

MCR10160

Preparations for Multics Networking Support

Revision 1.0

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1 Problem Description

In preparation for including the Multics Chaosnet networking and associated Multics Gateway Processor (MGP) software in the next release of Multics, various changes are required:

1. The directory `>system_library_network` (texttt>network, `>net`) must be created
2. The directory `>library_dir_dir>network` and its subdirectories must be created
3. The directory `>doc>network` must be created
4. The system default linker search paths must be updated to include `>system_library_network`
5. The system default translator search paths must be updated to include `>library_dir_dir>network>include`
6. The `multics_libraries_` library descriptor must be updated to know about `>system_library_network` and `>library_dir_dir>network`
7. The include segment `mlsys_mailer_data.incl.pl1` must be updated in a compatible manner to define a few more fields
8. The declaration of the network service list in `host_table_dcls.incl.pl1` must be removed
9. The include segment `network_service_list.incl.pl1` must be installed in the `>library_dir_dir>include` library
10. The source segment `mlsys_nit_interface.pl1` in `bound_mail_system_` must be updated to include `network_service_list.incl.pl1`
11. Some links must be added to the `>sss` library in order for the networking software and Multics network mail to work
12. The networking library directories must be populated with the appropriate Chaosnet software from MIT-MULTICS

As a brief introduction, the Chaosnet was a local area network using technology that was a forerunner of the Ethernet. This network was running at MIT, and at a few other locations and provided a local area campus network for various ITS, TOPS-20, Lisp Machine, and Multics systems. Multics was connected to the Chaosnet by the so-called Multics Gateway Process (MGP). This was a combination

of software running on Multics and on an attached PDP-11 computer. Multics connected to the PDP-11 via two IOM devices, MGPR (for reading) and MGPW (for writing).

Today, there exists a Global Chaosnet. See <https://www.chaosnet.net/> for details. There are approximately 68 hosts on this network, and they span many countries. There are Multics, TOPS-20, Lisp Machine, ITS, and Unix systems currently attached to the Chaosnet. With the addition of the Multics Chaosnet and MGP software, any user can set things up so their Multics system is on the Global Chaosnet. A separate document will describe how the Chaosnet and MGP work today on emulated Multics systems, and how to connect a Multics system to the Chaosnet. A prerequisite, of course, is the changes proposed in this document.

The proposed changes for MR12.9 involve taking the Chaosnet and MGP software from the MIT-MULTICS backup tapes and installing it in the new networking libraries. Because there is a lot of code, and because it all doesn't conform to the current Multics standards, this will be done without the normal auditing process. As a result, and in order to keep this network software separate, the software will not be installed in the standard system libraries (e.g. `>sss`, `>tools`, `>unb`), but rather in a library that used to exist back in the ARPANET days, `>system_library_network`, with sources, objects, and includes under `>library_dir_dir>network`. As changes are made to this software going forward, they will be audited, and if necessary, the code updated for current Multics standards.

However, some of the changes enumerated above are to standard system library programs and sources, and these will undergo the standard software auditing process.

2 Proposed Changes

2.1 Networking Libraries

The new library, `>system_library_network`, with its add_names `network` and `net` will be created, along with the libraries for sources, objects, and includes under `>library_dir_dir>network`. This changes will be done manually, and serve as the installation library for all the MIT-Multics Chaosnet software, as well as newly-written networking software. Eventually, the Internet (and possibly ARPANET) software will be installed in these libraries as well. The `>doc>network` directory will be created and populated with available info segments from the MIT-MULTICS Chaosnet and MGP distribution.

2.2 Linker Search Paths

So that users will be able to easily run networking programs, and so that the networking daemons will be able to locate their programs, the system linker search paths will be updated to include `>system_library_network`. This is done through an updated `active_hardcore_data.cds` source in the hardcore library. This is the only hardcore change required by the networking software.

To be fair, this change isn't strictly necessary. We could simply prepare a new search rules segment and have Initializer invoke the `set_system_search_rules` command upon system startup. However, since there are many Multics installations already in service, this would require manually editing `>sc1>system_start_up.ec` by each site, and not doing this might result in an unsatisfactory experience. Another approach would require all users to manually update their `start_up.ec` segments to include the new library, but this too, presents problems when users log in with the `-ns` control ar-

gument to the `login` command because they will not be able to access the network software without first updating their `linker` search paths.

Consequently, since there are other hardcore changes in MR12.9, it seems reasonable to just make this change so that all processes (excepting I/O daemons) will have access to the networking software automatically. (I/O daemons have their own linker search paths, and there is no reason to update these, as the I/O daemons don't use the networking software (at least presently).

The change is summarized by a `compare_ascii` comparison of the current and proposed `active_hardcore_data.cds` source:

```
cpa [lpn active_hardcore_data.cds] ==
```

```
A18      1) change(89-10-02, Farley), approve(89-10-19, MCR8144),
A19      audit(89-10-20, Parisek), install(89-10-30, MR12.3-1102):
Changed by B to:
B18      1) change(1989-10-02, Farley), approve(1989-10-19, MCR8144),
B19      audit(1989-10-20, Parisek), install(1989-10-30, MR12.3-1102):

Inserted in B:
B23      2) change(2026-03-23, Swenson), approve(2026-03-23, MCR10160):
B24      Updated to include >system_library_network in the linker search paths.
Preceding:
A23                                     END HISTORY COMMENTS */
```

```
A182      AHD.search_rule (8).name = ">system_library_auth_maint";
Changed by B to:
B184      AHD.search_rule (8).name = ">system_library_network";
B185      AHD.search_rule (9).name = ">system_library_auth_maint";
```

```
Inserted in B:
B194      AHD.search_rule (9).flag = "110"b;
Preceding:
A191      AHD.sr_tag (1).name = "default";
```

```
Comparison finished: 4 differences, 10 lines.
```

2.3 Translator Search Paths

So that networking programs can be compiled, the `translator` search paths will be updated to include the new include library `>library_dir_dir>network>include`. This is summarized in the `compare_ascii` comparison of the current and proposed `search_list_defaults_.cds`:

```
cpa [lpn search_list_defaults_.cds] ==
```

```
Inserted in B:
B27      4) change(2026-03-23, Swenson), approve(2026-03-23, MCR10160):
B28      Updatred to include >ldd>net>include translator search path.
```

Preceding:

A27

END HISTORY COMMENTS */

A133

3 paths

(4) like search_path,

Changed by B to:

B135

3 paths

(5) like search_path,

A290

lists.translator.paths (4).pathname = ">ldd>aml>include";

Changed by B to:

B292

lists.translator.paths (4).pathname = ">ldd>net>include";

B293

lists.translator.paths (5).type = ABSOLUTE_PATH;

B294

lists.translator.paths (5).pathname = ">ldd>aml>include";

Comparison finished: 3 differences, 8 lines.

2.4 Multics Libraries Descriptor

In order that the library maintenance commands can locate and manipulate the new networking libraries, the `multics_libraries_` library descriptor will be updated to include the new libraries. This change is summarized in the `compare_ascii` comparison of the current and proposed `multics_libraries_.ld`:

`cpa [lpn multics_libraries_.ld] ==`

A37

Changed by B to:

B37

5) change(2026-03-03,Swenson), approve(2026-03-03,MCR10160):

B38

Added definition of new `system_library_network` (network, net) library.

A81

library names: online_libraries.source supervisor_library.source

sss.include;

Changed by B to:

B82

library names: online_libraries.source supervisor_library.source

sss.include net.include;

Inserted in B:

B154

Root:

(network_library network net online_libraries online

on "").(source s "");

B155

path:

>ldd>network>source;

B156

search procedure:

multics_library_search_\${source_dirs};

B157

B158

Root:

(network_library network net online_libraries online

on "").(object o "");

B159

path:

>ldd>network>object;

B160

search procedure:

multics_library_search_\${object_dirs};

B161

B162

Root:

(network_library network net online_libraries online

```

        on "").(listings);
B163      path:                >ldd>network>listings;
B164      search procedure:    multics_library_search_$list_info_dirs;
B165
B166
B167      Root:                (network_library network net online_libraries online
on "").(execution x "");
B168      path:                >network;
B169      search procedure:    multics_library_search_$execution_dirs;
B170
B171      /* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* * * * * * */
B172      \014
Preceding:
A153      /* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* * * * * * */

Inserted in B:
B238      Root:                (network_library net
B239                                offline_libraries offline off
B240                                online_libraries online on ""          ).(include incl
        "");
B241      path:                >ldd>net>include;
B242      search procedure:    multics_library_search_$list_info_dirs;
B243
B244
Preceding:
A218      Root:                (standard_library std sss

Inserted in B:
B250                                network_library net
Preceding:
A223                                obsolete_library obsolete obs

Inserted in B:
B280      Root:                (network_library net
B281                                offline_libraries offline off
B282                                online_libraries online on "").(info "");
B283      path:                >doc>network;
B284      search procedure:    multics_library_search_$list_info_dirs;
B285
Preceding:
A252      Root:                (subsystem_library subsystem ss

Comparison finished: 6 differences, 38 lines.

```

2.5 Multics Mailer Changes

In order to allow the Multics mailer to support network mail delivery a few changes to the existing Multics code must be made.

First, the include segment `mlsys_mailer_data.incl.pl1` must be updated in a compatible manner to define a few more fields required by the network mailer. There is no need for a version number change, nor for any existing software to be recompiled, because these changes do not change the layout of the existing structure, and only define a couple additional bit fields in an aligned flags word. The changes are summarized by the `compare_ascii` comparison of the current `mlsys_mailer_data.incl.pl1` and the proposed version:

```
cpa [lpn mlsys_mailer_data.incl.pl1] ==
```

Inserted in B:

```
B3
B4      /****~ HISTORY COMMENTS:
B5      1) change(2026-03-04,Swenson), approve(2026-03-04,MCR10160):
B6      Updated to include returning and unspooling bits. No version number change
B7      since change is compatible.
B8                                          END HISTORY COMMENTS */
B9
```

Preceding:

```
A3      dcl MLSYS_MAILER_DATA_VERSION_1 char (8) aligned static options (constant) init
        ("mlsmdv_1");
```

Inserted in B:

```
B24      4 returning bit (1) unaligned,          /* now attempting to return
to sender */
B25      4 unspooling bit (1) unaligned,          /* now attempting to
deliver this message */
B26      4 mbz1 bit (28) unaligned,
Preceding:
A17      3 source varying char (256),            /* original source of mail
*/
```

Inserted in B:

```
B40      3 mbz2 bit(30) unaligned,
Preceding:
A30      2 original_recipient_index fixed bin,    /* index of unexpanded
recipient */
```

Comparison finished: 3 differences, 11 lines.

These fields allow networking support for "return to (network) sender" and for spooling network mail requests for later delivery. The `mbz1` field is added to make clear the remaining bits in the aligned flags word.

In addition, there is a concept developed for Multics networking called the "network service list". A placeholder definition of a data structure for this data exists in MR12.8, but this structure has

been enhanced for the networking software. In MR12.8, this structure is defined in the existing `host_table_dcls.incl.pl1`. But in the networking software this defined in a standalone include segment, `network_service_list.incl.pl1`.

The proposed changes include removing the dummy network service list structure definition in `host_table_dcls.incl.pl1` and installing the standalone include segment, `network_service_list.incl.pl1`. Here is the `compare_ascii` comparison of the existing `host_table_dcls.incl.pl1` and the proposed one:

```
cpa [lpn host_table_dcls.incl.pl1] ==

Inserted in B:
B3
B4      /****~ HISTORY COMMENTS:
B5          1) change(2026-03-23,Swenson), approve(2026-03-23,MCR10160):
B6          Removed definition of service_list, n_services, and service_list_ptr,
B7          since these are now in standalone network_service_list.incl.pl1.
B8                                  END HISTORY COMMENTS */
B9
Preceding:
A3      dcl host_table_mgr_$address entry (char (*) var, char (*) var) returns (char (40)
        var);

A33      dcl n_services fixed bin;
A34      dcl service_list_ptr ptr;
A35      dcl 1 service_list aligned based (service_list_ptr),
A36          2 version char (4),
A37          2 n_services fixed bin,
A38          2 service (n_services refer (service_list.n_services)),
A39          3 type char (8),
A40          3 module varying char (168),
A41          3 argument varying char (168);
A42
A43      /* End include file host_table_dcls.incl.pl1 */
Changed by B to:
B40      /* End include file host_table_dcls.incl.pl1 */

Comparison finished: 2 differences, 19 lines.
```

The new include segment `network_service_list.incl.pl1` will be installed in the `>library_dir_dir>include` library since the mail system will now be dependent on it. This include segment is shown below:

```
pr network_service_list.incl.pl1

        network_service_list.incl.pl1 03/23/26 1727.1 pdt Mon

/* START OF:      network_service_list.incl.pl1      * * * * *
* * * * * */
```

```

/****^ HISTORY COMMENTS:
1) change(2026-03-23,Swenson), approve(2026-03-23,MCR10160):
    Added from MIT-MULTICS networking software since this is required by the
    existing mail system.
                                END HISTORY COMMENTS */

/* format: style3,ifthenstmt,indcomtxt,indproc,idind30 */

declare  alloc_service_count      fixed bin (17),
         service_list_ptr        ptr;

declare  1 service_list          aligned based (service_list_ptr),
         2 version               char (8),
         2 count                 fixed bin (17),
         2 service               (alloc_service_count refer (service_list.count)),
         3 name                  char (32) varying,
         3 address_type          char (32) varying,
         3 module                char (168) varying,
         3 argument              char (168) varying;

declare  SERVICE_LIST_VERSION_1  char (8) aligned static options (constant) initial
         ("NSrvLst1");

/* END OF:      network_service_list.incl.pl1      * * * * *
   * * * * * */

```

The existing source segment `mlsys_nit_interface_.pl1` in `bound_mail_system_` must be updated to include the new `network_service_list.incl.pl1`. The comparison of existing and proposed versions is shown below:

```
cpa [lpn mlsys_nit_interface_.pl1] ==
```

```

A12      1) change(86-06-11,Mills), approve(86-06-11,MCR7419),
A13      audit(86-06-17,Margolin), install(86-06-30,MR12.0-1080):
Changed by B to:
B12      1) change(1986-06-11,Mills), approve(1986-06-11,MCR7419),
B13      audit(1986-06-17,Margolin), install(1986-06-30,MR12.0-1080):

A16      2) change(89-07-13,Lee), approve(89-08-01,MCR8125),
A17      audit(89-08-29,LZimmerman), install(89-10-02,MR12.3-1079):
Changed by B to:
B16      2) change(1989-07-13,Lee), approve(1989-08-01,MCR8125),
B17      audit(1989-08-29,LZimmerman), install(1989-10-02,MR12.3-1079):

```

Inserted in B:

```

B20      3) change(2026-03-23,Swenson), approve(2026-03-23,MCR10160):
B21      Updated to include network_service_list.incl.pl1 since the definition of

```

```

B22      the service_list structure has been removed from
B23      host_table_dcls.incl.pl1.
Preceding:
A20                                           END HISTORY COMMENTS */

```

```

Inserted in B:
B253     %include network_service_list;
Preceding:
A249
A250     end mlsys_nit_interface_;

```

Comparison finished: 4 differences, 13 lines.

2.6 Links in >sss

Finally, some links must be added to the >sss directory to allow the existing mail system to support network mail. These links are:

Source	Target
nit_	>net>nit_
mlsys_mailer_	>net>mlsys_mailer_
nit_data_	>site>net>data>nit_data_
host_table_mgr_	>net>host_table_mgr_

And in addition, a link is required in order for the `chaos_file`, or `cftp` file transfer program to locate its process overseer.

Source	Target
chfile_overseer_	>net>chfile_overseer_

2.7 Populate the Networking Libraries with MIT-MULTICS Chaosnet Software

The following will be installed in the >net library, along with their sources, objects, and required include segments.

bound_mgp_daemon_ The MGP Daemon software

bound_mgp_utils_ Chaos telnet, name, time, status commands, as well as list_mgp_connections

bound_net_commands_ Finger, qsend, whois, and supdup commands

bound_chaos_file_ The cftp client and server

mm_extract_sender_ A helper function used by the network mailer

smtplib_return_path_ A helper function used by the network mailer

mgp_user_ The user callable gate to the MGP inner ring software

mgp_priv_ A privileged gate to the MGP inner ring software

mgp_daemon_ A gate only the MGP daemons use to access MGP inner ring software

mgp_record_lock_ A utility function for MGP

mgp_debug_ Debugging entries for MGP

mgp_call A utility to make debugging calls to MGP

list_queued_mail A program to list queued network mail

bound_network_servers_ The finger and SMTP servers

bound_mmd_ Network mail support subroutines

bound_mlsys_mailer_ The network mailer

bound_mgp_server_ The finger, mail, smtp, and send servers

bound_host_table_ The host table support commands and subroutines

bound_mgp_servers_ The telnet, supdup, login, and time servers

3 Documentation

Where document existed on the installed software on MIT-MULTICS, that documentation, in the form of info segments will be installed in the >doc>network directory. Additional document will be added in the future.

4 Test

Extensive testing has already been done on the networking software and two Multics systems (GHM and GHM-TEST) are already on the Global Chaosnet. A third system will be up shortly, allowing some additional testing.

5 Version History

2026-03-23	1.0	Initial version of the MCR.
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