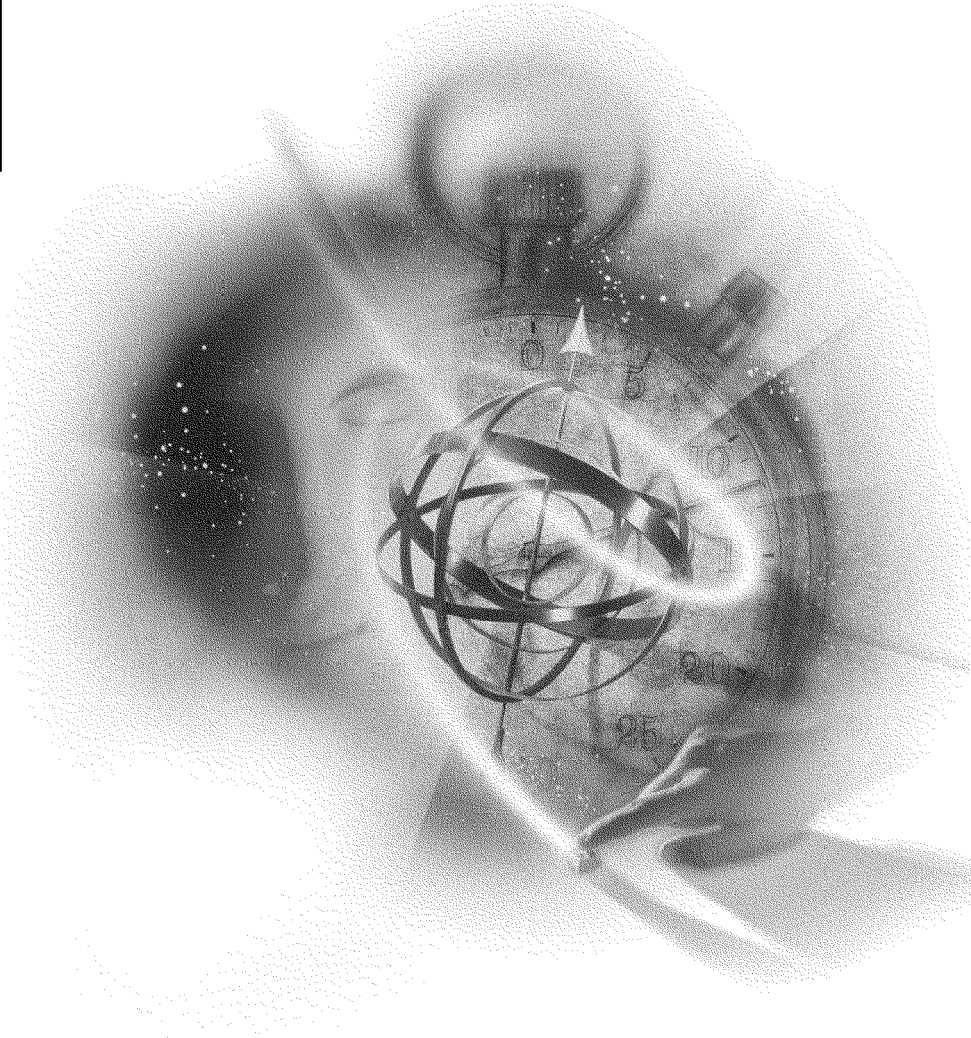


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**Network Time Management Guide**



**NetWare<sup>®</sup> 5.1**  
NETWORKING SOFTWARE

**Novell<sup>®</sup>**

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# Overview of Network Time Synchronization

Synchronizing time across the NetWare® network lets you maintain 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®

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.





# 1

## Understanding

In NetWare<sup>®</sup> time synchronization ensures that all servers in an NDS<sup>®</sup> 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. “Interoperability of NTP with TimeSync” on page 22 in mixed protocol networks allows the use of an external Internet time source for time synchronization. NTP is configured manually using a configuration file called NTP.CFG. For information about configuring NTP, see “Configuring NTP” on page 31.

There are two ways to configure TimeSync on the network: “SAP and Custom Configuration” on page 20.

On a small network “SAP (Service Advertising Protocol)” on page 20 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 20 can reduce network traffic, but requires more initial planning and administrative time.

Domain Name System (DNS) has been added to Timesync version 5.14 so users can enter a DNS name rather than an IP address. See “DNS Name Recognition in TimeSync” on page 21 for information.

Timesync can also autodiscover time sources over IP. See “AutoDiscovery Over IP in TimeSync” on page 21 for information.

For more configuration recommendations, see “Time Synchronization Methods” on page 11. For detailed information about TimeSync, see “How TimeSync Works” on page 10.

# 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 (as a time stamp) the time of each event relative to a common time source. 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, referred to as *time synchronization*.

Accurate time may be necessary for other reasons in a networked environment, including database synchronization, tape backup, compression, and archiving routines.

## 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 the 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 12, the “Single Reference Time Server” on page 12, the “Reference Time Server” on page 16, the “Primary Time Server” on page 14 and the “Secondary Time Server” on page 17.

## 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 UTC.

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

- ♦ “Using Internal Time Synchronization” on page 12
- ♦ “Using External Time Synchronization” on page 12

## 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.

## 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.

## Time Servers

When you install NetWare, by default you are using a single reference time server, the single source of time on the network. In a more complex network you may want to consider “Time Provider Groups” on page 17 to include primary, reference, and secondary time servers.

Each designation performs a particular time synchronization function:

### ♦ **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.

This server determines the time for the entire network and is the only source of time on the network. All other servers must be able to contact this server. The network administrator sets the time on the single reference time server.

This server configuration is adequate for networks with the following conditions:

- Fewer than 30 NetWare servers
- No WAN links
- Single time zone

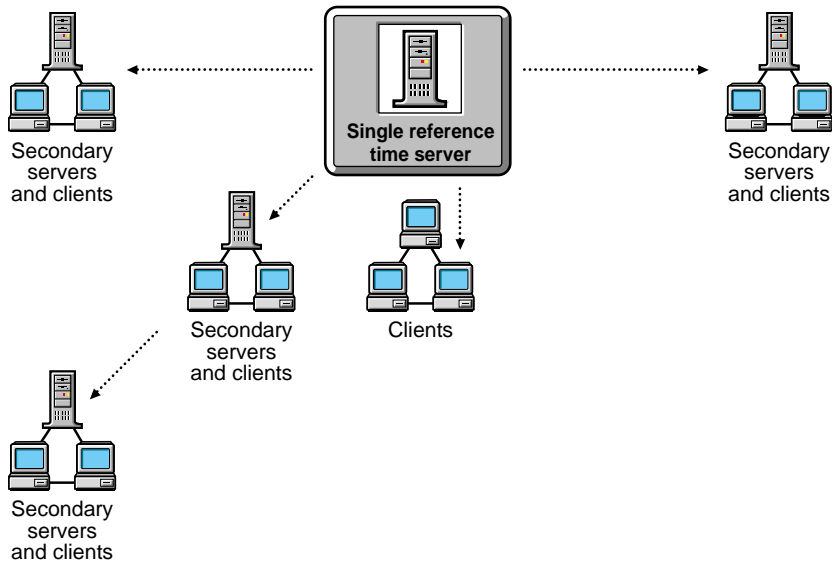
Ensure that the single reference time server is centrally located and is equipped with an accurate internal clock. This server should be monitored on a daily basis to ensure proper time of day and time synchronization.

One limitation of this 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. If the connection is lost, you can designate one of the secondary time servers as a temporary single reference 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; time references might conflict.

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 Single Reference Time Server



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

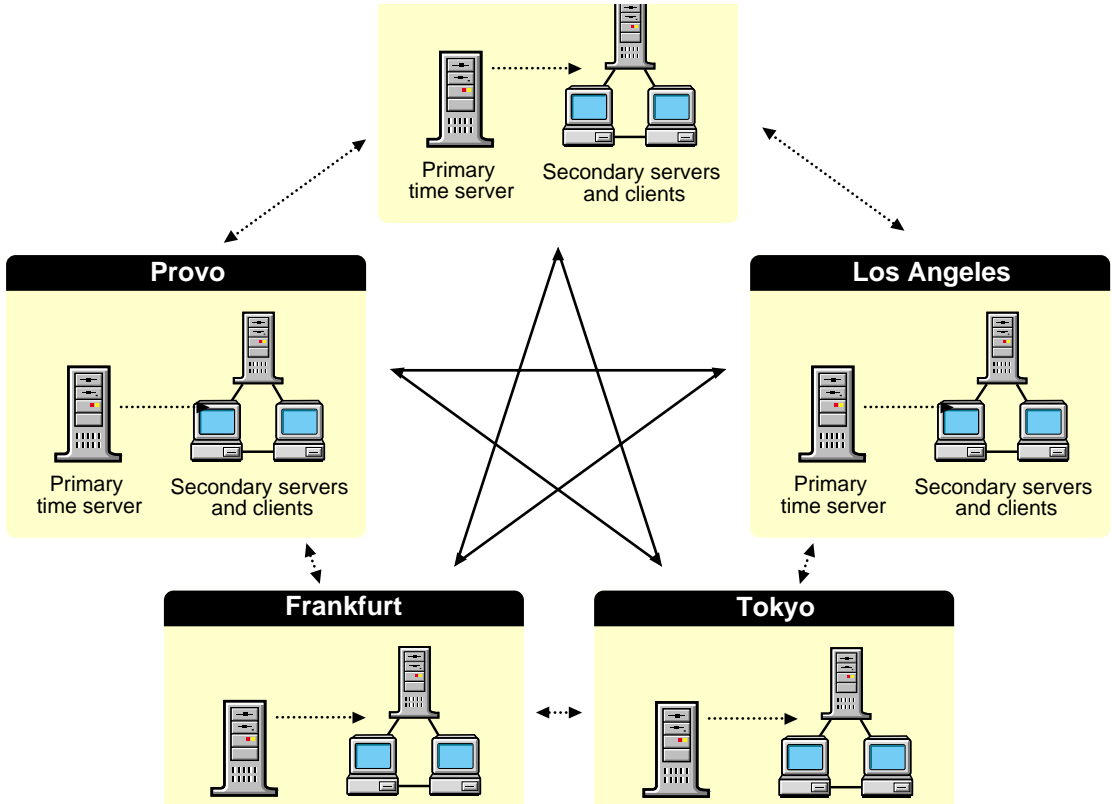
#### ◆ Primary Time Server

A 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 compare times 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 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.

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

Primary time servers adjust their internal clocks to synchronize with common network time so network time can drift slightly.

### ◆ Reference Time Server

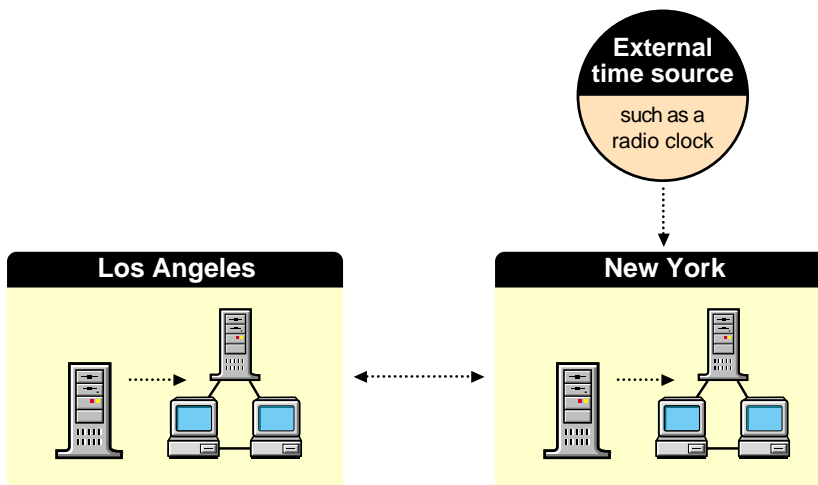
A reference time server provides the time to which all other time servers and workstations synchronize, including synchronization with an external time source.

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

These servers don't adjust their internal clocks; instead, the primary servers' internal clocks are adjusted to synchronize with the reference time server. 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 3 Reference Time Server



Use a reference time server when you need 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.



**IMPORTANT:** 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 the 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 designate a server on the network as a single reference time server, designate all other servers on the network as secondary time servers.

If you designate several servers on the network as primary or reference time servers, 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.

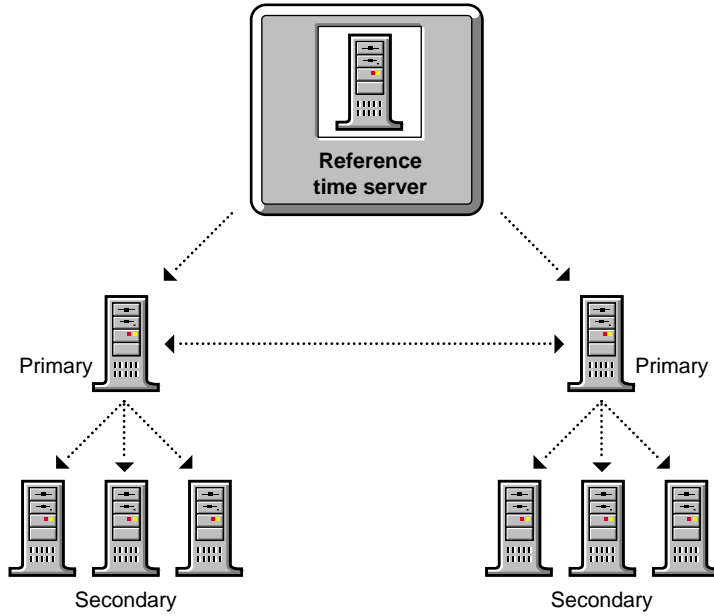
For optimal time synchronization, minimize the number of intervening routers and slow LAN segments between secondary time servers and their single reference, primary, or reference time server.

#### ◆ **Time Provider Groups**

Using a time provider group requires that at least one server be designated as a reference time server and two servers be 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.

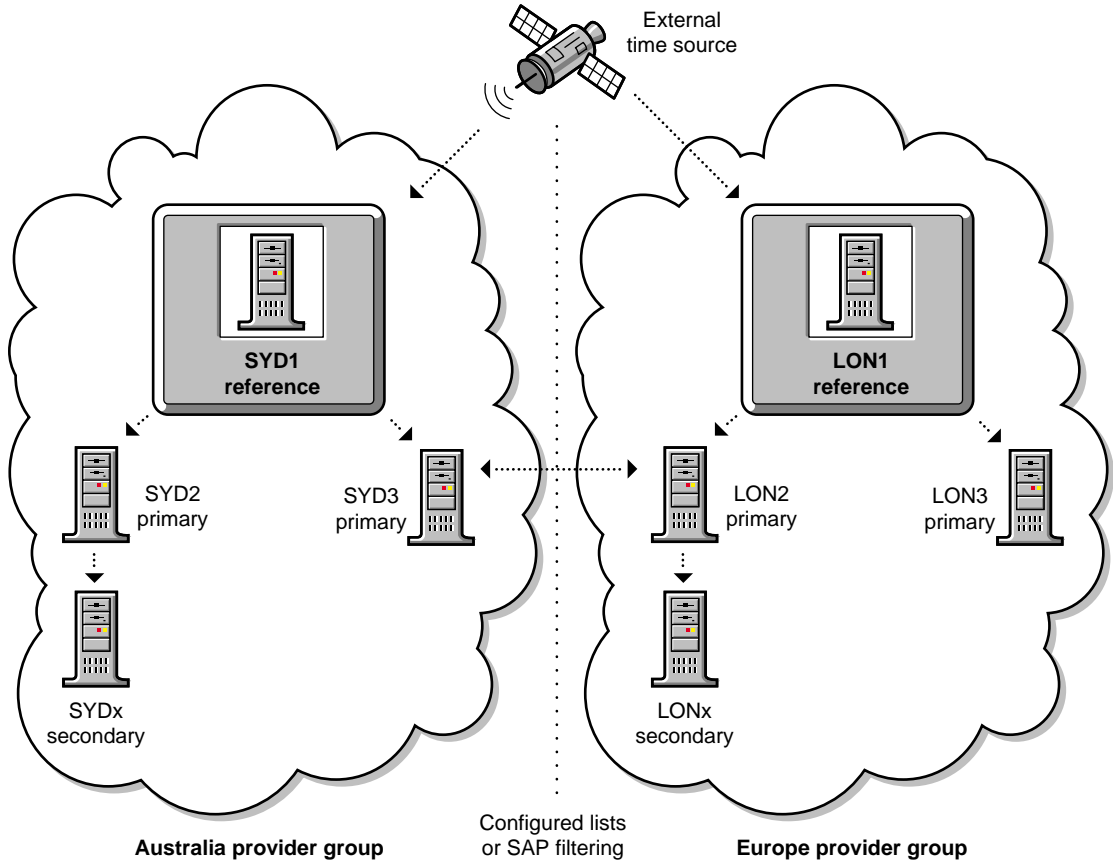
The following figure illustrates a single reference time server providing time to primary time servers. Primary servers provide time to secondary time servers. Each of these servers can provide time to their own client workstations.

Figure 4 Time Provider Group with a Single Reference Time Server



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

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

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 advertise 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 select 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**

The Custom Configuration list lets you list the specific time servers that a server should contact.

You can also specify that a server shouldn't acknowledge 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.

**HINT:** 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 (the installation default).

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

## DNS Name Recognition in TimeSync

In NetWare 5.1, rather than entering an IP address, you can enter a DNS name to contact your NetWare server for time. The full DNS name must be entered, including the domain name; for example,

```
Timesync Time Sources=MYSERVER.PROVO.NOVELL.COM.
```

If time is being taken from an NTP server, the DNS name must be followed by the port number 123. For example,

```
Timesync Time  
Sources=NTPSERVER.PROVO.NOVELL.COM:123
```

TimeSync internally resolves the name by performing a DNS lookup using the Winsock APIs exported by the winsock modules.

## AutoDiscovery Over IP in TimeSync

In NetWare 5.1, you can use autodiscovery of time sources with IP. TimeSync uses SLP in IP autodiscovery and works much the same as the autodiscovery feature in IPX, which uses SAP.

The SET parameters used with this feature are TIMESYNC SERVICE ADVERTISING and DIRECTORY TREE MODE. Set both of these ON to enable this feature.

- ◆ **TIMESYNC SERVICE ADVERTISING** enables TimeSync to advertise the timesync.novell service in SLP. It also enables advertising over SAP if IPX is enabled on the server.
- ◆ **DIRECTORY TREE MODE** confines autodiscovery to servers in the same tree.

See SET for more information.

## 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 module is automatically installed by NetWare, but NTP.NLM must be manually loaded whenever the network has an IP stack in use.

Network Time Protocol (NTP) provides a means for networked computers to serve and maintain accurate time on the Internet. An NTP client is a computer which obtains its time from a time source. An NTP server is the computer that provides an accurate source of time.

When NTP is loaded on an IP server, TimeSync operates as an NCP request responder only, and NTP manages and sets the clock. When NTP is loaded on any IP server, NTP becomes the main source of time for both the IP and IPX networks. The IPX/TimeSync servers must become secondary time sources and will point to IP/NTP through the Migration Agent (MA) for the primary source of time.

For more information, see *Using NTP with NetWare 5* (<http://developer.novell.com/research/appnotes/1999/july/a3frame.htm>) or “Configuring NTP” on page 31.

## NTP and NetWare TIMESYNC

TIMESYNC.NLM is an adaptation of NTP and uses algorithms similar to NTP for network delay when obtaining time from a time source. However, NTP is heavily weighted, so some NTP features for TimeSync were omitted for NetWare, such as:

- ◆ **Leap second insertion.** At regular intervals, clocks need to be compensated by inserting a leap second to the clock time.
- ◆ **Drift compensation.** NTP keeps track of the pattern of changes to the clock, and over a period of time, it computes a drift compensation factor that is applied to the clock.

- ◆ Clock filtering and clock selection of algorithms. NTP uses complex algorithms to assess the reliability of each time source in its list of time sources and selects only those which are considered to be reliable.
- ◆ Authentication. NTP uses authentication to ensure the integrity of the time source. TIMESYNC.NLM trusts all time sources.
- ◆ NTP is strict when considering time sources. If a time source is more than 1000 seconds (about 17 minutes) away from the local clock, NTP rejects the time source as unreliable. The time source is labeled as unreliable and is not used in NTP exchanges.

NTP never corrects time directly. The time polled is given as feedback to the clock, and the clock corrects its time. In TimeSync, the time is gradually applied to the local clock. The TIMESYNC.NLM module attempts to correct time within one polling interval, so TimeSync is able to synchronize time in a network much more quickly.

## Using NTP with NetWare 5

With this version of NetWare 5, we suggest that you use TIMESYNC.NLM rather than NTP.NLM, as TIMESYNC.NLM is much more robust.

TIMESYNC.NLM 5.08, a recent enhancement, provides both NTP client and server capability. TIMESYNC.NLM 5.09 included in this NetWare release provides the following:

- ◆ A comprehensive collection of set parameters
- ◆ Easy configuration
- ◆ Operation over IPX or TCP/IP protocols
- ◆ Automatic discovery of time sources using IPX
- ◆ Interoperability with NetWare 4 and NetWare 5
- ◆ NTP client capability
- ◆ NTP server capability

TIMESYNC.NLM in NetWare 5 has been enhanced to run with TCP/IP or IPX. If you have a network comprising both IP and IPX servers, time can flow from IPX to IP and vice versa.

No Compatibility Mode Driver (CMD) is required for IP. However, if an IP network needs to obtain time from an IPX server by giving a server name in the time sources set parameter, CMD is required to resolve the IPX address.

**IMPORTANT:** At least one server in the network must be configured for both IP and IPX to provide translation between the two sides. The Migration Gateway is not needed.

In TCP/IP networks, the Service Location Protocol (SLP) is used to advertise and locate services. SLP uses less bandwidth than SAP but requires more administration. TimeSync has not yet been enhanced to perform automatic discovery of time servers over IP using SLP.



# 2

## Planning

Plan your time synchronization strategy carefully to ensure that a common time source is maintained efficiently and accurately.

Here are some guidelines to follow:

- ◆ Determine an efficient time synchronization method to use and identify the best way to set up and manage that method across the network. If you have a single server environment, you do not need to plan for time synchronization.
- ◆ Use resource maps, location maps, LAN and WAN topology maps, and the NDS<sup>®</sup> 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 26
- ◆ “Determining an Efficient Configuration” on page 27
- ◆ Multiserver networks that don't meet the default criteria listed in “Time Servers” on page 12 (under Single Reference Time Servers) should consider doing the following:
  - ◆ If consistent time with UTC is important, consider “Using External Time Synchronization” on page 12.
  - ◆ If you maintain slow WAN links, consider using a “Custom Configuration List” on page 20.
  - ◆ If you have more than seven primary time servers, and you are using a Time Provider Group as described in “Time Servers” 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 example used here shows the colon as a time separator. The character used as the time separator is determined by the country information for each server. In most instances, 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

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

- ◆ “Identifying an Efficient Time Source” on page 26
- ◆ “Determining an Efficient Configuration” on page 27

## Identifying an Efficient Time Source

The time source type for your network is based on the method of synchronization you choose. See “Determining an Efficient Configuration” on page 27 for more information.

Time servers are divided into two types as time providers or time consumers: internal time sources as in “Using Internal Time Synchronization” on page 12 and external time sources as in “Using External Time Synchronization” on page 12. These servers function on the same principles:

- ◆ All servers provide time to any time provider, time consumer, or workstation.
- ◆ All servers are responsible for their own synchronization; they must determine 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.

# Determining an Efficient Configuration

Efficient configuration of time synchronization depends on the physical layout of your network infrastructure. Keep a reference of any planning documents related to the LAN and WAN topology of your network.

There are two efficient time server configurations:

- ◆ “Single Reference Time Server” on page 12
- ◆ “Time Provider Groups” on page 17

Select one of these configuration models for a time synchronization strategy of your network.



# 3

## Setting Up

Making sure TimeSync is set up correctly is important to having NDS<sup>®</sup> function correctly. Make sure you have read the previous sections in this document before you attempt to set up time synchronization.

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

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

- ◆ In what time zone is this server installed?
- ◆ In what type of time server category does this server fall?
- ◆ Whether the server is in a time zone that observes daylight saving time (DST).

## Time Synchronization

This procedure is part of the NetWare installation program.

### Procedure

- 1 Select the time zone for the 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 Insert 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 12, select the Time Server Type field and press Enter.

There are four time server types:

- ◆ “Single Reference Time Server” on page 12
- ◆ “Reference Time Server” on page 16
- ◆ “Primary Time Server” on page 14
- ◆ “Secondary Time Server” on page 17

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 12 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, then press 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 1 Daylight Saving Time Options**

<b>If</b>	<b>Select</b>	<b>And then</b>
Your time zone switches to DST (and back to standard time) during each year	Yes	Continue with Step 7.
Your time zone never switches to DST	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 DST, 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 DST is one hour ahead of your standard time.

If DST 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 DST.

Follow the screen prompts to decide which format to use.

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

**11** Save the time configuration information by pressing F10.

## Configuring NTP

Network Time Protocol (NTP) is configured using the NTP feature of TimeSync.

## Configuring a NetWare Server as an NTP Client

To configure the network for NTP, identify the [Root] time servers in the network.

- ♦ If you use the single reference - secondary time synchronization model, the single reference server is considered the [Root].
- ♦ If you use the reference - primary - secondary model, the reference server and primary servers together act as the [Root] for serving time to the others servers in the network.

After identifying the [Root] servers, update them so they obtain time from the NTP time source. Change the following parameter either in SET or MONITOR:

```
SET TIMESYNC TIME SOURCE=10.1.1.1:123
```

As the network checks the [Root] time sources for time, that will ensure that the entire network takes time from the NTP time source.

## Configuring a NetWare Server as an NTP Server

The best way to set up time synchronization in a mixed environment (such as NetWare, UNIX\*, Windows\* NT\*, and mainframes) is to use an open-standard protocol such as NTP.

UNIX servers often have NTP built in to the UNIX operating system. NTP implementations are also available for Windows NT and Apple\* Macintosh\* computers in addition to others. After identifying and deploying an NTP implementation on your platform, your platform is ready to communicate with other NTP sources on your intranet or the Internet.

TIMESYNC.NLM 5.08 or later has the capacity to provide time to an NTP client using UDP port 123.

For example, if you want your UNIX computers to take time from a NetWare server, set up NTP on your UNIX computers with the IP address of the NetWare server, such as:

```
server <NetWare server DNS name or IP address>
```

No parameter settings need to be changed on the NetWare server.

For more information, see Using NTP with NetWare 5 (<http://developer.novell.com/research/appnotes/1999/july/a3frame.htm>).



# 4

## Managing

Once NetWare<sup>®</sup> is installed and time synchronization is established, the network may need further time synchronization management, including:

- ♦ “Determining Time Synchronization Status” on page 33
- ♦ “Ensuring that the Server's DOS Clock Is Accurate” on page 34
- ♦ “Setting Time in NetWare” on page 34
- ♦ “Maintaining Network Time Synchronization” on page 36

### 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:

**DSREPAIR**

If DSREPAIR is in a directory other than SYS:SYSTEM, enter the full path to the utility.

Once DSREPAIR loads, the NDS<sup>®</sup> database locks so that information can't be accessed or updated until the operation is completed.

- 2** Select Time Synchronization.

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

Press F1 for Help information at each field.

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, all servers in NDS are contacted.

## Ensuring that the Server's DOS Clock Is Accurate

When running patches that update SERVER.EXE, make sure the DOS clock is set correctly. If the time and date are incorrect, version control problems may occur.

To do this, bring down the server and set the correct date and time in DOS. Booting the server sets the DOS clock to match the complementary metal oxide semiconductor (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.

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** Power down the server and power it up again. Make sure the hardware clock is maintaining the correct time.
- 5** Restart NetWare.
- 6** At the server console, type

```
SET TimeSync DEBUG = 7
```

If a secondary time server is used, messages will show the server contacting a primary server and calculating the time offset.

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

This 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 whether the other contacted server is communicating. If it is, make sure the routers are not restricting TIMESYNC.SAP.

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

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

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 (DST) 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

You can use SET commands at the server console or add commands to the TIMESYNC.CFG file for 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 EDIT 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. TIMESYNC.CFG is read *after* STARTUP.NCF.

Use the SET command to customize your network's time synchronization in TIMESYNC.CFG.

## Editing the TIMESYNC.CFG File

To change the time synchronization configuration on a NetWare server, modify the parameters in the TIMESYNC.CFG file, and 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.

## Prerequisite

- Access to the server console or an established RCONSOLE session

## Procedure

- 1 At the server console prompt, type  
`EDIT`  
`SYS:SYSTEM\TIMESYNC.CFG`
- 2 Use the arrow keys to move the cursor to the line you need to edit.
- 3 Modify the settings for the TimeSync parameters you want to change.  
See SET for information on these parameters.
- 4 To save your changes, press Esc.
- 5 To save the TIMESYNC.CFG file, select Yes.

**6** 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.

## SET Parameters for TimeSync

SET 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 39.

## Creating a Custom Time Source Configuration

Time servers use one of two methods to find each other on the internetwork: SAP and custom time source configuration. See “SAP and Custom Configuration” on page 20.

The custom configuration method requires careful planning before you install NetWare, but it gives you 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. You may 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.

### Prerequisite

- A prioritized list of time sources

## Procedure

- 1 At the server console prompt, enter

```
EDIT
SYS:SYSTEM\TIMESYNC.CFG
```

- 2 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).

- 3 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;
```

A server's IP address is 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 still 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.

- 4 To save your changes, press Esc.
- 5 To save the TIMESYNC.CFG file, select Yes.
- 6 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.

## 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]
```

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, 1999, you would enter

```
SET TimeSync Time Adjustment=-00:10:00 at 9/1/99 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.

## 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 40
- ◆ “Configuring Multiple Time Servers” on page 41
- ◆ “Avoiding Parameter Inconsistencies” on page 41

## 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 a 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 “SAP and Custom Configuration” on page 20 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 may 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 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) 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.



# 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 = timezone in AUTOEXEC.BAT
- ♦ DOS SET TZ=timezone in login script

## Synthetic Time Problem

NetWare<sup>®</sup> server reports the following error:

```
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 two minutes until the server time is later than the last modified time stamp.

## Solution

- 1** Run DSREPAIR.
- 2** Select the Advanced Options menu > Replica and Partition Operations > the partition you want to update.

# A

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