10.5.3 Time Zone Facts

A time zone is a geographic region of the world that has the same standard time.

This lesson covers the following topics:

- General considerations
- Linux clocks
- UTC offset
- Time zone tools and files

General Considerations

When dealing with time zones, be aware of the following details:

- The time zone ensures that daylight hours fall within a certain time period, regardless of the area of the world.
- In many areas, daylight savings time (DST) moves clocks ahead by one hour from the standard time zone time during "summer" when there are more daylight hours. Not all locations observe daylight savings time. For example, areas along the equator typically do not because the number of daylight hours does not vary significantly throughout the year.
- The local time is the time used in your physical location, adjusting for the time zone and daylight savings time (if used).
- As you change your physical location, the local time can also change based on the time zone used in that area.
- Time zone names used in the United States (Eastern, Central, Mountain, Pacific) are not part of the official time zone standards, but are useful in comparing time between different parts of the country. In the United States, the time zone names can also reflect whether or not daylight time is in effect.
    - Eastern Daylight Time (EDT) identifies the Eastern time zone, observing daylight standard time.
    - Mountain Standard Time (MST) identifies the Mountain time zone, not observing daylight standard time.

Linux Clocks

Linux systems keep time using two clocks:

Clock	Description
Hardware clock	The hardware clock keeps time using a chip on the system's motherboard. • The hardware clock runs independently of any software. The clock does not require access to the CPU or system RAM to run. • Soft power from the power supply and the CMOS battery ensures that the clock continues to run when the computer is turned off or even unplugged. • The hardware clock is sometimes called the real-time clock (RTC), BIOS clock, CMOS clock, or time of year (TOY) clock. • The current hardware clock time is stored in the **/proc/driver/rtc** file.
System time	System time keeps time using software running within the operating system. • Time on the system clock is measured as the number of seconds that have elapsed since 12:00 AM on Jan 1, 1970. • By default, when the computer boots, it initially sets the system time using the current time from the hardware clock. • After the operating system is running, the system time is the only clock used by applications and services. The hardware clock is ignored. • Changing the system time does not automatically change the hardware clock, although you can change the system time and change the hardware clock to match.

UTC Offset

Clocks on a Linux computer can use local time or UTC time. The following table describes these and explains how to calculate a UTC offset:

Time	Description
Coordinated Universal Time (UTC)	Coordinated Universal Time (UTC), formerly known as Greenwich Mean Time (GMT), is a method of identifying a common time between devices regardless of their physical location in the world. • UTC is adjusted periodically to match the rotation of the earth by adding leap seconds. Leap seconds are required because the official duration of a second does not exactly match the earth's rotation (but it is very close). • UTC matches time to the rotation of the earth using a single fixed point in Greenwich, England. A line drawn from the North Pole to the South Pole that passes through Greenwich is called the prime meridian. • It is preferable for Linux systems to use UTC (not local time). This ensures that a single method of keeping time is used, regardless of the physical location of the computer. It also ensures that timestamps on files, within logs, and on database records remain consistent, especially on networks with hosts residing in multiple time zones.

	• Time expressed using UTC is identified by adding UTC or Z to the time. For example, 09:30 UTC is the same as 09:30Z or 0930Z. UTC is also called Zulu time.

UTC offset	The UTC offset identifies the amount of time that local time is ahead of or behind Coordinated Universal Time (UTC).
	• Local time in each time zone is identified by the UTC offset. For example:
	  ◦ Time zones used in the United States are UTC-05 (Eastern), UTC-06 (Central), UTC-07 (Mountain), and UTC-08 (Pacific), with time being behind UTC.
	  ◦ Time zones used in Europe and Asia are ahead of UTC. For example, time in Germany is UTC+01, and time in Japan is UTC+09.
	• To convert UTC to local time, add time based on the UTC offset (UTC + offset). For example, if UTC is 06:00:
	  ◦ Local time in New York (UTC-05) would be 01:00 (06:00 + - 5:00 = 1 am).
	  ◦ Local time in Los Angeles (UTC-08) would be 22:00 the previous day (10 pm).
	  ◦ Local time in Japan (UTC+09) would be 15:00 (3 pm).
	• To convert local time to UTC, subtract time based on the UTC offset (UTC - offset). For example:
	  ◦ If the local time in New York (UTC-05) is 14:00, UTC is 19:00 (14:00 - - 5:00 = 14:00 + 5:00).
	  ◦ If the local time in Japan (UTC+09) is 14:00, UTC is 5:00 (14:00 - + 9:00).
	• UTC does not change for daylight savings time; however, the offset used by a time zone will change. During daylight savings time, add one hour to the UTC offset. For example:
	  ◦ Standard time in New York is UTC-05; daylight time in New York is UTC-04.
	  ◦ Standard time in Germany is UTC+01; daylight time in Germany is UTC+02.

Local time	Local time is the current time in a local time zone. It is designated using the number of hours ahead or behind UTC time. For example the local time for the Mountain Time Zone in the United States is UTC -7. The default setting for several hardware clocks in a system BIOS is often local time.

Time Zone Tools and Files

The following table describes the tools and files used to determine and change time zone settings:

Item	Description	Examples
/usr/share/zoneinfo	Contains time zone configuration files and directories, with each file identifying	**ls /usr/share/zoneinfo** displays the names for time zones that Linux

	a specific time zone. • Files are typically organized in subfolders based on continent (such as Australia) or major country (such as US). • Individual files identify a major city in the time zone (such as Perth) or a specific region (either a division of the country or a country within the continent). • Information in the file identifies the UTC offset and any rules for daylight savings time. Depending on the distribution, time zone files might be located at **/usr/lib/zoneinfo**.	uses. Additional settings are located in the subdirectories.
/etc/localtime	Identifies the current time zone file used on the system. This file is a symbolic link to the appropriate time zone file in the **/usr/share/zoneinfo** directory. Relinking this file to a different time zone file changes the system's time zone.	**ln -s /usr/share/zoneinfo/***time_zone_file* **/etc/localtime** creates a symbolic link to the time zone file that permanently alters the time zone for the entire system. **cp -s /usr/share/zoneinfo/***time_zone_file* **/etc/localtime** accomplishes the same result as the example above.
/etc/timezone	Configures the time zone on Debian-based distributions. **/etc/timezone** identifies the current time zone by region and zone.	
/etc/sysconfig/clock	Configures the time zone on some distributions, such as openSUSE. The syntax is: TIMEZONE="*timezone*"	TIMEZONE="America/Denver"
date	Used to view and manually set the system time.	**date** shows the current local time and the time zone.
tzselect	Changes the value of the time zone (TZ) environment variable. When executed,	

	the utility prompts you to select a region, then a country, and so on until it has enough information to determine the time zone. Only the root user can invoke the tzselect utility. To use **tzselect**: 1. Enter **tzselect**. 2. Enter the number from the list that corresponds to the correct continent or ocean. 3. Enter the number from the list that corresponds to the correct region. 4. Enter the number from the list that corresponds to the correct timezone. 5. Press 1 to confirm the setting. Use the **tzconfig** command on Debian-based Linux distributions instead of **tzselect**.	
TZ=*time_zone* **export TZ**	Changes the time zone environment variable. Use the file names in the **/usr/share/zoneinfo** directory to select the appropriate names for time zones. Environment variable changes are only permanent if they are added to a shell configuration file similar to **~/.bashrc** or **~/bash_profile**.	TZ='America/Denver' export TZ
timedatectl	Can be used to query and change the system clock and its settings. With no options, this command lists information on the system's current date and time, as well as time-related settings. A few options for this command include: • **set-time** *yyyy/mm/dd hh/mm/ss* changes the date and time according to the parameters entered.	• **timedatectl set time "2019-12-02 13:40:15"** sets the date and time to 2 Dec 2019 and 1:40:15 pm. • **timedatectl list-timezones** shows all the known time zones available. • **timedatectl set-timezone America/Denver** changes the time zone used by the

	• **list-timezones** lists the available time zones recognized on your system. • **set-timezone** *region/area* sets the system time zone to the specified value • **set-local-rtc** *x* where x is the value of 0 or 1. Configures the real-time clock (RTC) to either maintain the RTC in universal time or to maintain the RTC in local time instead. Remember that the <img> tag does not need the closing </img> tag, but the <blockquote> tag does need the closing </blockquote> tag. • **set-ntp** *true/false* Controls whether NTP based network time synchronization is enabled.	mountain time zone in the United States . • **timedatectl set-local-rtc 0** the value of zero tells the system to maintain the RTC in universal time • **timedatectl set-ntp true** enables NTP-based time synchronization.