              Network Subsystem for Time Sharing Hosts

Introduction

    A set of network primitives has been defined (Network Working Group
    Note 11) for inclusion in the monitor systems of the respective
    HOSTS. These primitives are at the level of system calls: SPOP's or
    BRS's on the 940; UUO's on the PDP-10. Presumably these UUO's are
    accessible to all user programs when executing for users whose status
    bits allow network access.

    In addition to user program access, a convenient means for direct
    network access from the terminal is desirable. A sub-system called
    "Telnet" is proposed which is a shell program around the network
    system primitives, allowing a teletype or similar terminal at a
    remote host to function as a teletype at the serving host.

System Primitives

    G. Deloche of U.C.L.A. has documented a proposed set of basic network
    primitives for inclusion in the operating systems of the respective
    HOSTs (NWG Note: 11). The primitives are:

        Open primary connection

        Open auxiliary connection

        Transmit over connection

        Close connection.

    The details and terminology are defined by Deloche and others in
    previous memos. The primitives are system calls, available to
    programmers, and are most likely a part of the resident monitor,
    rather than the swappable executive.

Basic Terminal Access

    In addition to user programming access, it is desirable to have a
    subsystem program at each HOST which makes the network immediately
    accessible from the teletype without special programming. Subsystems
    are commonly used system components such as text editors, compilers
    and interpreters. The first network-related subsystem should allow

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users at HOST A to connect to HOST B and appear as a regular terminal
user to HOST B. It is expected that more sophisticated subsystems
will be developed in time, but this basic one will render the early
net immediately useful.

```
   Teletype
   Terminal            _____                          _____
  _____         |      |      _____      _____ |      |
 |          |        | USER |     |      |     |      || SERVING |
 |          |-----|  HOST |----|      |---//---|      |---  HOST |
 |          |        |  A   |     |      |     |      ||   B   |
 |_____|        |_____|     |_____|     |_____||_____|
                  University                         Stanford
                   of Utah                           Research
                                                     Institute
```
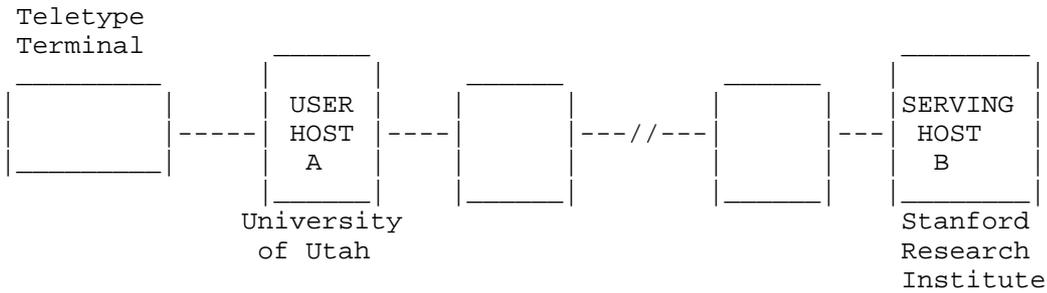
   Figure 1: User accesses distant serving HOST via shunt
              subsystem in his own Host computer.

Simple Dialogue -- PDP-10 to 940

   A user at Utah is sitting at a teletype dialed into the University's
   dual PDP-10's. He wishes to operate the CAL sub-system on the 940 at
   SRI in Menlo Park, California.

      ------------   is issued to call and start
                                        the TELNET subsystem.
   *ESCAPE CHARACTER IS #<CR>   The user indicates an escape
    ------------------------   character which TELNET
                                        will watch for in subsequent
                                        input from the user.

   *CONNECT TO SRI<CR>   The TELNET subsystem will make
    ------------------   the appropriate system call
                                        (UUO) to establish a primary
                                        connection. The connection
                                        will be established, provided:
                                        1. SRI is willing to accept
                                        another foreign user;
                                        2. The UTAH user is cleared
                                        for network access at UTAH.
                                        This is determined by a
                                        status word kept in the PDP-10
                                        monitor for each user.

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```
    @LOGIN CARR.                        The user logs in SRI.
     --     -----
```

Characters typed on the user's teletype are transmitted unaltered
through the PDP-10 (user Host) and on to the 940 (serving HOST.)
(The exception to this is a possible one-for-one code conversion
required between the UCLA Sigma 7 and the PDP-10, for example).

```
    @CAL.                               The PDP-10 TELNET subsystem
     -  -                               switches to full duplex,
                                        character-by-character
                                        transmission, since this is
                                        required by 940's.  Characters
                                        typed by the user are
                                        underlined. Full duplex
                                        operation is allowed for by
                                        the PDP-10, though not used
                                        by most DEC subsystems.
```

The user wishes to load a CAL file into 940 CAL from the file system
on his local PDP-10.

```
    CAL AT YOUR SERVICE
    >READ FILE FROM NETWRK.             'NETWRK' is a predefined
     ---------------------              940 name similar to PAPER
                                        TAPE OR TELETYPE.  The 940
                                        file opening BRS is set to
                                        expect an auxiliary connection
                                        and the file from UTAH.

    #NETWRK: <- DSK:MYFILE.CAL<CR>      The user types the prescribed
     ----------------------------       escape character, followed by
                                        the TELNET command, to send
                                        the desired file to SRI on an
                                        auxiliary connection.  The
                                        user's next statement is in
                                        CAL again.
```

The Telnet Subsystem

The Telnet subsystem coding should fit easily into one core page, for
it does very little. It effectively establishes a shunt in the user
HOST between the remote user and the serving HOST. Telnet commands
are:

```
ESCAPE CHAR IS _____<CR>        Declares a character which
                                        Telnet will watch for.
                                        Subsequent strings typed
                                        between this character and
                                        a carriage return are not
                                        shunted through to the serving
                                        host, but sent instead to the
                                        Telnet program in the user's
                                        local HOST.
```

This escape character is not the same as the user's host
rubout character.

```
CONNECT TO _____<CR>      The official site name of the
                                        desired serving HOST is typed
                                        (i.e.: SRI, UTAH, UCLA, UCSB).
                                        Telnet attempts to establish a
                                        connection.  If the attempt is
                                        successful, the following
                                        characters are shunted through
                                        the user's local machine.  The
                                        connection places the user in
                                        the pre-logged in state at
                                        the serving HOST.
```

```
LOGOUT<CR>                              Telnet issues the logout command
                                        sequence to the serving HOST.
                                        If the user simply rubs out and
                                        kills his PDP-10 job, the
                                        PDP-10 will indicate to the 940
                                        that the connection is closed.
                                        The 940 system primitives do
                                        whatever they do when a normal
                                        dataphone connection is
                                        suddenly broken.
```

```
COPY FILE                               A file copying command is
                                        available in TELNET to
                                        move data along on auxiliary
                                        connections from the
                                        user's HOST file system
                                        to the serving HOST.
```

     On the 940 this is:

COPY <file name> TO NETWRK.
-                       -   -

       On the PDP-10:

   NETWRK <- DSK: <file name>

   These TELNET commands are accepted when the TELNET subsystem is first
   entered or following the declared escape character.

CONCLUSION

   Given the basic system primitives, the TELNET subsystem at the user
   host and a manual for the serving host, the network can be
   profitably employed by a remote user. TELNET subsystem constitutes a
   "level 0" network program which will quickly be surpassed. It is,
   however, simple enough to be working fairly soon.

   [Editor's note: <CR> has been used in this document to indicate end-
   of-line, in place of the original handwritten arrows.]

         [This RFC was put into machine readable form for entry]
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