To: Operations

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Subject: Operating Instructions for the Network Daemon

Introduction

The ARPA Network connects about fifty computer systems (known as
"hosts") for the purposes of resource sharing and facilitating
very remote terminal access to time-sharing systems.   The
geographic range of this network currently extends from Hawaii to
Western Europe.   Multics uses a software subsystem called the
Network Control Program (NCP) to connect it to the ARPA Network,
via an interface to the Multics IOM called an Asynchronous Bit
Serial Interface (ABSI), and a special computer called the
Interface Message Processor (IMP). Broadly speaking, the Network
software allows Multics processes to initiate contact with other
hosts on the network, and it allows other hosts' processes to
communicate with Multics. In particular, it allows other hosts'
users to log in to Multics as interactive users through an ARPA
Network connection rather than a direct-dialed telephone
connection.

The Multics NCP requires a system daemon process to manage
traffic between Multics and the network. The "Network Daemon" is
automatically logged in whenever Multics is started, as the user
"Network_Daemon.SysDaemon", with the source identifier "nw".

Users logged in to Multics from the ARPA Network are just like
users logged in over telephone connections, as far as the
operator is concerned. Their channel identifiers have the form
"net001" and so forth. The terminal ID code listed by "who" for
a network user will be the four-character site mnemonic listed in
appendix A, or the string "NET" if the user's site cannot be
determined.   The "bump" and "warn" commands which are used for
regular users will work for network users too.

Each network site has an IMP, which is a small computer,
controlled by the Network Control Center at Bolt, Beranek, and
Newman in Cambridge, connected to the host computer by cable.
The IMPs are inter-connected by special high-speed telephone
lines, which they use to pass messages from IMP to IMP; since
each IMP is connected to only a few other IMPs, a message from
one host computer to another may be passed through many IMPs. If
the Multics IMP goes down, or is taken down by remote control by
the Network Control Center, not only will all users logged in via
the network be logged out and all network communication links

with Multics be broken, but other IMPs will have to re-route
their messages around the Multics IMP.

When the network begins operating, it must first initialize the
NCP. Then it enters its normal operating mode in which it
provides service necessary to maintain traffic between Multics
and the network. The daemon must be in continuous operation
whenever network users are to be served; if the daemon process
is destroyed or the NCP is turned off, all existing network
communication links will be destroyed, and all users logged in
via the network will be automatically logged out.

In addition to the normal operating mode, there exists a network
exec mode, in which operator commands are accepted. When the
network daemon is in network exec mode, it cannot perform normal
network service and important functions will be delayed until it
returns to normal operating mode. Therefore, while the NCP is in
operation, the Network Daemon should not be put into network exec
mode except at the request of responsible members of the system
programming staff, and the Network Daemon should be returned to
operating mode as soon as possible.

Operator Intervention

The network daemon is intended to run completely without
intervention from the operator, both under normal operation and
in the event of most network failures.

There is one type of network failure which is very common, and
for which the network daemon has a limited capability for
automatic recovery. If the IMP fails (as it does with some
regularity), or if the cable connection to the IMP encounters
some error, network communications become disrupted and users
logged in via the network are logged out. A message of the
following form appears in the network daemon's output:

        1234 nw network_exec_: IMP state has changed to XXX:

If XXX is "down", the IMP itself has failed. The Network Daemon
will wait until the IMP state changes to "up", and then reset the
NCP so that network processing can resume.

If XXX is "absent", the Multics system has not been configured
properly. The operator should check to make sure that the ABSI
on the service IOM is connected to the IMP cables. (If the ABSI
is connected to the IOM through a peripheral switch, the operator
should check the peripheral switch settings.) When the
configuration error has been fixed, the IMP state changes
automatically to "up", and no further operator action is needed.

An IMP state change message of any other type indicates that some

error which is fatal to the Multics network subsystem has
occurred in communicating with the IMP. All network
communications are disrupted and network users are logged out.
When an error of this sort occurs, the network daemon attempts to
automatically reinitialize the NCP. Operator intervention is not
required.

If a fatal internal error occurs, or if an excessive number of
automatic reinitializations have occurred, the message

        NETWORK CONTROL PROGRAM HAS GONE DOWN

is printed on the BOS console, with an audible alarm. The
Network Daemon prints a similar message, and automatically enters
network exec mode. This always requires operator intervention.
The operator should issue the command "re_init". If the NCP will
not stay up after several attempts, contact the programming
staff.

Network Exec Mode

To enter network exec mode, send a quit to the Network Daemon.
It will type

        1234 nw   NETWORK PROCESSING SUSPENDED
        1234 nw   Enter Request:
        --> nw

Reply to the network command using the system control "reply"
command, for example:

        r nw re_init

The Network Daemon will process the request and, except for
requests which remove the Network Daemon from network exec mode,
will then wait for another request. If the NCP is operating, do
not remain in network exec mode any longer than necessary.

There is a safety timer which will automatically cause the
Network Daemon to return from network exec mode to operating mode
30 seconds following the last request if the NCP is running.

Network Control Center

In certain circumstances, it may be necessary for the operator to
contact the Network Control Center directly. Local site
procedures will specify when this procedure should be followed.

The telephone number for the Network Control Center at Bolt,
Beranek, and Newman in Cambridge, Mass. is (617)-661-0100.

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 admln

Command: admln

Effect: Enter "admln" mode

Usage: Admln mode allows the operator to use the Network
Daemon process to execute normal Multics commands.   Type

     r nw admln

to enter admln mode. No password Is required.   To return to
network exec mode, type

     r nw ame (or "admln_mode_exlt")

Errors: none

                                                    _____

                                                          comment

                                                    _____

Command: comment

Effect: Add a comment line to the network log

Usage: This command places the remainder of the command   line
into the   network   log   as a comment for the system programmers.
For example, the operator may type

        r nw comment COMMENT TO GO INTO THE LOG

The comment may include spaces.

Errors: none

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  down

Command: down

Effect: Turn off the network subsystem

Usage: This command allows the operator to turn off the NCP;
that is, to disable all communications between Multics and the
network and to bump all users logged in from the network.

Errors: none

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                                                                 dump

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Command: dump

Effect: Create a network dump

Usage: This command creates a network dump segment recording
the current state of the network subsystem data bases. To record
an abnormal network situaition for later inspection by system
programmers, type

     r nw dump

The dump command will print a dump ID which identifies this
particular dump. It should be reported to the system programmers
who are to examine the dump.

Errors: none

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 hold

Command: hold

Effect: disable the automatic return from network exec

Usage: Except when the NCP is not operating, the network
daemon automatically reverts to normal operation from network
exec mode 30 seconds following the latest command. To disable
this feature, type

     r nw hold

This hold has effect only during the current invocation of
network exec mode.

Because the automatic return from network exec is an important
safety feature, the hold command should not be used except in
extraordinary situations.

Errors: none

                                                    _____

                                                    host_list

                                                    _____

Command: host_list

Effect: Process "host_activation_list"

Usage: The NCP requires that each host on the network with
which it is to communicate be specified to it prior to any user
communications   involving   that   host.   These   hosts   are
administratively   specified   in   a   segment   named
"host_activation_list" which is automatically processed when the
NCP is started. This command processes the list manually.

Except for the "up" command, all ways of starting the NCP
automatically process the "host_activation_list".

Errors:

network_exec_: entry not found. host_activation_list
also see errors for host_up

_____

 host_off
_____

Command: host_off

Effect: Turn off a network host

Usage: This   command   permits   the   operator   to   disable
communications with a previously enabled foreign host.   Type

     r nw host_off HOST1 HOST2 ...

to turn off HOST1, HOST2, and so on. A host is specified by its
network address (in octal) or by its four-letter mnemonic name.
(See Appendix A.)

Errors:

network_exec_: Entry not found. HOST1

network_exec_: Communications with this foreign host not enabled.
HOST1

                                            _____

                                            host_on

                                            _____

Command: host_on

Effect: Turn on a specified network host

Usage: This command   permits   the   operator   to   enable
communications with a currently un-enabled foreign host.   Type

      r nw host_on HOST1 HOST2 ...

A host is specified by its network address (in octal) or by its
four-letter mnemonic. (See Appendix A.)

Errors:

network_exec_: request is inconsistent with state of socket.
HOST1

_____

   logout

_____

Command: logout

Effect: Turn off the NCP and log out the network daemon

Usage: Sometimes   the   network   hardware   or   software   is
hopelessly damaged, so that attempting to use it may cause
Multics to crash. If such a situation arises, the operator may
wish to completely shut off the network.   The logout command
turns off the NCP, so that network communications are disabled
and all users logged in via the network are bumped; it then logs
out the Network Daemon.

Use the "logout" command to the Network Daemon rather than the
system_control logout command, or the NCP will keep fussing that
the Network Daemon must be restarted.

Errors: none

                                                    _____

                                                    new_proc
                                                    _____

Command: new_proc

Effect: Cause the network daemon to switch to a new process

Usage: The new_proc command causes the Network Daemon to
request a new process from the answering service. When the new
process is created, the Network Daemon will automatically start
the NCP and begin normal operation.

Because this command disrupts any current network communications
and bumps users logged in from the network, its use should be
limited to situations in which the NCP is not operating or is
malfunctioning.

Errors: see Errors during Initialization

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  re_init

Command: re_init

Effect: Reinitialize the NCP

Usage: The re_init command causes the NCP to be reset and
started again.   All users currently logged in via the network
will be logged out. The Network Daemon will reinitialize the NCP
and return from network exec mode to normal operation.

Because this command disrupts any current network communications
and bumps users logged in from the network, its use should be
limited to situations in which the NCP is not operating or is
malfunctioning.

Errors: see Errors during Initialization

                                                    _____

                                                         start

                                                    _____

Command: start

Effect: Return from network exec mode

Usage: The   start command causes the Network Daemon to return
from network exec mode to normal operating mode.

Errors: none

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 survey

Command: survey

Effect: Print a survey of network activity

Usage: The survey command prints a brief on-line survey of
network activity.

Errors: none

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                                   _____

                                              up
                                   _____
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Command: up

Effect: Turn on the NCP.

Usage: This command turns on the NCP without processing
"host_activation_list".

The Network Daemon remains in network exec mode.

Errors: see Errors during Initialization

network_exec_: MESSAGE.   Fatal   error   quit   during   process
                    initialization.

        Source: nw (user_output)

        Time: Network Daemon startup.

        Meaning: This message indicates an error initializing
                   the Network Daemon. An error was returned by
                   the I/O system when attempting to enable quit
                   signals for the Network Daemon. The Network
                   Daemon will not come up.

        Action: If the network daemon does not log out, log
                   it out and back in again, and start the
                   initialization   over.   If   the
                   re-initialization   fails,   contact   system
                   programmers.

network_exec_: MESSAGE.   Fatal   error   swdr   during   process
                    initialization.

        Source: nw (user_output)

        Time: Network Daemon startup.

        Meaning: This message indicates an error initializing
                   the Network Daemon. The network daemon was
                   unable to set its working directory   to
                   >udd>SysDaemon>Network_Daemon.   This   may
                   occur because the directory has been lost in
                   a crash. The Network Daemon will not come up
                   until this situation is repaired.

                    Network Daemon Error Messages

        Action: If the directory has been lost, attempt to
                   retrieve the directory and then log in the
                   daemon. Contact system programmers.

network_exec_: MESSAGE. Error assc bringing up the NCP.

        Source: nw (user_outout)

        Time: NCP Initialization.

        Meaning: This message indicates an error initializing
                  the   Network Daemon.   An error has been
                  returned   by   hcs_$assign_channel   when
                  attempting to create an event channel for use
                  by the daemon. The NCP cannot be brought up.

        Action: Contact system programmers.

network_exec_: MESSAGE. Error crec bringing up the NCP.

        Source: nw (user_outout)

        Time: NCP Initialization.

        Meaning: This message indicates an error initializing
                  the   Network Daemon. An error code has been
                  returned by ipc_$create_ev_chn when creating
                  an event channel for use by the daemon. The
                  NCP cannot be brought up.

        Action: Contact system programmers.

Network Daemon Error Messages

network_exec_: MESSAGE. Error ncps bringing up the NCP.

       Source: nw (user_output)

       Time: NCP Initialization.

       Meaning: This message indicates an error initializing
                the Network Daemon. An error code has been
                returned by netp_$set_global_evchn when
                attempting to set the event channel used to
                report IMP state changes. The NCP cannot be
                brought up.

       Action: Contact system programmers.

network_exec_: MESSAGE. Error ncoi bringing up the NCP.

       Source: nw (user_output)

       Time: NCP Initialization.

       Meaning: This message indicates an error initializing
                the Network Daemon. An error code has been
                returned by netp_$ncp_init when attempting to
                initialize the NCP. The NCP cannot be
                brought up.

       Action: Contact system programmers.

                    Network Daemon Error Messages

network_exec_: Request is inconsistent with state of socket. HHH

         Source: nw (user_output)

         Time: NCP Initialization.

         Meaning: This message indicates an error initializing
                   the Network Daemon. The host HHH cannot be
                   enabled for communication.

         Action: Note for system programmers.

network_exec_: Bad queue   entry   TYPE   returned   by
                   ncp_daemon_wakeup.

         Source: nw (user_output)

         Time: While system is running.

         Meaning: This message indicates an IMP error or a bug
                   in   the   network   software.   The program
                   neto_$ncp_daemon_wakeup has returned a type
                   other than 3. The NCP will be shut down.

         Action: Take a network dump. Then contact system
                   programmers.

network_exec_: Bad wakeup occurred on Index II.

        Source: nw (user_output)

        Time: While system is running.

        Meaning: This message indicates an IMP error or a   bug
                  in the network software.

        Action: Take a   network   dump.   Then   contact   system
                  programmers.

network_exec_: IMP going down in HOW_SOON   for   REASON.   Expected
               down time is HOW_LONG.

        Source: nw (user_output)

        Time: While system is running.

        Meaning: This   message   is   typed   when   the   Network
                  Control Center needs to shut down the Multics
                  IMP   for   testing   or   to   reload   the   IMP
                  software.   This is a warning message only.

        Action: Note in shift log, so that if users   complain
                  that   they cannot log in via the network, you
                  can explain that the IMP has been shut down.

network_exec_: IMP going down MESSAGE.

            Source: nw (user_output)

            Time: While system is running.

            Meaning: This message is typed when the Network
                       Control Center needs to shut down the Multics
                       IMP   for   testing or to reload the IMP
                       software.

            Action: Ignore

network_exec_: Unexpected special IMP message of type   TYPE
                    received.

            Source: nw (user_output)

            Time: While system is running.

            Meaning: This   message   indicates   that   an
                       incomprehensible message has been received
                       from the IMP, which appears to be a "special
                       message." The message will be ignored.

            Action: Ignore, unless it happens repeatedly. Then
                       contact system programmers.

network_exec_: IMP state has changed to STATE.

        Source: nw (user_output)

        Time: While system is running.

        Meaning: This message is typed whenever the status of
                   the IMP changes.   STATE may be "up" -- in
                   which case the NCP will reset itself; "down"
                   -- in which case the Network Daemon will
                   clean up and sleep waiting for the IMP to
                   come up; or some other value, in which case
                   the daemon will attempt to re-initialize the
                   NCP.

        Action: If STATE is "up", ignore. Otherwise, wait a
                   few minutes to see if the software recovers.
                   If it does not, contact the Network Control
                   Center to see if the IMP is down, or contact
                   system programmers.

network_exec_: Error while resetting NCP.

        Source: nw (user_output)

        Time: While system is running.

        Meaning: This message indicates an IMP error or a bug
                   in the network software. The IMP state has
                   just changed to "up", but the NCP cannot be
                   reset. The NCP will be brought down.

        Action: Take a network dump. Then contact system
                   programmers.

network_exec_: Too many auto reinitializations.

        Source: nw (user_output)

        Time: While system is running.

        Meaning: This message indicates an IMP error or a bug
                   in the network software. The Network Daemon
                   will not try forever to restart the network
                   software.   This message is typed when it
                   gives up. The NCP will be brought down, and
                   network exec mode will be entered.

        Action: Contact system programmers.

network_exec_: Too many IMP state changes.

        Source: nw (user_output)

        Time: While system is running.

        Meaning: This message indicates an IMP error or a bug
                   in the network software. The Network Daemon
                   will not try forever to restart the network
                   software, if errors persist. This message is
                   typed when it gives up.   The NCP will be
                   brought down, and network exec mode will be
                   entered.

        Action: Contact system programmers.

Network Daemon Error Messages

network_exec_: Reinitializing the NCP.

       Source: nw (user_output)

       Time: While system is running.

       Meaning: This message indicates that the Network
                 Daemon is attempting to re-initialize the
                 NCP, probably because the IMP state has just
                 changed.

       Action: Ignore

network_exec_: Sending the NCP down.

       Source: nw (user_output)

       Time: While system is running.

       Meaning: This message indicates an IMP error or a bug
                 in the network software. The Network Daemon
                 has decided that the NCP or the IMP is beyond
                 recovery, and is shutting off the network.

       Action: Contact system programmers.

                    Network Daemon Error Messages

network_exec_: Network control program not in operation.

          Source: nw (user_output)

          Time: While system is running.

          Meaning: This message is typed when the   NCP   is   shut
                    off.

          Action: If the network does   not   recover   in   a   few
                    minutes, contact system programmers.

network_exec_: 100 network wakeups, cpusec = XXX, pages = YY+ZZ.

          Source: nw (user_output)

          Time: While system is running.

          Meaning: This message is metering   output.   It   shows
                    the   system   resource   usage   of   the network
                    daemon.

          Action: Ignore

                    Network Daemon Error Messages

CAN'T INITIALIZE THE NETWORK DAEMON PROCESS.

        Source: BOS console

        Time: Network Daemon startup.

        Meaning: This message indicates an IMP error or a bug
                   in the network software.

        Action: Contact system programmers.

CAN'T INITIALIZE NETWORK CONTROL PROGRAM.

        Source: BOS console

        Time: Network startup.

        Meaning: This message indicates an IMP error or a bug
                   in the network software.

        Action: Contact system programmers.

                 Network Daemon Error Messages

IMP IS ABSENT. PLEASE CHECK CONFIGURATION.

        Source: BOS console

        Time: Network startup.

        Meaning: This message is printed on the BOS console
                   when the IMP cannot be contacted.

        Action: Check the configuration deck, the ABSI
                   switches, the peripheral switch, and the IMP
                   and its cables to determine if there is a
                   configuration error. If an error is found,
                   correct the error and re-initialize the
                   Network Daemon. Otherwise, contact system
                   programmers.

NETWORK HOST LIST NOT FOUND.

        Source: BOS console

        Time: Network startup.

        Meaning: This message is printed when the network is
                   starting up, if the host_activation_list
                   cannot be found in
                   >udd>SysDaemon>Network_Daemon. It may have
                   been lost due to a crash.

        Action: If the file cannot be retrieved, contact
                   system programmers.

NETWORK CONTROL PROGRAM HAS GONE DOWN.

        Source: BOS console

        Time: While system is running.

        Meaning: This message indicates an IMP error or a bug
                   in the network software.

        Action: Attempt a "re_init" command.   If this does
                   not work, contact system programmers.

APPENDIX A - Host Table

Octal	Decimal	Abbrev	Full Name
1	1	sex	ucla-nmc
101	65	ccn	ucla-ccn
201	129	ucsd	ucsd-cc
2	2	nlc	sri-arc
102	66	sral	sri-al
3	3	ucsb	ucsb-mod75
4	4	utah	utah-10
5	5	ncc	bbn-ncc
105	69	bbna	bbn-tenexa
205	133	bbnb	bbn-tenexb
305	197	bbn1	bbn-1d
6	6	mult	mit-multics
106	70	dmcg	mit-dmcg
206	134	mlta	mit-al
306	198	math	mit-ml
7	7	rand	rand-rcc
10	8	sdc	sdc-adept
11	9	harv	harv-10
111	73	har1	harv-1
211	137	ha11	harv-11
12	10	ll67	ll-67
112	74	tx2	ll-tx2
212	138	tsp	ll-tsp
13	11	sual	su-al
14	12	llla	lll-ants
15	13	case	case-10
16	14	cmu	cmu-cc
17	15	llac	lllac
117	79	ames	ames
20	16	am67	ames-67
220	144	amtp	ames-tip
21	17	mitr	mitre
221	145	mtrt	mitre-tip

APPENDIX A - Host Table

22	18	radm	radc-645
222	146	radt	radc-tlp
23	19	nbs	nbs-ccst
223	147	nbst	nbs-tlp
24	20	etac	etac
224	148	etat	etac-tlp
25	21	tlnk	tlnk-418
26	22	mccl	mccl-418
126	86	lsl	usc-lsl
27	23	usc4	usc-44
227	151	usct	usc-tlp
30	24	gwc	gwc
230	152	gwct	gwc-tlp
31	25	noaa	noaa
231	153	docb	docb
32	26	saac	saac
232	154	saat	saac-tlp
33	27	amec	amec
233	155	belv	belvoir
34	28	arpa	arpa
234	156	arpt	arpa-tlp
35	29	aber	aberdeen
36	30	bbnt	bbn-tlp
236	158	bbtt	bbn-testlp
37	31	cca	cca
237	159	ccat	cca-tlp
40	32	maxc	parc-maxc
140	96	vts	parc-vts
41	33	fnwc	fnwc
241	161	fnwt	fnwc-tlp
42	34	lbl	lbl
43	35	aloh	aloha
243	163	alot	aloha-tlp