

LPIC-1 102-500 – Lesson 9

108.1 Maintain system time



Software and Hardware Clock

- Computer systems have two clocks to keep the time:
 - **Software clock:** this is from where the operating systems and the applications read the time. It is usually set in the local timezone. Some commands we use to set it: **date**, **ntpdate**, **ntpd**, **chronyd**.
 - **Hardware clock:** also known as **System Clock**. this is the clock used by the motherboard. There is a small long endurance battery to keep the right time and pass it on to the software clock during bootup. It is usually set in the **UTC** timezone. We can use the **hwclock** command to set it.



Set Software Clock with `date`

- The **date** command it can also set the current date, time and timezone in the software clock. The format we use to set the date looks like this: **MMDDhhmm**[[**CC**]**YY**][.ss]
- **# date 092014252021** # set the local date and time at **2:25** pm om **20th** of **September 2021**
- **# date -s "2010-09-20 2:25 PM"** # the **-s** option allows setting the time using more human readable datetime formats.
- **# date -s "2:45 PM"** # set the time at **2:45** pm
- **# date -s "+2 minutes"** # add 2 minutes on the current time



Set hardware clock with `hwclock`

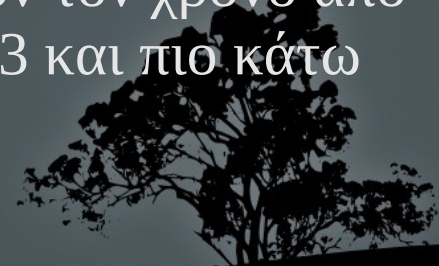
The **hwclock** command is used to show and set the system clock

- `# hwclock # = hwclock -r | --show`, show system datetime. This will show the time at the local timezone even though the clock may be set at UTC.
- `# hwclock --localtime --set --date="2012-12-16 5:24 AM"`
set the system time at localtime
- `# hwclock --utc --set --date="2012-12-16 5:24 AM"` # set the system time at UTC. This will happen in the background and the time that needs to be defined at the `--date` option needs to be the local!
- `# hwclock --systohc` # Synchronize the hardware clock to the software clock (software clock is the master)
- `# hwclock --hctosys` # Synchronize the software clock to the hardware clock (hardware clock is the master)

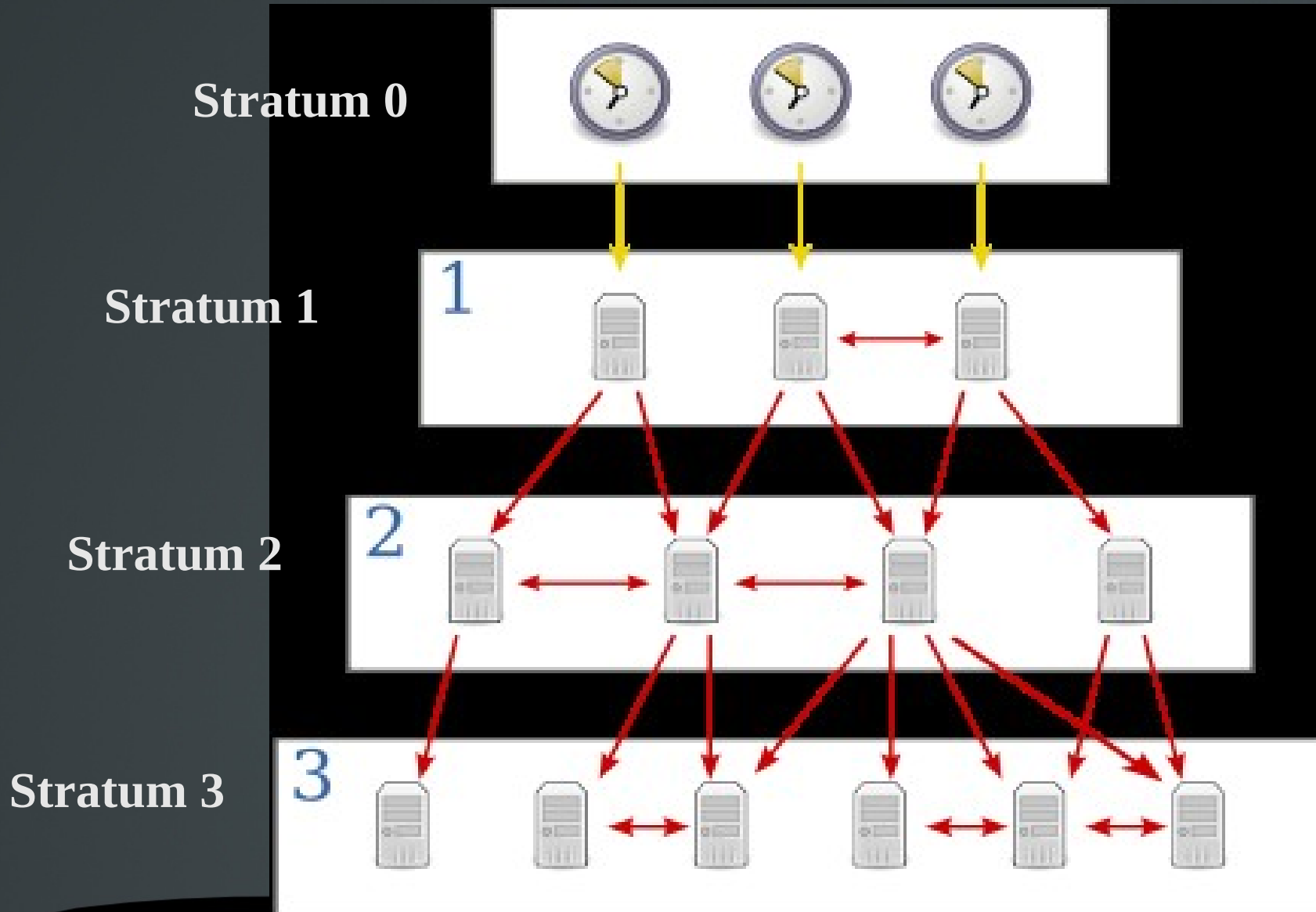


Setting the time through *NTP*

- The **NTP (Network Time Protocol)** system is used to synchronise the time a lot more accurately than the **date** and **hwclock** commands.
- Our purpose is to synchronise the software clock to the UTC) timezone. The local timezone is set using the localisation settings (locales)
- NTP is a hierarchical system and at the top we have clocks of high accuracy:
 - **Stratum 0**: they are the top of the pyramid and are high accuracy clocks like atomic, GPS receivers, etc.
 - **Stratum 1**: These are time servers that are syncing their clocks directly from stratum 0 and pass it on lower strata servers.
 - **Stratum 2**: είναι συστήματα που παίρνουν τον χρόνο από stratum 1 και τον στέλνουν σε stratum 3 και πιο κάτω



NTP Hierarchy



Setting time from NTP with `ntpdate`

- The `ntpdate` command sets the software time using an NTP server
- `# apt-get install ntpdate # install on Debian`
- `# yum install ntp # install on RedHat`
- `# ntpdate pool.ntp.org # set the time using the pool.ntp.org time server.`
- `# ntpdate -q pool.ntp.org # show the time server time with out setting the local time`
- `# ntpdate -v pool.ntp.org # set the system time from pool.ntp.org and display verbose output`



Sync the time with the `ntpd` daemon

- The **ntpd** daemon is used for the continuous synchronisation of the time with a higher stratum server.
- It also functions as a time server and can server as stratum for other network machines.
- The constant communication with a time server allows **ntpd** to achieve a better accuracy than **ntpdate**.
- `# apt-get install ntp # install in Debian`
- `# yum install ntp # install in RedHat`

Setting up `ntpd` using `/etc/ntp.conf`

- The most important parameter in the `/etc/ntp.conf` is the **server** parameter where we set the **NTP** timeservers to be used by **ntpd**. Another useful parameter is the **restrict** which defines which IPs have what rights on our ntp server and the **peer** parameter where we define another time server in the same stratum as our own server, but with different sources.
- **# Example `/etc/ntp.conf` file in Ubuntu:**

```
server 0.ubuntu.pool.ntp.org
server 1.ubuntu.pool.ntp.org
server 2.ubuntu.pool.ntp.org
server 3.ubuntu.pool.ntp.org
server ntp.ubuntu.com
```



Verify the ntpd operation with `ntpq`

- The `ntpq` command is a utility that helps verify the correct operation of an NTP server:

```
$ ntpq
ntpq> peers
      remote                refid          st t when poll reach  delay  offset  jitter
=====
+bart.nexcellent. 193.67.79.202    2 u   37  64  377  78.260  0.193  0.505
 95.140.150.140   .INIT.          16 u   - 1024  0    0.000  0.000  0.000
-vpn.cumquat.nl  131.188.3.221   2 u   36  64  377  99.611  10.760  7.545
+lswb-nl-81.serv 193.79.237.14   2 u   38  64  377  83.148  -1.212  0.478
*europium.canoni 193.79.237.14   2 u   27  64  377  80.753  0.352  0.838
ntpq> q
```

```
$ ntpq -p
      remote                refid          st t when poll reach  delay  offset  jitter
=====
+bart.nexcellent. 193.67.79.202    2 u    4  64  377  78.260  0.193  0.672
 95.140.150.140   .INIT.          16 u   - 1024  0    0.000  0.000  0.000
-vpn.cumquat.nl  131.188.3.221   2 u    5  64  377  99.611  10.760  7.618
+lswb-nl-81.serv 193.79.237.14   2 u    5  64  377  83.148  -1.212  0.616
*europium.canoni 193.79.237.14   2 u   60  64  377  80.753  0.352  0.838
```

Sync the time with the `chronyd` daemon

- **chrony** is another NTP implementation and an alternative to **ntpd**. It boasts faster, more accurate operation and more secure operation **ntpd**.
- Install **chrony**:
 - `# apt-get install chrony` # install in Debian
 - `# yum install chrony` # install in RedHat



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- Install **chrony**:
 - `# apt-get install chrony` # install in Debian
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Setting up chronyd using `/etc/chrony.conf`

- The most important parameter in the `/etc/chrony.conf` is the **pool** parameter where we set the **NTP** timeservers to be used by **chronyd**.
- **# Example** `/etc/chrony.conf` file in Debian:

```
pool 2.debian.pool.ntp.org iburst
```



The `chronyc` command

- We can also update the **chrony** configuration while the server is running with the **chronyc** command. An example usage:

```
$ chronyc sources
```

```
210 Number of sources = 4
```

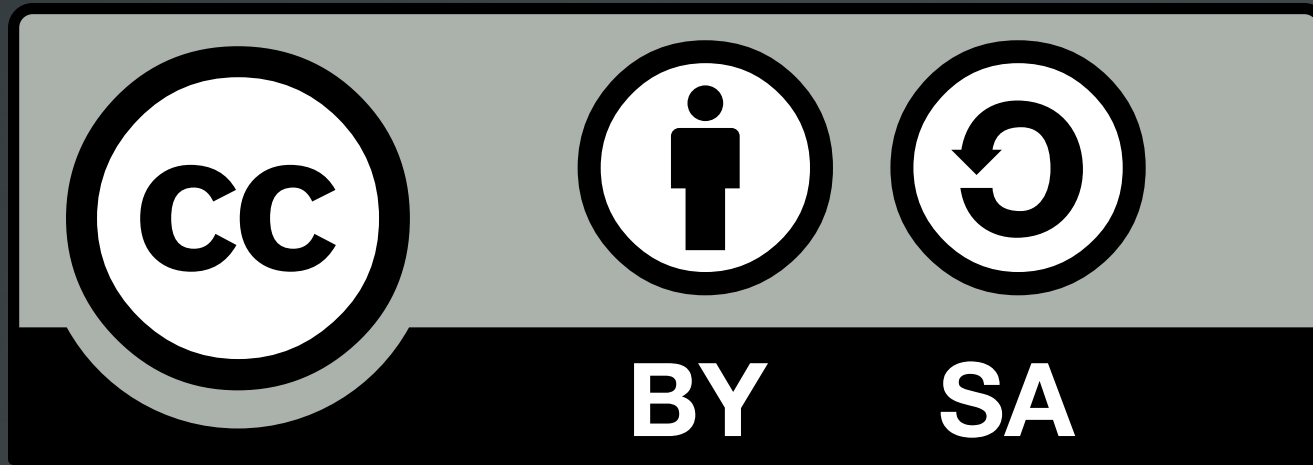
```
MS Name/IP address      Stratum Poll Reach LastRx Last sample
```

```
=====
```

| | | | | | | |
|----------------------------|---|----|-----|-----|------------------|----------|
| ^+ 1.chronos.airtel.net.cy | 2 | 10 | 377 | 816 | +5507us[+5619us] | +/- 91ms |
| ^+ 2.chronos.airtel.net.cy | 2 | 10 | 377 | 381 | +3719us[+3719us] | +/- 81ms |
| ^* time.cloudflare.com | 3 | 10 | 377 | 608 | -1735us[-1624us] | +/- 44ms |
| ^+ time.cloudflare.com | 3 | 10 | 377 | 723 | -941us[-830us] | +/- 47ms |



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