1.111.6
Maintain system time
Weight 4

Linux Professional Institute Certification — 102

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Outline

Topic 111 Administrative Tasks [21]

Where we are up to

- 1.111.1 Manage users and group accounts and related system files [4]
- 1.111.2 Tune the user environment and system environment variables [3]
- 1.111.3 Configure and use system log files to meet administrative and security needs [3]
- 1.111.4 Automate system administration tasks by scheduling jobs to run in the future [4]
- 1.111.5 Maintain an effective data backup strategy [3]
- 1.111.6 **Maintain system time [4]**

Description of Objective
1.111.6 Maintain system time

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

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

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
```

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 0ffset)

```
$ 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

- 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.

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hwclock
RTC vs. System clock

Hwclock is used to do the following:

- 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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hwclock
Set System clock to Hardware clock

- 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

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 unpriveledged 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 — Network Time Protocol

The suite of tools

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 — Network Time Protocol

Quick install guide

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

- 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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ntpd usage & configuration

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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Public Time Servers

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
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$
```

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