

LOCAL GPS CAPTURE FOR TIMEKEEPING

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Most computers attached to a network can perform adequate time keeping.

However, older machines with failing CMOS batteries often fail to keep accurate time. This becomes an issue when working off network when primary time keeping machines are not available to provide Network Time Protocol (NTP) services.

This paper will document GPS based time keeping and the process to turn a Windows 10 PC into an authoritative time keeping device for an off-grid computer network.

STOP: If you have a different model GPS you may not have to install this software. If you GPS dongle is working with the provided software then skip to the bottom of this document where the instructions for setting up an NTP server on Windows 10 and 11 ENTERPRISE can be found.

The basic steps are as follows:

1. Install all software
2. Plug in dongle and make sure it's getting time and the computer is updating it's time from the GPS.
3. Give your PC a static IP Address if this is a permanent setting for your network. You can leave the random IP address for the purposes of field day.
4. Install Group Policy add-on if you have Windows 10 or 11 home edition.
5. Turn on NTP services
6. Make your router ask your PC for NTP time.
7. Make sure all the other PCs have static IP addresses on the same network.

For this experiment a Waterproof GPS receiver for Laptop USB interface by UBLOX was purchased and attached to the computer.

https://www.amazon.com/dp/B071XY4R26?psc=1&ref=ppx_yo2ov_dt_b_product_details

Step one download required software:

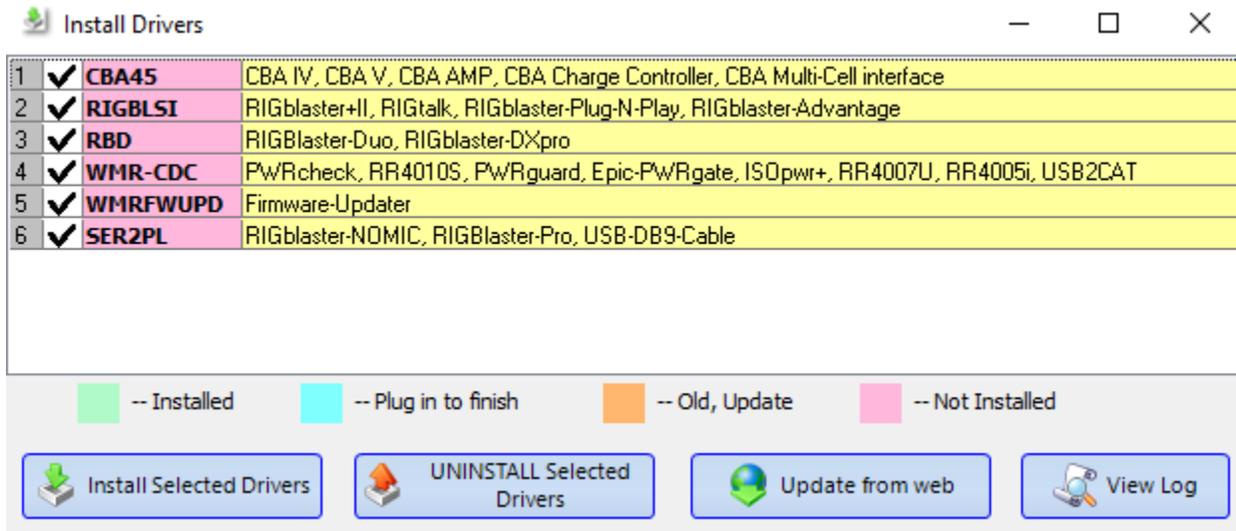
West Mountain Radio diagnostic software was downloaded from their website.

https://www.westmountainradio.com/product_info.php?products_id=gps-dongle

This is a link to the West Mountain Radio installation instructions.

<https://www.westmountainradio.com/content.php?page=wmr-diagnostics>

Be sure to select all the drivers. It's not very clear that you must put a check mark in the white area next to the name of the driver.



Step 2: Plug your USP GPS dongle into the computer

In the process this will create a new virtual serial port. In my case it's port 5. Yours may be different. I also had to scroll down past mine to find it.

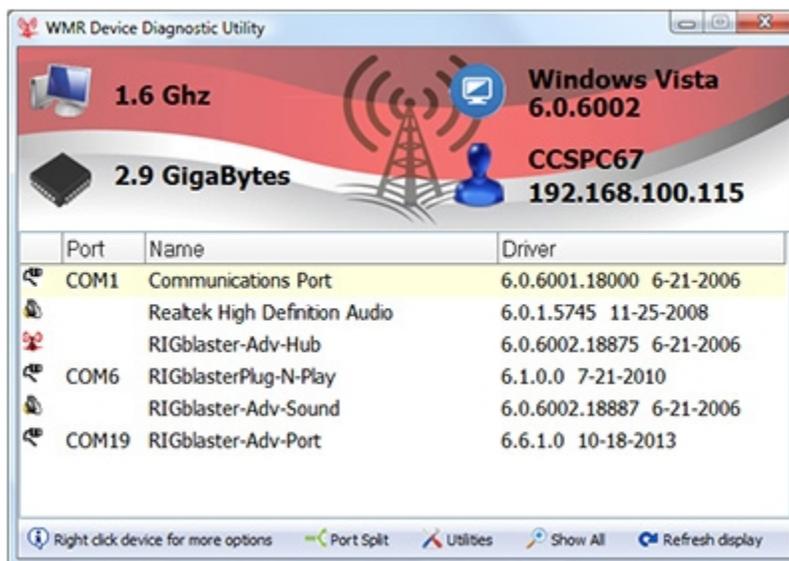
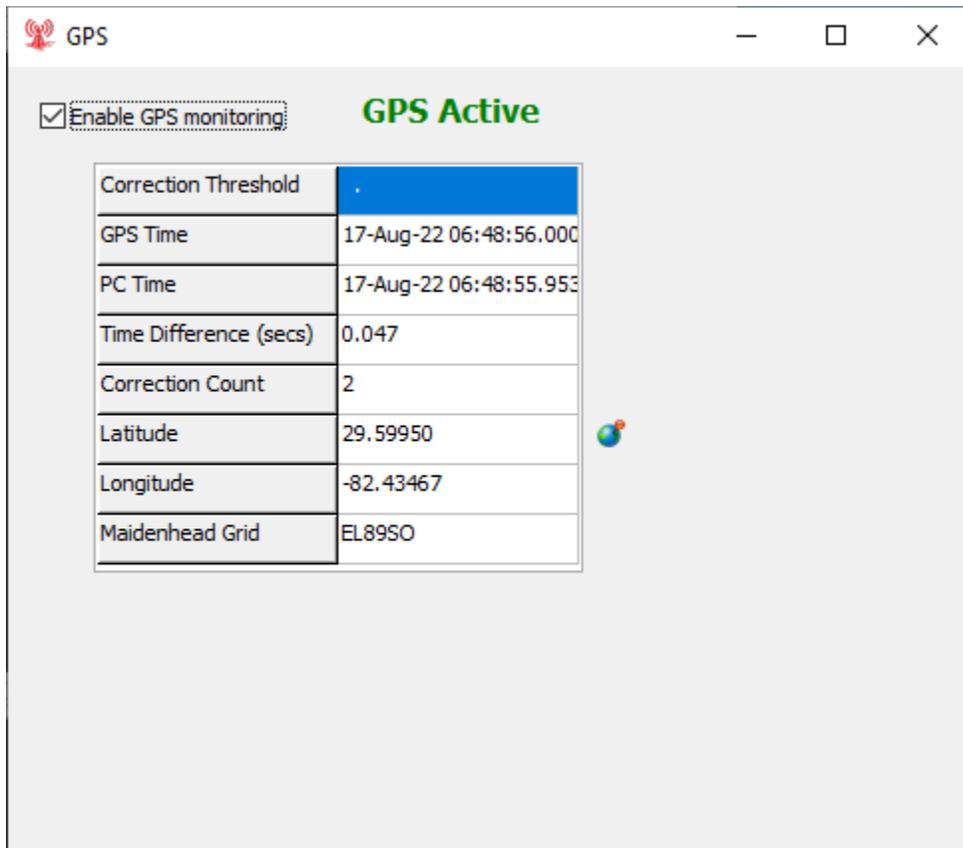


Figure A2 - WMR Diagnostics Main Screen

When attached to the GPS port the software produces a small screen showing the GPS is active.



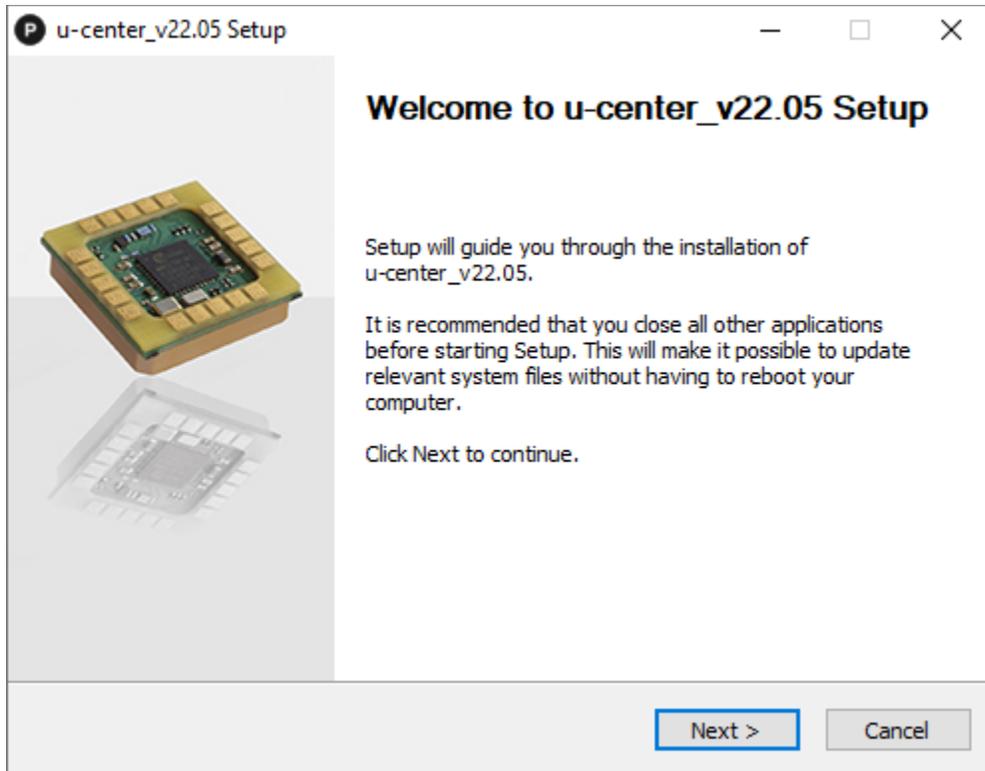
The computer now has GPS based time keeping the PC time accurate. In my case I have seen Time Differences of .001 and 000 indicating a perfect match between more than a dozen GPS satellites.

Step 3: Install Ublox software and drivers

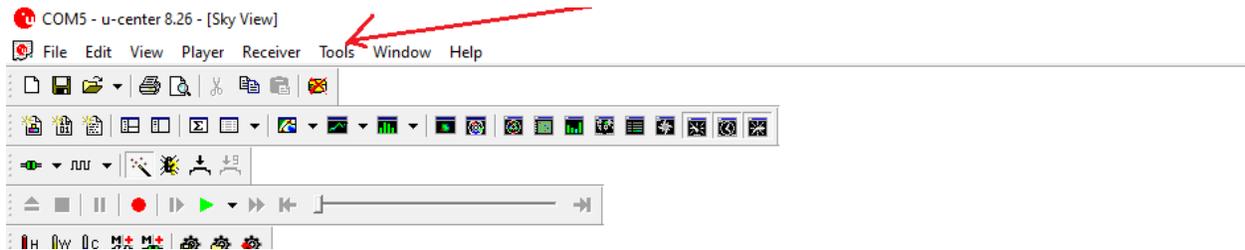
Software version U-Center_v22.05.

<https://www.u-blox.com/en/product/u-center>

DO NOT install the drivers that came with this software.

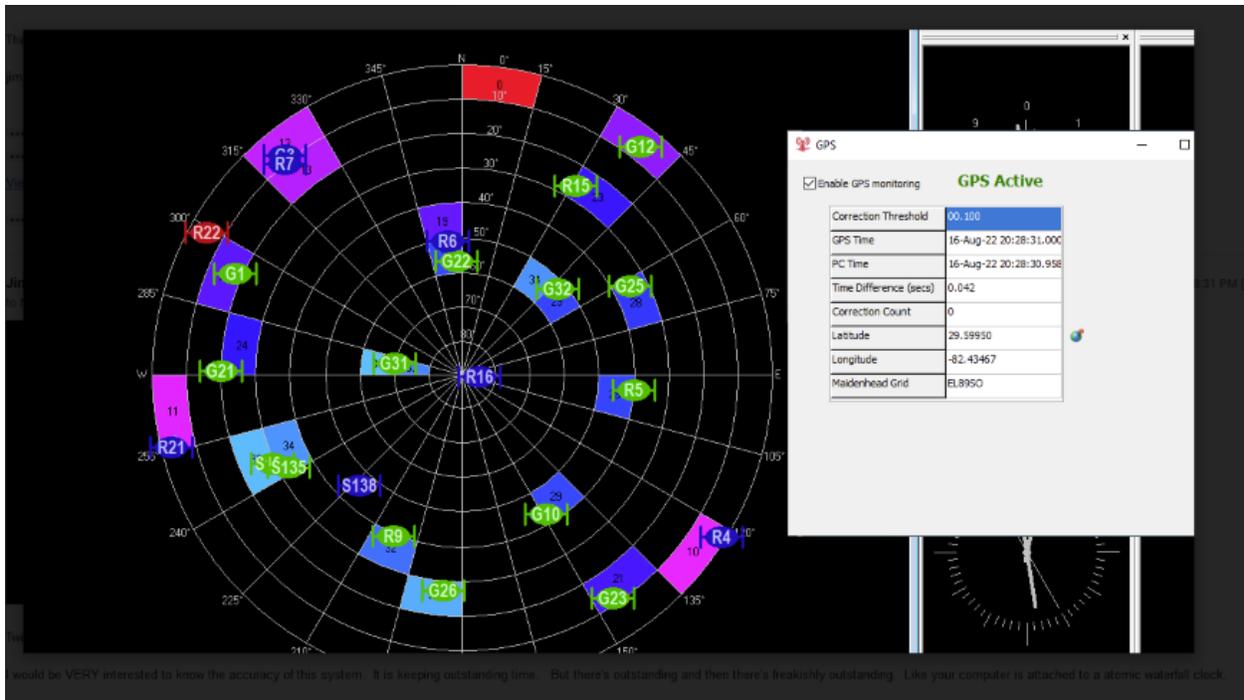


Once this software was installed, I had to configure the software to see Port 5 on my computer. Remember the West Mountain Software created this virtual port.



The option to change the port is found under tools and port settings.

At this point the software will run and you can see what satellites are being seen by your computer.



This screen shot shows both software packages working at the same time. Signals are being received from the GPS satellites marked with a green dot.

The Ublox software can show additional data about what the antenna is hearing. It shows GPS time is being heard.

COM5 - u-center 8.26 - [Statistic View]

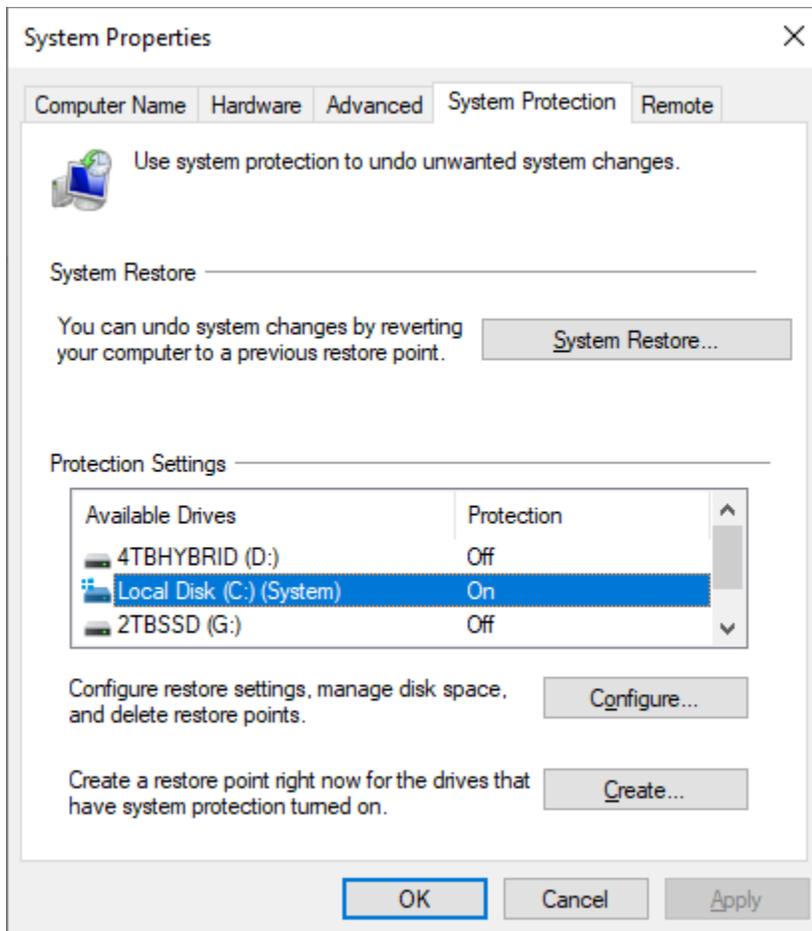
File Edit View Player Receiver Tools Window Help

Title	Count	Age	Current	Minimum	Maximum	Average	Deviation	Unit	Description
UTC	291	0	16:24:38.000 ...	16:19:48.000 ...	16:24:38.000 ...			time d...	Time UTC
GPS time	291	0	2223:231896....	2223:231606....	2223:231896....			wno:to	Time GPS
iTOW	291	0	231896.000	231606.000	231896.000			s	GPS iTOW
NAV-HNR iTOW	0							s	NAV-HNR iTOW
TACC	0					0.000000		us	Time Accuracy
TimeStartup	291	0	1215.866	925.866	1215.866	1070.866	84.149	s	Time since Startup
TTF	1	290	38.376	38.376	38.376	38.376		s	Time to first fix
TM0 rising	0					0.00000000			Timemark0 Rising Edge
TM0 falling	0					0.00000000			Timemark0 Falling Edge
TM1 rising	0					0.00000000			Timemark1 Rising Edge
TM1 falling	0					0.00000000			Timemark1 Falling Edge

At this point it might be a good idea to perform a system restore point because we are going to modify the computer's local group policy to turn on the three services related to NTP.

Step four: Keeping things safe:

To create a restore point go to the Windows Search box in the lower left of your screen and type the word RESTORE and press enter.

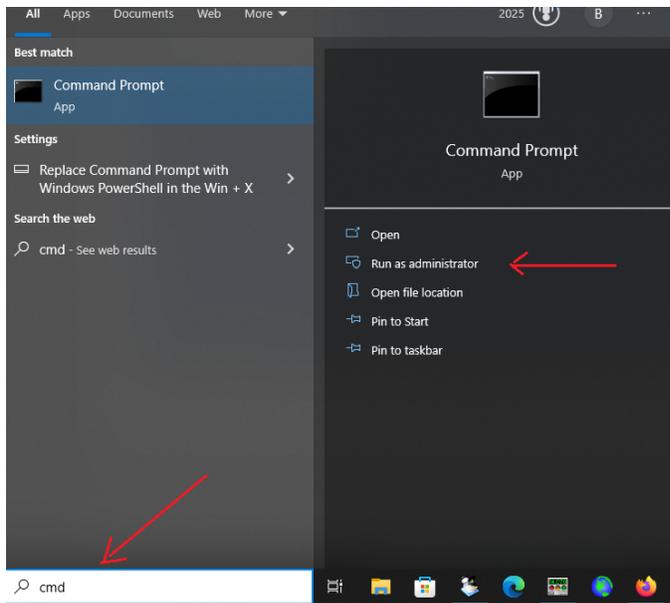


This box should appear and make sure you select drive C. This is where your operating system is and where we will modify the group policy. Make sure you click on the CREATE button and give yourself a name you'll remember later.

Steve five: Give yourself a STATIC IP address

First let's find out what your IP address is:

Click on Search and type CMD. To the right look for run as administrator.



Type in IPConfig and press enter and you should see something like this:

```
Ethernet adapter Ethernet:  
  
    Connection-specific DNS Suffix  . :  
    Link-local IPv6 Address . . . . . : fe80::a93e:d0ba:42a2:92aa%14  
    IPv4 Address. . . . . : 192.168.1.9  
    Subnet Mask . . . . . : 255.255.255.0  
    Default Gateway . . . . . : 192.168.1.1
```

The IP address is my computer is 192.168.1.9

Do this for a permanent installation. For field day just write the number down. It should remain the same IP address until the NTP server is shut down and restarted.

If you leave the address random and the NTP server does not work repeat this process and have the other computers point their time software at the new IP address.

Here is a brief video on to make this address a static IP. <https://www.youtube.com/watch?v=5iRp1Nug0PU>

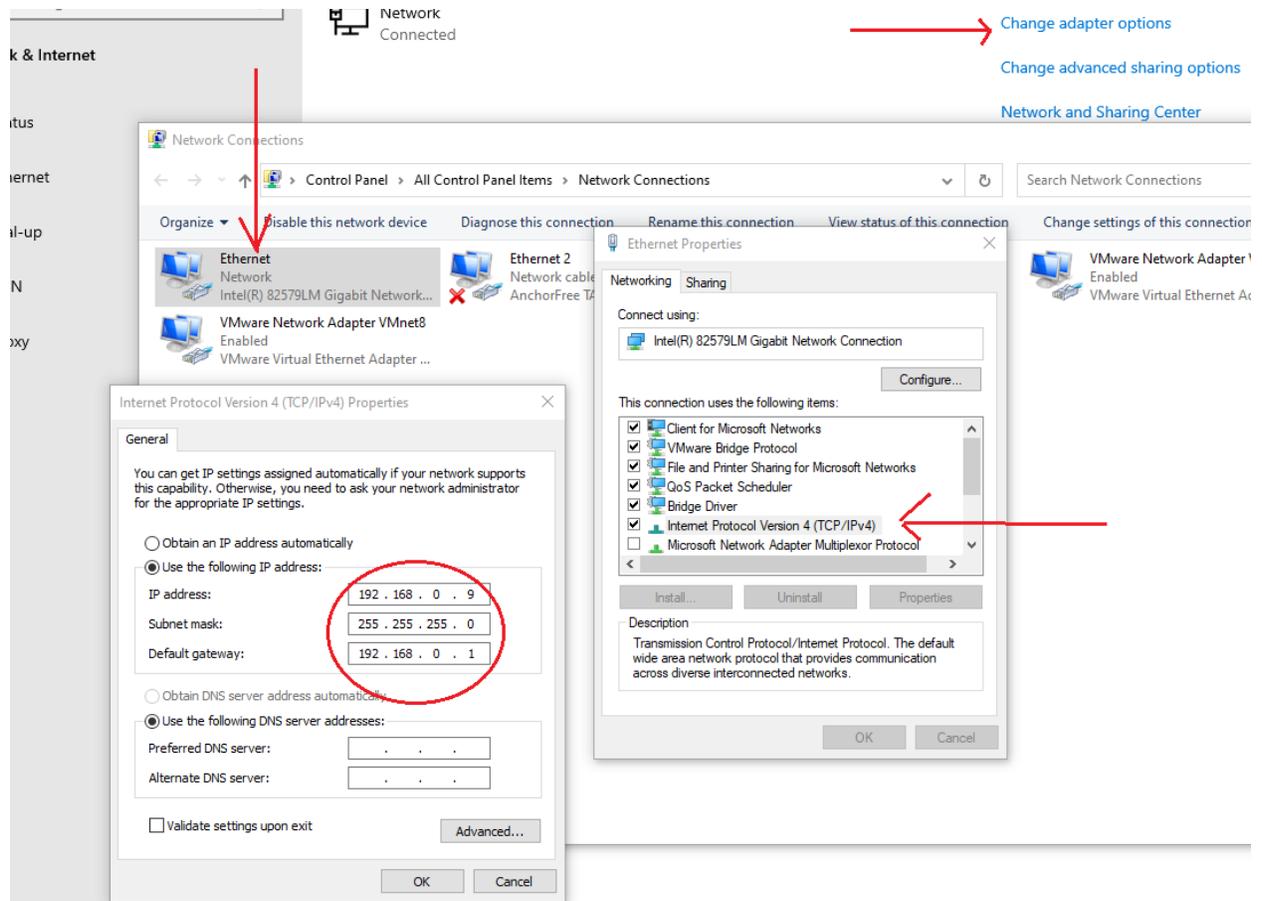
Steps for static: Click on the **Windows search** bar and type **ETHERNET**. This will bring up **the Ethernet settings page**. In the upper right click on **Change Adapter Options**. This will open the Network Connections page and show you the Ethernet cards on your PC.

Right click on your active Ethernet connection and select properties. This opens the properties window. Click on the Internet Protocol Version 4 (tcp/ipv4) selection and choose properties.

Enter your IP address. You will also need to add the following:

Subnet Mask: 255.255.255.0

Gateway: The first three portions of your IP address followed by the number one.



For example, if your IP address is 192.168.0.9 then your Gateway should be 192.168.0.1 with a subnet mask of 255.255.255.0.

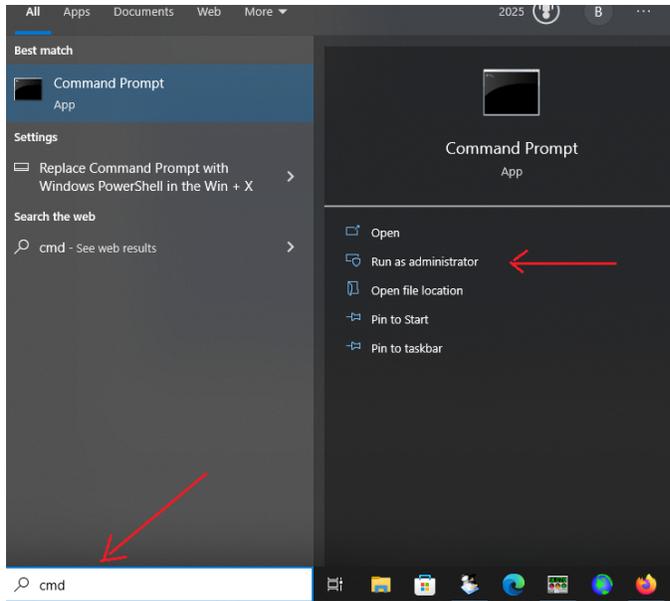
Step six:

STOP! If you are running Windows Home version 10 or 11 you will have to install the Group Policy module. It is not normally found on these editions of the software.

You may skip this depending on the version of Windows you have.

If you can run GPEDIT.MSC from a command prompt and get a window full of group policy options you can skip to Section Seven.

Click on the search window and type CMD and click on run as administrator.



Copy and past the following script into the window and press enter.

```
@echo off
```

```
pushd "%~dp0"
```

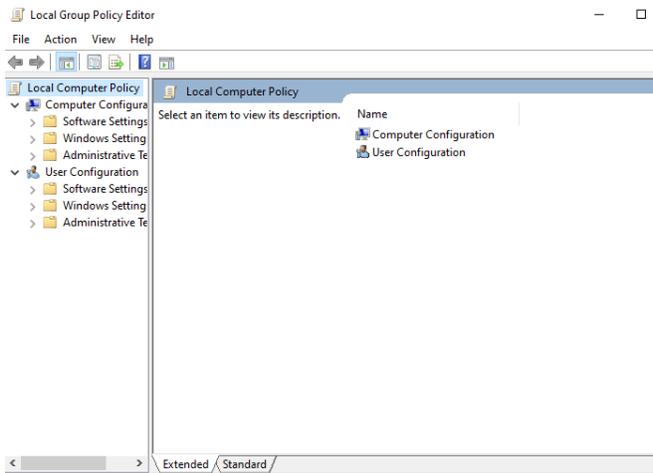
```
dir /b %SystemRoot%\servicing\Packages\Microsoft-Windows-GroupPolicy-ClientExtensions-  
Package~3*.mum >List.txt
```

```
dir /b %SystemRoot%\servicing\Packages\Microsoft-Windows-GroupPolicy-ClientTools-  
Package~3*.mum >>List.txt
```

```
for /f %%i in ('findstr /i . List.txt 2^>nul') do dism /online /norestart /add-package:"%SystemRoot%\  
servicing\Packages\%%i"
```

```
pause
```

Step seven: From the command prompt type GPEDIT.MSC and press enter and the Group Policy Window will appear.

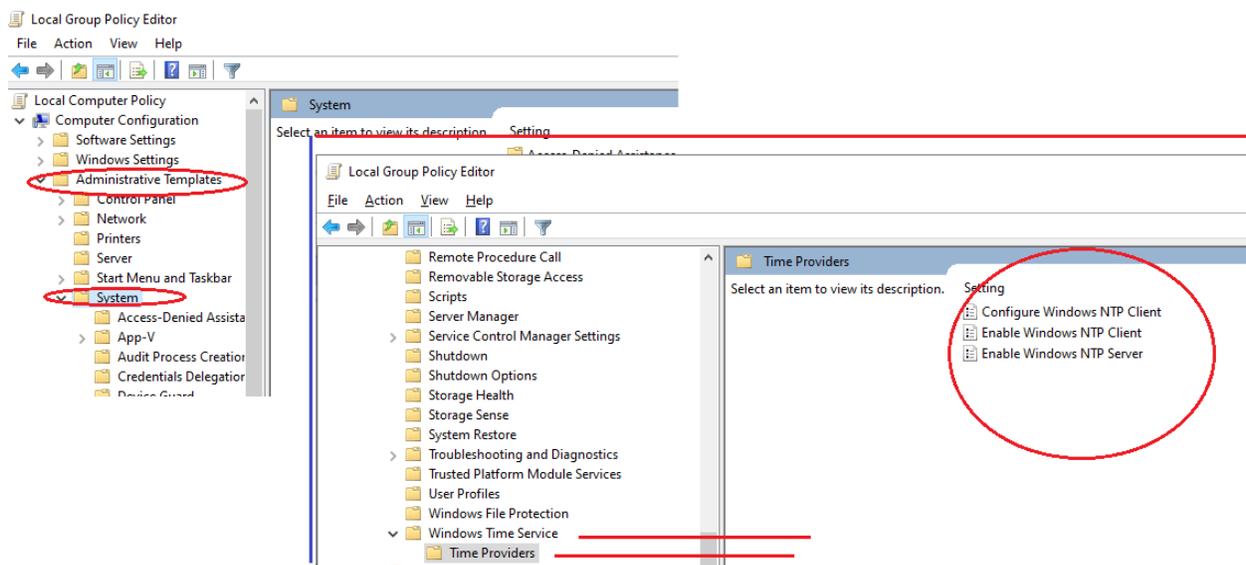


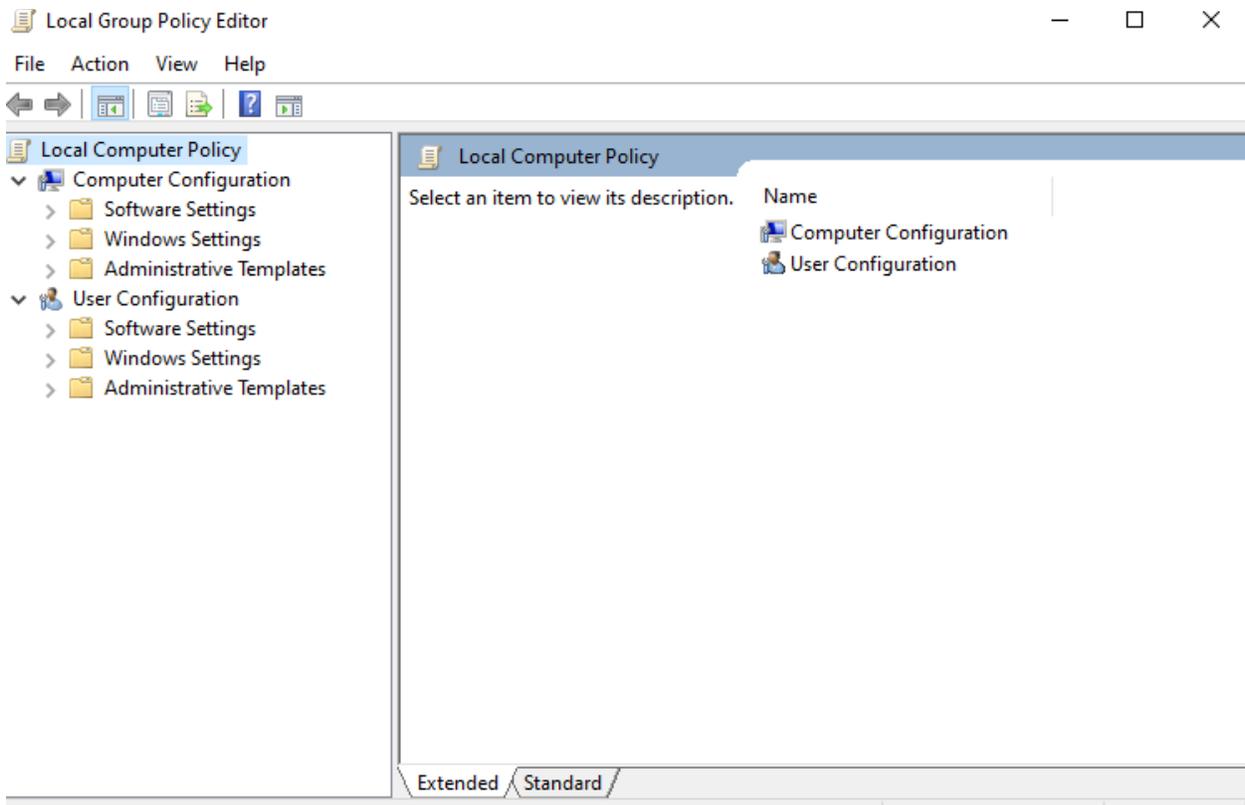
Step eight: Watch this video about NTP settings. It will explain all the information that follows.

https://www.youtube.com/watch?v=BXow_iBljxo

In your computers search box (bottom left of your monitor) type **GPEDIT.msc** and press enter.

This box should appear, and you can adjust the group policy for your computer.





We are going to drill down through the areas marked in red circles.

Administrative Templates

System

Windows Time Services

Time providers

This is where you will make the group policy change.

Double click on enable Windows NTP Client and set this to ENABLED and click on Apply and OK.

Enable Windows NTP Client

Enable Windows NTP Client Previous Setting Next Setting

Not Configured Comment:

Enabled

Disabled

Supported on: At least Windows Server 2003 operating systems or Windows XP Professional

Options: Help:

This policy setting specifies whether the Windows NTP Client is enabled.

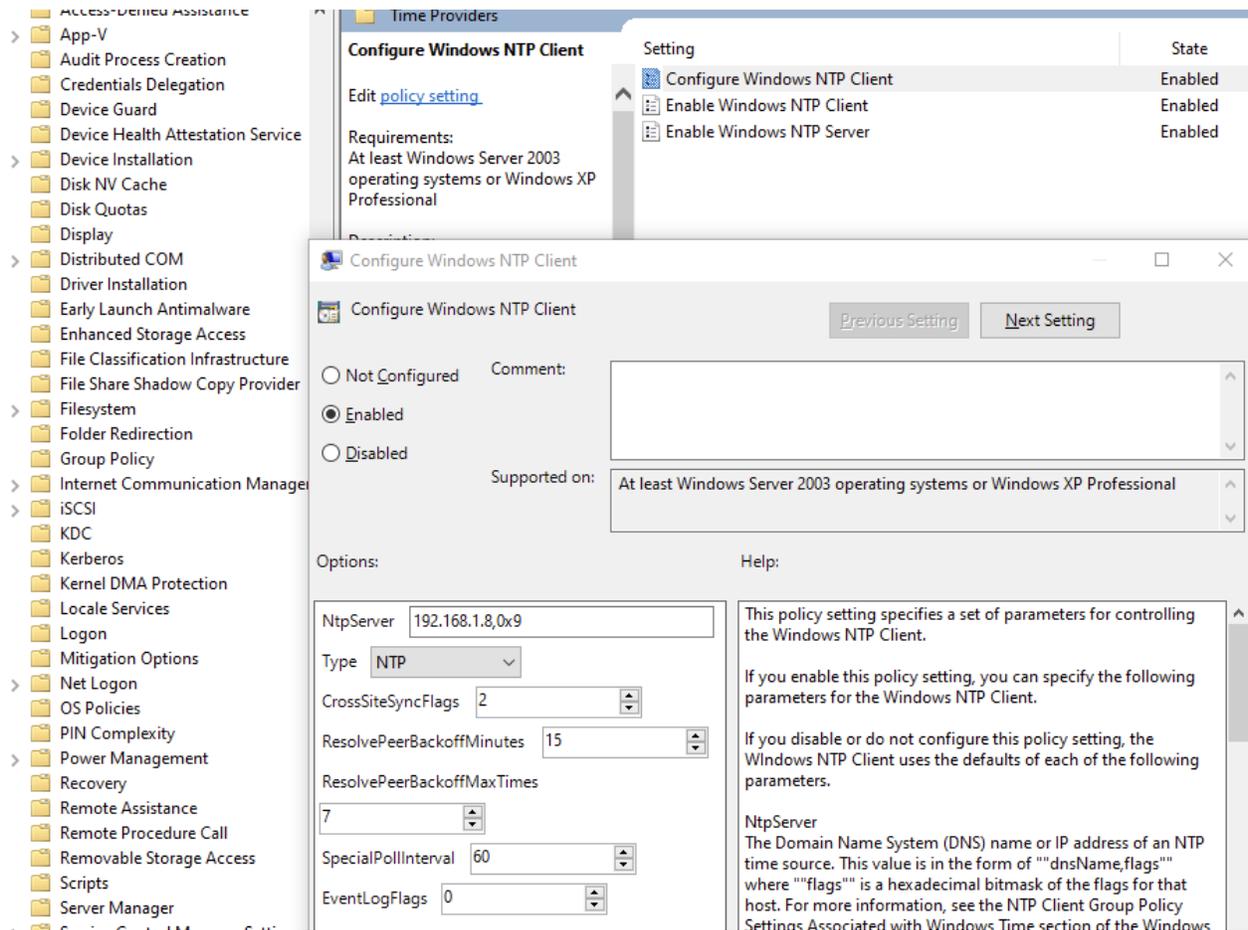
Enabling the Windows NTP Client allows your computer to synchronize its computer clock with other NTP servers. You might want to disable this service if you decide to use a third-party time provider.

If you enable this policy setting, you can set the local computer clock to synchronize time with NTP servers.

If you disable or do not configure this policy setting, the local computer clock does not synchronize time with NTP servers.

OK Cancel Apply

Next click on CONFIGURE WINDOWS NTP CLIENT.



Select ENABLE and the change the NTP server to the STATIC IP address of your computer.

TYPE should be changed to NTP.

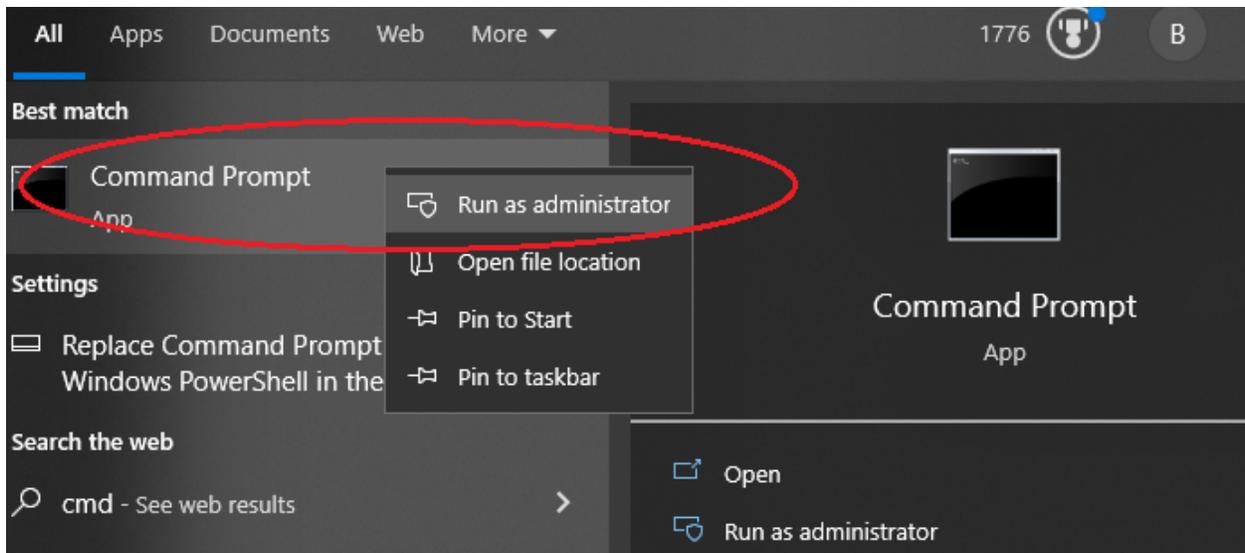
CrossSiteSuncFalgs should be set to 2.

SpecialPollInterval should be set to 60.

Every sixty second the computers on the network will be polled for accurate time and adjusted if needed.

Now you will need to open Power Shell or at least a Command Prompt.

For command prompt go back to the Windows Search Box and type in CMD and press enter. When you see Command Prompt at the top left right click on the icon and choose RUN AS ADMINISTRATOR.



Right click on the power shell icon and copy the following into the command prompt and press enter.

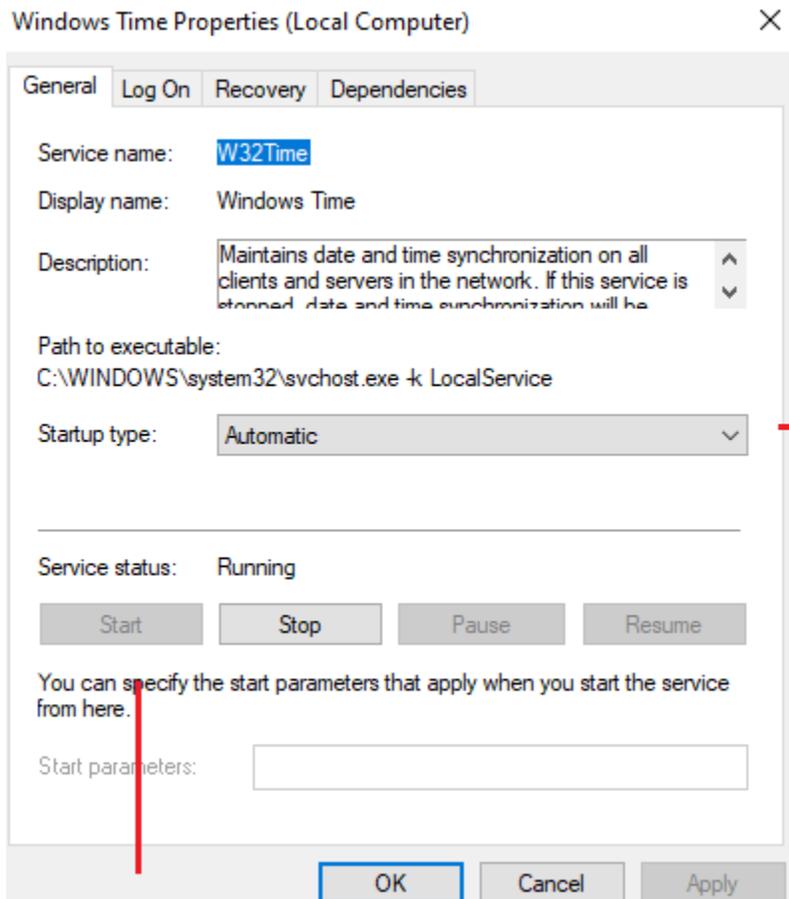
```
w32tm /config /manualpeerlist:"192.168.1.8,0x1" /syncfromflags: manual /reliable:YES /update
```

Make sure the IP ADDRESS in this command matches your computers static IP address. Otherwise, it will throw an error message.

The final step on the computer is to turn on the Windows Time Server and change its policy to AUTOMATIC.

Return to the Windows Search box and type SERVICES and press enter. This will load the computers services. Find WINDOWS TIME and double click on it.

Change the start up to AUTOMATIC and CLICK on START.

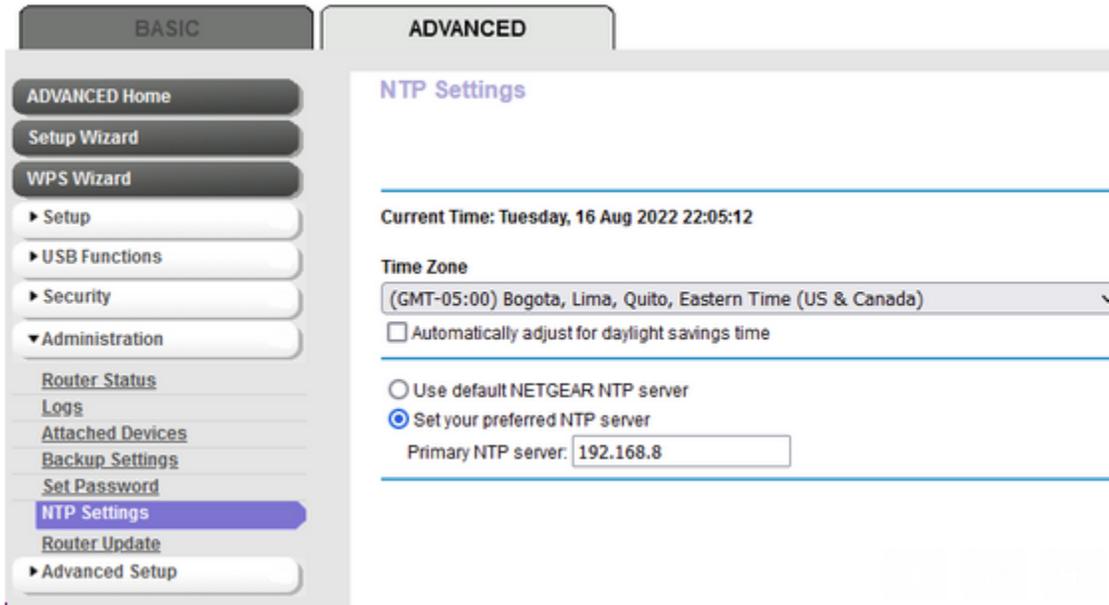


Finish with pressing APPLY and OK.

The final step is to go to your router. This screen will look different to many users because we don't have the same router.

Log into our router as an administrator.

Find your NTP settings and set your preferred NTP server to your static IP address.



At this point everything in your network will reference your PC as the NTP server for your network. Any DHCP addresses will automatically get GPS based time.

Making your PC use the your NTP server.

Another way is to go directly to the computer that is acting as an NTP server for time.

To do this load your favorite time software (such as Dimension four or BKTTimeSync)

In the location where NTP server is listed change the option to the IP address of your NTP server.

The screenshot displays the BktTimeSync software interface, version 1.7.0, running on a Windows desktop. The desktop background is black with several icons: Recycle Bin, Panda Dome, Wires-X, Ham Radio Deluxe (showing a frequency of 14.070), a folder named PL2303_Pro..., a folder named New folder, and a VARA application icon. The software window is titled "BktTimeSync by IZ2BKT - Version 1.7.0" and is divided into several sections:

- Internet Configuration:** The "NTP server" field is highlighted with a red circle and contains the IP address "192.168.0.8". Other fields include "List Time Server" (a button), "Port" (123), and "Offset" (+0).
- GPS Configuration:** Includes "Serial Port" (COM1), "BAUD" (4800), "Bit" (8), "Bit of Stop" (1), "Parity" (dropdown), "RTS" (ON), "DTR" (ON), "Max Error" (0.3 s), "Offset" (dropdown), "Always connected to the GPS" (checked), "Disconnect GPS" (button), and "Protocol" (NMEA).
- Coordinates:** Fields for "Coordinates" and "Altitude" are present, with "WW Lo" (Worldwide Location) also visible.
- General Options:** Includes checkboxes for "Start on windows startup" and "Start on system tray", a "Sync" checkbox, "Sync every" (60 minutes), "to second" (0), "If error NT" (dropdown), "Maximum correction" (12 hours), "Checks updates every" (30 days), "Display notifications" (unchecked), "Enable BktClock" (unchecked), and "Diagnostic Log" (checked).
- Log:** A text area at the bottom shows sync history:
 - Last Sync :Sunday, September 04, 2022 07:26:16
Time was successfully synchronized using NTP server
Local clock offset was 0.489172 seconds
 - Last Sync :Wednesday, September 07, 2022 12:04:12
Time was successfully synchronized using NTP server
Local clock offset was 0.626512 seconds