COMMENTS ON NCP/TCP MAIL SERVICE TRANSITION STRATEGY

INTRODUCTION

   This memo reviews and expands on the mail service transition plan
   [20].

   The principal aim of the plan is to provide for the orderly support
   of the most commonly used network service (mail) during the period of
   transition from ARPANET to Internet Protocol-based operation.

   The goal of the transition is, at the end, to provide in the internet
   environment service which is equivalent to or better than what has
   been available in the ARPANET environment. During the interim
   period, when both internet and the older ARPANET-based protocols are
   in use, the goal of the transition is to minimize user impact and, to
   the extent possible, to minimize software development or modification
   required to deal with transitional problems.

   It is assumed that the reader is familiar with both the ARPANET and
   internet protocol hierarchies [1-17]. The internet hierarchy is
   designed to interface to many different packet networks (e.g., packet
   satellite, packet radio, Ethernet, LCS Ring net, X.25 public
   nets, ...), while the ARPANET hierarchy is limited to ARPANET IMPs
   (This is less true of the levels above NCP, but NCP itself is closely
   bound to ARPANET services).

   The objective of the transition plan is to specify means by which the
   ARPANET electronic mail services may be supported across the boundary
   between the purely ARPANET environment and the more general internet
   environment during the period of transition by ARPANET hosts to the
   richer internet world.

ELECTRONIC MESSAGE SERVICES

   DARPA is beginning a new phase of research into automatic electronic
   message handling systems. Ultimately, it is intended that electronic
   messages incorporate multiple media such as text, facsimile,
   compressed digitized voice, graphics and so on. Success in this new
   research will require substantial progress in developing multimode
   user interfaces to computer-based services (voice input/output,
   graphics, tablet/light pen, facsimile input/output, video/bit mapped
   displays, ...).

   At the same time, progress must be made towards an environment based
   on internet protocols so as to avoid confining the results of the

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multimedia effort to any one network. As a result, DARPA is planning
to make several transitions over the next few years, from the
existing, text-based ARPANET electronic message system to an
internet-based, multimedia electronic message system.

This paper addresses only the first of the transitions from NCP-based
text mail to TCP-based multimedia mail. The transition to the new
multimedia mail system [7,19] lies ahead, but need not be planned in
detail until we have some experience with the basic concepts. This
first step only provides for the transition to TCP-based text mail.

The basic ground rules for transition from ARPANET-based electronic
mail to internet electronic mail are the following:

    1. ARPANET mailbox names must continue to work correctly.

    2. No change required to mail editors which parse message headers
        to compose replies and the like.

    3. Accommodation of non-ARPANET mailbox designators without
        change to the header parsing and checking mechanisms of mail
        composition programs.

    4. Automatic forwarding of messages between NCP and TCP
        environments without user intervention.

    5. During the transition, old style mail mechanisms must still
        work.

ELECTRONIC MESSAGE MECHANISMS

    In order to make progress at all, it has been necessary to postulate
    fairly sophisticated changes to the "mailer" function which accepts
    as input an electronic text message and causes it to be delivered to
    the destination (or to an intermediate forwarder).

    We also posit the existence of special, well-known mail forwarding
    hosts on the ARPANET which are responsible for accepting messages
    from NCP (TCP)-based message senders and forwarding them to
    TCP (NCP)-based message receivers.

    In the ARPANET, electronic messages are transported via special
    procedures of the File Transfer Protocol: MAIL and MLFL. The former
    method sends electronic messages via the FTP Telnet command channel

while the latter achieves this by actual file transfer. In both
cases, it is generally assumed that the receiving FTP server is
colocated with the destination mailbox.

Thus, the sending procedure identifies to the receiver the
destination mailbox identifier, but not the destination host (or
network) identifier. For example, messages sent from Postel at
USC-ISIF to Adams at USC-ISIA would arrive at ISIA with an indicator
"Adams" but no indication of "ISIA". This creates some problems when
messages must be staged at an intermediate host for further
processing, as is the case when moving from an NCP-based sender to a
TCP-based receiver, or vice-versa. Similar considerations arise when
dealing with compatible, but different, message systems requiring
re-formatting of messages at intermediate points.

In the following paragraphs, a mechanism is proposed for dealing with
the naming, addressing and routing [18] of messages between systems.

At the source, it is assumed that the user has prepared the text of
the message (including "To:" and "CC:" fields) in the conventional
way [12]. The mailbox identifiers will continue to exhibit the
format:

    User@Host

but "host" may in fact be a compound name (which is not necessarily
parsed), such as:

    USC-ISIA
    ARPANET-ISIA
    SATNET-NDRE
    PPSN-RSRE
    HOST1.SRINET
    LCSNET/MAILROOM

or even the name of an organization, such as:

    BBN
    ARPA
    MIT
    SRI

The only restriction is that the "@" not appear in either "user" or
"host" strings in the mailbox identifier.

During message composition, the "user" or "host" portions of the

   mailbox identifier may be verified for correctness (or at least for
   validity). The "user" string may incorporate parenthetical
   information such as

      RAK(Richard A. Karp)@SU-AI

   as is currently allowed.

   After composition, messages are either sent immediately or left as
   "unsent mail" files to be sent later by mailer demons. The actual
   sending process uses the "host" string to determine where and how to
   send the message.

NEW MAIL MECHANISMS

   At this point, we encounter the first critical new requirement to
   support the transition plan. A new table is needed within the mailer
   or in the host supporting the mailer or accessible to the mailer via
   the internet name server (for instance). This table must provide for
   mapping of the "host" string into an internet destination address
   (i.e., 32 bits: 8 bits of net, 24 bits of host), and must also
   indicate whether the destination is NCP or TCP capable.

   In the event that the source and destination hosts do not have a
   compatible host level protocol (e.g. source is NCP only, destination
   is TCP only) then the message must be passed to a "forwarder" which
   can stage the transport by accepting via one protocol and forwarding
   by another.

   This leads to a problem for the forwarding host since the basic FTP
   mail mechanism sends only the "user" portion of the mailbox
   identifier ("user@host") because the assumption is that the "host" is
   the destination. In the case of forwarding, the "host" is not the
   forwarder. Even if we cleverly arrange for "host" to translate into
   the internet address of a forwarder, we will have two problems.
   First, the forwarder may need the "host" information to figure where
   now to forward the message and second, depending on which network the
   source is in, "host" may need to translate into different forwarder
   addresses. The latter observation raises the spectre of many
   different mappings of a given "host" string which would require
   different tables for different mail sources. This would lead to
   considerable complexity in the maintenance and distribution of tables
   of forwarder addresses. Furthermore, a single-entry table mapping
   "host" to forwarder would limit reliability since only one forwarder
   would be bound to serve a giver "host".

For the NCP/TCP transition, it may be sufficient to declare some set
of well-known hosts to be NCP/TCP forwarders. Each mailer, when it
discovers an incompatible destination, can send the message to any
forwarder which is available. In addition, however, the mailer must
provide full mailbox identifier information "user@host" to the
forwarding host.

In the present mailers, only the "user" portion of the mailbox
identifier is sent, so all mailers must change to send "user@host"
when sending to a forwarder. The mailers all have to learn how to do
table look-up a new way, also, to map "host" into internet addresses
and to interpret the NCP or TCP capability information.

For purposes of this discussion, we postulate three different cases
of electronic mail service implementation which must be made to
interoperate during the transition:

    1.   Unchanged OLD NCP (RFC733) mail

    2.   NCP mail with new internet tables

    3.   TCP mail with new internet tables.

The second case assumes that the host has adopted a new host-string
to address table (including NCP/TCP capability bits) and new mailer -
mail server programs, but continues to use the old NCP host level
protocol, modified to send "user@host" when sending to a forwarder.
For such hosts, the only table entries which result in direct
source-destination mail delivery are those showing NCP capability.
If the destination is TCP capable only then the source host selects a
forwarder address from another table and sends the message to it for
further processing.

In the third case, the source host has fully transitioned to TCP,
uses the new internet address tables to translate host-strings into
internet addresses, and uses the new mailer - mail server.
Destinations which are NCP-compatible only are reached via NCP/TCP
forwarders.

Mail composition programs (e.g. SNDMSG, MSG, Hermes, MH,...) which
today use ARPANET string-to-address tables to verify the legality of
host names in mailbox entries can continue to use these "old" tables
as long as these are updated to include internet host names as well
as ARPANET host names.

Indeed, expanding the old tables is essential to handle the hardest

transition case: OLD NCP to new TCP mail. The three types of hosts
lead to a 3 by 3 matrix of cases of mail transfer. In all but one
case, mail is either handled directly or explicitly by forwarder.
The only case needing further explanation is OLD NCP to NEW TCP which
uses an "implicit forwarder."

IMPLICIT FORWARDING VS EXPLICIT FORWARDING

If the source host has adopted the new internet tables, it can tell
whether the destination host has a compatible mail acceptance
protocol. Incompatibility is explicitly resolved by selection of an
intermediate forwarder.

If, however, the source host is still using pure NCP tables, it will
not be able to tell that a particular destination host is only
TCP-capable. To provide service for this case, it is proposed to
expand the conventional NCP host table to include internet host
names, but to map them into the addresses of implicit mail forwarders
(i.e. Aliases).

Since we are postulating a case in which the NCP host has made no
change (except for extending the host table). we also assume that the
source host cannot send the "user@host" information via FTP to the
intermediate forwarder.

This leaves the intermediate forwarder with the problem of figuring
out where to forward a message identified by "user" only. In this
case, we postulate that internet TCP-only mailboxes are registered at
implicit forwarders so that incoming mail from conventional NCP
sources can be forwarded successfully to the destination.

In the reverse direction, the source can use explicit forwarding
because it is assumed that all TCP hosts use the new internet tables.

The use of registered names in the implicit forwarder raises two
problems:

    1. How can we deal with ambiguous mailbox names? (e.g. USERX@BBN
        and USERX@ISI look the same if only the string "USERX" is
        presented to the intermediate forwarder)

    2. How can we collect, update and distribute changes to the
        registries at implicit forwarders?

In the first case, we propose to duck the problem by insisting on

unambiguous mailbox names everywhere. This may force some internet
mail users to change their mailbox names, but we believe this will be
rare.

The second problem can be solved by collecting information on a
regular basis from all network mail users and cataloging this data in
a database which can be accessed automatically (e.g. by mailer
programs).

One possible mechanism is to make the data available through an
internet mailbox name server analogous to the internet host name
server [6]. This data might be collectible as a natural part of the
TIP LOGIN database which is under development to permit expanded
access to the ARPANET TIPs by legitimate ARPANET users.

In any case, internet mail users need supply their mailbox
information to a single collection site which would disseminate it to
all implicit forwarders on ARPANET. Note that such forwarders are
only needed on ARPANET since all other systems are starting with the
TCP-base. It is the internet mailbox users who must register,
however, since they are the ones who cannot otherwise be reached via
NCP.

FORWARDER CHARACTERISTICS

By their definition, NCP/TCP forwarders must be both NCP and TCP
capable. Consequently, all NCP/TCP forwarders must be ARPANET hosts.

Implicit forwarders must accept conventional NCP/FTP mail [11] and be
equipped with tables of valid internet user mailbox names which can
be associated with the proper destination host. To allow implicit
forwarders to also accept ordinary mail for users with mailboxes on
the implicit forwarder, the forwarder should check first whether
incoming mail is for a local user.

Explicit mail forwarders must be able to accept both conventional
NCP-FTP mail commands (for local user mail) and both NCP-based and
TCP-based mail server commands (whose arguments include the full
destination mailbox strings "user@host").

To prevent potentially anomalous behavior, the NCP-based and
TCP-based mail servers will offer service on socket/port 57 (71
octal). To summarize the communication patterns:

   (a) TCP sends/receives mail via well known port 57.

        (b) implicit forwarder receives conventional NCP/FTP mail on
             well-known socket 3, and sends TCP mail to port 57.

        c)   explicit forwarder receives NCP mail on well-known socket 57,
             but sends NCP mail via NCP/FTP on socket 3. TCP mail is
             sent/received via port 57.

USER HOST CHARACTERISTICS

   NCP hosts must at minimum, update host name tables to include aliases
   for internet hosts (i.e. map to NCP implicit forwarder host
   addresses).

   The next most useful step is to update NCP hosts to include internet
   address tables and NCP/TCP capability bits so as to make use of
   explicit forwarders. This requires implementation of the mail server
   and modification of the mailer programs for sending mail to explicit
   forwarders. This also requires addition of explicit forwarder
   address tables.

   Finally, a host can implement full TCP mail services, incorporating
   internet name tables and explicit forwarder address tables as well.

DANGLING PARTICIPLES

   1. Error message handling needs to be worked out in detail to assure
       reasonable reporting of problems with the use of forwarders.

   2. Designation of forwarding hosts.

   3. Collection of internet mailbox names for implicit forwarders.

   4. Format and distribution of internet name table and NCP/TCP
       capability information.

   5. Dealing with mail systems not compatible with NCP, TCP or RFC733.
       (e.g. Telemail, On-Tyme, Phonenet, TWX, TELEX,...)

PLANS

    To encourage this transition, the following schedule is proposed:

        1. January 1, l981 - implicit and explicit NCP/TCP forwarders
            made available on various service hosts (e.g. TOPS-20).

        2. January 1, l982 - implicit NCP/TCP forwarder service removed;
            explicit forwarding service continues.

        3. January 1, l983 - explicit NCP/TCP forwarding service
            terminated, transition to TCP complete.

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