11.0 Server Network Time Protocol (NTP) Set Up

The Network Time Protocol (NTP) executables are included with the Solaris 7 operating system. Scripts in the FEMIS application configure NTP for the UNIX server and Windows NT v4.0. Once NTP has been installed and checked out, all PCs on an EOC's LAN acquire time synchronization from the NTP service running on the UNIX server for that LAN.

Note: The NTP server for a LAN could be located on a different LAN than the PCs. If so, select the UNIX server closest to the PCs' LAN.

A Network Time Policy needs to have been established at each site because this installation procedure does not prescribe a specific solution for synchronizing time on the UNIX servers. However, the following general practice may be appropriate.

PCs should synchronize with the closest UNIX server's NTP service. This probably is the UNIX server on the PC's LAN. If there is not a UNIX server on the PC's LAN, use the UNIX server on which the PC maintains its database.

One UNIX server on the WAN should be chosen as the secondary time standard for all EOCs. All other UNIX servers on the WAN should synchronize with that server.

The UNIX server chosen as the secondary time standard should acquire time synchronization from a primary time standard, via: 1) a local Global Positioning System (GPS) or WWV (National Institute of Standards and Technology [NIST] radio station broadcasting continuous time status) hardware clock, 2) stratum 1 host on the Internet, 3) dial-up modem connection to NIST using Automated Computer Time Service (ACTS) protocol, or 4) other as appropriate for each site.

Generally speaking, the options listed are in the order of decreasing reliability. Thus, the least reliable is local clock discipline, where no synchronization from an outside time standard exists. The most reliable methods are WWV radios and GPS. Synchronization via modem or Internet offers acceptable accuracy at a modest cost.

Configuration scenarios for each method differ—however, the NTP service on the UNIX system receives its instructions via the configuration file at /etc/inet/ntp.conf. This file contains two important lines. One defines the path of the drift file. The other defines the server address or identifier of the source through which the NTP service on the UNIX system will obtain its time synchronization.

For more information on NTP, refer to the University of Delaware Web site on time synchronization: http://www.eecis.udel.edu/~ntp/.

Note: PNNL does not endorse any specific vendor or approach to establishing logical connections to time standard clocks, recognizing that sites have differing needs and topology constraints.

Whichever method for synchronizing time on the Sun server is chosen, please note that the hardware utilized must be fully compliant with NTP. Many ways are available to acquire time displays that are based on transmission from GPS, WWV, and NIST over modems. However, be careful with solutions that offer only proprietary data formats and interfacing methods, as these may not work as desired in an NTP environment.

This following sections summarize six clock disciplines.

11.1 NTP Synchronization Via Undisciplined Local Clock

This driver allows a machine to use its own system clock as the reference clock, with no outside clock discipline source. To establish a local clock, specify the following server directive in the ntp.conf file:

```
server 127.127.1.0
```

11.2 Synchronization Via NIST Modem Time Service

This driver supports the NIST ACTS. It periodically dials a pre-specified telephone number, receives the NIST timecode data, and calculates the local clock correction. It was designed primarily for use when neither a radio clock nor connectivity to Internet time servers are available. The available accuracy is within the requirements to operate FEMIS.

ACTS is located at NIST, Boulder, Colorado. A membership fee may be required. For more information, you can call them at (303) 494-4774 or refer to the NIST Automated Computer Time Service (ACTS) Web site (http://www.bldrdoc.gov/timefreq/service/acts.htm).

Required modem parameters are a minimum 1200 baud, 8-bits, no parity, 1 stop bit and Hayes compatible. The NIST ACTS telephone number and modem setup strings are hard-coded in this driver. If you need to change them, you will need to acquire the source code, edit, and recompile.

To establish a NIST modem time service in the configuration file, use

```
server 127.127.18.u
```

where u is the port number on /dev/actsu.

11.3 NTP Synchronization Via Internet

FEMIS sites that have continuous access to Internet can configure NTP on their Sun computer to synchronize with any of about 50 time-standard clock servers on the Internet.

Set up the actual host you want to synchronize with by listing its domain name or IP address in a server directive in the ntp.conf file. Example:

```
server 192.43.244.18   # time.nist.gov          (recommended for west coast)
server 192.5.41.40     # tick.usno.navy.mil     (recommended for east coast)
```

For some EOCs, Internet time synchronization may be desirable because no additional hardware costs are involved once network access is already in place. Access to the primary time servers is free. The available accuracy is well within the requirements to operate FEMIS.

Using the Internet to gain access to primary time servers has a potential network routing issue associated with it. NTP uses UDP port number 123. As a matter of policy, some sites block this specific access for security reasons. Sites considering NTP over Internet should look at the security impacts. Many firewall components offer solutions to this problem. Also note that some routers support NTP internally.

11.4 NTP Synchronization Via WWV Radio Receivers

Many networking equipment manufacturers offer WWV radio-receiver-driven clocks that can be interfaced directly, via the serial port, to the Sun computer and an NTP driver. Refer to the NTP Web site, and locate the Reference Clock Drivers (http://www.eecis.udel.edu/~mills/ntp/refclock.htm), which lists about 20 different hardware solutions.

Note: Either WWV or GPS receivers are considerably more expensive than any of the previously mentioned methods. However, if accuracy and reliability are important, these methods offer substantial benefits and should be given serious consideration.

11.5 NTP Synchronization Via GPS Receivers

Many networking equipment manufacturers offer GPS-receiver-driven clocks that can be interfaced directly, via the serial port, to the Sun computer and an NTP driver. Refer to the NTP Web site, and locate the Reference Clock Drivers, which lists about 20 different hardware solutions.

Note: GPS receivers for synchronization of NTP clocks are considerably more expensive than either modem or Internet methods. However, if accuracy and reliability are important, this method offers substantial benefits.

Also, in some geographical locations, GPS may have a slight advantage over WWV radios, depending on the amount of high frequency radio interference present. You may want to check with a radio installation consultants in your area.

11.6 NTP Synchronization Via Network Time Server

Vendors now offer both WWV and GPS Network Time Servers. These devices interface directly to your Ethernet via either 10Base-T or coaxial connections. Time synchronization signals are obtained either via WWV or GPS radio and antenna. These devices interface directly to the network and not through the computer's serial port. As such, they do not depend on specific computer hardware and operating systems for support. Possible vendors include Bancomm, TrueTime, Spectracom, Austron, Magnavox, Datum, and NMEA.