**Week 3 Lab 3b Establishing and maintaining time and date settings**

Linux-based systems have two types of clocks:

* **System Clock**: This is a clock maintained by the kernel and is interrupt-driven. The value of this clock is initialized from the hardware clock at boot time. The system time is calculated as the number of seconds since January 1st 1970 00:00:00. (This reference time is known as epoch time or sometimes UNIX time.) The system clock contains the current time as well as time zone information.
* **Hardware Clock**: This is a battery-powered clock that keeps time even when the system is shut down. When the system boots, the system clock is set using the value of the hardware clock. When the system is shut down, the hardware clock is set to the value of the system clock. This ensures that both the clocks are synchronized. The hardware clock is also known as the real time clock (RTC) or the CMOS/BIOS clock. The hardware clock stores the following values: year, month, day, hour, minute, and seconds.

Maintaining the Harware Clock

The hwclock (hardware clock) command is used by the root user to update and query the hardware clock. The command accesses the hardware clock by performing Input/Output (I/O) via the /dev/rtc device file. Some systems may have more than one rtc file, so listing the /dev/rtc\* files may show multiple files like /dev/rtc0 and /dev/rtc1.

* To view the time of the hardware clock, execute the following command as root:
* **root@localhost:~#** hwclock
* 2019-11-21 02:18:18.577020+0000
* To set the value of the hardware clock, execute the following command as root:
* **root@localhost:~#** hwclock --set --date "1/1/2025 18:30:50"
* **root@localhost:~#** hwclock
* 2025-01-01 18:30:50.045616+0000

Maintaining the System Clock

The date command is used to display and set the system date and time. To view the current date and time, execute the following command:

**root@localhost:~#** date

Tue Dec 17 18:50:20 UTC 2024

The system date can be displayed in different formats to suit a user's needs. For example, to display only the month, day, and year, execute the following command:

**root@localhost:~#** date "+%m/%d/%y"

12/17/24

The following table lists the common format options that the date command supports:

| **Specifier** | **Meaning** |
| --- | --- |
| %d | Day of month (e.g., 30) |
| %H | Hour (0-23) |
| %I | Hour (1-12) |
| %m | Month (1-12) |
| %M | Minute (0-59) |
| %S | Seconds (0-60) |
| %T | Time (%H:%M:%S) |
| %u | Day of week (1-7, 1=Monday) |
| %Y | Year |
| %F | Full date; same as %Y-%m-%d |

The man page for the date command provides a complete list of all the format options.

Displaying and Setting the Time Zone

### **The /etc/localtime File**

On CentOS the /etc/localtime file is used to configure the time zone of the system. The time zone data for different regions is maintained in the /usr/share/zoneinfo directory. To set up a particular time zone, a symbolic link is created from the /etc/localtime file to the corresponding file in the /usr/share/zoneinfo directory.

To view the contents of the /usr/share/zoneinfo directory, execute the following command:

**root@localhost:~#** ls /usr/share/zoneinfo

Africa Cuba GMT+0 Kwajalein Poland WET America EET GMT-0 Libya Portugal Zulu Antarctica EST GMT0 MET ROC iso3166.tab Arctic EST5EDT Greenwich MST ROK leap-seconds.list Asia Egypt HST MST7MDT Singapore localtime Atlantic Eire Hongkong Mexico SystemV posix Australia Etc Iceland NZ Turkey posixrules Brazil Europe Indian NZ-CHAT UCT right CET Factory Iran Navajo US zone.tab CST6CDT GB Israel PRC UTC zone1970.tab Canada GB-Eire Jamaica PST8PDT Universal Chile GMT Japan Pacific W-SU

To set the time zone to the America Tijuana time zone (PST), execute the following link ln command as the root user, then verify the change with date:

**root@localhost:~#**:~# date Tue Dec 17 21:00:59 UTC 2024 **root@localhost:~#** ln -sf /usr/share/zoneinfo/America/Tijuana /etc/localtime**root@localhost:~#** date Tue Dec 17 13:01:32 PST 2024

## Understanding chronyd

Chrony is a set of programs that are used to ensure that the clock on a system is accurate. chrony lends itself to working well in environments with intermittent network connectivity, such as on a laptop or virtual system that may be created through an automated process.

The daemon portion of chrony is the command chronyd. The daemon synchronizes the system with time retrieved from NTP servers. Along with synchronizing time on the system it is running, chronyd can also operate as an NTP server providing time service to other systems that are allowed network access.

To control chronyd, you use the chronyc program to interface with chronyd via the command line. The chronyc command can be used in two different modes; interactive and non-interactive mode. If no argument is specified on the command line, the chronyc command will run in interactive mode and return a chrony> prompt where you can then enter chronyc commands.

**root@localhost:~#** chronyc

chrony version 3.2

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chronyc>

Note that the chonyc command should be run as the root user since some of the chronyc commands may be restricted for regular users.

Common chronyc commands are listed below:

| **Argument** | **Description** |
| --- | --- |
| tracking | Displays performance statistics about the system clock |
| sources | Displays the NTP sources being used for chronyd |
| activity | Displays the status of NTP sources |
| settime <TIME> | Allows you to manually set the time used for chronyd. The format for settime can be any of the below:  hh:mm  hh:mm:ss  Month Day, YYYY hh:mm:ss |

To demonstrate, if you want to display information and performance statistics about the system clock in interactive mode, use the tracking command at the chronyc> prompt:

chronyc> tracking

Reference ID : 6C3D49F3 (hydrogen.constant.com)

Stratum : 3

Ref time (UTC) : Thu Nov 07 03:10:17 2019

System time : 0.000021801 seconds slow of NTP time

Last offset : -0.00021801 seconds

RMS offset : 0.000106846 seconds

Frequency : 26.657 ppm slow

Residual freq : -0.007 ppm

Skew : 0.093 ppm

Root delay : 0.013896370 seconds

Root dispersion : 0.017410904 seconds

Update interval : 257.5 seconds

Leap status : Normal

The **Ctrl+D** keys can be used to exit interactive mode.

To run chronyc in non-interactive mode, the following syntax can be used:

chronyc command

For example, to display a list of NTP sources being used for chronyd in non-interactive mode, use the following command:

**root@localhost:~#** chronyc sources

210 Number of sources = 4

MS Name/IP address Stratum Poll Reach LastRx Last sample

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^\_ au.kashra.pictures 2 6 377 4 -2991us[-2991us] +/- 125ms

^\* hydrogen.constant.com 2 9 377 205 -756us[ -678us] +/- 33ms

^- lax1.justaguy.be 2 8 377 20 +1559us[+1559us] +/- 98ms

^+ li924-200.members.linode> 2 10 377 671 +1321us[+1394us] +/- 31ms

Upon examining the output above, we can see that one of the sources listed, the hydrogen.constant.com source, matches the source in the Reference ID field in the output of the tracking command used previously.