols are character oriented).

A TCP connection between a client and a user to transfer characters will be set up using the telnet application with the following arguments:

- server (indicates the server computer (its domain name or IP address)),
- port (indicates the port number at which the application-layer server is reachable).

Use the »**telnet protokoli.lkn.fe.uni-lj.si 25**« command to set up a TCP connection with the SMTP server and the »**telnet protokoli.lkn.fe.uni-lj.si 110**« command to set up a TCP connection with the POP3 server.

SMTP Protocol

The protocol SMTP (Simple Mail Transfer Protocol) is a character-oriented protocol; this means that SMTP protocol data units are written as sequences of characters. Normally, end-of-line markers also delimit protocol data units that follow one another. An exception is the protocol data unit DATA which is an information protocol data unit (it contains a user message, and this can consist of more than one line of text). Therefore, the protocol data unit DATA is always concluded with a single period in a line, hence with the sequence CR-LF-».«-CR-LF, where the sequence CR-LF indicates the end-of-line. However, it may well happen that the user message (electronic mail) contains this same sequence; therefore, a single period in a line is always added another period by the SMTP transmitter, and the SMTP receiver removes this additional period.

A client and a server communicate according to the SMTP protocol by exchanging commands (client) and replies (server). The commands of a client are composed of keywords and parameters, while the replies of a server are composed of number codes and textual explanations. Commands of a client and replies of a server in the normal course of communication are shown in the table and are used in that same order. Each command (except for DATA command) is exactly one line long. While the commands are written in the standard (RFC 822) exactly as given in this table (hence all uppercase letters and command arguments within angle brackets »<<« and »>>«), it depends on the server, how exactly it requires the format of commands to comply with standard; our server is quite tolerant in this respect, as it allows both lowercase and uppercase letters, and even the angle brackets may be omitted. In any case, one must be aware that such protocols are normally implemented with software and are therefore not so tolerant to errors as man-machine interfaces.

client commands	server replies
connection setup	220
HELO <client domain>	250
MAIL FROM: <sender_address>	250
RCPT TO: <recipient_address>	250
DATA	354
user message, possible in more than one line	
. (a single period within a line)	250
QUIT	connection release

YOUR TASK

Use the telnet application to establish a TCP connection between the local computer and port 25 on the server »**protokoli.lkn.fe.uni-lj.si**«. Whatever you then type on the keyboard is transferred through the TCP connection to the SMTP server on the computer »**protokoli.lkn.fe.uni-lj.si**«. Your messages are interpreted by the SMTP server as SMTP protocol data units; the server executes the operations you request and replies to them. Also, **send** an electronic message (formatted according to the description in the previous paragraph) to your colleague's mailbox on the server »**protokoli.lkn.fe.uni-lj.si**«.

POP3 Protocol

The protocol POP3 (Post Office Protocol, version 3) allows a user to manage the mailbox on a distant mail server and to transfer electronic messages from server to client computer. This protocol is normally used by software, not human users, and is therefore not very tolerant to user errors. Similarly as in case of the protocol SMTP, POP3 protocol data units are lines of text which can therefore be very easily generated on keyboard and read on display. We will transfer these messages through a TCP connection between client and server computers with the port number 110 on the server side. To set up this connection, telnet application will be used.

According to the POP3 protocol, a client and a server communicate by exchanging commands (client) and responses (server). A client command consists of a keyboard and possibly a parameter. There are two possible server responses: "+OK" (success) and "-ERR" with textual explanation (error). A POP3 session consists of three phases. In the first phase (Authorisation), the client is authenticated with a username/password pair for the user whose mailbox is to be examined; the server then locks the mailbox to prevent other users to access it. In the second phase (Transactions), the client can examine the mailbox and transfer electronic messages to the local computer. In the third phase (Update), the server deletes the messages marked for deletion, unlocks the mailbox and releases the connection. Client commands, server actions and the respective session phases are shown in the table.

phase	client command	server operation
	TCP connection setup	greet the client and go to phase A
A	USER <i>name</i>	username of the mailbox owner
A	PASS <i>password</i>	password of the mailbox owner; if correct, go to phase T
T	STAT	return the number of messages and mailbox size
T	LIST <i>n</i>	return the number and size of message No. <i>n</i>
T	LIST	return the numbers and sizes of all messages in the mailbox
T	RETR <i>n</i>	transfer the message No. <i>n</i> to the client (a multiline message and the concluding ».«
T	DELE <i>n</i>	mark the message No. <i>n</i> for deletion
T	RSET	cancel all marks for deletion
T	QUIT	go to the phase U and disconnect

YOUR TASK

Use the telnet application to establish a TCP connection between your local computer and the port 110 on the server »**protokoli.lkn.fe.uni-lj.si**«. Whatever you type on the keyboard of your local computer will be transferred through this connection to the POP3 server on the »**protokoli.lkn.fe.uni-lj.si**« computer. Your messages will be interpreted by the POP3 server as POP3 protocol data units; the server will execute necessary operations and reply to your messages. Server replies will be displayed on your local computer. In this way, **examine** the messages in your mailbox on the server, transfer them to your local computer and read them there.