



## Configuring NTP

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This chapter describes how to configure the Network Time Protocol (NTP) on the Catalyst 6000 family switches.



**Note**

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For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 6000 Family Command Reference* publication.

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## Understanding How NTP Works

NTP synchronizes timekeeping among a set of distributed time servers and clients. This synchronization allows events to be correlated when system logs are created and other time-specific events occur.

An NTP server must be accessible by the client switch. NTP runs over User Datagram Protocol (UDP), which runs over IP. NTP is documented in RFC 1305. All NTP communication uses Coordinated Universal Time (UTC), which is the same as Greenwich Mean Time. An NTP network usually gets its time from an authoritative time source, such as a radio clock or an atomic clock attached to a time server. NTP distributes this time across the network. NTP is extremely efficient; no more than one packet per minute is necessary to synchronize two machines to within a millisecond of one another.

NTP uses a stratum to describe how many NTP hops away a machine is from an authoritative time source. A stratum 1 time server has a radio or atomic clock directly attached; a stratum 2 time server receives its time from a stratum 1 time server, and so on. A machine running NTP automatically chooses as its time source the machine with the lowest stratum number that it is configured to communicate with through NTP. This strategy effectively builds a self-organizing tree of NTP speakers.

NTP has two ways to avoid synchronizing to a machine whose time might be ambiguous:

- NTP never synchronizes to a machine that is not synchronized itself.
- NTP compares the time reported by several machines and does not synchronize to a machine whose time is significantly different from the others, even if its stratum is lower.

The communications between machines running NTP, known as associations, are usually statically configured; each machine is given the IP address of all machines with which it should form associations. Accurate timekeeping is possible by exchanging NTP messages between each pair of machines with an association. However, in a LAN environment, you can configure NTP to use IP broadcast messages. With this alternative, you can configure the machine to send or receive broadcast messages, but the accuracy of timekeeping is marginally reduced because the information flow is one-way only.

Cisco's implementation of NTP does not support stratum 1 service; it is not possible to connect to a radio or atomic clock. We recommend that you obtain the time service for your network from the public NTP servers available in the IP Internet. If the network is isolated from the Internet, Cisco's NTP implementation allows a machine to be configured so that it acts as though it is synchronized using NTP, when in fact it has determined the time using other means. Other machines then synchronize to that machine using NTP.

A number of manufacturers include NTP software for their host systems, and a publicly available version for systems running UNIX and its various derivatives is also available. This software allows host systems to be time-synchronized as well.

## NTP Default Configuration

Table 25-1 shows the default NTP configuration.

**Table 25-1 NTP Default Configuration**

Feature	Default Value
Broadcast client mode	Disabled
Client mode	Disabled
Broadcast delay	3000 microseconds
Time zone	Not specified
Offset from UTC	0 hours
Summertime adjustment	Disabled
NTP server	None specified
Authentication mode	Disabled

## Configuring NTP

These sections describe how to configure NTP:

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## Configuring NTP in Broadcast-Client Mode

Configure the switch in NTP broadcast-client mode if an NTP broadcast server, such as a router, regularly broadcasts time-of-day information on the network. To compensate for any server-to-client packet latency, you can specify an NTP broadcast delay (a time adjustment factor for the receiving of broadcast packets by the switch).

To enable NTP broadcast-client mode on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Enable NTP broadcast-client mode.	<b>set ntp broadcastclient enable</b>
Step 2	(Optional) Set the estimated NTP broadcast packet delay.	<b>set ntp broadcast delay <i>microseconds</i></b>
Step 3	Verify the NTP configuration.	<b>show ntp [noalias]</b>

This example shows how to enable NTP broadcast-client mode on the switch, set a broadcast delay of 4000 microseconds, and verify the configuration:

```

Console> (enable) set ntp broadcastclient enable
NTP Broadcast Client mode enabled
Console> (enable) set ntp broadcastdelay 4000
NTP Broadcast delay set to 4000 microseconds
Console> (enable) show ntp

Current time: Tue Jun 23 1998, 20:25:43
Timezone: '', offset from UTC is 0 hours
Summertime: '', disabled
Last NTP update:
Broadcast client mode: enabled
Broadcast delay: 4000 microseconds
Client mode: disabled

NTP-Server
-----
Console> (enable)

```

## Configuring NTP in Client Mode

Configure the switch in NTP client mode if you want the client switch to regularly send time-of day requests to an NTP server. You can configure up to ten server addresses per client.

To configure the switch in NTP client mode, perform this task in privileged mode:

	Task	Command
<b>Step 1</b>	Specify the IP address of the NTP server.	<b>set ntp server <i>ip_addr</i></b>
<b>Step 2</b>	Enable NTP client mode.	<b>set ntp client enable</b>
<b>Step 3</b>	Verify the NTP configuration.	<b>show ntp [noalias]</b>

This example shows how to configure the NTP server address, enable NTP client mode on the switch, and verify the configuration:

```

Console> (enable) set ntp server 172.20.52.65
NTP server 172.20.52.65 added.
Console> (enable) set ntp client enable
NTP Client mode enabled
Console> (enable) show ntp

Current time: Tue Jun 23 1998, 20:29:25
Timezone: '', offset from UTC is 0 hours
Summertime: '', disabled
Last NTP update: Tue Jun 23 1998, 20:29:07
Broadcast client mode: disabled
Broadcast delay: 3000 microseconds
Client mode: enabled

NTP-Server
-----
172.16.52.65
Console> (enable)

```

## Configuring Authentication in Client Mode

Authentication can enhance the security of a system running NTP. When you enable the authentication feature, the client switch sends time-of-day requests to trusted NTP servers only. The authentication feature is documented in RFC 1305.

You can configure up to ten authentication keys per client. Each authentication key is actually a pair of two keys:

- A public key number—A 32-bit integer that can range from 1 to 4294967295
- A secret key string—An arbitrary string of 32 characters, including all printable characters and spaces

To authenticate the message, the client authentication key must match that of the server. Therefore, the authentication key must be securely distributed in advance (that is, the client administrator must get the key pair from the server administrator and configure it on the client).

To configure authentication, perform this task in privileged mode:

	Task	Command
Step 1	Define an authentication key pair for NTP and specify whether the key is trusted or untrusted.	<b>set ntp key</b> <i>public_key</i> [ <i>trusted \ untrusted</i> ] <b>md5</b> <i>secret_key</i>
Step 2	Specify the IP address of the NTP server and the public key.	<b>set ntp server</b> <i>ip_addr</i> [ <i>key public_key</i> ]
Step 3	Enable NTP client mode.	<b>set ntp client enable</b>
Step 4	Enable NTP authentication.	<b>set ntp authentication enable</b>
Step 5	Verify the NTP configuration.	<b>show ntp</b> [ <i>noalias</i> ]

This example shows how to configure the NTP server address, enable NTP client and authentication modes on the switch, and verify the configuration:

```

Console> (enable) set ntp server 172.20.52.65 key 879
NTP server 172.20.52.65 with key 879 added.
Console> (enable) set ntp client enable
NTP Client mode enabled
Console> (enable) set ntp authentication enable
NTP authentication feature enabled
Console> (enable) show ntp

```

```

Current time: Tue Jun 23 1998, 20:29:25
Timezone: '', offset from UTC is 0 hours
Summertime: '', disabled
Last NTP update: Tue Jun 23 1998, 20:29:07
Broadcast client mode: disabled
Broadcast delay: 3000 microseconds
Client mode: enabled
Authentication: enabled

```

```

NTP-Server                               Server Key
-----
172.16.52.65

```

```

Key Number  Mode      Key String
-----

```

```

Console> (enable)

```

## Setting the Time Zone

You can specify a time zone for the switch to display the time in that time zone. You must enable NTP before you set the time zone. If NTP is not enabled, this command has no effect. If you enable NTP and do not specify a time zone, UTC is shown by default.

To set the time zone, perform this task in privileged mode:

	Task	Command
Step 1	Set the time zone.	<b>set timezone</b> <i>zone hours [minutes]</i>
Step 2	Verify the time zone configuration.	<b>show timezone</b>

This example shows how to set the time zone on the switch:

```
Console> (enable) set timezone Pacific -8
Timezone set to 'Pacific', offset from UTC is -8 hours
Console> (enable)
```

## Enabling the Daylight Saving Time Adjustment

Following U.S. standards, you can have the switch advance the clock one hour at 2:00 a.m. on the first Sunday in April and move back the clock one hour at 2:00 a.m. on the last Sunday in October. You can also explicitly specify the start and end dates and times and whether or not the time adjustment recurs every year.

To enable the daylight saving time clock adjustment following the U.S. rules, perform this task in privileged mode:

	Task	Command
Step 1	Enable the daylight saving time clock adjustment.	<b>set summertime enable</b> [ <i>zone_name</i> ] <b>set summertime recurring</b>
Step 2	Verify the configuration.	<b>show summertime</b>

This example shows how to set the clock adjusted for Pacific Daylight Time following the U.S. standards:

```
Console> (enable) set summertime enable PDT
Console> (enable) set summertime recurring
Summertime is enabled and set to 'PDT'
Console> (enable)
```

To enable the daylight saving time clock adjustment that recurs every year on different days or with a different offset than the United States standard, perform this task in privileged mode:

	Task	Command
Step 1	Enable the daylight saving time clock adjustment.	<b>set summertime recurring</b> <i>week day month</i> <i>hh:mm week day month hh:mm offset</i>
Step 2	Verify the configuration.	<b>show summertime</b>

This example shows how to set the daylight saving time clock adjustment, repeating every year, starting on the third Monday of February at noon and ending on the second Saturday of August at 3:00 p.m. with a 30-minute offset forward in February and back in August.

```
Console> (enable) set summertime recurring 3 mon feb 3:00 2 saturday aug 15:00 30
Summer time is disabled and set to ''
  start: Sun Feb 13 2000, 03:00:00
  end: Sat Aug 26 2000, 14:00:00
  Offset: 30 minutes
  Recurring: yes, starting at 3:00am Sunday of the third week of February and ending
  14:00pm Saturday of the fourth week of August.
Console> (enable)
```

To enable the daylight saving time clock adjustment to a nonrecurring specific date, perform this task in privileged mode:

	<b>Task</b>	<b>Command</b>
<b>Step 1</b>	Enable the daylight saving time clock adjustment.	<b>set summertime date</b> <i>month date year hh:mm month date year hh:mm offset</i>
<b>Step 2</b>	Verify the configuration.	<b>show summertime</b>

This example shows how to set the nonrecurring daylight saving time clock adjustment on April 30, 1999 at 11:32, ending on February 1, 2003 at 12:02 a.m., with an offset of 50 minutes.

```
Console> (enable) set summertime date apr 13 2000 4:30 jan 21 2002 5:30 1440
Summertime is disabled and set to ''
Start : Thu Apr 13 2000, 04:30:00
End   : Mon Jan 21 2002, 05:30:00
Offset: 1440 minutes (1 day)
Recurring: no
Console> (enable)
```

## Disabling the Daylight Saving Time Adjustment

To disable the daylight saving time clock adjustment, perform this task in privileged mode:

	<b>Task</b>	<b>Command</b>
<b>Step 1</b>	Disable the daylight saving time clock adjustment.	<b>set summertime disable</b> [ <i>zone_name</i> ]
<b>Step 2</b>	Verify the configuration.	<b>show summertime</b>

This example shows how to disable the daylight saving time adjustment:

```
Console> (enable) set summertime disable Arizona
Summertime is disabled and set to 'Arizona'
Console> (enable)
```

## Clearing the Time Zone

To clear the time zone settings and return the time zone to Coordinated Universal Time (UTC), perform this task in privileged mode:

Task	Command
Clear the time zone settings.	<b>clear timezone</b>

This example shows how to clear the time zone settings:

```
Console> (enable) clear timezone
Timezone name and offset cleared
Console> (enable)
```

## Clearing NTP Servers

To clear an NTP server address from the NTP servers table on the switch, perform this task in privileged mode:

	Task	Command
<b>Step 1</b>	Specify the NTP server to clear.	<b>clear ntp server</b> [ <i>ip_addr</i>   <b>all</b> ]
<b>Step 2</b>	Verify the NTP configuration.	<b>show ntp</b> [ <b>noalias</b> ]

This example shows how to clear an NTP server address from the NTP server table:

```
Console> (enable) clear ntp server 172.16.64.10
NTP server 172.16.64.10 removed.
Console> (enable)
```

## Disabling NTP

To disable NTP broadcast-client mode on the switch, perform this task in privileged mode:

	Task	Command
<b>Step 1</b>	Disable NTP broadcast-client mode.	<b>set ntp broadcastclient disable</b>
<b>Step 2</b>	Verify the NTP configuration.	<b>show ntp</b> [ <b>noalias</b> ]

This example shows how to disable NTP client mode on the switch:

```
Console> (enable) set ntp broadcastclient disable
NTP Broadcast Client mode disabled
Console> (enable)
```

To disable NTP client mode on the switch, perform this task in privileged mode:

	<b>Task</b>	<b>Command</b>
<b>Step 1</b>	Disable NTP client mode.	<b>set ntp client disable</b>
<b>Step 2</b>	Verify the NTP configuration.	<b>show ntp [noalias]</b>

This example shows how to disable NTP client mode on the switch:

```
Console> (enable) set ntp client disable  
NTP Client mode disabled  
Console> (enable)
```

