To: Operations
From: T. H. Van Vleck, Edwin Meyer
Date: 11/07/73
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 loaded 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 "NFT" 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_1 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 ABSystem on the service IOM is connected to the IMP cables. (If the ABSystem 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.
admin

Command: admin

Effect: Enter "admin" mode

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

   r nw admin

   to enter admin mode. No password is required. To return to network exec mode, type

   r nw ame (or "admin_mode_exit")

Errors: none
Network Daemon Commands

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
**Network Daemon Commands**

---

**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
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 situation 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
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
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
Network Daemon Commands

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

    network 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

```
run 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
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
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
Network Daemon Commands

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
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
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 Daemon Error Messages

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 assoc bringing up the NCP.

Source: nw (user_output)

Time: NCP initialization.

Meaning: This message indicates an error initializing the Network Daemon. An error has been returned by hcsassoc_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 crac 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 loc_bcreate_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 ncp0 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_iset_global_event 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 ncp1 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_iset_nblock 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_ncpy_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 Daemon Error Messages

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 Daemon Error Messages

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 Daemon Error Messages

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 Daemon Error Messages

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 = YYY 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
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: ROS console

Time: Network startup.

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

Action: Check the configuration deck, the ARSI 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: ROS 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 Daemon Error Messages

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.
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# APPENDIX A - Host Table

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