

# 1.111.6

## Maintain system time

### Weight 4

Linux Professional Institute Certification — 102

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# Topic 111 Administrative Tasks [21]

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# Description of Objective

## 1.111.6 Maintain system time

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Candidate should be able to properly maintain the system time and synchronize the clock over NTP. Tasks include:

- ▶ setting the system date and time,
- ▶ setting the BIOS clock to the correct time in UTC,
- ▶ configuring the correct timezone for the system and
- ▶ configuring the system to correct clock drift to match NTP clock.

## Key files, terms, and utilities include:

`/usr/share/zoneinfo` — a directory containing time zone information for many different regions

`/etc/timezone` — On Debian systems, holds the timezone

`/etc/localtime` — a symbolic link to the correct file in `/path/usr/share/zoneinfo/`

`/etc/ntp.conf` — configuration file for NTP

`/etc/ntp.drift` — where NTP stores correction for local clock being fast/slow

`date` — command for showing/setting system time

`hwclock` — command for setting hardware clock, or setting system time from hardware clock

`ntpd` — NTP server

`ntpdate` — used to set system time from a remote NTP server

# Maintain system time [4]

Resources of interest

**web** `http://www.ntp.org`

**Debian ntp-doc** `/usr/share/doc/ntp-doc/index.html`  
on sarg.

**LPI Linux Certification in a Nutshell:** by Jeffrey Dean  
O'Reilly

**LPIC 1 Certification Bible:** *Angie Nash and Jason Nash*  
Hungry Minds

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# date

## Display or Set System Date & Time

The `date` command without any options will print the current date and time. The date will be relative to any timezone set for the machine.

```
$ date ↵
```

```
Tue May 21 09:57:51 EST 2002
```

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# date

## Options to the Date command

- I** Output an ISO-8601 compliant date (YYYY-MM-DD)

```
$ date -I ↵  
2002-05-21
```

- R** Output an RFC-822 compliant date (Local time + GMT Offset)

```
$ date -R ↵  
Tue, 21 May 2002 10:14:09 +1000
```

- r <file>** Display the last modification time of file

```
$ date -r ~/ivr/va/src/va.c ↵  
Mon May 20 12:55:48 EST 2002
```



# date

## Options to the Date command

**-d <STRING>** Display date described by string instead of now

```
$ date -d "last Monday 4 years ago" ↵
```

```
Mon May 18 00:00:00 EST 1998
```

**-u** Display UTC time & date instead of localtime

```
$ date ↵
```

```
Tue May 21 10:55:34 EST 2002
```

```
$ date -u ↵
```

```
Tue May 21 00:55:34 UTC 2002
```

# date

## Options to the Date command

**-s <date>** Set the system time (must be superuser)

```
# date -s "Tue May 21 10:03:06 EST 2002"
```

```
↵
```

```
Tue May 21 10:03:06 EST 2002
```

**+FORMAT** Display date in user defined format

```
$ date +"Today is %A, %d %B, %Y" ↵
```

```
Today is Tuesday, 21 May, 2002
```

# Hardware (“RTC”) vs. System Clock

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- ▶ The *Hardware, or Real Time Clock (RTC)*
  - ▶ hardware clock is located on the motherboard
  - ▶ Sometimes (for **hysterical** reasons) called the Real Time Clock (RTC)
  - ▶ keeps track of the time when the system is not powered up.
- ▶ The *system clock*
  - ▶ maintained in the Linux kernel and
  - ▶ is used while the system is running.

# Hardware (“RTC”) vs. System Clock

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- ▶ Set the system clock from the Hardware clock
- ▶ Set the hardware clock from the system clock
- ▶ Show the time/date held by the RTC
- ▶ Adjust the RTC to account for clock drift

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Set System clock to Hardware clock

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- ▶ To set the system time from the RTC, use the following option to hwclock:

```
hwclock -s (or hwclock -hctosys)
```

- ▶ To set the RTC from the system time, use this option:

```
hwclock -w (or hwclock -systohc)
```

- ▶ To display the contents of the RTC, use this option:

```
hwclock -r (or hwclock -show)
```

- ▶ To adjust the RTC for clock drift, use this option:

```
hwclock -a (or hwclock -adjust)
```

Note that the file `/etc/adjtime` is used to hold information about the extent to which (and direction) your RTC drifts

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# NTP — Network Time Protocol

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NTP is a time protocol used to synchronise a systems clock to master time source. For example, the CSIRO maintains a nationwide time source with atomic clock accuracy. As a user I can synchronise my system to that time source by sending a request to the CSIRO's ntp server.

Features and properties of NTP include:

- ▶ NTP takes into account the time taken to send/receive NTP packets
- ▶ Uses the UDP protocol
- ▶ Uses Port 123 plus one other unprivileged port (1024:65535)
- ▶ Can operate in both client & server modes
- ▶ There are 3 versions of the protocol (ntp1, ntp2 & ntp3)
- ▶ Available for Unix & Windows machines.

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NTP normally comes in a package and contains the following binaries:

- ▶ `ntpd` — Network Time Protocol (NTP) daemon
- ▶ `ntpq` — standard NTP query program
- ▶ `ntpdc` — special NTP query program
- ▶ `ntpdate` — set the date and time via NTP
- ▶ `ntptrace` — trace a chain of NTP servers to the primary source
- ▶ `tickadj` — set time-related kernel variables
- ▶ `ntptime` — read kernel time variables
- ▶ `ntp-genkeys` — generate public and private keys

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NTP normally comes in a package and contains the following binaries:

- ▶ `ntpd` — Network Time Protocol (NTP) daemon
- ▶ `ntpq` — standard NTP query program
- ▶ `ntpdc` — special NTP query program
- ▶ `ntpdate` — set the date and time via NTP
- ▶ `ntptrace` — trace a chain of NTP servers to the primary source
- ▶ `tickadj` — set time-related kernel variables
- ▶ `ntptime` — read kernel time variables
- ▶ `ntp-genkeys` — generate public and private keys

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A quick guide to installing & setting up NTP:

- ▶ Install NTP package (`yum install ntp`)  
or  
`apt-get install ntp`
- ▶ Modify `/etc/ntp.conf` to reflect time servers
- ▶ Start the service: `service ntpd start`
- ▶ Ensure service starts at boot with `chkconfig ntp on`
- ▶ Confirm operation using `ntpq -p`

That's all there is to it! The hardest part is deciding which public time servers to use.

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# NTP — Network Time Protocol

`ntpdate` — Set system time & date

- ▶ `ntpdate` is a command line utility that will set the local machines time & date from the indicated remote time server(s).
- ▶ More than one server can be specified in order for `ntp` to get a better idea of the transit time and overall server accuracy.
- ▶ Running as a cron job is a simple way to maintain system time

**Usage:** `ntpdate [options] server ...`

```
# ntpdate ntp.nml.csiro.au
21 May 14:01:13 ntpdate[4002]: adjust time server 10.27.1.10
offset -0.000804 sec
```

This will set the local machines system time using server `ntp.nml.csiro.au`

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# ntpd — The NTP daemon

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- ▶ `ntpd` is a better way to maintain the system time on a permanent basis.
- ▶ `ntpd` acts as both a client & server (Linux only).
- ▶ In server mode, other machines on the local network can use the server to set their own system clocks
- ▶ For Windows machines, `automachron` is available.
- ▶ `ntpd` also keeps track of drift in the hardware clock.

The NTP daemon is normally started up by the system initialisation scripts:

**Debian or Red Hat** : `$ /etc/init.d/ntp start` ←

**Red Hat** : `$ service ntp start` ←

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**Usage:** `ntpd [options] &`  
(normally done in the `/etc/init.d` scripts)

NTPD is configured using these files:

- ▶ `/etc/ntp.conf` — Configuration file
- ▶ `/etc/ntp.drift` — RTC drift file
- ▶ `/etc/ntp.keys` — Key file (for authentication mode)

The only file of concern to the user is `ntp.conf`. The other files are all written to and read by the ntp applications.

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# NTP — Network Time Protocol

Sample `ntp.conf` file

```
# Disable authentication mode
disable auth
restrict default ignore          # ignore all requests by default
server ntp.cs.mu.OZ.AU          # 128.250.36.2
server apphys16.mst.csiro.au    # 138.194.21.154
server ntp.nml.csiro.au         # 130.155.98.1
server 127.0.0.1                 # localhost

# Lift restrictions on time servers
restrict 128.250.36.2 nomodify   # time service only, no rt mods
restrict 138.194.21.154 nomodify
restrict 130.155.98.1 nomodify
# All local addresses are unrestricted
restrict 127.0.0.1
restrict 10.27.1.0 mask 255.255.255.0
# Set the default drift file
driftfile /etc/ntp/drift
```

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A (partial) list of public time servers is shown below. When using these servers, it is considered polite to advise the administrator of the service that you intend to use it.

## ▶ Primary NTP Time Servers

- ▶ [ntp.cs.mu.OZ.AU](#) (128.250.36.2)
- ▶ [apphys16.mst.csiro.au](#) (138.194.21.154)
- ▶ [ntp.nml.csiro.au](#) (130.155.98.1)

## ▶ Secondary NTP Time Servers

- ▶ [ntp.saard.net](#) (203.21.37.18)
- ▶ [ntp.iprolink.co.nz](#) (36.50.59.6)

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# NTP — Network Time Protocol

## Testing NTP

Once you have the NTP daemon up & running, the easiest way of testing it is to use the `ntpq` utility.

```
$ ntpq
ntpq> pe
      remote          refid      ...          delay    offset  jitter
=====
localhost.local 0.0.0.0    ...          0.000     0.000  4000.00
xmurgon.cs.mu.OZ .GPS.      ...          526.202   -206.43  208.270
+apphys16.mst.cs .ATOM.     ...          169.956   -5.576   87.828
*tictoc.tip.CSIR .ATOM.     ...          149.988   -24.328   6.761
ntpq> q
$
```

Or more simply:

```
$ ntpq -p
      remote          refid      ...          delay    offset  jitter
=====
localhost.local 0.0.0.0    ...          0.000     0.000  4000.00
xmurgon.cs.mu.OZ .GPS.      ...          526.202   -206.43  208.270
+apphys16.mst.cs .ATOM.     ...          169.956   -5.576   87.828
*tictoc.tip.CSIR .ATOM.     ...          149.988   -24.328   6.761
$
```

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