MIL-STD 1781

10 MAY 1984

MILITARY STANDARD

SIMPLE MAIL TRANSFER PROTOCOL

NO DELIVERABLE DATA

REQUIRED BY THIS DOCUMENT

IPSC/SLHC/TCTS

MIL-STD-1781
10 May 1984

FOREWORD

This document specifies the Simple Mail Transfer Protocol (SMTP), a protocol
designed to transfer mail reliably and efficiently. The document includes an
introduction to SMTP with a model of operation, procedures, and specifica-
tions, including state diagrams.

CONTENTS - Continued

FIGURES

1. SCOPE

1.1 **Purpose.** This standard establishes criteria for the Simple Mail Transfer Protocol (SMTP), a protocol designed to transfer mail reliably and efficiently.

1.2 **Organization.** This standard introduces the Simple Mail Transfer Protocol's design and procedures in sending and receiving mail and specifies the commands and other mechanisms needed to support SMTP. This standard also describes the uses of SMTP with various transport services.

1.2.1 **Transport services.** One of the most important features of SMTP is its capability to relay mail across transport service environments. A transport service provides an interprocess communication environment (IPCE). An IPCE may cover one network, several networks, or a subset of a network. It is important to realize that transport systems (or IPCEs) are not one-to-one with networks. A process can communicate directly with another process through any mutually known IPCE. Mail is an application or use of inter-process communication. Mail can be communicated between processes in different IPCEs by relaying through a process connected to two (or more) IPCEs. More specifically, mail can be relayed between hosts on different transport systems by a host on both transport systems.

1.3 **Application.** The Simple Mail Transfer Protocol is approved for use in all DoD packet switching networks which connect or have the potential for utilizing connectivity across network and subnetwork boundaries and which require a mail transfer service. The term network as used herein includes Local Area Networks.

3. DEFINITIONS

3.1 Definition of terms. The definition of terms used in this standard shall comply with FED-STD-1037. Terms and definitions unique to MIL-STD-1781 are contained herein.

a. Command
A request for a mail service action sent by the sender-SMTP to the receiver-SMTP.

b. Domain
The hierarchially structured global character string address of a host computer in the mail system.

c. End of mail data indication
A special sequence of characters that indicates the end of the mail data. In particular, the five characters carriage return, line feed, period, carriage return, line feed, in that order.

d. Host
A computer in the internetwork environment on which mailboxes or SMTP processes reside.

e. Line
A sequence of ASCII characters ending with a <CRLF>.

f. Mail data
A sequence of ASCII characters of arbitrary length, which conforms to the standard set in the Standard for the Format of ARPA Internet Text Messages.

g. Mailbox
A character string (address) which identifies a user to whom mail is to be sent. Mailbox normally consists of the host and user specifications. The standard mailbox naming convention is defined to be "user@domain". Additionally, the "container" in which mail is stored.

h. Receiver-SMTP process
A process which transfers mail in cooperation with a sender-SMTP process. It waits for a connection to be established via the transport service. It receives SMTP commands from the sender-SMTP, sends replies, and performs the specified operations.

i. Reply
A reply is an acknowledgment (positive or negative) sent from receiver to sender via the transmission channel in response to a command. The general form of a reply is a completion code (including error codes) followed by a text string. The codes are for use by programs and the text is usually intended for human users.

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4. THE SMTP MODEL

4.1 **SMTP design.** The SMTP design is based on the following model of communication: as the result of a user mail request, the sender-SMTP establishes a two-way transmission channel to a receiver-SMTP. The receiver-SMTP commands are generated by the sender-SMTP and sent to the receiver-SMTP. SMTP replies are sent from the receiver-SMTP to the sender-SMTP in response to the commands.

4.1.1 **Mail command.** Once the transmission channel is established, the SMTP-sender sends a MAIL command indicating the sender of the mail. If the SMTP-receiver can accept mail it responds with an OK reply. The SMTP-sender then sends a RCPT command identifying a recipient of the mail. If the SMTP-receiver can accept mail for that recipient it responds with an OK reply; if not, it responds with a reply rejecting that recipient (but not the whole mail transaction). The SMTP-sender and SMTP-receiver may negotiate several recipients. When the recipients have been negotiated the SMTP-sender sends the mail data, terminating with a special sequence. If the SMTP-receiver successfully processes the mail data it responds with an OK reply. The dialog is purposely lock-step, one-at-a-time.
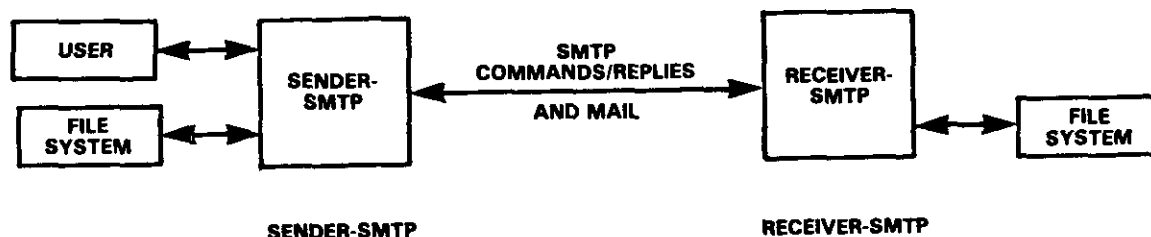
FIGURE 1. **Model for SMTP use.**

4.1.2 **Transmission of mail.** The SMTP provides mechanisms for the transmission of mail; directly from the sending user's host to the receiving user's host when the two hosts are connected to the same transport service, or via one or more relay SMTP-servers when the source and destination hosts are not connected to the same transport service. To be able to provide the relay capability, the SMTP-server must be supplied with the name of the ultimate destination host as well as the destination mailbox name.

4.1.2.1 **Forward- and reverse-path.** The argument to the MAIL command is a reverse-path, which specifies who the mail is from. The argument to the RCPT command is a forward-path, which specifies who the mail is to. The forward-path is a source route, while the reverse-path is a return route (which may be used to return a message to the sender when an error occurs with a relayed message).

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5. THE SMTP PROCEDURES

5.1 Introduction. This section presents the procedures used in SMTP in
several parts. First comes the basic mail procedure defined as a mail trans-
action. Following this are descriptions of forwarding mail, verifying mailbox
names and expanding mailing lists, sending to terminals instead of or in com-
bination with mailboxes, and the opening and closing exchanges. At the end
of this section are comments on relaying, a note on mail domains, and a dis-
cussion of changing roles. Throughout this section are examples of partial
command and reply sequences.

5.2 Mail. There are three steps to SMTP mail transactions. The trans-
action is started with a MAIL command which gives the sender identification.
A series of one or more RCPT commands follows giving the receiver informa-
tion. Then a DATA command gives the mail data. And finally, the end of mail
data indicator confirms the transaction.

5.2.1 MAIL command. The first step in the procedure is the MAIL command.
The <reverse-path> contains the source mailbox.

MAIL <SP> FROM:<reverse-path> <CRLF>

This command tells the SMTP-receiver that a new mail transaction is starting
and to reset all its state tables and buffers, including any recipients or
mail data. It gives the reverse-path which can be used to report errors.
If accepted, the receiver-SMTP returns a 250 OK reply. The <reverse-path>
can contain more than just a mailbox. The <reverse-path> is a reverse
source routing list of hosts and source mailbox. The first host in the
<reverse-path> should be the host sending this command.

5.2.2 RCPT command. The second step in the procedure is the RCPT command.

RCPT <SP> TO:<forward-path> <CRLF>

This command gives a forward-path identifying one recipient. If accepted,
the receiver-SMTP returns a 250 OK reply, and stores the forward-path. If
the recipient is unknown the receiver-SMTP returns a 550 Failure reply.
This second step of the procedure can be repeated any number of times. The
<forward-path> can contain more than just a mailbox. The <forward-path> is
a source routing list of hosts and the destination mailbox. The first host
in the <forward-path> should be the host receiving this command.

5.2.3 DATA command. The third step in the procedure is the DATA command.

DATA <CRLF>

If accepted, the receiver-SMTP returns a 354 Intermediate reply and considers
all succeeding lines to be the message text. When the end of text is received
and stored the SMTP-receiver sends a 250 OK reply. Since the mail data is
sent on the transmission channel the end of the mail data must be indicated

b. 551 User not local; please try <forward-path>. This reply indi-
cates that the receiver-SMTP knows the user's mailbox is on
another host and indicates the correct forward-path to use. Note
that either the host or user or both may be different. The re-
ceiver refuses to accept mail for this user, and the sender must
either redirect the mail according to the information provided or
return an error response to the originating user.

Paragraph 5.3.1 illustrates the use of these responses.

5.3.1 Example of forwarding. Either:

    S: RCPT TO:<Postel@USC-ISI.ARPA>
    R: 251 User not local; will forward to <Postel@USC-ISIF.ARPA>

    Or:

    S: RCPT TO:<Paul@USC-ISIB.ARPA>
    R: 551 User not local; please try <Mockapetris@USC-ISIF.ARPA>

5.4 Verifying and expanding. SMTP provides as additional features, com-
mands to verify a user name or expand a mailing list. This is done with the
VRFY and EXPN commands, which have character string arguments. For the VRFY
command, the string is a user name, and the response may include the full
name of the user and must include the mailbox of the user. For the EXPN
command, the string identifies a mailing list, and the multiline response
may include the full name of the users and must give the mailboxes on the
mailing list. "User name" is a fuzzy term and used purposely. If a host
implements the VRFY or EXPN commands then at least local mailboxes must be
recognized as "user names". If a host chooses to recognize other strings as
"user names" that is allowed. In some hosts the distinction between a mail-
ing list and an alias for a single mailbox is a bit fuzzy, since a common
data structure may hold both types of entries, and it is possible to have
mailing lists of one mailbox. If a request is made to verify a mailing
list, a positive response can be given if on receipt of a message so
addressed it will be delivered to everyone on the list, otherwise an error
should be reported (e.g., "550 That is a mailing list, not a user"). If a
request is made to expand a user name a positive response can be formed by
returning a list containing one name, or an error can be reported (e.g.,
"550 That is a user name, not a mailing list"). In the case of a multi-
line reply (normal for EXPN) exactly one mailbox is to be specified on each
line of the reply. In the case of an ambiguous request, for example, "VRFY
Smith", where there are two Smith's the response must be "553 User ambiguous".
The case of verifying a user name is straightforward as shown in paragraph
5.4.1.

5.4.1 Example of verifying a user name. Either:

    S: VRFY Smith
    R: 250 Fred Smith <Smith@USC-ISIF.ARPA>

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these two functions are combined in SMTP. However the sending commands are not included in the required minimum implementation (paragraph 6.5.1). Users should have the ability to control the writing of messages on their terminals. Most hosts permit the users to accept or refuse such messages. The following three commands are defined to support the sending options. These are used in the mail transaction instead of the MAIL command and inform the receiver-SMTP of the special semantics of this transaction:

a. SEND <SP> FROM:<reverse-path> <CRLF>. The SEND command requires that the mail data be delivered to the user's terminal. If the user is not active (or not accepting terminal messages) on the host a 450 reply may return to a RCPT command. The mail transaction is successful if the message is delivered to the terminal. The same reply code which is used for the MAIL commands is used for this command.

b. SOML <SP> FROM:<reverse-path> <CRLF>. The SEND or MAIL command requires that the mail data be delivered to the user's terminal if the user is active (and accepting terminal messages) on the host. If the user is not active (or not accepting terminal messages) then the mail data is entered into the user's mailbox. The mail transaction is successful if the message is delivered either to the terminal or the mailbox. The same reply code which is used for the MAIL commands is used for this command.

c. SAML <SP> FROM:<reverse-path> <CRLF>. The SEND and MAIL command requires that the mail data be delivered to the user's terminal if the user is active (and accepting terminal messages) on the host. In any case the mail data is entered into the user's mailbox. The mail transaction is successful if the message is delivered to the mailbox. The same reply code which is used for the MAIL commands is used for this command.

5.6 Opening and closing. At the time the transmission channel is opened there is an exchange to ensure that the hosts are communicating with the hosts they think they are. The following two commands are used in transmission channel opening and closing:

a. HELO <SP> <domain> <CRLF>

b. QUIT <CRLF>

In the HELO command the host sending the command identifies itself; the command may be interpreted as saying "Hello, I am <domain>".

5.6.1 Example of connection opening.

R: 220 BBN-UNIX.ARPA Simple Mail Transfer Service Ready
S: HELO USC-ISIF.ARPA
R: 250 BBN-UNIX.ARPA

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notification message is shown in paragraph 5.7.4. This notification is in
response to a message originated by JOE at HOSTW and sent via HOSTX to HOSTY
with instructions to relay it on to HOSTZ. What we see in the example is
the transaction between HOSTY and HOSTX, which is the first step in the return
of the notification message.

5.7.4   Example of an undeliverable mail notification message.

```
S:  MAIL FROM:<>
R:  250 ok
S:  RCPT TO:<@HOSTX.ARPA:JOE@HOSTW.ARPA>
R:  250 ok
S:  DATA
R:  354 send the mail data, end with .
S:  Date:  23 Oct 81 11:22:33
S:  From:  SMTP@HOSTY.ARPA
S:  To:  JOE@HOSTW.ARPA
S:  Subject:  Mail System Problem
S:
S:  Sorry JOE, your message to SAM@HOSTZ.ARPA lost.
S:  HOSTZ.ARPA said this:
S:  "550 No Such User"
S:  .
R:  250 ok
```

5.8   Domains. Domains are a recently introduced concept in the ARPA Inter-
net mail system. The use of domains changes the address space from a flat
global space of simple character string host names to a hierarchically struc-
tured rooted tree of global addresses. The host name is replaced by a domain
and host designator which is a sequence of domain element strings separated
by periods with the understanding that the domain elements are ordered from
the most specific to the most general. For example, "USC-ISIF.ARPA",
"Fred.Cambridge.UK", and "PC7.LCS.MIT.ARPA" might be host-and-domain identi-
fiers. Whenever domain names are used in SMTP only the official names are
used, the use of nicknames or aliases are not allowed.

5.9   Changing roles. The TURN command may be used to reverse the roles of
the two programs communicating over the transmission channel. If program-A
is currently the sender-SMTP and it sends the TURN command and receives an
ok reply (250) then program-A becomes the receiver-SMTP. If program-B is
currently the receiver-SMTP and it receives the TURN command and sends an ok
reply (250) then program-B becomes the sender-SMTP.

5.9.1   Refusal to change roles. To refuse to change roles the receiver
sends the 502 reply. Please note that this command is optional. It would
not normally be used in situations where the transmission channel is TCP.
However, when the cost of establishing the transmission channel is high,
this command may be quite useful. For example, this command may be useful
in supporting the mail exchange using the public switched telephone system
as a transmission channel, especially if some hosts poll other hosts for
mail exchanges.

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it may use the same reply it would for an unknown local user (550). When mail is relayed, the relay host must remove itself from the beginning forward-path and put itself at the beginning of the reverse-path. When mail reaches its ultimate destination (the forward-path contains only a destination mail-box), the receiver-SMTP inserts it into the destination mailbox in accordance with its host mail conventions. For example, mail received at relay host A with arguments

```
        FROM:<USERX@HOSTY.ARPA>
        TO:<@HOSTA.ARPA,@HOSTB.ARPA:USERC@HOSTD.ARPA>
will be relayed on to host B with arguments

        FROM:<@HOSTA.ARPA:USERX@HOSTY.ARPA>
        TO:<@HOSTB.ARPA:USERC@HOSTD.ARPA>.
```

This command causes its forward-path argument to be appended to the forward-path buffer.

6.1.1.4 <u>DATA (DATA)</u>. The receiver treats the lines following the command as mail data from the sender. This command causes the mail data from this command to be appended to the mail data buffer. The mail data may contain any of the 128 ASCII character codes. The mail data is terminated by a line containing only a period, that is the character sequence "<CRLF>.<CRLF>" (see paragraph 6.5.2 on Transparency). This is the end of mail data indication. The end of mail data indication requires that the receiver must now process the stored mail transaction information. This processing consumes the information in the reverse-path buffer, the forward-path buffer, and the mail data buffer, and on the completion of this command these buffers are cleared. If the processing is successful the receiver must send an OK reply. If the processing fails completely the receiver must send a failure reply. When the receiver-SMTP accepts a message either for relaying or for final delivery it inserts at the beginning of the mail data a timestamp line. The timestamp line indicates the identity of the host that sent the message, and the identity of the host that received the message (and is inserting this timestamp), and the date and time the message was received. Relayed messages will have multiple timestamp lines. When the receiver-SMTP makes the "final delivery" of a message it inserts at the beginning of the mail data a return path line. The return path line preserves the information in the <reverse-path> from the MAIL command. Here, final delivery means the message leaves the SMTP world. Normally, this would mean it has been delivered to the destination user, but in some cases it may be further processed and transmitted by another mail system. It is possible for the mailbox in the return path to be different from the actual sender's mailbox; for example, if error responses are to be delivered to a special error handling mailbox rather than to the message senders. The preceding implies that the final mail data will begin with a return path line, followed by one or more timestamp lines. These lines will be followed by the mail data header and body. See paragraph 8.

6.1.1.4.1 <u>Response and further action</u>. Special mention is needed of the response and further action required when the processing following the end of mail data indication is partially successful. This could arise if, after

command clears the reverse-path buffer, the forward-path buffer, and the mail data buffer; and inserts the reverse-path information from this command into the reverse-path buffer.

6.1.1.7 **SEND and MAIL (SAML).** This command is used to initiate a mail transaction in which the mail data is delivered to one or more terminals and mailboxes. For each recipient the mail data is delivered to the recipient's terminal if the recipient is active on the host (and accepting terminal messages), and for all recipients to the recipient's mailbox. The argument field contains a reverse-path. This command is successful if the message is delivered to the mailbox. The reverse-path consists of an optional list of hosts and the sender mailbox. When the list of hosts is present, it is a "reverse" source route and indicates that the mail was relayed through each host on the list (the first host in the list was the most recent relay). This list is used as a source route to return non-delivery notices to the sender. As each relay host adds itself to the beginning of the list, it must use its name as known in the IPCE to which it is relaying the mail rather than the IPCE from which the mail came (if they are different). This command clears the reverse-path buffer, the forward-path buffer, and the mail data buffer; and inserts the reverse-path information from this command into the reverse-path buffer.

6.1.1.8 **RESET (RSET).** This command specifies that the current mail transaction is to be aborted. Any stored sender, recipients, and mail data must be discarded, and all buffers and state tables cleared. The receiver must send an OK reply.

6.1.1.9 **VERIFY (VRFY).** This command asks the receiver to confirm that the argument identifies a user. If it is a user name, the full name of the user (if known) and the fully specified mailbox are returned. This command has no effect on any of the reverse-path buffer, the forward-path buffer, or the mail data buffer.

6.1.1.10 **EXPAND (EXPN).** This command asks the receiver to confirm that the argument identifies a mailing list, and if so, to return the membership of that list. The full name of the users (if known) and the fully specified mailboxes are returned in a multiline reply. This command has no effect on any of the reverse-path buffer, the forward-path buffer, or the mail data buffer.

6.1.1.11 **HELP (HELP).** This command causes the receiver to send helpful information to the sender of the HELP command. The command may take an argument (e.g., any command name) and return more specific information as a response. This command has no effect on any of the reverse-path buffer, the forward-path buffer, or the mail data buffer.

6.1.1.12 **NOOP (NOOP).** This command does not affect any parameters or previously entered commands. It specifies no action other than that the receiver send an OK reply. This command has no effect on any of the reverse-path buffer, the forward-path buffer, or the mail data buffer.

"smith" is different from the user "Smith." The argument field consists of a
variable length character string ending with the character sequence <CRLF>.
The receiver is to take no action until this sequence is received. Square
brackets denote an optional argument field. If the option is not taken, the
appropriate default is implied.

6.1.3.1 List of SMTP commands. The following are the SMTP commands:

    a. HELO <SP> <domain> <CRLF>

    b. MAIL <SP> FROM:<reverse-path> <CRLF>

    c. RCPT <SP> TO:<forward-path> <CRLF>

    d. DATA <CRLF>

    e. RSET <CRLF>

    f. SEND <SP> FROM:<reverse-path> <CRLF>

    g. SOML <SP> FROM:<reverse-path> <CRLF>

    h. SAML <SP> FROM:<reverse-path> <CRLF>

    i. VRFY <SP> <string> <CRLF>

    j. EXPN <SP> <string> <CRLF>

    k. HELP [<SP> <string>] <CRLF>

    l. NOOP <CRLF>

    m. QUIT <CRLF>

    n. TURN <CRLF>

6.1.3.2 SMTP syntax. The syntax of the above argument fields (using BNF
notation where applicable) is given below. The "..." notation indicates
that a field may be repeated one or more times.

    a. <reverse-path> ::= <path>

    b. <forward-path> ::= <path>

    c. <path> ::= "<" [<a-d-l> ":"] <mailbox> ">"

    d. <a-d-l> ::= <at-domain> | <at-domain> "," <a-d-l>

    e. <at-domain> ::= "@" <domain>

    f. <domain> ::= <element> | <element> "." <domain>

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ee. <special> ::= "<" | ">" | "(" | ")" | "[" | "]" | "\" | "."
| "," | ";" | ":" | "@" """ | the control
characters (ASCII codes 0 through 31 inclusive and
127)

6.1.3.2.1 Special note. Note that the backslash, "\", is a quote character,
which is used to indicate that the next character is to be used literally
(instead of its normal interpretation). For example, "Joe,Smith" could be
used to indicate a single nine character user field with comma being the
fourth character of the field. Hosts are generally known by names which are
translated to addresses in each host. Note that the name elements of domains
are the official names -- no use of nicknames or aliases is allowed. Some-
times a host is not known to the translation function and communication is
blocked. To bypass this barrier two numeric forms are also allowed for host
"names". One form is a decimal integer prefixed by a pound sign, "#", which
indicates the number is the address of the host. Another form is four small
decimal integers separated by dots and enclosed by brackets, e.g.,
"[123.255.37.2]", which indicates a 32-bit ARPA Internet Address in four
8-bit fields.

6.1.3.3 Timestamp and return path lines. The timestamp line and the
return path line are formally defined as follows:

a. <return-path-line> ::= "Return-Path:" <SP><reverse-path><CRLF>

b. <time-stamp-line> ::= "Received:" <SP> <stamp> <CRLF>

c. <stamp> ::= <from-domain> <by-domain> <opt-info> ";"
<daytime>

d. <from-domain> ::= "FROM" <SP> <domain> <SP>

e. <by-domain> ::= "BY" <SP> <domain> <SP>

f. <opt-info> ::= [<via>] [<with>] [<id>] [<for>]

g. <via> ::= "VIA" <SP> <link> <SP>

h. <with> ::= "WITH" <SP> <protocol> <SP>

i. <id> ::= "ID" <SP> <string> <SP>

j. <for> ::= "FOR" <SP> <path> <SP>

k. <link> ::= The standard names for links are registered with
the Network Information Center.

l. <protocol> ::= The standard names for protocols are
registered with the Network Information Center.

m. <daytime> ::= <SP> <date> <SP> <time>

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<CRLF>, or a multiline reply (as defined in Appendix E). Only the EXPN and HELP commands are expected to result in multiline replies in normal circum- stances; however, multiline replies are allowed for any command.

6.2.1 Reply codes by function groups.

a. 500 Syntax error, command unrecognized
    [This may include errors such as command line too long]

b. 501 Syntax error in parameters or arguments

c. 502 Command not implemented

d. 503 Bad sequence of commands

e. 504 Command parameter not implemented

f. 211 System status, or system help reply

g. 214 Help message
    [Information on how to use the receiver or the meaning of a particular non-standard command; this reply is useful only to the human user]

h. 220 <domain> Service ready

i. 221 <domain> Service closing transmission channel

j. 421 <domain> Service not available,
    closing transmission channel
    [This may be a reply to any command if the service knows it must shut down]

k. 250 Requested mail action okay, completed

l. 251 User not local; will forward to <forward-path>

m. 450 Requested mail action not taken: mailbox unavailable
    [e.g., mailbox busy]

n. 550 Requested action not taken: mailbox unavailable
    [e.g., mailbox not found, no access]

o. 451 Requested action aborted: error in processing

p. 551 User not local; please try <forward-path>

q. 452 Requested action not taken: insufficient system storage

r. 552 Requested mail action aborted: exceeded storage allocation

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r. 551 User not local; please try <forward-path>

s. 552 Requested mail action aborted: exceeded storage allocation

t. 553 Requested action not taken: mailbox name not allowed
[E.g., mailbox syntax incorrect]

u. 554 Transaction failed

6.3 _Sequencing of commands and replies._ The communication between the sender and receiver is intended to be an alternating dialogue, controlled by the sender. As such, the sender issues a command and the receiver responds with a reply. The sender must wait for this response before sending further commands. One important reply is the connection greeting. Normally, a receiver will send a 220 "Service ready" reply when the connection is completed. The sender should wait for this greeting message before sending any commands. All the greeting type replies have the official name of the server host as the first word following the reply code. For example, 220 <SP> USC-ISIF.ARPA <SP> Service, ready <CRLF>. Paragraph 6.3.1 lists alternative success and failure replies for each command. These must be strictly adhered to; a receiver may substitute text in the replies, but the meaning and action implied by the code numbers and by the specific command reply sequence cannot be altered.

6.3.1 _Command-reply sequences._ Each command is listed with its possible replies. The prefixes used before the possible replies are "P" for preliminary (not used in SMTP), "I" for intermediate, "S" for success, "F" for failure, and "E" for error. The 421 reply (service not available, closing transmission channel) may be given to any command if the SMTP-receiver knows it must shut down. This listing forms the basis for the State Diagrams in paragraph 6.4.

```
CONNECTION ESTABLISHMENT
     S: 220
     F: 421
HELO
     S: 250
     E: 500, 501, 504, 421
MAIL
     S: 250
     F: 552, 451, 452
     E: 500, 501, 421
RCPT
     S: 250, 251
     F: 550, 551, 552, 553, 450, 451, 452
     E: 500, 501, 503, 421
DATA
     I: 354 -> data -> S: 250
                       F: 552, 554, 451, 452
     F: 451, 554
     E: 500, 501, 503, 421
```
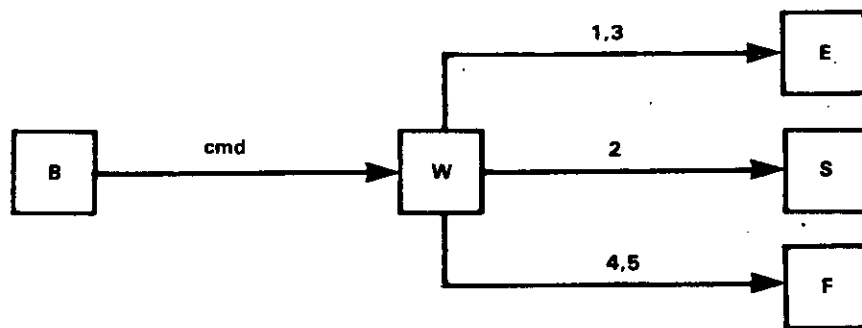
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FIGURE 2. Representation of most of the SMTP commands.

Figure 2 models the commands:

HELO, MAIL, RCPT, RSET, SEND, SOML, SAML, VRFY, EXPN, HELP, NOOP, QUIT, TURN.

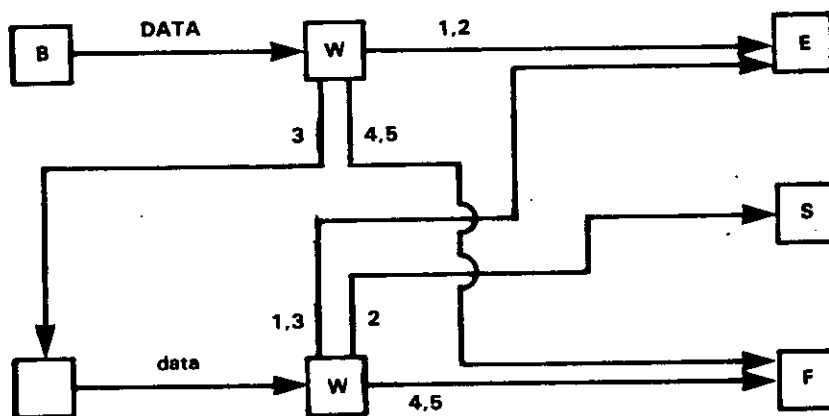6.4.2 The DATA command. Figure 3 models the DATA command.

FIGURE 3. The DATA command.

Note that the "data" here is a series of lines sent from the sender to the receiver with no response expected until the last line is sent.

6.5 Details.

6.5.1 Minimum implementation. In order to make SMTP workable, the following minimum implementation is required for all receivers:

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d. Command Line

The maximum total length of a command line including the command word and the <CRLF> is 512 characters.

e. Reply Line

The maximum total length of a reply line including the reply code and the <CRLF> is 512 characters.

f. Text Line

The maximum total length of a text line including the <CRLF> is 1000 characters (but not counting the leading dot duplicated for transparency).

g. Recipients Buffer

The maximum total number of recipients that must be buffered is 100 recipients.

6.5.3.1 **Error reply codes.** Errors due to exceeding these limits may be reported by using the reply codes, for example:

500 Line too long.

501 Path too long.

552 Too many recipients.

552 Too much mail data.

8. THEORY OF REPLY CODES

8.1 Introduction. The three digits of the reply each have a special significance. The first digit denotes whether the response is good, bad or incomplete. An unsophisticated sender-SMTP will be able to determine its next action (proceed as planned, redo, retrench, etc.) by simply examining this first digit. A sender-SMTP that wants to know approximately what kind of error occurred (e.g., mail system error, command syntax error) may examine the second digit, reserving the third digit for the finest gradation of information.

8.1.1 Values for the first digit. There are five values for the first digit of the reply code.

8.1.1.1 Positive preliminary reply (1yz). The command has been accepted, but the requested action is being held in abeyance, pending confirmation of the information in this reply. The sender-SMTP should send another command specifying whether to continue or abort the action. SMTP does not have any commands that allow this type of reply, and so does not have the continue or abort commands.

8.1.1.2 Positive completion reply (2yz). The requested action has been successfully completed. A new request may be initiated.

8.1.1.3 Positive intermediate reply (3yz). The command has been accepted, but the requested action is being held in abeyance, pending receipt of further information. The sender-SMTP should send another command specifying this information. This reply is used in command sequence groups.

8.1.1.4 Transient negative completion reply (4yz). The command was not accepted and the requested action did not occur. However, the error condition is temporary and the action may be requested again. The sender should return to the beginning of the command sequence (if any). It is difficult to assign a meaning to "transient" when two different sites (receiver- and sender-SMTPs) must agree on the interpretation. Each reply in this category might have a different time value, but the sender-SMTP is encouraged to try again. A rule of thumb to determine if a reply fits into the 4yz or the 5yz category (see below) is that replies are 4yz if they can be repeated without any change in command form or in properties of the sender or receiver. (E.g., the command is repeated identically and the receiver does not put up a new implementation.)

8.1.1.5 Permanent negative completion reply (5yz). The command was not accepted and the requested action did not occur. The sender-SMTP is discouraged from repeating the exact request (in the same sequence). Even some "permanent" error conditions can be corrected, so the human user may want to direct the sender-SMTP to reinitiate the command sequence by direct action at some point in the future (e.g., after the spelling has been changed, or the user has altered the account status).

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9. SCENARIOS

9.1 <u>Introduction</u>. This section presents complete scenarios of several types of SMTP sessions.

9.2 <u>A typical SMTP transaction scenario</u>. This SMTP example shows mail sent by Smith at host USC-ISIF, to Jones, Green, and Brown at host BBN-UNIX. Here we assume that host USC-ISIF contacts host BBN-UNIX directly. The mail is accepted for Jones and Brown. Green does not have a mailbox at host BBN-UNIX.

```
R: 220 BBN-UNIX.ARPA Simple Mail Transfer Service Ready
S: HELO USC-ISIF.ARPA
R: 250 BBN-UNIX.ARPA

S: MAIL FROM:<Smith@USC-ISIF.ARPA>
R: 250 OK

S: RCPT TO:<Jones@BBN-UNIX.ARPA>
R: 250 OK

S: RCPT TO:<Green@BBN-UNIX.ARPA>
R: 550 No such user here

S: RCPT TO:<Brown@BBN-UNIX.ARPA>
R: 250 OK

S: DATA
R: 354 Start mail input; end with <CRLF>.<CRLF>
S: ...etc. etc. etc.
S: ...etc. etc. etc.
S: .
R: 250 OK

S: QUIT
R: 221 BBN-UNIX.ARPA Service closing transmission channel
```

9.3 <u>Aborted SMTP transaction scenario</u>.

```
R: 220 MIT-Multics.ARPA Simple Mail Transfer Service Ready
S: HELO ISI-VAXA.ARPA
R: 250 MIT-Multics.ARPA

S: MAIL FROM:<Smith@ISI-VAXA.ARPA>
R: 250 OK

S: RCPT TO:<Jones@MIT-Multics.ARPA>
R: 250 OK

S: RCPT TO:<Green@MIT-Multics.ARPA>
R: 550 No such user here
```

```
S: Date: 2 Nov 81 22:33:44
S: From: John Q. Public <JQP@MIT-AI.ARPA>
S: Subject:  The Next Meeting of the Board
S: To: Jones@BBN-Vax.ARPA
S:
S: Bill:
S: The next meeting of the board of directors will be
S: on Tuesday.
S:                              John.
S: .
R: 250 OK

S: QUIT
R: 221 USC-ISIE.ARPA Service closing transmission channel
```

9.5 <u>Verifying and sending scenario</u>.

```
R: 220 SU-SCORE.ARPA Simple Mail Transfer Service Ready
S: HELO MIT-MC.ARPA
R: 250 SU-SCORE.ARPA

S: VRFY Crispin
R: 250 Mark Crispin <Admin.MRC@SU-SCORE.ARPA>

S: SEND FROM:<EAK@MIT-MC.ARPA>
R: 250 OK

S: RCPT TO:<Admin.MRC@SU-SCORE.ARPA>
R: 250 OK

S: DATA
R: 354 Start mail input; end with <CRLF>.<CRLF>
S: ...etc. etc. etc.
S: ...etc. etc. etc.
S: .
R: 250 OK

S: QUIT
R: 221 SU-SCORE.ARPA Service closing transmission channel
```

9.6 <u>Sending and mailing scenarios</u>. First the user's name is verified, then
an attempt is made to send to the user's terminal. When that fails, the
message is mailed to the user's mailbox.

```
R: 220 SU-SCORE.ARPA Simple Mail Transfer Service Ready
S: HELO MIT-MC.ARPA
R: 250 SU-SCORE.ARPA

S: VRFY Crispin
R: 250 Mark Crispin <Admin.MRC@SU-SCORE.ARPA>

S: SEND FROM:<EAK@MIT-MC.ARPA>
R: 250 OK
```

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9.7.1 Expanding the first list.

```
R: 220 MIT-AI.ARPA Simple Mail Transfer Service Ready
S: HELO SU-SCORE.ARPA
R: 250 MIT-AI.ARPA

S: EXPN Example-People
R: 250-<ABC@MIT-MC.ARPA>
R: 250-Fred Fonebone <Fonebone@USC-ISIQ.ARPA>
R: 250-Xenon Y. Zither <XYZ@MIT-AI.ARPA>
R: 250-Quincy Smith <@USC-ISIF.ARPA:Q-Smith@ISI-VAXA.ARPA>
R: 250-<joe@foo-unix.ARPA>
R: 250 <xyz@bar-unix.ARPA>

S: QUIT
R: 221 MIT-AI.ARPA Service closing transmission channel
```

9.7.2 Expanding the second list.

```
R: 220 MIT-MC.ARPA Simple Mail Transfer Service Ready
S: HELO SU-SCORE.ARPA
R: 250 MIT-MC.ARPA

S: EXPN Interested-Parties
R: 250-Al Calico <ABC@MIT-MC.ARPA>
R: 250-<XYZ@MIT-AI.ARPA>
R: 250-Quincy Smith <@USC-ISIF.ARPA:Q-Smith@ISI-VAXA.ARPA>
R: 250-<fred@BBN-UNIX.ARPA>
R: 250 <xyz@bar-unix.ARPA>

S: QUIT
R: 221 MIT-MC.ARPA Service closing transmission channel
```

9.7.3 Mailing to all via a relay host.

```
R: 220 USC-ISIE.ARPA Simple Mail Transfer Service Ready
S: HELO SU-SCORE.ARPA
R: 250 USC-ISIE.ARPA

S: MAIL FROM:<Account.Person@SU-SCORE.ARPA>
R: 250 OK
S: RCPT TO:<@USC-ISIE.ARPA:ABC@MIT-MC.ARPA>
R: 250 OK
S: RCPT TO:<@USC-ISIE.ARPA:Fonebone@USC-ISIQA.ARPA>
R: 250 OK
S: RCPT TO:<@USC-ISIE.ARPA:XYZ@MIT-AI.ARPA>
R: 250 OK
S: RCPT
   TO:<@USC-ISIE.ARPA,@USC-ISIF.ARPA:Q-Smith@ISI-VAXA.ARPA>
R: 250 OK
S: RCPT TO:<@USC-ISIE.ARPA:joe@FOO-UNIX.ARPA>
R: 250 OK
S: RCPT TO:<@USC-ISIE.ARPA:xyz@BAR-UNIX.ARPA>
```

```
S: QUIT
R: 221 USC-ISIF.ARPA Service closing transmission channel
```

9.9.2 Delivering the mail at the second host.

```
R: 220 USC-ISI.ARPA Simple Mail Transfer Service Ready
S: HELO LBL-UNIX.ARPA
R: 250 USC-ISI.ARPA

S: MAIL FROM:<mo@LBL-UNIX.ARPA>
R: 250 OK

S: RCPT TO:<Jones@USC-ISI.ARPA>
R: OK

S: DATA
R: 354 Start mail input; end with <CRLF>.<CRLF>
S: ...etc. etc. etc.
S: ...etc. etc. etc.
S: .
R: 250 OK

S: QUIT
R: 221 USC-ISI.ARPA Service closing transmission channel
```

9.10 Too many recipients scenario.

```
R: 220 BERKELEY.ARPA Simple Mail Transfer Service Ready
S: HELO USC-ISIF.ARPA
R: 250 BERKELEY.ARPA

S: MAIL FROM:<Postel@USC-ISIF.ARPA>
R: 250 OK

S: RCPT TO:<fabry@BERKELEY.ARPA>
R: 250 OK

S: RCPT TO:<eric@BERKELEY.ARPA>
R: 552 Recipient storage full, try again in another transaction

S: DATA
R: 354 Start mail input; end with <CRLF>.<CRLF>
S: ...etc. etc. etc.
S: ...etc. etc. etc.
S:
R: 250 OK

S: MAIL FROM:<Postel@USC-ISIF.ARPA>
R: 250 OK

S: RCPT TO:<eric@BERKELEY.ARPA>
R: 250 OK
```

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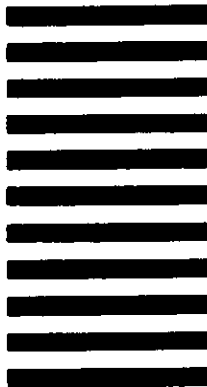*(Fold along this line)*

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