

## How to use timedatctl and NTP on Ubuntu

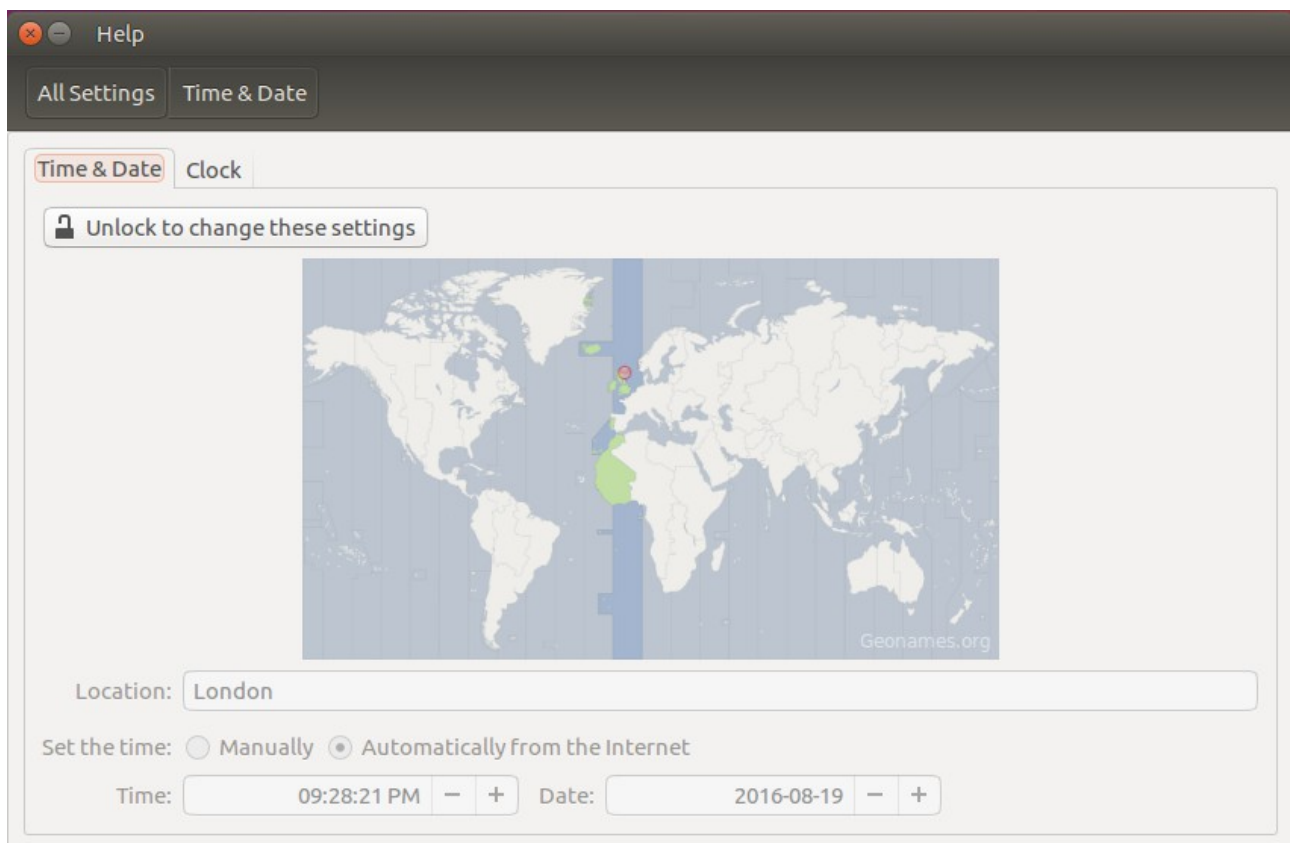
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This "How To" document describes the timedatctl utility in Ubuntu and shows examples of how to set and adjust the time both manually and automatically.

When the OSBoxes Ubuntu VM is first launched, the time-zone is set to Europe/London. To verify this, you can enter the timedatctl command or use the "System Settings" "Time & Date" dialog.

Note that the "timedatctl" command functionally the same as the "timedatctl status" command.

```
dwalling@osboxes:~$ timedatctl
Local time: Fri 2016-08-19 21:17:17 BST
Universal time: Fri 2016-08-19 20:17:17 UTC
RTC time: Wed 2016-08-17 17:35:23
Time zone: Europe/London (BST, +0100)
Network time on: yes
NTP synchronized: no
RTC in local TZ: no
dwalling@osboxes:~$
```

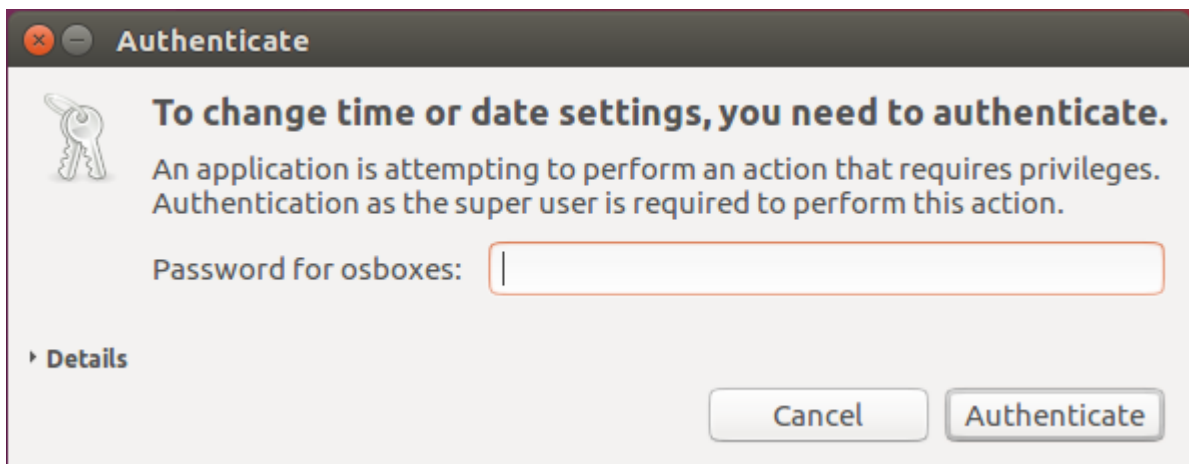


Use the "set-time" option with `timedatectl` to change the date and/or time. Or use, the "Time & Date" dialog. The "set-time" option with `timedatectl` will set system clock time *and* the real-time clock of the VM.

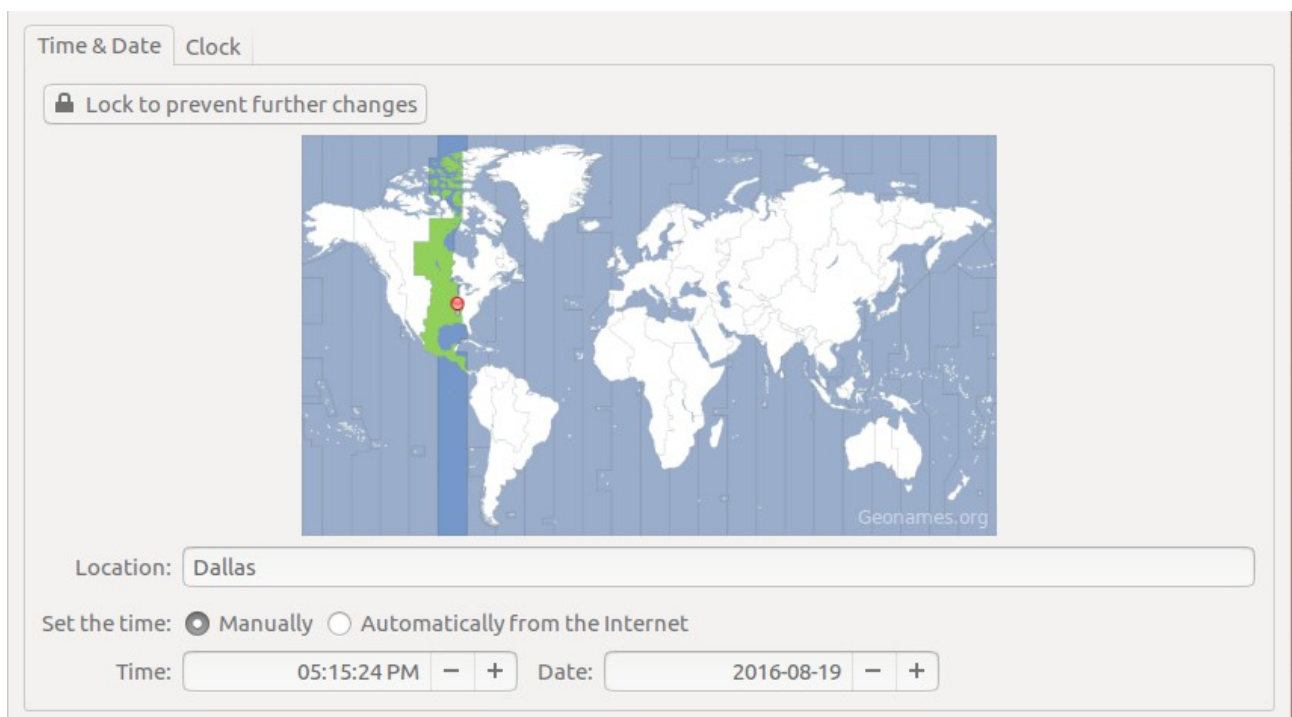
Trying to use the "set-time" option with `timedatectl`, however, will fail if automatic time synchronization is enabled. This is indicated by the value "yes" next of the "Network time on:" setting in the `timedatectl` output. We can turn this option off using the Time & Date System Setting dialog.

```
dwalling@osboxes:~$ timedatectl set-time "2016-08-19 17:00:00"  
Failed to set time: Automatic time synchronization is enabled
```

First, unlock the Time & Date settings by entering the password for `osboxes`.



Adjust the "Location:" value so that the correct time-zone is selected. Update the "Set the time:" value to "Manually". But, for now, leave the "Time:" and "Date:" values as they are.



Now the automatic time synchronization is off, allowing us to update the date and/or time either on the Time & Date dialog or with the `timedatectl` command.

```
dwalling@osboxes:~$ timedatectl status
Local time: Fri 2016-08-19 17:17:52 CDT
Universal time: Fri 2016-08-19 22:17:52 UTC
RTC time: Wed 2016-08-17 19:35:57
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
dwalling@osboxes:~$
```

We will deliberately set the time a little off for now and then observe what happens when we enable the Network Time Protocol (NTP) to automatically correct our settings.

```
dwalling@osboxes:~$ timedatectl set-time "2016-08-19 17:00:00"
dwalling@osboxes:~$ timedatectl
Local time: Fri 2016-08-19 17:00:04 CDT
Universal time: Fri 2016-08-19 22:00:04 UTC
RTC time: Fri 2016-08-19 22:00:04
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
dwalling@osboxes:~$
```

Note that the time entered in the "timedatectl" command above is understood as local time. The Universal time and RTC time have been synchronized to the local time.

Interestingly, even though we set an incorrect time with `timedatectl`, a few minutes after that, Ubuntu's clock mysteriously sets itself to the correct time values ...

```
dwalling@osboxes:~$ timedatectl
Local time: Fri 2016-08-19 17:22:44 CDT
Universal time: Fri 2016-08-19 22:22:44 UTC
RTC time: Fri 2016-08-19 22:01:44
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
```

What's going on here? By default, OSBoxes Ubuntu will synchronize the guest OS time to the host OS time. They may be perfectly acceptable. However, if you would prefer to have the guest OS synchronize time to a network time server or not sync at all, this feature can be disabled.

Disabling automatic synchronization of the Guest OS time to the Host OS time is accomplished by updating the OSBoxes VM manager on the host. In our case, this is a Windows 10 host. OSBoxes has installed a set of executable files in the `Oracle\VirtualBox` directory. One of the utility programs here is `VBoxManage.exe`.

```
C:\Program Files\Oracle\VirtualBox>VBoxManage --version
5.1.2r108956
```

```
C:\Program Files\Oracle\VirtualBox>VBoxManage list vms
"Ubuntu 16.04 Xenial 1" {328b5886-901d-4fa8-9da7-c904ecddd081}
```

Using the "list vms" command arguments as shown above, we can find both the unique name and the UUID used to identify our Guest OS VM.

Now we can add a new configuration variable, "GetHostTimeDisabled", and assign it a value of "1", indicating "true". Logout of Ubuntu and stop the VM. Here is the command to disable Host OS time sync. Enter this command from the host OS command line.

Note that if you don't stop the Guest OS VM, the command below will return an error indicating a failure to lock the configuration database to make the update.

```
VBoxManage          setextradata          "Ubuntu          16.04          Xenial          1"
"VBoxInternal/Devices/VMMDev/0/Config/GetHostTimeDisabled" "1"
```

This command updates the configuration file for the VM. In this example, the file is located in the Windows 10 "Users" folder for the current user. In our case, the file is located at:

```
C:\Users\Me\VirtualBox VMs\Ubuntu 16.04 Xenial 1\Ubuntu 16.04 Xenial 1.vbox
```

If you open and look at the file, you will see that it is in XML format. Our new setting is highlighted in the screenshot below.

```
1 <?xml version="1.0"?>
2 <!--
3 ** DO NOT EDIT THIS FILE.
4 ** If you make changes to this file while any VirtualBox related application
5 ** is running, your changes will be overwritten later, without taking effect.
6 ** Use VBoxManage or the VirtualBox Manager GUI to make changes.
7 -->
8 <VirtualBox xmlns="http://www.virtualbox.org/" version="1.16-windows">
9   <Machine uuid="{328b5886-901d-4fa8-9da7-c904ecddd081}" name="Ubuntu 16.04 Xenial 1" OSType="Ubuntu_64" snapshotFolder="Snapshots" lastStateChange="2016-08-23T19:03:42Z">
10     <MediaRegistry>
11       <HardDisks>
12         <HardDisk uuid="{0cb71ad6-a172-49c0-8d4f-f7bf68f01f07}" location="C:/VirtualBox/Ubuntu 16.04 Xenial 1/Ubuntu 16.04 64bit.vdi" format="VDI" type="Normal"/>
13       </HardDisks>
14     </MediaRegistry>
15     <ExtraData>
16       <ExtraDataItem name="GUI/LastGuestSizeHint" value="1136,1027"/>
17       <ExtraDataItem name="GUI/LastNormalWindowPosition" value="73,50,640,522"/>
18       <ExtraDataItem name="GUI/RestrictedRuntimeDevicesMenuActions" value="HardDrives"/>
19       <ExtraDataItem name="GUI/RestrictedRuntimeMachineMenuActions" value="SaveState,PowerOff"/>
20       <ExtraDataItem name="GUI/ScaleFactor" value="1"/>
21       <ExtraDataItem name="GUI/StatusBar/IndicatorOrder" value="HardDisks,OpticalDisks,FloppyDisks,Network,USB,SharedFolders,Display,VideoCapture,Features,Mouse,Keyboard"/>
22       <ExtraDataItem name="VBoxInternal/Devices/VMMDev/0/Config/GetHostTimeDisabled" value="1"/>
23     </ExtraData>
```

Now exit the configuration file and restart Ubuntu. Logon as our normal user. Now, the `timedatectl` command can be used to update the Guest OS time, and after some delay, no synchronization occurs.

```
dwalling@osboxes:~$ timedatectl
Local time: Tue 2016-08-23 14:24:02 CDT
Universal time: Tue 2016-08-23 19:24:02 UTC
RTC time: Tue 2016-08-23 19:24:01
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
dwalling@osboxes:~$ timedatectl set-time 14:00
dwalling@osboxes:~$ timedatectl
Local time: Tue 2016-08-23 14:00:03 CDT
Universal time: Tue 2016-08-23 19:00:03 UTC
RTC time: Tue 2016-08-23 19:00:03
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
dwalling@osboxes:~$ timedatectl
Local time: Tue 2016-08-23 14:00:57 CDT
Universal time: Tue 2016-08-23 19:00:57 UTC
RTC time: Tue 2016-08-23 19:00:57
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
```

Now, we will configure Ubuntu to synchronize its date and time using a network time server, communicating over the network using the Network Time Protocol (NTP). Once configured, NTP will accept UDP datagrams on port 123. Since NTP traffic is not connection-oriented, like TCP, we do *not* say that NTP "listens" for connections. Before installing NTP, note what ports are open on Ubuntu.

```
osboxes@osboxes:~$ netstat -an | more
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 127.0.0.1:631          0.0.0.0:*                LISTEN
tcp        0      0 192.168.43.86:8642     0.0.0.0:*                LISTEN
tcp6       0      0 :::1:631               :::*                    LISTEN
udp        0      0 0.0.0.0:5353          0.0.0.0:*                *
udp        0      0 0.0.0.0:68            0.0.0.0:*                *
udp        0      0 0.0.0.0:49318         0.0.0.0:*                *
udp        0      0 0.0.0.0:631          0.0.0.0:*                *
udp6       0      0 :::5353                :::*                    *
udp6       0      0 :::43037               :::*                    *
```

By default, the OSBoxes Ubuntu 16.04 Guest OS does not come configured with the ntp service installed. We can use "apt" to install it.

```
dwalling@osboxes:~$ su -l osboxes
Password:
osboxes@osboxes:~$ sudo apt install ntp
[sudo] password for osboxes:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libopts25
Suggested packages:
  ntp-doc
The following NEW packages will be installed
  libopts25 ntp
0 to upgrade, 2 to newly install, 0 to remove and 28 not to upgrade.
Need to get 576 kB of archives.
After this operation, 1,786 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

```
Get:1 http://pubmirrors.dal.corespace.com/ubuntu xenial/main amd64 libopts25 amd64 1:5.18.7-3 [57.8 kB]
Get:2 http://pubmirrors.dal.corespace.com/ubuntu xenial/main amd64 ntp amd64 1:4.2.8p4+dfsg-3ubuntu5 [518 kB]
Fetched 576 kB in 1s (335 kB/s)
Selecting previously unselected package libopts25:amd64.
(Reading database ... 208014 files and directories currently installed.)
Preparing to unpack .../libopts25_1%3a5.18.7-3_amd64.deb ...
Unpacking libopts25:amd64 (1:5.18.7-3) ...
Selecting previously unselected package ntp.
Preparing to unpack .../ntp_1%3a4.2.8p4+dfsg-3ubuntu5_amd64.deb ...
Unpacking ntp (1:4.2.8p4+dfsg-3ubuntu5) ...
Processing triggers for libc-bin (2.23-0ubuntu3) ...
Processing triggers for systemd (229-4ubuntu7) ...
Processing triggers for ureadahead (0.100.0-19) ...
Processing triggers for man-db (2.7.5-1) ...
Setting up libopts25:amd64 (1:5.18.7-3) ...
Setting up ntp (1:4.2.8p4+dfsg-3ubuntu5) ...
Processing triggers for libc-bin (2.23-0ubuntu3) ...
Processing triggers for systemd (229-4ubuntu7) ...
Processing triggers for ureadahead (0.100.0-19) ...
osboxes@osboxes:~$
```

After installing ntp, Ubuntu starts the service. Now, we can see port 123 open for UDP.

```
osboxes@osboxes:~$ netstat -an | more
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 127.0.0.1:631           0.0.0.0:*                LISTEN
tcp        0      0 192.168.43.86:8642      0.0.0.0:*                LISTEN
tcp6       0      0 :::1:631                 :::*                    LISTEN
udp        0      0 0.0.0.0:5353            0.0.0.0:*                *
udp        0      0 0.0.0.0:68              0.0.0.0:*                *
udp        0      0 192.168.43.86:123       0.0.0.0:*                *
udp        0      0 127.0.0.1:123           0.0.0.0:*                *
udp        0      0 0.0.0.0:123             0.0.0.0:*                *
udp        0      0 0.0.0.0:49318           0.0.0.0:*                *
udp        0      0 0.0.0.0:631             0.0.0.0:*                *
udp6       0      0 :::5353                  :::*                    *
udp6       0      0 :::43037                  :::*                    *
udp6       0      0 fe80::a00:27ff:fe15:123 :::*                    *
udp6       0      0 2600:100c:b221:62de:123 :::*                    *
udp6       0      0 :::1:123                  :::*                    *
udp6       0      0 :::123                    :::*                    *
```

Returning to our `timedatectl` command, now with NTP traffic reaching our server, the "NTP synchronized" value displays "yes". This indicator tells us that Ubuntu's clock is synchronized. It can be reset to "no" by manually updating the time.

```
osboxes@osboxes:~$ timedatectl
Local time: Tue 2016-08-23 15:07:16 CDT
Universal time: Tue 2016-08-23 20:07:16 UTC
RTC time: Tue 2016-08-23 19:42:45
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: yes
RTC in local TZ: no
osboxes@osboxes:~$ timedatectl set-time 15:00
osboxes@osboxes:~$ timedatectl
Local time: Tue 2016-08-23 15:00:03 CDT
Universal time: Tue 2016-08-23 20:00:03 UTC
RTC time: Tue 2016-08-23 20:00:04
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
```

NTP synchronization can be toggled on and off using the "set-ntp" option of the `timedatectl` program. This option takes a boolean argument indicating whether NTP synchronization should occur. Note that the "NTP Synchronized" value displayed by `timedatectl` does NOT show the "set-ntp" boolean setting. It indicates whether Ubuntu's time is considered to be synchronized at the current time. Once the "set-ntp" boolean is set to false AND the date or time is set manually, the "NTP synchronized" value returns to display "no".

Now, we might expect things to stay this way, with our clock deliberately incorrect and NTP Synchronization off. But wait, something happens after a minute or so ...

```
osboxes@osboxes:~$ timedatectl
Local time: Tue 2016-08-23 15:00:23 CDT
Universal time: Tue 2016-08-23 20:00:23 UTC
RTC time: Tue 2016-08-23 20:00:24
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: no
RTC in local TZ: no
osboxes@osboxes:~$ timedatectl
Local time: Tue 2016-08-23 15:00:25 CDT
Universal time: Tue 2016-08-23 20:00:25 UTC
RTC time: Tue 2016-08-23 20:00:25
Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: yes
RTC in local TZ: no
```

Here, the NTP Synchronized indicator has returned "yes" automatically. Why? Well, the `ntp` service is still running and network time data will still arrive. So now we are in a state where Ubuntu thinks it is "NTP Synchronized" but the time is still wrong.

So, we can assume, wrongly, that simply turning on the "set-ntp" option will fix everything. Well, that does activate the use of the network time, but it does not synchronize, yet.

```
osboxes@osboxes:~$ timedatectl
    Local time: Tue 2016-08-23 15:04:17 CDT
    Universal time: Tue 2016-08-23 20:04:17 UTC
    RTC time: Tue 2016-08-23 20:04:18
    Time zone: America/Chicago (CDT, -0500)
Network time on: no
NTP synchronized: yes
RTC in local TZ: no
osboxes@osboxes:~$ timedatectl set-ntp true
osboxes@osboxes:~$ timedatectl
    Local time: Tue 2016-08-23 15:04:26 CDT
    Universal time: Tue 2016-08-23 20:04:26 UTC
    RTC time: Tue 2016-08-23 20:04:26
    Time zone: America/Chicago (CDT, -0500)
Network time on: yes
NTP synchronized: yes
RTC in local TZ: no
osboxes@osboxes:~$ █
```

Restarting the ntp service will cause Ubuntu to apply the correct time. But, the NTP Synchronized option returns to "no".

```
osboxes@osboxes:~$ timedatectl
    Local time: Tue 2016-08-23 15:07:50 CDT
    Universal time: Tue 2016-08-23 20:07:50 UTC
    RTC time: Tue 2016-08-23 20:07:50
    Time zone: America/Chicago (CDT, -0500)
Network time on: yes
NTP synchronized: yes
RTC in local TZ: no
osboxes@osboxes:~$ sudo service ntp restart
osboxes@osboxes:~$ timedatectl
    Local time: Tue 2016-08-23 15:26:58 CDT
    Universal time: Tue 2016-08-23 20:26:58 UTC
    RTC time: Tue 2016-08-23 20:08:45
    Time zone: America/Chicago (CDT, -0500)
Network time on: yes
NTP synchronized: no
RTC in local TZ: no
osboxes@osboxes:~$ █
```



As we saw before, after a period of time, Ubuntu records that NTP synchronization is active.

```
osboxes@osboxes:~$ timedatectl
    Local time: Tue 2016-08-23 15:34:57 CDT
    Universal time: Tue 2016-08-23 20:34:57 UTC
    RTC time: Tue 2016-08-23 20:16:43
    Time zone: America/Chicago (CDT, -0500)
    Network time on: yes
    NTP synchronized: yes
    RTC in local TZ: no
osboxes@osboxes:~$
```

If we restart Ubuntu and check these settings again, we are back as we were on our last restart - "Network time on" is set to "yes" as we left it and "NTP Synchronized" is, temporarily, "no". The date and time are correct.

```
dwalling@osboxes:~$ timedatectl
    Local time: Tue 2016-08-23 15:42:08 CDT
    Universal time: Tue 2016-08-23 20:42:08 UTC
    RTC time: Tue 2016-08-23 20:42:06
    Time zone: America/Chicago (CDT, -0500)
    Network time on: yes
    NTP synchronized: no
    RTC in local TZ: no
dwalling@osboxes:~$
```

Finally, the "RTC in local TZ" indicator on the timedatectl output indicates whether the Guest OS's real-time clock setting is stored in the local time zone. Ubuntu documentation warns that setting this option to yes with the "set-local-rtc" option may cause some applications to behave abnormally. This "How To" document does not explore changing this option.

This concludes this "How To". We have seen how to manage keeping our Ubuntu VM's time settings synchronized using both the built-in Host OS synchronization and using NTP.

In our next "How To", we will install the Java JDK and Eclipse IDE.