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Technical Information

Operating Instructions

Time Synchronization for NetWare

Impressum

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Time Synchronization in Novell NetWare Networks

Time synchronization in networks can be implemented in three major steps:

1. One or more file servers which have a radio clock installed are declared to work as reference time servers.

2. Other file servers without a radio clock are declared to be time clients (or secondaries) which query one or more time servers and adjust their clocks to the time server's clock.

3. Workstations on the network receive periodic broadcast time packets which can be used to adjust the workstation clocks to the broadcast transmitter's system time.

Radio clocks manufactured by Meinberg can be used to provide a reference time to a Novell network. The driver packet for NetWare can do all the tasks described above. A time server NLM (NetWare Loadable Module) can be loaded on a NetWare 3.1x/ 4.x file server where it reads its reference time from either a plug-in radio clock or an external radio clock connected to one of the computer's serial ports. The time server NLM adjusts the file server's system time, responds to requests from time clients, and can be configured to broadcast time packets into up to 10 IPX networks.

Both the SAP code used to identify a Meinberg time server NLM and the socket number used to broadcast time packets on the network have been registered at Novell.

NetWare 4.x And Above

File servers running NetWare 4.x have a built-in TIMESYNC function which lets the servers synchronize their system times across the network. If one of the servers is configured as a reference time server and the others as secondaries you just have to keep the reference time server's system time accurate and all secondaries will be accurate, too.

In a NetWare 4.x environment, exact time stamps are needed to know the order of events that have happened, especially events concerning the synchronization of directory services rely heavily on monotonically increasing time stamps. Due to this fact, the file server time should never be set backward. NetWare 4.x has an enhanced software interface which lets add-on software products adjust the file server's system clock to a reference time by making the system clock tick faster or slower until the difference between system time and reference time is at its minimum. This way to adjust system time has the advantage that neither there are discontinuities in time nor time change events are generated which are logged in the file server's error log file. If the Meinberg time server NLM finds itself loaded on a NetWare 4.x server it uses this enhanced interface to adjust the server's system clock.

In order to be able to sort events by time, even in large networks across continents, all NetWare 4.x server clocks run internally on UTC (Universal Time Coordinated, formerly called GMT, Greenwich Mean Time). The time displayed to the user is converted to local time using the time zone settings which must be configured individually when a server is installed. Due to the fact that the server's time zone setting must not necessarily match the time zone settings used in Germany, Meinberg's NLMs compute the UTC time from the radio clock's time and compare it against the server's UTC time. So it is guaranteed that the server's UTC time always increases monotonically. It is the task of the file server's TIMESYNC.NLM to switch the file server's local time to daylight saving time and back, as configured in the server's time zone settings. The administrator should check carefully that the server's time zone settings match his requirements.

NetWare 4.x Time Zone Settings

A short description of the time zone settings is given below, for further information refer to the NetWare manuals. Time zone settings include the following information:

- the name of the local time zone
- how much the local standard time is ahead or behind UTC
- whether the local time supports daylight saving (summertime)

Additionally, whether the local time supports daylight saving:

- the time offset from local standard time while daylight saving is in effect
- whether daylight saving is currently in effect or not
- the time at which daylight saving starts
- the time at which daylight saving ends

The time zone settings for a NW4 server are configured in the first lines of the file server's AUTOEXEC.NCF file. For Central Europe, these lines should read as shown below:

```
set Time Zone = MEZ-1MESZ
set Daylight Savings Time Offset = 1.00.00
set Start Of Daylight Savings Time = (MARCH SUNDAY LAST  2.00.00 )
set End Of Daylight Savings Time = (OCTOBER SUNDAY LAST  3.00.00 )
```

which is interpreted as follows:

```
set Time Zone = MEZ-1MESZ
set Daylight Savings Time Offset = 1.00.00
```

Local standard time is called MEZ from which 1 hour must be subtracted to get UTC, in other words: MEZ = UTC + 1 hour. The local time supports daylight saving time

(DST). While DST is in effect, the name of the time zone changes to MESZ and local time goes ahead by 1 hour: MESZ = MEZ + 1 hour.

```
set Start Of Daylight Savings Time = (MARCH SUNDAY LAST  2.00.00)
set End Of Daylight Savings Time = (OCTOBER SUNDAY LAST  3.00.00)
```

The lines above enable NetWare's TIMESYNC.NLM to compute the start and end of daylight saving time for any year. With the configuration shown here, the TIMESYNC.NLM switches to DST and back to standard time as used in Germany.

Multiple NetWare 4.x Servers

Time synchronization between different NW4 servers is done by NetWare's TIME-SYNC mechanism. If one of the servers can access a high precision time base like a radio clock, this machine can claim to be the only one who knows the excact time. To achieve this, the server must be configured as single reference time server. All other file servers in the network should be configured to be secondary time servers who adjust their clocks to the reference time server.

By default, a single reference time server refers to the computer's built-in real time clock to adjust its system clock. However, if a radio clock driver such as TSRVNW controls the system clock, the time read from the radio clock should override the time read from the built-in real time clock. So the TIMESYNC.NLM must be configured not to resynchronize system time with the built-in real time clock.

If a TIMESYNC.CFG file exists in the server's SYSTEM directory, this file must be modified to configure the TIMESYNC mechanism on that file server. On single reference time servers running TSRVNW, the file must be modified to contain the lines

```
type = SINGLE
hardware clock = OFF
```

On every secondary time server, the file must contain the line

```
type = SECONDARY
```

If the TIMESYNC.CFG file does not exist, the TIMESYNC.NLM can be configured from the AUTOEXEC.NCF file. The lines

```
set timesync type = SINGLE
set timesync hardware clock = OFF
```

should be added to the single reference server's AUTOEXEC.NCF **after** the lines specifying the file server name and internal address, but **before** TSRVNW is loaded. Secondary servers are configured using the line

set timesync type = SECONDARY

For more information on TIMESYNC and time zone settings on NetWare 4.x servers refer to the NetWare manuals.

NetWare 3.1x

NetWare 3.1x does neither distinguish UTC from local time, nor does it include the software interface mentioned above. The server clock always runs on local time, so if the Meinberg time server NLM is running under NetWare 3.1x, the server's system time is set to the radio clock's local time whenever the difference between the server's time and the reference time exceeds one second. Every correction of system time results in a time change event which is logged in the system error log file provided by NetWare. Also, if the file server's system clock runs too fast, a discontinuity of time occurs when the system clock must be set backward by one second.

NetWare 3.1x servers can not synchronize their system times across the network, so Meinberg has added a time client NLM to the driver packet which can be loaded on any NetWare 3.1x fileserver without a radio clock. If the time client NLM finds a Meinberg time server NLM on the network is sends a request for reference time to the time server NLM which returns a packet containing its system time, so the time client can adjust its time to network time.

SFT III Considerations

NetWare SFT III is the name of a server system which is build using two identical computers which appear in the network as a single machine. The computers are connected directly to each other via a special high speed link which is used to mirror the server status on both the machines. Whenever one of the machines fails and goes down, the other machine can continue providing network services. This is transparently for the network clients. Existing SFT III versions are based on either NetWare 4.x or NetWare 3.x

Both of the machines should receive the same reference time, so it is recommended to use a radio clock with two serial ports and connect each of the machines to one of the serial ports. If one of the servers goes down, the radio clock is not affected and keeps supplying the reference time for the remaining machine.

Each of the servers has divided its memory into two parts which are totally independend from each other. One of these parts is used by the hardware dependend programs and is therefore called I/O Engine. The other part provides the hardware-independend services seen from the network (MS Engine, Mirrored Server Engine). The radio clock driver must read the reference time from a radio clock, so it must be loaded in the I/O Engine. This can either be done manually by entering the load

command in the I/O Engine's console window, or automatically if the load command is added to the I/O Engine's startup file IOSTART.NCF. The command syntax is like described below for standard NetWare servers.

DOS/Windows Workstations

Neither NetWare 3.1x nor NetWare 4.x provides a function that keeps the workstations' system time close to the network time. However, the Meinberg time server NLM can send broadcast time packets into up to 10 IPX networks. A small TSR included in the driver package can be loaded on any DOS, Windows 3.1x, or Windows 95 workstation which receives these broadcast time packets and adjusts the workstation's system time if necessary. The client software for Windows NT, however, is part of the Windows NT driver package. Please refer to the Windows NT client manual for detailed information.

The Time Server NLM

The time server NLM TSRVNW reads its reference time either from a plug-in radio clock or via serial port from a radio clock transmitting Meinberg's standard time string. The driver is designed to run under both NetWare 3.1x and NetWare 4.x. If TSRVNW finds that it runs under NetWare 4.x, it uses NW4's enhanced clock interface to control NetWare's timesync mechanism.

If the driver shall read the time from a external radio clock via a serial port, the AIO drivers shipped with NetWare are required to access the file server's serial port. If the AIO drivers have not been loaded when TSRVNW comes up, TSRVNW tries to load AIO.NLM and AIOCOMX.NLM for the COM port specified on the command line.

After the file TSRVNW.NLM has been copied to the SYS:SYSTEM directory on the file server, it can be loaded using the following command line which may either be entered at the file server console or be added to the file server's AUTOEXEC.NCF file:

```
LOAD TSRVNW [<name>] PORT=<xxx> [NET=nnn[,nnn,nnn...]]
[IGNORE_SYNC]
```

<name> [optional]
The name to be used to advertise the time server on the network. If no name is given, the NLM uses the file server's name.

PORT=<xxx> [required]
This parameter can only be omitted if a radio clock with a PCI interface is installed because in this case the computer's BIOS has assigned a I/O address to

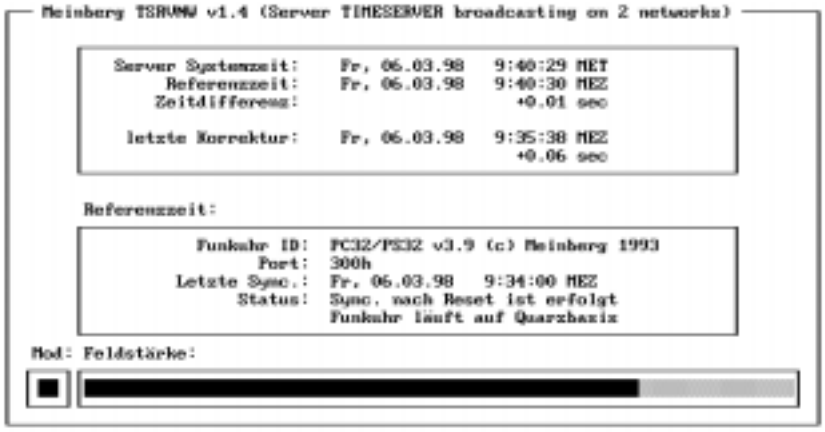
the clock and the NLM can query that address from the BIOS. If there is a plug-in radio clock without PCI bus the port address (hex) must be given in the following format, e.g.: PORT=300

If the reference time shall be read via serial port, the COM port and the communication parameters must be given. Be sure the parameters match exactly those which have been configured for the external clock.
Example: PORT=COM1,2400,8N1

NET=nnn[,nnn,nnn...] [optional]
Broadcast network address(es). A maximum of 10 broadcast networks can be specified. If addresses are specified, the NLM broadcasts one time packet per second into each of the networks. Each network address must match the address of an existing network as defined in a BIND command in the server's AUTOEXEC.NCF file.

IGNORE_SYNC [optional]
If this parameter is given the NLM evaluates the reference time from the radio clock even if the clock has not sync'd since after the last reset.

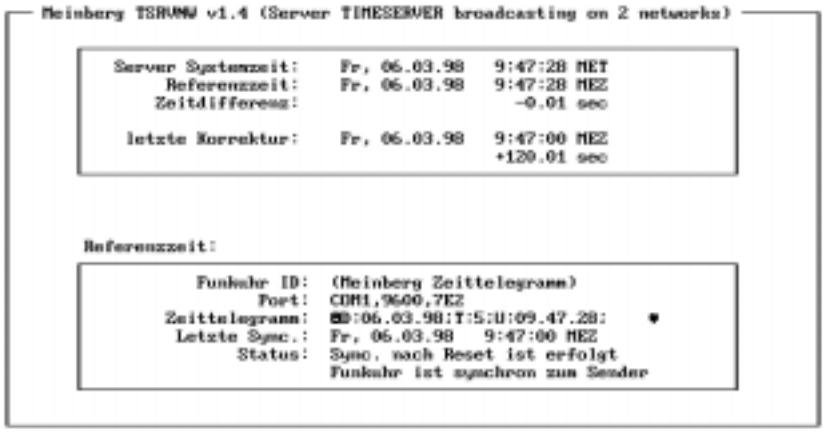
When the time server NLM has been loaded a screen is displayed which shows two windows. The head line shows the version of the NLM, the time server name and whether the NLM broadcasts time packets to the network or not. The upper window shows information on the time adjustment: the server's system time, the current reference time, the time difference, and the date and time and amount of the last time correction. The lower window shows information on the reference time source. If a plug-in radio clock is installed the NLM comes up with a screen similar to that shown below:



The reference time window reports the radio clock ID (software version), the I/O port address, the last time the radio clock has synchronized with its time source (DCF77 or GPS) and the receiver status. If the radio clock receives its information on time from

the long wave transmitter DCF77 the lower part of the screen also shows the signal strength (Feldstärke) and the demodulated time marks (Mod). It is important that the Mod field is blinking exactly once per second. If the contents of the Mod field flickers there are problems receiving the signal from the long wave transmitter which may prevent the radio clock from synchronizing.

If an external radio clock is connected to the computer the NLM shows a screen like this:



The radio clock ID in the reference time section only says that the reference time is being read from a Meinberg standard time string. The line labeled **port:** reports the number of the serial port used by the NLM and the framing parameters as specified on the command line. The third line in this field shows the contents of the serial time string read from the external clock. The other lines are as described above. However, no information on the quality of the received signal is available to the NLM if an external clock is connected.

The Time Client NLM

This time client NLM TCLNTNW periodically contacts a time server like TSRVNW to read the time server's system time across the network. Although TCLNTNW runs under both NetWare 3.1x and NetWare 4.x, it should only be used to keep the system time of NetWare 3.1x servers without own radio clock synchronized. Under NetWare 4.x, this mechanism is implemented in the TIMESYNC.NLM which is part of the operating system.

After the NLM has been copied to the SYS:SYSTEM directory on the file server, it can be loaded using the following command line which may either be entered at the file server console or be added to the file server's AUTOEXEC.NCF file:

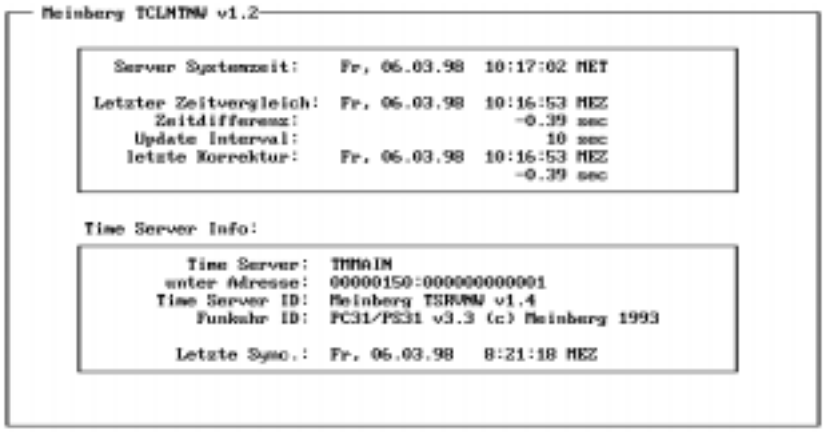
LOAD TCLNTNW [<name>] [UPDATE=y] [IGNORE_SYNC]

<name> [optional]
The name of the preferred time server to poll. If no time server is specified or the time server with the specified name can not be found on the network, the client tries to query the time from the first time server which is available.

UPDATE=y [optional]
The time interval between two requests for time service. If the parameter is not specified, it defaults to 10 seconds (the client requests the network time once every 10 seconds).

IGNORE_SYNC [optional]
Evaluate radio clock time even if has clock not sync'd after reset.

After the NLM has loaded, it shows a screen similar to that below:



Again, the upper window shows information on time adjustment. However, system time is only checked in intervals as specified on the command line, so the first line displays the current system time whereas the next lines are only refreshed when an update interval has expired.

The lower window shows information on the time server which has been contacted to read the reference time. These information include the name of the time server, its IPX network address, the versions of the time server NLM and the reference clock, and the last time the reference clock could synchronize to its time source.

Synchronizing the Workstations' System Time

The broadcast packets generated by TSRVNW can be used to spread the reference time across a network. It must be made sure that the parameter NET=... was given at the command line when TSRVNW was loaded. The TSR which receives the broadcast packets under DOS and Windows 3.1 is called TRCVRDOS. This TSR automatically loads high, if possible, and can be unloaded from the command line. Because the memory management has changed in Windows 95, a TSR called PCPSIPX must be used with Windows 95 or newer. This TSR can not be unloaded. Each of the TSRs evaluates the contents of the broadcast packets and adjusts the workstation time if needed.

The IPX protocol must have been loaded on a workstation before the time packet receiver can be installed. On a DOS workstation the TSR may be installed at the end of the AUTOEXEC.BAT file, if the network drivers have been loaded before. Under Windows 3.x and Windows 95 the network drivers are often not loaded from the AUTOEXEC.BAT file, so the time packet receiver can't be, either. However, both versions of Windows look for a file called WINSTART.BAT located in the Windows directory. The commands listed in this file are executed after the network drivers have been loaded, so this is the right place to install the time packet receiver TSR. Using any text editor, the command to load the TSR can be added to an existing WINSTART.BAT file, or a new WINSTART.BAT file can be created.

The TSR TRCVRDOS.COM can be loaded using the following command syntax:

```
TRCVRDOS [/I]
```

By default, the TSR only adjusts the workstation's system time if the radio clock has synchronized at least once after power-up. However, if the optional parameter **/I** is given on the command line the TSR ignores this status flag and evaluates any broadcast packet. The TSR automatically loads high, if possible, and can be deinstalled using the following command:

```
TRCVRDOS /U
```

Like TRCVRDOS, PCPSIPX can be loaded using the following command syntax:

```
PCPSIPX [/I]
```

The optional flag **/I** may be given as described above. However, PCPSIPX does not automatically load high, and it can not be removed from memory.

Utility Programs for Workstations

On the driver disk, there are also some utilitiy programs which can be used to monitor and control the function of the time packet receiver. These utilities are described below.

SHOWPACK.EXE This program can be used to check whether time broadcast packets arrive at the workstation. However, users must take into account that only **one** packet per second arrives. So if both a time packet receiver TSR and SHOWPACK are running, only one of the two programs can receive the packet, the other won't.

DRV.EXE temporarily disables the resident driver. This access to the board. Command: DRV ON or DRV OFF
Default: enabled

DISP.EXE enables or disables the date/time window on the screen in text mode. Command: DISP ON or DISP OFF
Default: disabled

COLOR.EXE sets up the screen attribute of the date/time window
Command: COLOR fg bg
with fg and bg the color numbers of the foreground/background
Default: white characters on black

POSXY.EXE sets up the screen position of the date/time window.
Command: POSXY column row
Default: upper right corner of the screen

Using these utilities, you can enable or disable the date/time window only when special applications are run.