

VERSION 5

Network Time

Management

NetWare⁵TM
NETWORK SOFTWARE



Novell[®]

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Network Time Synchronization

Synchronizing time across the NetWare® network provides a service that maintains consistent time stamps for enterprise environments with several servers in different time zones.

Time synchronization provides network time for the following services:

- ◆ File systems
- ◆ Messaging Services
- ◆ Network applications
- ◆ NDS™

Time Servers provide synchronized time for network services.

If there are fewer than 30 servers on the network, use the default settings of a single reference time server and a secondary time server.

For more than 30 servers, plan a custom environment using reference, primary and secondary time servers. You can also specify which communication method the time servers will use: SAP or a configured list.

Understanding

In NetWare[®], time synchronization ensures that all servers in an NDS[™] tree report the same time and order events correctly.

NetWare 5[™] can use the TimeSync utility, or a combination of TimeSync and Network Time Protocol (NTP), for server and client time synchronization. Previous versions of NetWare used TimeSync exclusively for time synchronization over IPX, while external time sources were limited to asynchronous (modem) connections. “Interoperability of NTP with TimeSync” on page 16 in mixed protocol networks allows the use of an external Internet time source for time synchronization. NTP is an open IP standard defined in RFC-1305 that produces consistent and accurate time stamps for proper synchronization of services such as NDS.

There are two ways to configure TimeSync on the network: “SAP and Custom Configuration” on page 15.

On a small network, “SAP (Service Advertising Protocol)” on page 15 is the preferred and default method because it requires little planning and minimal administrative time. Using SAP, the single reference time server advertises its presence through network broadcasts which increase network traffic.

For a larger network, using “Custom Configuration List” on page 15 can reduce network traffic, but requires more initial planning and administrative time.

NTP is configured manually using a configuration file called `ntp.cfg`. For information about configuring NTP, see “Configuring NTP” on page 24.

For more configuration recommendations see “Time Synchronization Methods” on page 3. For more detailed information about TimeSync, see “How TimeSync Works” on page 2.

Why Time Synchronization Is Necessary

Novell® network objects exist in a database that is maintained and managed by NDS™. The database can exist on a single server, or it can be partitioned and distributed as replicas on other servers. NDS ensures that when changes are made to objects in a partition, the changes are made to all replicas of that partition in the proper order in which they were performed.

If multiple events exist for a particular object within a partition, NDS checks that the events are made to the object in their proper sequence. An example of this would be one administrator renaming an object and another moving the object. If these events occurred out of sequence, the object might not be renamed because it would not exist in the original tree context.

To ensure that events occur in their proper sequence, NDS records the time of each event relative to a common time source. This record is referred to as a *time stamp*. NDS uses the time stamp to ensure that when it modifies the database, the particular event occurs in the time and order that was intended. NDS also uses time stamps to record “real world” time values for the network and to set expiration dates.

In a single server environment, the server’s internal clock is adequate to maintain a common and consistent time source for the network.

In a multiple server environment, NetWare includes functionality to maintain a common time for all NetWare servers in the network. This functionality is referred to as *time synchronization*.

How TimeSync Works

TimeSync determines if the computer’s internal clock is synchronized within a specific time radius of the value received from the time provider. If the synchronization radius is within the set amount of time, the server sends a time synchronization flag to indicate that synchronization is established.

The synchronization radius is by default 2000 milliseconds, or roughly two seconds. You can change the synchronization radius with server SET commands or in MONITOR.

The server's internal time is set to the offsets allowed by Universal Time Coordinated (UTC), the worldwide time standard coordinated to the zero meridian (0° of longitude, sometimes known as GMT or Greenwich Mean Time). Internal clocks are set to adjust for time zone offsets and for daylight saving time. Servers exchange time synchronization information in UTC.

TimeSync reads time zone and daylight saving time adjustments from parameters set in the autoexec.ncf file. Here is a sample of those parameters:

```
set Time Zone = MST7MDT
```

```
set Daylight Savings Time Offset = 1:00:00
```

```
set Start Of Daylight Savings Time = (APRIL SUNDAY FIRST 2:00:00 AM)
```

```
set End Of Daylight Savings Time = (OCTOBER SUNDAY LAST 2:00:00 AM)
```

Another command in the autoexec.ncf file (or, optionally, in the timesync.cfg file) sets the time server type:

```
set Default Time Server Type = SINGLE
```

The time server type determines which servers adjust their clocks to maintain a common time source. Time synchronization provided in NetWare supports four types of “Time Servers” on page 5: “Single Reference Time Server” on page 5, “Reference Time Server” on page 8, “Primary Time Server” on page 6 and the “Secondary Time Server” on page 9.

Time Synchronization Methods

NetWare needs to maintain a common system time for keeping file date and time stamps correctly, for auditing and logging, and to manage users' login time restrictions. It is also important to maintain a common time for the entire network system of servers.

This is done by designating one or a group of servers to act as the time source for all other servers and client workstations in the network. All other servers act as secondary time servers, receiving UTC values from

the time source. This relationship ensures that any drifts between time settings of different server's internal clocks are corrected and common time is maintained.

Time synchronization provides mechanisms to adjust and compensate for the rate of the operating system software clock. In addition, it also provides support for Universal Time Coordinated (UTC), the worldwide time standard coordinated to the zero meridian (0° of longitude, sometimes known as GMT or Greenwich Mean Time).

Establishing a common time source for the network can be done by:

- ◆ “Using Internal Time Synchronization” on page 4
- ◆ “Using External Time Synchronization” on page 5
- ◆ “Using a Combination of Time Synchronization Methods” on page 5

Using Internal Time Synchronization

NetWare provides you with the functionality to maintain the same UTC on all servers. This is done through a server utility named `timesync.nlm`. TimeSync allows you to set up different types of time source servers that provide time to other servers and clients.

All NetWare servers automatically load TimeSync, which manages the updating of each server's UTC relative to the UTC of the network. Time synchronization is active whenever TimeSync is loaded.

TimeSync determines if its internal clock coordinates with that of the time provider. This is done by determining if the internal clock time is synchronized within a specific time radius of the value received from the time provider. If the synchronization radius is within the set amount of time, the server sends a time synchronization flag to indicate that synchronization is established.

The synchronization radius is set with TimeSync parameters in the MONITOR utility or the SET command at the server console prompt. The default setting is 2000 milliseconds, or roughly 2 seconds.

Using External Time Synchronization

Common time can be established by connecting all network servers to the same external time source. Depending on the cost of the source or hardware setup, this can be an effective method for maintaining common time on your network.

Some examples of external time source are radio clocks, atomic clocks, or Internet time.

Using a Combination of Time Synchronization Methods

Time synchronization services does not attempt to provide correct time of day to the servers. It can only keep the internal clocks of each server set to a common time.

You can ensure the accuracy of your network's time of day by simply checking the time provider's UTC value against a wristwatch, or by attaching the time provider to an external time source service through a modem, radio, or Internet time source.

Note: Adjust the synchronization radius if the time provider servers are separated by WAN or satellite links that cause delays in packet transmissions.

Time Servers

When you install NetWare on a server, by default you are "Using a Single Reference Time Server" on page 11 because it is the single source of time on the network. In a more complex network you may want to consider "Using a Time Provider Group" on page 12 which may include primary, reference, and secondary time servers.

Each designation performs a particular time synchronization function:

- ◆ **Single Reference Time Server**

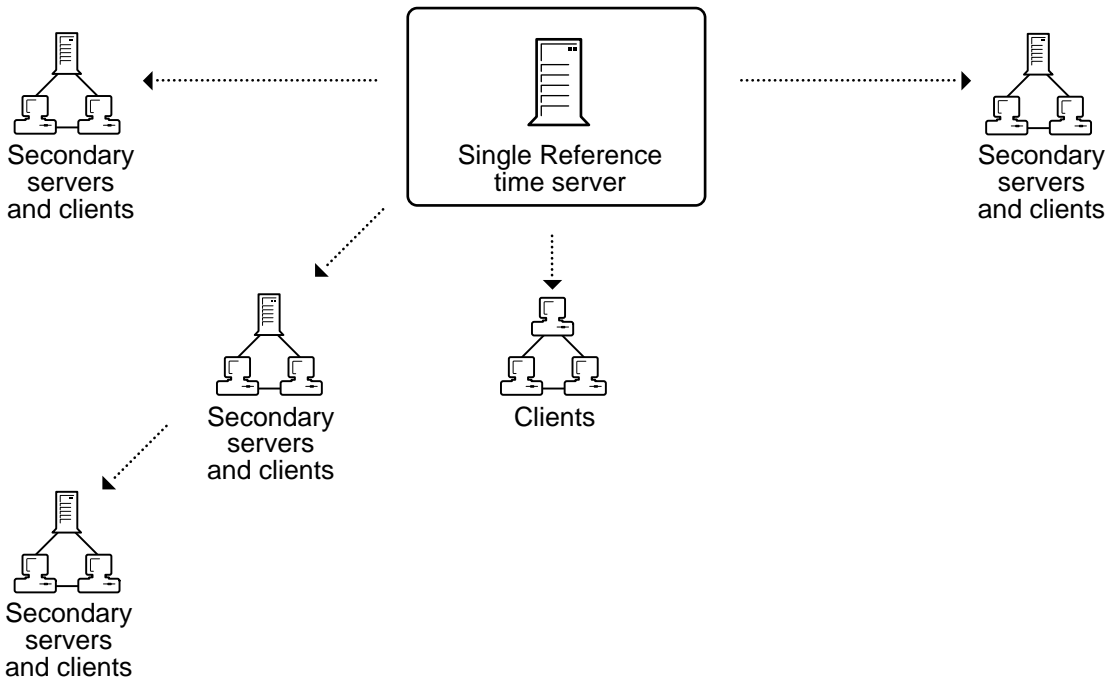
Provides time to secondary time servers and to workstations.

This server determines the time for the entire network and is the only source of time on the network. The network administrator sets the time on the single reference time server.

Because the single reference time server is the source of time on the network, all other servers must be able to contact it.

The following figure illustrates a single reference time server providing time to secondary time servers and to its own workstations. The secondary time servers, in turn, provide time to their workstations.

Figure 1-1
Single Reference Time Server



The single reference time server works on networks of any size, but this configuration is used primarily for small networks that aren't WANs.

Important: If you use a single reference time server, don't use any primary or reference time servers on the network.

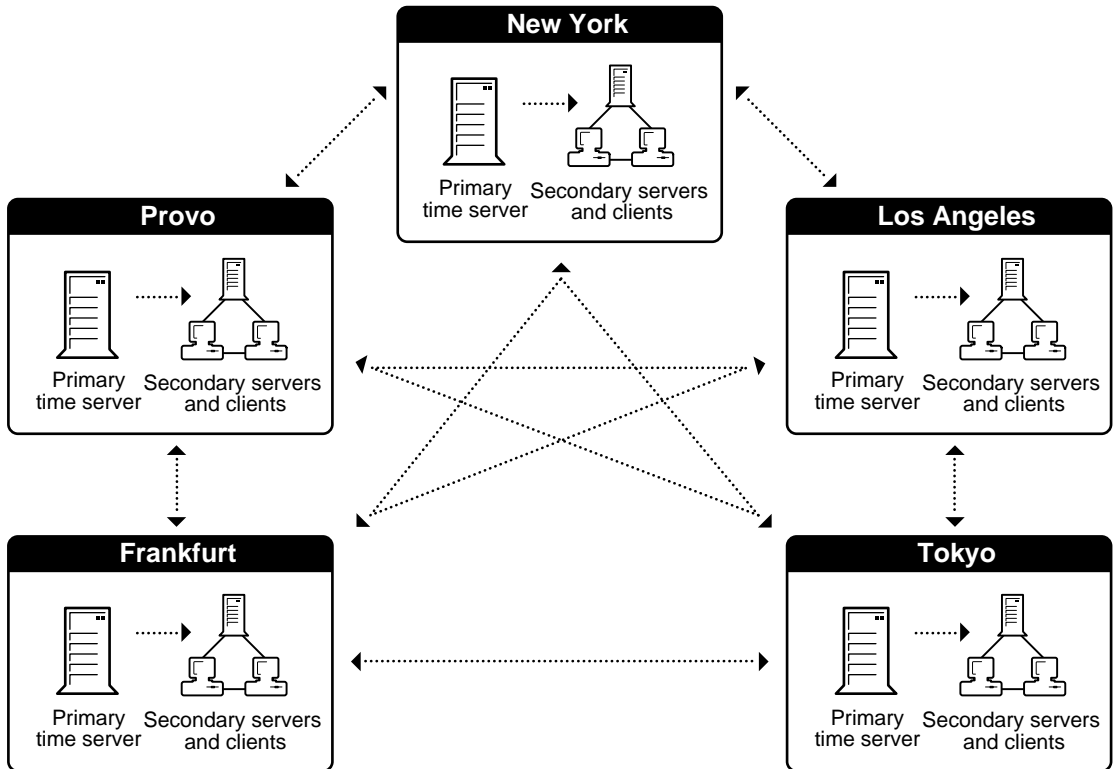
◆ **Primary Time Server**

Synchronizes the time with at least one other primary or reference time server and provides the time to secondary time servers and to workstations.

Primary time servers also vote with other primary or reference time servers to determine what the common network time should be.

The following figure shows primary time servers in various locations providing time to their respective secondary time servers. Secondary time servers, in turn, provide time to their workstations.

Figure 1-2
Primary Time Servers



Use the primary time server on larger networks to increase fault tolerance by providing redundant paths for secondary time servers.

If a primary time server goes down, the secondary time server can get the time from an alternate primary time server.

Place a primary time server in each geographically distinct area so that secondary servers and workstations can access them without using WAN links.

You must have at least one other primary or reference time server that the primary time server can contact. Whenever primary and reference time servers are on a network, they must be able to contact each other for polling.

However, primary time servers do adjust their internal clocks to synchronize with common network time. Because all primary servers adjust their clocks, network time can drift slightly.

◆ **Reference Time Server**

Provides a time to which all other time servers and workstations synchronize.

Reference time servers can be synchronized with an external time source, such as an atomic clock.

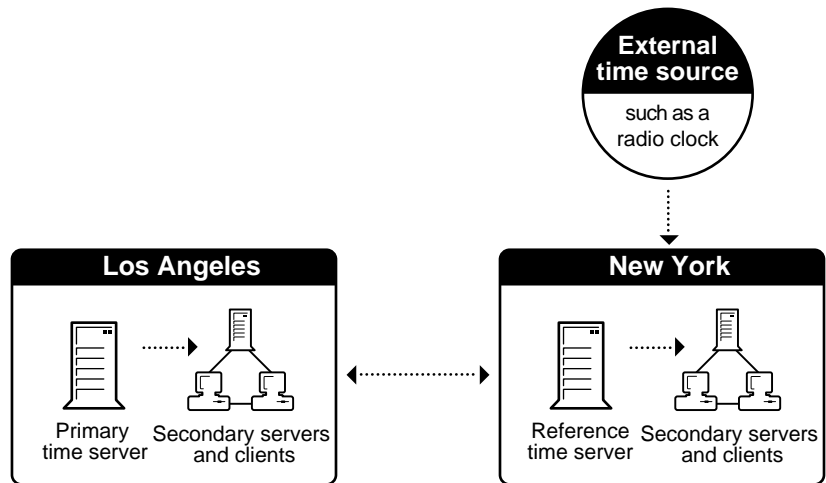
Reference time servers vote with other primary or reference time servers to determine what the common network time should be.

However, reference time servers don't adjust their internal clocks; instead, the primary servers' internal clocks are adjusted to synchronize with the reference time server.

Therefore, a reference time server acts as a central point to set network time. Eventually, all primary time servers adjust their clocks to agree with a reference time server.

The following figure shows a reference time server synchronized to an external clock. The reference time server, in turn, provides time to its own secondary servers and workstations, as well as to the primary time server at another location.

Figure 1-3
Reference Time Server



Use a reference time server when it is important to have a central point to control time on the network. Usually, only one reference time server is installed on a network.

You can use more than one reference time server on a network, but you must synchronize each reference time server with an external time source, such as a radio clock.

You must have at least one other primary time server that the reference time server can contact.

Whenever primary and reference time servers are on a network, they must be able to contact each other for polling.

◆ Secondary Time Server

Secondary time servers obtain the time from a single reference, primary, or reference time server. They adjust their internal clocks to synchronize with the network time, and they provide the time to workstations. A secondary time server doesn't participate in determining the correct network time.

If you have designated a server on the network as a single reference time server, then designate all other servers on the network as secondary time servers.

If you have designated several servers on the network as primary or reference time servers, then designate all other servers on the network as secondary time servers.

To keep network traffic to a minimum, connect secondary time servers to primary or reference time servers that are physically nearby.

For optimal time synchronization, minimize the number of intervening routers and slow LAN segments between secondary time servers and their single reference, primary, or reference time server.

Types of NetWare Time Servers

The TimeSync utility allows you to set up four types of time servers.

Table 1-1
Time Server Types

| Server Type | Function | Caution | Description |
|---------------------|--|---|---|
| Secondary | Receives time from a time source server and provides time to client workstations. | You can have a secondary time server contact another secondary time server to obtain the correct time. However, if the intermediate secondary time server is unavailable, servers that contact it for the correct time might be too many hops away from a time source server to be synchronized. | Attempts to stay synchronized with one time source. Does not participate in voting. Most servers will be secondary time servers. |
| Primary time server | Polls and votes with other primary time servers to determine time, and provides time to secondary time servers and client workstations. Use with reference time servers to pass time to secondary time servers and client workstations. | Must be able to contact at least one other primary time server or a reference time server. | Polls all other time sources to determine correct network time and compensate for clock errors Sets synchronization status based on its deviation from calculated network time, without regard to status of other time sources polled. |

Table 1-1
Time Server Types

| Server Type | Function | Caution | Description |
|---|---|---|---|
| Single reference time server (Default) | Provides time to secondary time servers and client workstations. Typically used for smaller LANs. | All servers must be able to contact the single reference time server. No primary or reference time servers can be on the network. | Functions the same as reference time server; however, it does not synchronize with any other server. |
| Reference time server | Receives time from an external time source and provides time to primary and secondary time servers. Use when it is important to have a central point of control for time on the network. | Typically, only one reference time server is installed on a network. If there is more than one reference time server, each must be synchronized with the same external time source. | Functions the same as a primary time server, except that it does not adjust its internal clock. Provides a central point of time control for the entire network. |

Each time-synchronized server performs three fundamental functions:

- ◆ Provides time to any NLM or client workstation that requests it
- ◆ Provides status information indicating whether the time is synchronized
- ◆ Adjusts its internal clock rate to correct for drift and to maintain synchronization

Using a Single Reference Time Server

NetWare uses a single reference time server as its default configuration. The first server installed in a NetWare network is automatically configured as a single reference time server. All other NetWare servers installed on the network are configured as secondary time servers.

The single reference time server configuration is adequate for networks with the following conditions:

- ◆ Fewer than thirty NetWare servers
- ◆ No WAN links

- ◆ Single time zone

You should ensure that the single reference time server is centrally located and is equipped with an accurate internal clock. The single reference time server should be monitored on a daily basis to ensure proper time of day and time synchronization.

A limitation of a single reference time server configuration is the lack of fault tolerance if the time server loses its connection for an extended period of time. This may cause secondary servers to fall out of sync with the network UTC.

However, if the single reference time server loses its connection, you can designate one of the secondary time servers as a temporary single reference time server until the original is reconnected.

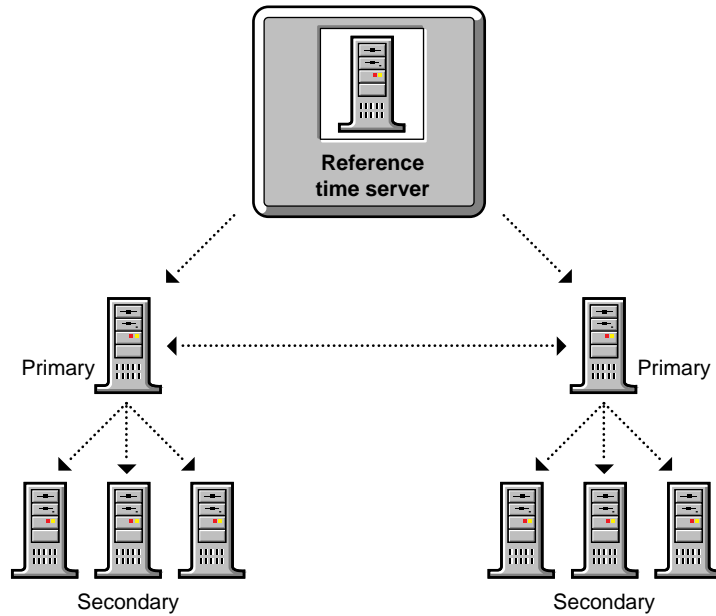
Important: If you use a single reference time server, avoid using primary or reference time servers in the same tree because the time references might conflict.

Using a Time Provider Group

Using a time provider group requires that at least one server is designated as a reference time server and two servers are designated as primary time servers. The reference time server polls the primary time servers within the time provider group to vote on the correct time.

The following figure illustrates a single reference time server providing time to primary time servers. Primary servers, in turn, provide time to secondary time servers. Each of these servers can provide time to their own client workstations.

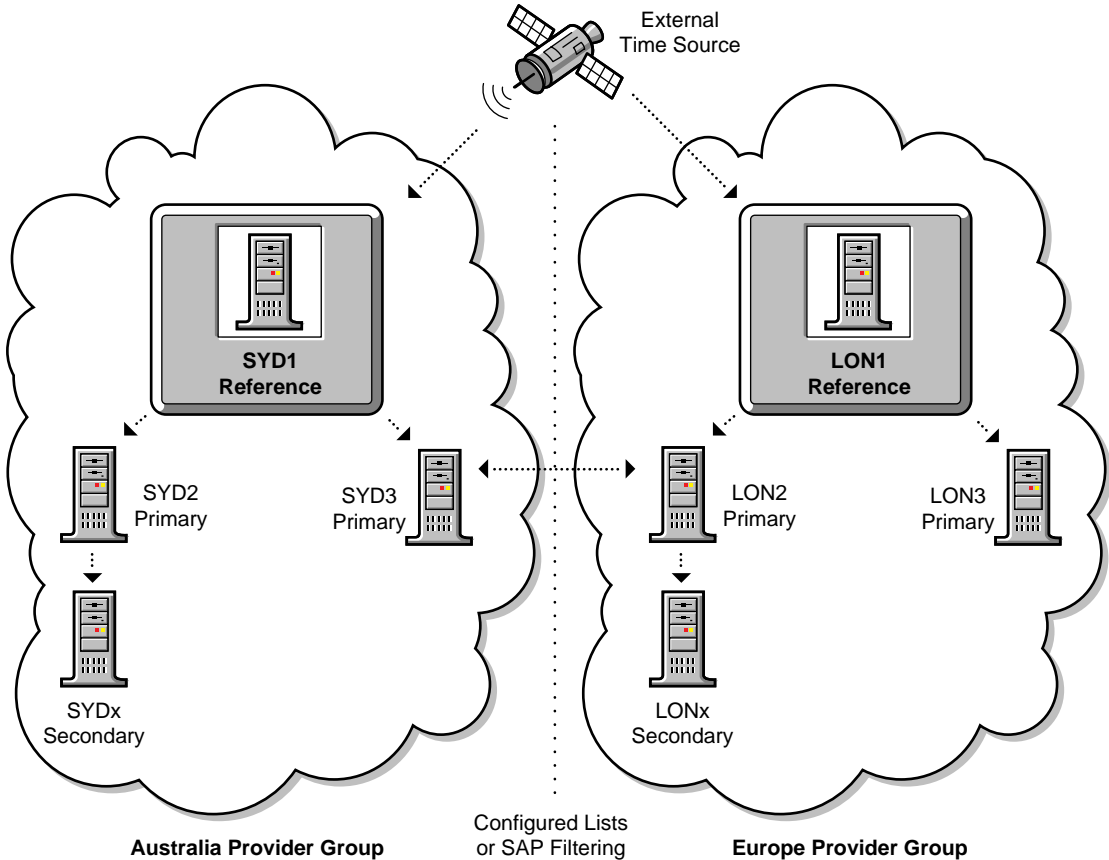
Figure 1-4
Time Provider Group with a Single Reference
Time Server



Usually, only one reference time server is installed on a network. If you use more than one reference time server, you must synchronize each reference time server with the same external time source, such as a radio clock, atomic clock, or Internet time.

The following figure illustrates a network using an external time server to provide time to two individual reference time servers.

Figure 1-5
Two Reference Time Servers Using an
External Time Source



This configuration requires that you modify the time parameters on the NetWare servers in the time provider group.

The NetWare server that is designated as the reference time server should be placed in a central location. NetWare servers designated as primary time servers should be located either at the same central location as the reference time server or used as locational time servers.

If you are configuring for a multiple campus network, you should distribute primary time servers strategically across the WAN infrastructure. This will reduce WAN traffic by providing a time source for secondary time servers and client workstations at each location.

If your WAN infrastructure forces you to have more than seven primary time servers in the time provider group, you should implement additional time provider groups as necessary. However, you should ensure that each reference time server is synchronized to the same external time source. Reference time servers cannot synchronize time with other reference time servers.

All other servers in the network should be designated as secondary time servers.

SAP and Custom Configuration

Time source servers use one of two methods to find each other: SAP and custom configuration.

◆ **SAP (Service Advertising Protocol)**

By default, primary, reference, and single reference servers use SAP to announce their presence on the network.

Primary and reference time servers use SAP information to determine the other servers to poll to determine the network time.

Secondary time servers use SAP information to pick a time server to follow.

SAP generates a small amount of additional network traffic, but allows quick installation with little preparation and automatic reconfiguration when new servers are added to the network.

◆ **Custom Configuration List**

You can list the specific time servers that a particular server should contact.

You can also specify that a server shouldn't listen for SAP information from other time sources and that it shouldn't advertise its presence using SAP.

Custom configuration requires more planning than SAP, but it helps reduce network traffic and gives the administrator complete control of the time synchronization environment.

◆ **Using a Combination of Communication Formats**

You can use both the SAP and custom configuration methods on the same network. However, the custom configuration list that is stored on a server always takes precedence over the SAP information received by the server.

If a server does not have a custom configuration list, SAP information is used for time synchronization.

Suggestion: On a network where servers are rarely added or reconfigured after initial installation and where the network uses a single reference time server, consider using SAP (this is the installation default).

On a network where servers are added or removed frequently, use a custom configuration list.

Interoperability of NTP with TimeSync

Time synchronization in NetWare 5 always uses TimeSync, whether servers are using IP only, IPX only, or IPX and IP protocols. The `timesync.nlm` is automatically installed by the NetWare server installation program, but `ntp.nlm` must be manually loaded whenever the network has an IP stack in use.

When NTP is loaded on an IP server, TimeSync will operate as an NCP request responder only, and NTP will manage and set the clock.

This means that when NTP is loaded on any IP server, NTP will become the main source of time for both the IP and IPX networks. The IPX/TimeSync servers have to become secondary time sources and will point to IP/NTP through the Migration Agent for the primary source of time.

2 *Planning*

The common time source necessary for tracking the proper sequence of events is provided through time synchronization across all NetWare[®] servers. You should plan your time synchronization strategy to ensure that a common time source is maintained efficiently and accurately.

The objective in planning the time synchronization strategy is to determine an efficient time synchronization method to use, and then identify the best way to set up and manage that method across the network.

Use resource maps, location maps, LAN and WAN topology maps, and the NDS[™] tree design document to determine which time servers to use and what communication format to use between the network servers.

Methods for planning a time synchronization strategy include the following:

- ◆ “Identifying an Efficient Time Source and Configuration” on page 18
- ◆ “Determining an Efficient Configuration” on page 20

If you have a single server environment, you do not need to plan for time synchronization.

Multiserver networks that meet the following conditions should accept all time synchronization defaults provided in NetWare:

- ◆ No WAN links exist
- ◆ Fewer than thirty servers exist
- ◆ Single time zone exists

You might also want to review information about using a combination of internal and external time synchronization methods. See “Using a Combination of Time Synchronization Methods” on page 5 for more information.

Multiserver networks that don't meet the default criteria listed above should consider doing the following:

- ◆ If consistent time with UTC is important, consider “Using External Time Synchronization” on page 5.
- ◆ If you maintain slow WAN links, consider using a “Custom Configuration List” on page 15.
- ◆ If you have more than seven primary time servers, and you are “Using a Time Provider Group” on page 12, implement additional time provider groups synchronized to the same external time source.

The standard format used for times and time offsets is [+ | -] HH:MM:SS. In practice, only the significant portion of the time need be specified (+7:0:0 is the same as 7).

In addition, the examples used here show the colon as a time separator. The actual character used as the time separator is determined by the country information for each server. In most instances in NetWare, input and output routines dealing with dates and times are language enabled to use the locally preferred format and characters.

Identifying an Efficient Time Source and Configuration

Identifying the best time source and configuration for your network depends on the following tasks:

- ◆ “Identifying an Efficient Time Source” on page 19
- ◆ “Determining an Efficient Configuration” on page 20
- ◆ “Identifying the Communication Format” on page 20

Identifying an Efficient Time Source

Identifying the time source type for your network is based on the method of synchronization you choose. See “Determining an Efficient Configuration” on page 20 for more information.

Time servers are divided into two types, “Internal and External Time Sources” on page 19, that act as time providers or time consumers. These servers function on primarily the same principles. These principles are:

- ◆ All servers provide time to any time provider, time consumer, or workstation.
- ◆ All servers are responsible for their own synchronization, meaning that they must decide if they’re synchronized to the network’s UTC or not, and report its synchronization status.
- ◆ All servers must adjust their internal clock rates to correct discrepancies and maintain time synchronization with other network servers.

Internal and External Time Sources

Internal Time Sources

“Using Internal Time Synchronization” on page 4 provided in NetWare supports three kinds of time providers.

Time synchronization identifies all time consumers as secondary time servers.

Secondary time servers obtain the time from a single reference, primary, or reference time server. They adjust their internal clocks to synchronize with the network time, and they provide the time to client workstations.

A secondary time server doesn’t participate in determining the correct network time.

External Time Sources

If you are “Using External Time Synchronization” on page 5, then the time provider is identified as an external time source.

Atomic clocks, radio clocks and Internet time sources are most commonly used to synchronize the clocks on workstations and NetWare servers.

Note: A list of third-party time source services is maintained in NOVLIB forum on NetWare. The file is currently named timesg.txt.

Use your planning documentation and documentation provided by the time source to identify setup and maintenance procedures.

Determining an Efficient Configuration

Determining an efficient configuration of time synchronization depends on the physical layout of your network infrastructure. You should reference any planning documents related to the LAN and WAN topology of your network.

There are basically two efficient time server configurations. The two configurations are:

- ◆ “Using a Single Reference Time Server” on page 11
- ◆ “Using a Time Provider Group” on page 12

Select one of the time server configurations to model the time synchronization strategy of your network.

Identifying the Communication Format

Time providers and time consumers need to communicate in order to send and receive time. Time providers need to communicate with other providers in order to vote and negotiate the correct network UTC.

Time source servers use one of two methods to find each other: “SAP (Service Advertising Protocol)” on page 15, or a “Custom Configuration List” on page 15. You might also consider “Using a Combination of Communication Formats” on page 15.

3 *Setting Up*

Time synchronization is part of the NetWare® server installation program. Making sure it is set up correctly is important to having NDS™ function correctly, because time synchronization

- ◆ Monitors and adjusts a NetWare server's internal time to ensure consistency of reported time across the network.
- ◆ Indicates when a server's time is synchronized with the rest of the network.
- ◆ Provides time stamps to establish the order of events in the NDS database.

Important: Setting up time synchronization incorrectly can cause problems within the NDS database.

To enable time synchronization, you need to know the following:

- ◆ What time zone this server is installed in.
- ◆ What type of time server category this server falls into.
- ◆ Whether the server is in a time zone that observes daylight saving time.

Time Synchronization

This procedure is part of the NetWare installation program.

Procedure

1. **Select the time zone for this server.**

| If the time zone | Then |
|------------------|--|
| Is listed | Move the cursor to the appropriate time zone and press <Enter>. Verify that the information presented is correct. If it is, continue with Step 11. If it isn't correct, follow Step 2 through Step 11. |
| Is not listed | Press <Ins> and continue with Step 2. |

2. **At the Time Configuration Parameters screen, verify or specify time synchronization parameters.**
3. **(Conditional) If you want to select different “Time Servers” on page 5, highlight the Time Server Type field and press <Enter>.**

There are four time server types:

- ◆ “Single Reference Time Server” on page 5
- ◆ “Reference Time Server” on page 8
- ◆ “Primary Time Server” on page 6
- ◆ “Secondary Time Server” on page 9

The default sets the first NetWare server in an NDS tree as a single reference time server. All other servers default as secondary time servers.

Important: Do not change the time server defaults without a clear understanding of time server types. Refer to “Time Servers” on page 5 in Understanding for a description of these time server types.

4. **In the Standard Time Zone Abbreviation field, enter the three-letter abbreviation for your standard time zone.**

Not all time zones have agreed-upon abbreviations. Time zone information is subject to local custom and national rules. Find out what the commonly used abbreviation for your standard time zone is, or enter your own abbreviation. The time information you specify is saved in this server's autoexec.ncf. You can change it later by editing this file.

5. **In the Standard Time Offset from UTC field, enter the offset (in hours) from UTC.**

If your time zone is east of UTC, use AHEAD with the number, since your time is ahead of UTC. For example, in Germany, you would type 1 <Enter> to toggle to AHEAD.

If your time zone is west of UTC, toggle to BEHIND, because your time is behind UTC.

- 6. In the Does Your Area Have Daylight Saving Time (DST) field, press <Enter> and use the arrow keys to toggle between Yes and No.**

Table 3-1
Daylight Saving Time Options

| If | Then choose | And then |
|--|-------------|-----------------------|
| Your time zone switches to daylight saving time (and back to standard time) during each year | Yes | Continue with Step 7. |
| Your time zone never switches to daylight saving time | No | Go to Step 11. |

- 7. In the DST Time Zone Abbreviation field, enter the three-letter abbreviation your time zone uses during daylight saving time.**

Important: If you do not specify the abbreviation for daylight saving time, the server won't automatically adjust for the seasonal change. Internal algorithms assume that if no DST abbreviation is specified, local custom is to not observe DST.

Not all time zones have agreed-upon abbreviations. Time zone information is subject to local custom and national rules. Find out what the commonly used abbreviation for your daylight saving time zone is, or enter your own abbreviation.

- 8. In the DST Offset from Standard Time field, enter the difference between standard time and daylight saving time.**

Enter the offset in hours:minutes:seconds. The default is 1:00:00 (one hour) *ahead*, meaning that your daylight saving time is one hour ahead of your standard time.

If daylight saving time in your area varies from your standard time by more or less than the default (one hour), enter a different time offset.

9. In the **DST Start** field, enter the starting day for daylight saving time.

Follow the screen prompts to decide which format to use.

10. In the **DST End** field, enter the day daylight saving time ends.

Follow the screen prompts to decide which format to use.

11. Save the time configuration information by pressing <F10> and then <Enter>.

Configuring NTP

NTP is configured with `ntp.cfg`, located in the `SYS:Etc` directory. When NTP is installed, a default `ntp.cfg` is created. This file should be edited to define the user's time synchronization subnetwork. The default `ntp.cfg` file specifies the local clock (127.127.1.0) as the time source.

The two commands listed below specify the mode in which to operate and the time server hostname or address to be used:

- ◆ Peer Address
- ◆ Server Address

Address

The address can be either a DNS name or an IP address in dotted-quad notation, such as 127.127.1.0. Please see the "Sample Ntp.cfg File" on page 25 for DNS or IP address notation.

Peer

The `peer` command specifies that the local server is to operate in symmetric active mode with the remote server. In this mode, the local server can be synchronized to the remote server, and in addition, the remote server can be synchronized by the local server. This is useful in a network of servers where, depending on various reliability scenarios, either the local or a remote server might be a better source of time.

Server

The server command specifies that the local server will operate in client mode with the specified remote server. In this mode, the local server can be synchronized to the remote server, but the remote server can never be synchronized to the local server. On a local network without Internet access, the server can use its own clock as the reference clock by using IP address 127.127.1.0 with the server option. The local reference clock is useful if you want to use NTP in an isolated environment where there are no other time sources available. When there are no synchronization sources, the local reference clock can use the local hardware clock as a last resort.

Loading NTP.nlm

Let's consider using the default Ntp.cfg file in this example. You will load NTP.nlm at the server console prompt and the following message will display:

"NTP is synchronizing local clock to remote time source 198.93.3.1"

"NTP is synchronizing local clock to remote time source 129.6.16.63"

"NTP is synchronizing local clock to remote time source 129.7.1.66"

Time synchronization has been established with remote time source 129.7.1.66

Date and Time is Thursday, June 04, 1998 02:00:30 PM MDT

If you modify the NTP.cfg file and specify more than one time source, the time servers will be loaded in reverse order, much like a DNS file entry.

Sample Ntp.cfg File

Below is a sample ntp.cfg file. The local clock timer is uncommented and will be used if other uncommented time sources are unavailable. To use any of the other time providers listed, remove the comment from the time server of your choice. Time servers can also be added to the configuration file. Use either the hostname or IP address to denote the server.

```
#The syntax is SERVER IPADDRESS or server HOSTNAME

#server bitsy.mit.edu

#or

#server 18.72.0.3

#This is the local clock timer.

#Only turn it on for the primary time source or in an isolated network.

#The primary time source is the server which acts as a time source
#for all internal servers (or the server that has the connection to the
#Internet or remote time source).

#Local clock timer will kick in when all outside sources become
unavailable.

#server 127.127.1.0

#Uncomment line below to point to time server at
#Lawrence Livermore National Laboratory
#serverclock.llnl.gov

#Uncomment line below to point to time server at
#NASA Ames Research Center
#server ntp.nasa.com

#Uncomment line below to point to time server at
#U.S. Naval Observatory
#server ntp2.usno.navy.mil

#MIT
server 129.7.1.66
```


#NIST Central Computer Facility

server 129.6.16.36

#Sony

server 198.93.3.1

4 *Managing*

Once the NetWare® server is installed and time synchronization established, the network might need further time synchronization management, including:

- ◆ “Determining Time Synchronization Status” on page 29
- ◆ “Ensuring that the Server’s DOS Clock Is Accurate” on page 31
- ◆ “Setting Time in NetWare” on page 31
- ◆ “Maintaining Network Time Synchronization” on page 33

Determining Time Synchronization Status

Prerequisites

- Access to the server console or an established RCONSOLE session with the server
- All servers in a tree using the same time source

Procedure

1. **At the server console prompt, load the module:**

```
LOAD DSREPAIR <Enter>
```

If you have placed DSREPAIR in a directory other than sys:system, you must enter the full path to the utility.

Once DSREPAIR is loaded, the NDS™ database is locked so that information can’t be accessed or updated until the operation is completed.

2. Select Time Synchronization.

The Collecting Time Synchronization and Server Status screen appears. A window is available to observe the operations in process.

Following the operation, the DSREPAIR log is displayed within a full text editor. You can annotate or modify the DSREPAIR log if you want to.

| Field | Indicates |
|-----------------|---|
| Server Name | All of the server names known to the local copy of the NDS database files. If this server contains a replica of the [Root] partition, then this list contains all the servers in the tree. |
| DS.NLM Version | The version of ds.nlm running on the server. |
| Replica Depth | The replica depth field reports "-1" if no replicas are stored on the server or "0" if the server contains a replica of the [Root] partition. A positive integer indicates how many objects deep from the [Root] the first replica is on that server. |
| Time Source | <p>The time server type. This information helps you determine if time synchronization for all the trees in the server is configured properly.</p> <p>All servers in a tree must be using the same time source.</p> <p>For example, if there are two single time servers, then you know that all servers in the tree cannot be polling the same time source and that there is a configuration problem.</p> |
| Time is in Sync | The local time synchronization status on each server. This status should be Yes. If the status is No, then the server is not able to contact its time source. |

| Field | Indicates |
|----------|---|
| Time +/- | <p>The difference in time between the local server and the selected server in the list. All servers should be within one second of each other; if they are not, they have not been configured properly.</p> <p>This field reports up to 999 minutes and 59 seconds (which is approximately 16 hours and 30 minutes) in the form <i>minutes:seconds</i>. If the time difference is greater than 16 hours and 30 minutes, then the maximum value is displayed as: -999:59.</p> <p>If the difference in time is more than a few minutes, it might indicate that the servers are using different time source servers.</p> |

Use the DSREPAIR Time Synchronization option before or after performing a repair. This option allows you to contact all servers within this server's local database to request information about NDS and time synchronization. If a replica of the [Root] partition is contained on this server, then all servers in the NDS tree are contacted.

Ensuring that the Server's DOS Clock Is Accurate

To ensure that the correct date and time is used when running patches that update server.exe, make sure that the DOS clock is set correctly.

If the time and date are incorrect, version control problems might arise.

Bring down the server and set the correct date and time in DOS. Booting the server sets the DOS clock to match the CMOS clock on the server.

Setting Time in NetWare

Time synchronization errors occur when

- ◆ A server has received an error while communicating with another time server.
- ◆ The TimeSync configuration file tells TimeSync to communicate with a nonexistent server.

- ◆ The clock time on a server is out of synchronization with the network time. In this case, TimeSync will eventually synchronize the times.

To verify whether these conditions exist use the following procedure.

1. **Type TIME at the console, and check the response to see if the time is correct.**

You should receive the following message:

```
TIME IS SYNCHRONIZED TO THE NETWORK
```

If you receive the following message, continue with this procedure:

```
TIME IS NOT SYNCHRONIZED
```

If the time is only minutes out of synchronization, TimeSync will soon synchronize the time. However, if the time difference is hours or days, go to Step 2.

2. **If the time difference between servers is too great for automatic synchronization, bring down the server using the DOWN command and exit to DOS.**
3. **Use the DOS TIME command to correct the DOS clock.**
Warning: Do not correct the server's time at the server console or while NetWare is running.
4. **Turn off the power to the server and then turn it on again. Make sure that the hardware clock is maintaining the correct time.**
5. **Restart the NetWare operating system.**
6. **At the server console, type**

```
SET TimeSync DEBUG = 7
```

TimeSync then displays its messages on the server console. If the server is a secondary time server, the messages will show it contacting a primary server and calculating the time offset.

If the server is a primary or a reference time server, the message shows the name of the server it is contacting, along with a polling weight.

The polling weight should be 1 for other contacted primary servers and 16 for reference servers. A polling weight of 0 indicates a communication failure.

Check to see that the other contacted server is communicating. If it is, make sure that the routers are not restricting the timesync.sap.

If the server is a primary or reference time server, it must vote successfully with at least one other primary time server.

If no vote is observed, the server is probably a single reference time server.

Use the TimeSync TYPE command at the server console to determine which type of time server it is.

Other causes of time synchronization errors are:

- ◆ The time zone is not set correctly.
- ◆ The daylight saving time parameter is not set.
- ◆ The previous version of autoexec.ncf file has accidentally overwritten the NetWare autoexec.ncf file during upgrade.

Maintaining Network Time Synchronization

NetWare uses TimeSync, which automatically loads when the server is booted, to control time synchronization. The timesync.cfg file in sys:system can contain parameters for the TimeSync NLM, if the default settings are inadequate.

To change the time synchronization configuration on a NetWare server, use the EDIT server utility to modify the parameters in the timesync.cfg file, and then reboot the server.

Important: Do not put SET time synchronization parameters in startup.ncf, because timesync.cfg is read *after* startup.ncf.

Use the Table 4-1 on page 34 to customize your network's time synchronization in `timesync.cfg`.

SET Parameters for TimeSync

Table 4-1 on page 34 shows the SET parameters used to configure time synchronization. The defaults are appropriate for most small networks. For large networks, see “Configuring Time Synchronization for Large Networks” on page 40.

Table 4-1
Time Synchronization SET Parameters

| SET parameter and default | Recommended usage |
|---|--|
| TimeSync Configuration File Default: <code>sys:system</code> | Use this parameter to specify the file path if the <code>timesync.cfg</code> file is <i>not</i> located in <code>sys:system</code> . |
| TimeSync Configured Sources Default: OFF | Set this parameter to ON if you are using a custom-configured list of time sources. |
| TimeSync NDS Tree Mode Default: ON | Set this parameter to OFF to allow SAP packets from other NDS trees to influence time synchronization on this server's NDS tree. |
| TimeSync Hardware Clock Default: ON | Set this parameter to OFF <i>only</i> if this server uses an external time source (such as a radio clock). All servers in the same tree should have the same setting for this parameter. |
| TimeSync Polling Count Default: 3 (time packets) | Do not increase this setting. Doing so adds unnecessary traffic to the network. |
| TimeSync Polling Interval Default: 600 (seconds) | Decrease this setting if you need to poll time servers more often than every 10 minutes. All servers in the same tree should have the same setting for this parameter. |
| TimeSync RESET Default: OFF | Instead of using this parameter, use EDIT to reset values in the <code>timesync.cfg</code> file and to remove the list of time sources. |
| TimeSync Restart Flag Default: OFF | Set this parameter to ON <i>only</i> if you want to reload the TimeSync NLM (because you edited <code>timesync.cfg</code>) without rebooting the server. |

Table 4-1

Time Synchronization SET Parameters

| SET parameter and default | Recommended usage |
|---|--|
| TimeSync Service Advertising Default: ON | Set this parameter to OFF if you are using a custom-configured list of time sources. |
| TimeSync Synchronization Radius Default: 2000 (milliseconds) | Increase this parameter to allow a wider margin of error for time synchronization between servers. If you decrease the radius too much (below 1,000), some time servers may never achieve synchronization. |
| TimeSync Time Adjustment Default: None | Use this parameter sparingly to correct network-wide time errors, or you may corrupt time synchronization and the order of events on your network. |
| TimeSync Time Sources Default: None | Instead of using this parameter, use EDIT to add a time server to the time source list in the timesync.cfg file or display the time source list. |
| TimeSync Type Default: SINGLE | Instead of using this parameter, use EDIT to change the default time server type in the timesync.cfg file. |

Editing the Timesync.cfg File

Time synchronization parameters are stored in their own configuration file, by default the timesync.cfg file in the sys:system directory.

To change the time synchronization configuration on a NetWare server, modify the parameters in the timesync.cfg file, and then reboot the server or use SET to turn ON the TimeSync Restart Flag parameter.

Note: You can use SET or MONITOR to change the TimeSync parameters; however, unless you also edit the timesync.cfg file, changes made in SET or MONITOR will be lost the next time the server starts.

Prerequisites

- ❑ Access to the server console, or an established RCONSOLE session.

Procedure

1. **At the server console prompt, type**

```
LOAD EDIT <Enter>
```

You are prompted to enter the file to edit.

2. **At the prompt, enter**

```
sys:system\timesync.cfg
```

The current timesync.cfg file appears.

3. **Use the arrow keys to move the cursor to the line you need to edit.**

4. **Modify the settings for the TimeSync parameters you want to change.**

5. **To save your changes, press <Esc>.**

A confirmation prompt appears.

6. **To save the timesync.cfg file, select Yes.**

7. **To exit EDIT, press <Esc>.**

Hint: If you have several parameters in your timesync.cfg file, you may want to copy the file from server to server. Be sure that each copied timesync.cfg file contains the correct default time server type and configured-sources list for the server it configures.

Creating a Custom Time Source Configuration

Time servers use one of two methods to find each other on the internetwork: SAP (Service Advertising Protocol) and custom time source configuration.

SAP Method

By default, primary, reference, and single reference time servers use SAP to announce their presence on the network. Secondary time servers

do not advertise, but they do receive SAP information to find the nearest time source.

The SAP method allows for quick installation without regard to the network layout. It also allows automatic reconfiguration if new servers are added to the network.

Custom Time Source Method

The custom time source method lists specific, authorized time servers that each server contacts to determine network time. In a custom time configuration, servers do not listen for SAP information from other time servers, and they do not advertise with SAP.

A configured-sources list resides in the `timesync.cfg` file of each time server on the network. The order of the server names in the list is the polling order the server follows to get the correct time.

The custom configuration method requires careful planning before NetWare installation, but it gives the network administrator complete control of the time synchronization environment.

In most circumstances, you can use the default SAP method and do not need to create a custom time source configuration. However, you might need a custom configuration if

- ◆ You have more than one reference or more than one primary time server on your network.
- ◆ You frequently add temporary (or test) servers to or remove them from your network.
- ◆ You need to prevent unauthorized time sources from determining network time.

Use this procedure to create a custom time source configuration. These steps must be repeated for each time server on your network.

Prerequisites

- A prioritized list of time sources.

Procedure

1. **At the server console prompt, enter**

```
LOAD EDIT
```

You are prompted to enter the file to edit.

2. **At the prompt, enter**

```
sys:system\timesync.cfg
```

The current timesync.cfg file appears.

3. **Add the following parameters to the timesync.cfg file:**

```
Type = x
```

```
Service Advertising = OFF
```

```
Configured Sources = ON
```

Replace *x* with this server's time server type (reference, single reference, primary, or secondary).

4. **Add the list of time sources for this server as follows:**

```
Time Sources = x;y;z
```

Replace *x* with the name of the first time server this server should contact (probably a reference server or the nearest primary time server). Replace *y* and *z* with the names of the other time servers this server should contact, in order of importance.

The server can be called by its NDS name or by its IP address. An NDS server name might look like the following with a trailing semicolon:

```
Time Sources = serverNDS.name;
```

And a server's IP address would be in the standard IP address notation with a trailing semicolon:

```
Time Sources = 000.000.000.000;
```

A trailing semicolon is always required to indicate the end of the server list. Even when there are no servers in the list, a semicolon is required or an error will result. For example:

```
Time Sources = ;
```

Note: The order of the time servers in the time source list determines their priority when advertising network time.

5. **To save your changes, press <Esc>.**

A confirmation prompt appears.

6. **To save the timesync.cfg file, select Yes.**

7. **To exit EDIT, press <Esc>.**

Hint: If you have several parameters in your timesync.cfg file, you might want to copy the file from server to server. Be sure that each copied timesync.cfg file contains the correct default time server type and time source list for the server it configures.

| For more information about | See |
|----------------------------|---|
| SAP | "SAP (Service Advertising Protocol)" on page 15 |
| Time server types | "Time Servers" on page 5 |
| Time synchronization | "Why Time Synchronization Is Necessary" on page 2 |

Adjusting a Fast or Slow Reference Time Server

If your reference time server is inaccurate by several minutes, all other time servers in your network will also be inaccurate.

To correct the time on the reference time server (and therefore, network-wide), type the following SET command at the reference server's console:

```
SET TimeSync Time Adjustment=[+|-] hour:minute:second  
at month/day/year hour:minute:second [AM|PM] <Enter>
```

For example, if your reference server is 10 minutes fast and you want to adjust the time at 2:00 a.m. on September 1, 1998, you would enter

```
SET TimeSync Time Adjustment=-00:10:00 at 9/1/98  
2:00:00 AM
```

Important: Adjusting network time affects the order of Novell® NDS events. It is best to schedule time adjustments during low-usage periods, such as late evening or early morning.

To cancel a time adjustment, enter the following SET command at the reference server's console:

```
SET TimeSync Time Adjustment = cancel
```

Important: The cancel command must be issued *before* the scheduled time adjustment and at the *same* server where the original time adjustment was set, or it will not cancel the time adjustment.

Configuring Time Synchronization for Large Networks

Some of the default settings for TimeSync are not suitable for large networks. This section explains time synchronization for large installations.

- ◆ “Time Providers and Time Consumers” on page 40
- ◆ “Time Synchronization and the NDS Tree” on page 42
- ◆ “Configuring Multiple Time Servers” on page 43
- ◆ “Avoiding Parameter Inconsistencies” on page 43

Time Providers and Time Consumers

Time synchronization servers are either *time providers* or *time consumers*. Secondary servers are time consumers. Single reference, reference, and primary servers are time providers.

Reference and primary servers must be able to exchange information with another time provider in order to synchronize. A reference or primary time server cannot claim to be synchronized if it is the only

time provider on the network, because it requires at least one other time provider to synchronize with.

The single reference server is, as its name implies, a special type of reference time server that does not need another time provider in order to synchronize.

Secondary time servers (time consumers) require at least one time provider.

Time Synchronization and the NDS Tree

Although time synchronization and NDS are independent features of NetWare, time synchronization can be configured to follow the NDS tree structure.

The default NetWare installation makes the [Root] server in an NDS tree a Single Reference time server. All other servers in the tree are, by default, secondary time servers.

The default time synchronization parameter, “SET TimeSync NDS Tree Mode = ON,” recognizes the NDS tree structure and synchronizes time only within that tree.

In a large installation with more than one NDS tree, the network administrator can change the defaults to configure time synchronization across NDS trees.

The default does not require custom time synchronization parameters during installation. However, the default relies on a single reference time server, thus permitting only a single point of failure and increasing network traffic at that server.

In addition, the default installation relies on Service Advertising Protocol (SAP) packets to identify the time providers.

On a large network, relying on SAP is not only inefficient, but can also lead to errors, especially if it is common for test servers (which can be misconfigured) to come and go on the network.

The custom time source method described under “Custom Time Source Method” on page 37 is recommended for large networks because it does not rely on SAP.

The time synchronization algorithm always attempts to contact explicitly named time sources before listening to SAP. This makes it

possible to synchronize across NDS trees, because the NDS Tree Mode applies only to SAP packets.

Network administrators with custom-configured time sources might choose to eliminate the use of SAP entirely.

Configuring Multiple Time Servers

One easy way to configure several time servers is to create a custom .ncf file containing the SET parameters required to configure time sources.

Most servers will have identical TimeSync configuration parameters, with the exception of the time source list, where the first entry in the list likely varies from server to server.

To change the first server in the time source list, edit the timesync.cfg file or issue the SET TimeSync Time Sources parameter from the server console before saving the configuration parameters.

Avoiding Parameter Inconsistencies

Several of the SET TimeSync parameters interact with each other. Because these parameters are set on each server, it is important to configure the entire network consistently.

Understanding the relationship of the parameters described here can help avoid time synchronization conflicts on large networks.

```
SET TimeSync Service Advertising = ON/OFF
```

When ON, time providers advertise using SAP. This parameter has no effect on time consumers (secondary time servers). When OFF, time providers do not advertise.

We recommend all servers be configured the same (ON or OFF) in order for this parameter to be effective.

```
SET TimeSync Configured Sources = ON/OFF
```

When ON, time servers do not listen to SAP information. They listen only to the time providers in the configured sources list (initially read

from the timesync.cfg file). When OFF, time servers listen for SAP information.

SET TimeSync NDS Tree Mode = ON/OFF

When ON, time providers do not advertise under the name of the host server. Instead, they advertise under the name of their NDS tree. When ON, servers listening for SAP packets will reject packets that are not from within their own tree. When OFF, time providers advertise under their host server name, and listening servers will accept packets from any time provider.

This parameter also interacts with the SET TimeSync Service Advertising and the SET TimeSync Configured Sources parameters. NDS Tree Mode has no effect if Service Advertising is OFF and Configured Sources is ON.

SET TimeSync Time Sources

This parameter identifies a time provider by server name. When configured sources are listed in a server's timesync.cfg file, their time information is always used before any SAP information is considered.

SET Default Time Server Type

This parameter provides a method to override the default TimeSync type, which is secondary, without using a timesync.cfg file.

However, when present, the SET TimeSync Type parameter always overrides the SET Default Time Server Type parameter.

If you use INSTALL to change the default type, it will have no effect if you have already created a timesync.cfg file with the overriding TimeSync Type parameter in it.

Example of Synchronizing Two NDS Trees

Suppose you have two NDS trees on your network and you want all the servers in both trees to synchronize to the same time.

You used the default installation, so the [Root] servers of each tree (ROOT1 and ROOT2) are single reference servers, NDS Tree Mode is ON, and Service Advertising is ON.

Each tree is synchronized within itself, but time between the trees differs by a few minutes. To synchronize both trees, create a custom .ncf file containing the following commands and execute it on the respective servers:

Server ROOT1:

```
SET TimeSync Type = REFERENCE
SET TimeSync Time Sources = ROOT2;
```

Server ROOT2:

```
SET TimeSync Type = PRIMARY
SET TimeSync Time Source = ROOT1
```

The root servers of both trees will synchronize, which in turn will synchronize all of the other servers in both trees.

Since the root servers are now both time providers, it is necessary to change the TimeSync Type from single to reference on Server ROOT1 and from single to primary on Server ROOT2.

Server ROOT1 is a reference time server so that there will be a central point for controlling time on the network.

The timesync.cfg is automatically rewritten so the changes will be in place if the servers are restarted.

Hint: When you synchronize two NDS trees, you basically double the size of the time synchronization network. You should examine the physical layout of the network and add other primary time servers, or consider hand-configuring the time sources and eliminating the use of SAP.

| For more information about | See |
|----------------------------|---|
| SAP | "SAP (Service Advertising Protocol)" on page 15 |
| Time server types | "Time Servers" on page 5 |
| Time synchronization | "Why Time Synchronization Is Necessary" on page 2 |

chapter **5** *Troubleshooting*

Time Zone Problem

Users are logged out at incorrect times and/or time restrictions are shown incorrectly and/or LASTLOGIN displays an incorrect time.

Cause

The time zone is not set correctly.

Solution

Use one of the following methods to set the time zone.

- ◆ SET TZ = time zone in autoexec.bat
- ◆ DOS SET TZ = time zone in login script

Synthetic Time Problem

NetWare® server reports “Synthetic time is being issued on partition.”

Cause

In NetWare 4™ and later versions, synthetic time is issued at a server with the error “DS- 4.63-12” if the server time is set backwards. The synthetic time will be cycled every 2 minutes until the server time is later than the last modified timestamp.

Solution

1. **Run DSREPAIR.**
2. **Select Advanced Options > Replica and Partition Operations > the partition you want to update.**
3. **Select Repair Time Stamps and declare a new epoch.**

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