Adding Your Cray Research System to Your Network [11]

This section describes how to place your CRAY J90se system on an existing TCP/IP network. This section also includes a table that describes some of the most common TCP/IP configuration files.

After you have placed your CRAY J90se system on an existing TCP/IP network by using the information in this section, see the *UNICOS Networking Facilities Administrator's Guide*, Cray Research publication SG–2304, for additional networking configuration information; this publication also includes which menus to use for various networking tasks.

11.1 Related network information

The following publications contain additional information that will be of use to you:

- *UNICOS Configuration Administrator's Guide*, Cray Research publication SG–2303
- *UNICOS Networking Facilities Administrator's Guide*, Cray Research publication SG–2304
- *UNICOS Administrator Commands Reference Manual*, Cray Research publication SR–2022 (man pages):

`arp`(8)	`inetd`(8)	`rlogind`(8)
`atmarp`(8)	`initif`(8)	`route`(8)
`enstat`(8)	`mkbinhost`(8)	`rshd`(8)
`fingerd`(8)	`netstart`(8)	`sdaemon`(8)
`ftpd`(8)	`ntalkd`(8)	`tcpstart`(8)
`gated`(8)	`ping`(8)	`traceroute`(8)
`ifconfig`(8)	`rexecd`(8)	

- *UNICOS User Commands Reference Manual*, Cray Research publication SR–2011 (man pages):

`ftp`(1B)

`hostname`(1)

`netstat`(1B)

`telnet`(1B)

- *UNICOS File Formats and Special Files Reference Manual*, Cray Research publication SR–2014 (man pages):

  `gated-config`(5)

  `hosts`(5)

  `hosts.equiv`(5)

  `inetd.conf`(5)

  `lo`(4)

  `networks`(5)

  `protocols`(5)

  `rhosts`(5)

  `services`(5)

  `shells`(5)

- The following publications also are recommended, but Cray Research does not provide them:
  - *Internetworking with TCP/IP, Volume 1: Principles, Protocols, and Architecture*, Douglas Comer. Prentice Hall, 1991.
  - *UNIX Networking*, S. Kochan and P. Wood. Hayden Books, 1989.
  - *Introduction to the Internet Protocols*, Charles Hedrick, Rutgers University, 1987. Anonymous `ftp` from `cs.rutgers.edu`.
  - *Introduction to the Administration of an Internet-based Local Network*, Charles Hedrick, Rutgers University, 1988. Anonymous `ftp` from `cs.rutgers.edu`.

Procedure 31: Adding a CRAY J90se system to an existing TCP/IP network

To place a CRAY J90se system on an existing TCP/IP network, you should complete the following steps:

Note: To add your CRAY J90se system to an existing TCP/IP network, you must have several configuration files. The easiest way to create these files is to configure the CRAY J90se system to talk to another host on the network, copy the necessary files from that machine to your CRAY J90se system, and then change them. The first five steps of this procedure make the changes to allow you to talk to another host. You then copy files you need and change them for your CRAY J90se system. This procedure assumes you are either an administrator of your network or that you will have a network administrator as a resource when you add your CRAY J90se system to your existing TCP/IP network.

1. Verify that the network section of the `/opt/CYRIos/`*sn9xxx*`/param` file on the SWS contains the proper configuration for your system. If you are adding network interfaces, you must reboot the system.

2. Create a minimal `/etc/hosts` file. (Do not overwrite the existing `/etc/hosts` file.)

   The `/etc/hosts` file contains the database of all locally known hosts on the TCP/IP network. Create an `/etc/hosts` file that contains a local host entry, entries for the interfaces on the CRAY J90se system, and an entry for at least one other host on the same network as the CRAY J90se system. The entry format is as follows:

   IPaddress host_name annotations

   Example:

```
# cat /etc/hosts

127.0.0.1      localhost loghost
(local host)


456.789.16.8    cray cray-eth
(your CRAY J90se system)


456.789.16.125  cyclone cyclone-eth1
(other host)
```

3. Compile a binary hosts file.

Cray Research systems support a binary `/etc/hosts` file called `/etc/hosts.bin`. Create this file by using the `/etc/mkbinhost` command, as follows:

```
# /etc/mkbinhost
/etc/hosts.bin: 3 entries written
```

4. Update the `/etc/config/interfaces` file.

   The `/etc/config/interfaces` file defines all network interfaces on the Cray Research system. Change the host name for each interface on your system to match those you chose in step 2; for additional information, see the `initif`(8) man page and the *UNICOS Networking Facilities Administrator's Guide*, Cray Research publication SG–2304. The entry format is as follows:

   interface_name family address ifconfig parameters

   Example:

```
# cat /etc/config/interfaces

...some comment lines omitted...

lo0   -     inet   localhost    -
gether0   -     inet   cray-eth     - netmask 0xffffff00
gfddi0 -    inet    cray-fddi    - netmask 0xffffff00
gatm0  -    inet    cray-atm     - netmask 0xffffff00 iftype pvc
ghippi0   /etc/ghipp0.arp inet cray-hippi - netmask 0xffffff00 hwloop
```

5. Activate the changes by executing the following`/etc/initif` script. ATM and HIPPI require additional configuration files, so you may want to comment out the lines that pertain to those network interfaces until their configuration files are complete.

```
# /etc/initif
Configuring all network interfaces: lo0 gether0 gfddi0 gatm0 ghippi0
```

6. Create a default route.

This step creates a default route to let you communicate with hosts that are on different networks than the Cray Research system. To reach hosts that are not on the same FDDI or Ethernet network as the CRAY J90se system, you must have a default route. To create a route, execute the `/etc/route`(8) command, as shown in the following example:

```
# /etc/route add default otherhost
add net default: gateway otherhost
```

The *otherhost* is the IP address of a host that is on the same network as the CRAY J90se system and connects to one or more additional networks.

This command can be placed in the `/etc/tcpstart.mid` script so that it will be run automatically at system startup.

Alternatively, the default route can be included in the `/etc/gated.conf` file. For more information on the use of the `/etc/gated.conf` file, see the `gated-config`(5), `gated`(8), and `tcpstart`(8) man pages.

7. Test the network.

Test the network connections by using the `ping` command and view the configuration by using the `netstat` command. The `ping` command tests whether you can reach another host on the network. If `ping` succeeds, you can be confident that the hardware and routing works on all hosts and gateways between you and the system to which you are sending `ping`. The `netstat` command has many options. The `-i` option lets you view a table of cumulative statistics for transferred packets, errors, and collisions for each interface that was autoconfigured. The interfaces that are statically configured into a system but are not located at boot time are not shown; the `-r` option lets you view the routing table. The network address (currently Internet-specific) of the interface and the maximum transmission unit (mtu) in bytes also are displayed. You should become familiar with how these displays look on your system so that you will recognize changes and problems immediately.

Examples:

```
# /etc/ping otherhost
PING otherhost : 56 data bytes
64 bytes from 123.123.12.13: icmp_seq=0. time=10. ms
CONTROL-c
```

```
# netstat -i
Name     Mtu   Network           Address         Ipkts       Ierrs    Opkts     Oerrs
gether0*     1496  cray-net          cray            0           0        2         0
gfddi0    4352  crau-fddi-net     cray-fddi       249466      0        57636     0
gfddi1*   4352  none              none            0           0        0         0
lo0      65535 loopback          localhost       264         0        264       0
```

Note: An * in the Name column of the `netstat -i` command output indicates that the interface is not configured up, so your CRAY J90se system cannot access that network.

8. Transfer full configuration files from another system, as shown in the following example.

Save copies of your original files and add the new entries for the CRAY J90se system to the files you transfer (for example, use ftp to transfer the `/etc/hosts` file from another system on your network).

Example:

```
# cd /etc
# cp hosts hosts.sav
# ftp cyclone
Connected to cyclone.cray.com.
220 fred FTP server (Version 5.2 Fri Feb 18 14:09:58 CDT 1994) ready.
Remote system type is UNIX.
Using binary mode to transfer files.
Name (fred:root): sam
331 Password required for sam
Password:    <-----
```

Enter your password

```
230 User sam logged in.
ftp> get /etc/hosts hosts
200 PORT command successful.
150 Opening BINARY mode data connection for /etc/hosts (328758 bytes).
226 Transfer complete.
328758 bytes received in 0.6 seconds (5.3e+02 Kbyte/s)
ftp> quit
221 Goodbye.
# vi /etc/hosts  <-----
```

Enter your password

```
# /etc/mkbinhost
/etc/hosts.bin: 2675 entries written
```

Your CRAY J90se system should now be on the network. You may want to also transfer an `/etc/networks` file to your CRAY J90se system in the same manner.

11.2 TCP/IP path between J90se and SWS

A TCP/IP path between the CRAY J90se mainframe and the SWS is required for system software installs and upgrades. In addition, you may find it necessary to transfer certain files between the CRAY J90se mainframe and the SWS (for example, the `param` UNICOS configuration file).

This TCP/IP path should be configured as part of the system installation procedures. It can consist of a simple link between a J90se Ethernet interface

and an SWS quad-board plug. The path may also be more complex; this TCP/IP traffic could use a J90se FDDI interface and then be routed between the FDDI ring and a customer Ethernet, to which the SWS is connected.

To start TCP/IP from the CRAY J90se mainframe while still in single-user mode, use one of the following procedures. (This will allow files to be transferred between the CRAY J90se mainframe and the SWS.)

Procedure 32: Start TCP/IP from mainframe

- For direct Ethernet connection between the CRAY J90se mainframe and the SWS:

```
# /etc/ifconfig gether0 CRAY_ETHERNET_IP_addr netmask 0xffffff00
# /etc/inetd
```

- When packets are routed from CRAY J90se FDDI interface to SWS Ethernet interface:

```
# /etc/ifconfig gfddi0 CRAY_FDDI_IP_address netmask 0xffffff00
# /etc/inetd
# /etc/route add default fddi_router_IP_address
```

To verify that the TCP/IP has started correctly, run the `ping`(8) command from the SWS, as follows:

`sws$ /etc/ping sn9`*xxx*

11.3 Changing the SWS host name and IP address

Use the following procedure to change the SWS host name and IP address:

Note: No example prompts are shown in this subsection; all commands are executed on the SWS.

Procedure 33: Changing the SWS host name and IP address

1. Ensure you are logged in as the root user.
2. Change the SWS host name in the following files:

   `/etc/hostname.le0`

   `/etc/nodename`

3. Change the SWS host name and IP address in the following file (you must also change your mainframe IP address in this file):

   `/etc/hosts` (a tab should separate the name from the IP address)

4. Change the SWS host name and IP address in the `/etc/hosts` file on the CRAY J90se mainframe.

11.4 Changing the CRAY J90se host name and IP address

Section 11.3, page 276, described how to change the SWS host name and IP address.

Use the following procedure to change the CRAY J90se mainframe host name and IP address:

- On the UNICOS system, edit the `/etc/hosts` file to change the CRAY J90se IP address.
- On the SWS, edit the `/etc/hosts` file to change the CRAY J90se IP address.

11.5 Backing up all changes

Remember, back up any changes you have made to files on the SWS.

11.6 Verifying the UNICOS configuration file

The UNICOS configuration file controls kernel configuration parameters. Because the CRAY J90se system is preconfigured, you do not need to make any changes to the UNICOS configuration file in order to boot a usable system.

The default configuration file is `/opt/CYRIos/`*`sn9xxx`*`/param`.

Note: After your system is running, you may want to make configuration changes, such as adding a file system. For information on changing the configuration file, see *UNICOS Configuration Administrator's Guide*, Cray Research publication SG–2303.

11.7 Rebooting in multiuser mode

As a final step in initializing the UNICOS system, you must reboot your mainframe to have the changes made in the `param` configuration file take effect. Use the following procedure:

Procedure 34: Rebooting in multiuser mode

1. Ensure that the CRAY J90se mainframe is in single user mode; if it is not, execute the following commands from the console window:

   ```
   # cd /
   # /etc/shutdown
   # sync
   # sync
   # sync
   ```

2. To start the mainframe, execute the following command:

   ```
   sws$ bootsys -c
   ```

   When this command completes, you will see another system prompt.

3. By default, the CRAY J90se system is booted in single-user mode. Execute the following UNICOS `init`(8) command in the console window to go to multiuser mode:

   ```
   # /etc/init 2
   ```

   You will see the type of output that is normally displayed during system boot. When this command completes, you will see the following prompt:

   ```
   Console login:
   ```
   This means that the system has successfully booted in multiuser mode.

11.8 Domain name service (DNS)

If you want to use domain name service (DNS) to perform host name lookup, you should configure your CRAY J90se system as a caching-only server. This should be done for the following reasons:

- A caching-only server is more efficient than a remote server (resolver only) because it maintains a cache of data and, therefore, requires less frequent network access.

- A caching-only server does not have authority over a particular zone, therefore, it does not have to answer queries from other authoritative servers.
- A caching-only server does not have to load configuration files from disk like a primary master server or across the network like a secondary master server, which gives it a faster start-up time.

To configure your Cray Research system as a caching-only server, you may configure both resolver and the local name server. You can perform most of this configuration by using the UNICOS Installation / Configuration Menu System.

Procedure 35: Configuring a caching-only server by using the menu system

Note: If you have not completed the previous procedure, "Adding a CRAY J90se system to an existing TCP/IP network," you should complete steps 3, 4, and 5 of that procedure before configuring a caching-only server.

To configure your CRAY J90se system as a caching-only server by using the UNICOS Installation / Configuration Menu System, complete the following steps:

1. Select `YES` for the `"Use domain name service?"` entry in the UNICOS Installation / Configuration Menu System. The menu system creates the `/etc/hosts.usenamed` file. The existence of this file indicates that UNICOS will use DNS, rather than the `/etc/hosts` file to look up host names. A sample `TCP/IP Host/Address Lookup Configuration` menu screen follows:

```
Configure System
    ->Network Configuration
        ->TCP/IP Configuration
            ->TCP/IP Host/Address Lookup Configuration
                ->TCP/IP Local Domain Name Server Config
```

```
                TCP/IP Host/Address Lookup Configuration

    Use Domain Name (DN) service ?              YES
S-> DNS lookup (resolver) ==>
    Local DN server (named) ==>
```

2. Configure the resolver, which consists of creating the `/etc/resolv.conf` file, which is created if you place information in the `DNS lookup`

(resolver) menu. When you have a local name server (named process) running, you should have the local host address (127.0.0.1) as the first name server; otherwise your local named will be bypassed, resulting in decreased performance and increased network traffic.

The following is an example of the menu screen:

```
       TCP/IP Domain Name Service Lookup (resolver) Configuration
    Local domain name                          cray.com
    Address for Domain Name server #1:         127.0.0.1
S-> Address for Domain Name server #2:         128.162.19.7
    Address for Domain Name server #3:         128.162.19.13
    Address for Domain Name server #4:
    Address for Domain Name server #5:
    Address for Domain Name server #6:
    Address for Domain Name server #7:
    Address for Domain Name server #8:
    Address for Domain Name server #9:
```

3. Configuring a caching-only local name server consists of creating the named.boot, root.cache, and localhost.rev files. You can do this by using the Local DN server (named) menu. Perform the following steps to create these files:

   a. The named.boot file is read when named starts up. It tells the server what kind of server it is, over which zones it has authority, and where to get its initial data. The following is an example of the menu screens:

```
Configure System
    ->Network Configuration
        ->TCP/IP Configuration
            ->TCP/IP Host/Address Lookup Configuration
                ->TCP/IP Local Domain Name Server Config
```

```
                TCP/IP Host/Address Lookup Configuration

    Use Domain Name (DN) service ?              YES
    DNS lookup (resolver) ==>
S-> Local DN server (named) ==>
```

```
             TCP/IP Local Domain Name Server Configuration

S-> Directory for name server files              /etc/named.d
    Address of forwarding name server #1         128.162.19.7
    Address of forwarding name server #2         128.162.19.13
    Address of forwarding name server #3         128.162.1.1
    Slave server?                                NO
    Root name server cache file                  root.cache
    Root name server cache ==>
    Primary zones ==>
    Secondary zones ==>
```

b. The local name server also needs configuration information for the zones for which it is the primary server (the zones for which it has authority). On a caching-only server, the only zone for which the local `named` has authority is the `0.0.127.IN-ADDR.ARPA` zone. This information is stored in the `localhost.rev` file; you can configure its name, but not its contents, by using the menu system:

```
Configure System
    ->Network Configuration
        ->TCP/IP Configuration
            ->TCP/IP Host/Address Lookup Configuration
                ->TCP/IP Local Domain Name Server Config
                    ->TCP/IP Root Nameserver Cache Config
```

```
                TCP/IP Root Nameserver Cache Configuration

      Server name     Server address  Time To Live
      --------------  --------------  ------------
 E->  earth.cray.com  128.162.3.55    1000000
```

```
              TCP/IP Root Nameserver Cache Configuration

S-> Server name                              earth.cray.com
    Server address                           128.162.3.55
    Time to live                             1000000
```

c. The local name server must know the name of the server that is the authoritative name server for the domain. The `root.cache` file is used to "prime the cache" with this information, and you can configure it by using the menu system:

```
Configure System
    ->Network Configuration
        ->TCP/IP Configuration
            ->TCP/IP Host/Address Lookup Configuration
                ->TCP/IP Local Domain Name Server Config
```

```
                TCP/IP Domain Name Service Primary Zones

     Name                  File           Account  Serial #
     --------------------  -------------  -------  --------
E-> 0.0.127.IN-ADDR.ARPA   localhost.rev
```

```
               TCP/IP Domain Name Service Primary Zones

    Zone name                                  0.0.127.IN-ADDR.ARPA
    File to contain zone information           localhost.rev
S-> Account name of responsible party
    Serial number for zone
```

4. Start the `named` daemon by executing the following command:

```
# /etc/sdaemon -s named
```

Procedure 36: Configuring a caching-only server without using the menu system

Note: If you have not completed the previous procedure, "Adding a CRAY J90se system to an existing TCP/IP network," you should complete steps 3, 4, and 5 of that procedure before configuring a caching-only server.

To configure your CRAY J90se system as a caching-only server without using the UNICOS Installation / Configuration Menu System, complete the following steps:

1. Enable the domain name system by creating the `/etc/hosts.usenamed` file. The existence of this file indicates that UNICOS will use DNS, rather than the `/etc/hosts` file to look up host names.

2. Configure the resolver by creating the `/etc/resolv.conf` file.

   When you have a local name server (`named` process) running, you should have the local host address (127.0.0.1) as the first name server; otherwise your local `named` will be bypassed, resulting in decreased performance and increased network traffic. The following is an example `/etc/resolv.conf` file:

```
## Domain name resolver configuration file
#
domain cray.com
#
nameserver 127.0.0.1
nameserver 128.162.19.7
nameserver 128.162.1.1
```

3. To configure a caching-only local name server, you must complete the following steps:

   a. Create the `/etc/name.boot` file. This file is read when `named` starts up. It tells the server what kind of server it is, over which zones it has authority, and where to get its initial data.

      The following example shows a sample `named.boot` file. The `directory` line tells the server that all file names referenced are relative to the `/etc/named.d` directory. The `forwarders` line tells the server to forward requests that it cannot resolve to the server at 128.162.19.7. The `cache` line tells the server to load the `root.cache` file (in the `/etc/named.d` directory)as its initial cache entries. The `primary` line tells the server that it has primary authority for the `0.0.127.IN-ADDR.ARPA` domain. The `domain` line tells the server that its default domain is `cray.com`.

```
directory       /etc/named.d
forwarders      128.162.19.7
cache           .                           root.cache
primary         0.0.127.IN-ADDR.ARPA    localhost.rev
domain          cray.com
```

b. Create the `localhost.rev` file. The local name server also needs configuration information for the zones for which it is the primary server (the zones for which it has authority). On a caching-only server, the only zone for which the local `named` has authority is the `0.0.127.IN-ADDR.ARPA` zone. This information is stored in the `localhost.rev` file. The following is an example of a `localhost.rev` file:

```
$ORIGIN 127.IN-ADDR.ARPA.
@               IN      SOA     localhost.cray.com. tas.cray.com. (
                                86400
                                3600
                                36000000
                                86400
                                )
                IN      NS      localhost.cray.com.
1.0.0           IN      PTR     localhost.cray.com.
```

c. Create the `root.cache` file. The local name server must know the name of the server that is the authoritative name server for the domain. The `root.cache` file is used to "prime the cache" with this information. The following is an example `root.cache` file:

```
$ORIGIN .

                    1000000 IN      NS      earth.cray.com.

earth.cray.com. 1000000 IN      A       128.162.3.55
```

4. Start the `named` daemon by executing the following command:

```
# /etc/sdaemon -s named
```

11.9 Common TCP/IP configuration files

After you have the Cray Research system on the network, you should do a few additional things to make sure it is a fully functional member of your network, including configuring `inetd`, adding additional routes, and updating other configuration files. If you are using the menu system, you should update these files by using the menu system options. Table 17 describes some of the most

common TCP/IP configuration files. The *UNICOS Networking Facilities Administrator's Guide*, Cray Research publication SG–2304, describes all of these files.

Table 17. TCP/IP configuration files

File (relative to `/etc`)	Description	Change
`config/atm.pvc`	If you are running your atm interfaces in Permanent Virtual Circuit mode, this file maps the Internet addresses of remote hosts on the atm network to VPI/VCI information.	Yes, if you have atm.
`config/daemons`	Lists system and network daemons to start at system boot.	Probably
`gated.conf` or `tcpstart.mid`	Contains routes to be installed at system boot.	Yes
`config/hostname.txt`	Contains text host name for TCP/IP.	Probably not
`hosts`	Maps Internet addresses to host names.	Yes
`hosts.equiv`	Lists trusted hosts for `rlogin`, `rsh`, and so on.	Optional
`ghippix.arp`	Maps HIPPI ifields to Internet addresses.	Yes, if you have HIPPI
`inetd.conf`	Lists network services to be handled by `inetd`.	Probably not
`config/interfaces`	Lists network interfaces and their characteristics.	Yes
`networks`	Maps network names to network Internet addresses.	Optional
`protocols`	Maps protocol names to protocol numbers.	No
`$HOME/.rhosts`	Lists trusted users for `rlogin`, `rsh`, and so on.	Optional
`services`	Maps protocol and port numbers to service names.	Probably not
`shells`	Lists shells allowed for `ftpd`.	Probably not