# LOCAL GPS CAPTURE FOR TIMEKEEPING BY JIM BLEDSOE KI4KEA Nov 7, 2022

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. <u>https://www.westmountainradio.com/product\_info.php?products\_id=gps-dongle</u>

This is a link to the West Mountain Radio installation instructions. <u>https://www.westmountainradio.com/content.php?page=wmr-diagnostics</u>

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.

3	🥹 Install Drivers → 🗆 ×										
1	CBA IV, CBA V, CBA AMP, CBA Charge Controller, CBA Multi-Cell interface										
2	$\checkmark$	RIGBLSI	iblaster+II, RIGtalk, RIGblaster-Plug-N-Play, RIGblaster-Advantage								
3	$\checkmark$	RBD	RIGBlaster-Duo, RIGblaster-DXpro								
4	<b>V</b>	WMR-CDC	PWRcheck, RR4010S, PWRguard, Epic-PWRgate, ISOpwr+, RR4007U, RR4	VRcheck, RR4010S, PWRguard, Epic-PWRgate, ISOpwr+, RR4007U, RR4005i, USB2CAT							
5	<b>V</b>	WMRFWUPD	Firmware-Updater	rmware-Updater							
6	<b>V</b>	SER2PL	RIGblaster-NOMIC, RIGBlaster-Pro, USB-DB9-Cable								
	Installed Plug in to finish Old, Update Not Installed										
	\$	Install Selected	Drivers UNINSTALL Selected Orivers Update from web		🔍 View	Log					

# 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.

🖞 GP	S			_	Х
⊠En	able GPS monitoring	GPS Active			
	Correction Threshold	4. (C)			
	GPS Time	17-Aug-22 06:48:56.000			
	PC Time	17-Aug-22 06:48:55.953			
	Time Difference (secs)	0.047			
	Correction Count	2			
	Latitude	29.59950	<b>3</b>		
	Longitude	-82.43467			
	Maidenhead Grid	EL89SO			

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-c	enter 8.26	- [Statist	ic View]						
💽 File Edit	View P	layer Re	eceiver Tools	Window Help					
🗅 🖬 🗃 🕶	68	X @	n 🖻 🛛 🖉 🗄 🖀	) 🛍 🛣 🖽 🛙		- 🔤 - 🔝	- 🖬 🚳 💈	s 🖬 🖬	
-OD VVV -	ペ業,	<b>+</b> 🗄		•   • • •	» ⊩ ⊥			∎н <b>≬</b> ₩	lo 88 👪 🏟 🕸 🏘
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:tow	Time GPS
TOW	291	0	231896.000	231606.000	231896.000			5	GPS iTOW
AV-HNR iTO	0							s	NAV-HNR iTOW
ACC	0					0.000000		us	Time Accuracy
imeStartup	291	0	1215.866	925.866	1215.866	1070.866	84.149	s	Time since Startup
TFF	1	290	38.376	38.376	38.376	38.376		s	Time to first fix
M0 rising	0					0.000000000			Timemark0 Rising Edge
M0 falling	0					0.000000000			Timemark0 Falling Edge
IM1 rising	0					0.000000000			Timemark1 Rising Edge
TM1 falling	0					0.000000000			Timemark1 Falling Edge
Th 4D states	0					0.00000000			Time and A Distance Education

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.

System Propertie	25				>	<				
Computer Name	Hardware	Advanced	System Protecti	on Remo	te					
Use system protection to undo unwanted system changes.										
System Restore	System Restore									
You can undo system changes by reverting your computer to a previous restore point. <u>System Restore</u>										
Protection Settin	ngs ———									
Available Dr	ives		Protection		^					
🕳 4TBHYE	BRID (D:)		Off							
🏪 Local Di	sk (C:) (Syste	em)	On							
= 2TBSSD	) (G:)		Off		$\sim$					
Configure restore settings, manage disk space, Configure										
Create a resto have system p	pre point right protection tu	t now for the med on.	drives that	<u>C</u> reate						
		OK	Canc	el	<u>A</u> pply					

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:



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. <u>https://www.youtube.com/watch?</u> <u>v=5iRp1Nug0PU</u>

**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 rum 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.



File Action View Help      Image: Computer Policy       Image: Computer Policy          Image: Computer Policy       Image: Computer Policy          Image: Computer Policy  Image: Computer Policy    Select an item to view its description. Name   Computer Configuration         Mindows Settings           Mindows Settings           Mindows Settings          Method Settings         Mindows Settings        Mindows Settings        Mindows Settings        Mindows Settings        Mindows Settings        Mindows Settings        Mindows Settings         Mindows Settings         Mindows Settings         Mindows Settings        Mindows Settings         Mindows Settings         Mindows Settings         Mindows Settings        Mindows Settings         Mindows Settings         Mindows Settings         Mindows Settings          Mindows Settings          Mindows Settings         Mindows Settings          Mindows Setting	Local Group Policy Editor	—	$\times$
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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.

8 <sup>4</sup>		Enable Windows NTP Client						
🛅 Enable Windows	NTP Client	Previous Setting Next Setting						
O Not <u>C</u> onfigured	Comment:							
Enabled								
O <u>D</u> isabled	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. <ul> <li>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.</li> <li>If you enable this policy setting, you can set the local computer clock to synchronize time with NTP servers.</li> <li>If you disable or do not configure this policy setting, the local computer clock does not synchronize time with NTP servers.</li> </ul>						
		OK Cancel <u>Apply</u>						

#### Next click on CONFIGURE WINDOWS NTP CLIENT.

		Access-Denied Assistance	2	Time Providers					
>		App-V		Configure Mindows NTD Clight		Cotting			State
		Audit Process Creation		Configure windows NTP Client		Setting			State
		Credentials Delegation		Edit policy setting	~	Configu	ire	Windows NTP Client	Enabled
		Device Guard		Luit poncy setting	-	📰 Enable V	Wi	ndows NTP Client	Enabled
		Device Health Attestation Service		Requirements:		🗄 Enable V	Wi	ndows NTP Server	Enabled
>		Device Installation		At least Windows Server 2003					
		Disk NV Cache		operating systems or Windows XP					
		Disk Quotas		Professional					
		Display		Description					
>		Distributed COM		Configure Windows NTP Client					$\Box$ $\times$
		Driver Installation							
		Early Launch Antimalware	5	Configure Windows NTP Client				Reg face Courts and Next Continue	
		Enhanced Storage Access						Previous Setting Next Setting	
		File Classification Infrastructure		Germant					
		File Share Shadow Copy Provider	C	) Not <u>C</u> onfigured Comment:					<u>^</u>
>		Filesystem	6	Enabled					
		Folder Redirection		<u>_</u>					
		Group Policy	C	) <u>D</u> isabled					×
>		Internet Communication Manager		Supported on:	At	least Windo	ow:	s Server 2003 operating systems or Windows XP Profes	sional 🔥
>		iSCSI							
		KDC							Ý
		Kerberos	Op	otions:				Help:	
		Kernel DMA Protection	· '						
		Locale Services					1 [	This policy setting specifies a set of parameters for co	ntrolling 🔿
		Logon		tpServer 192.168.1.8,0x9				the Windows NTP Client.	lioning
		Mitigation Options	Т	/pe NTP V					
>		Net Logon	1		_	7		If you enable this policy setting, you can specify the f	ollowing
		OS Policies	Cr	rossSiteSyncFlags 2	+			parameters for the Windows NTP Client.	
		PIN Complexity		seekePeerPackoffMinutes 15		-		If you disable or do not configure this policy setting t	he
>		Power Management		esolver eerbackonnundtes		•		Windows NTP Client uses the defaults of each of the f	ollowing
		Recovery	Re	esolvePeerBackoffMaxTimes				parameters.	-
		Remote Assistance	7						
		Remote Procedure Call	<u>  '</u>	•				NtpServer	of an NITD
		Removable Storage Access	Sp	pecialPollInterval 60	+			time source. This value is in the form of ""dosName fl	or an INTP
		Scripts		-		9		where ""flags"" is a hexadecimal bitmask of the flags	for that
		Server Manager	Ev	ventLogFlags 0				host. For more information, see the NTP Client Group	Policy
	-	6 1 6 <b>1 1</b> 6 0						Settings Associated with Windows Time section of the	Windows

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.

Al	Apps	Documents	Web	More 🔻			1776 😰 E	3		
Best	match									
Command Prompt			5	Run as adminis	strator	>	44,			
Setti	nas		Ц	Open file locat	ion					
	Poplaca Co	mmand Dramo	-⇔	Pin to Start			Command Prompt			
	Windows Po	ace Command Prompt dows PowerShell in the		コ Pin to taskbar			Арр			
Sear	ch the web					0				
Q	cmd - See web results			>		Run as adn	ninistrator			

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.

Windows Time Properties (Local Computer)

General	Log On	Recovery	Dependencies							
Service	name:	W32Time	W32Time							
Display	name:	Windows 1	Windows Time							
Descrip	tion:	Maintains ( clients and	Maintains date and time synchronization on all clients and servers in the network. If this service is stopped, date and time synchronization will be							
Path to C:\WIN	executabl IDOWS\sj	e: ystem32\svc	chost.exe + LocalService							
Startup	type:	Automatic	· · · ·							
Service	status:	Running								
S	Start	Stop	p Pause Resume							
You car from her Start pa	n <b>specify t</b> re. maneters:	he start para	ameters that apply when you start the service							
	1		OK Cancel Apply							

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.

BASIC	ADVANCED
ADVANCED Home	NTP Settings
Setup Wizard	
WPS Wizard	
► Setup	Current Time: Tuesday, 16 Aug 2022 22:05:12
► USB Functions	Time Zone
▶ Security	(GMT-05:00) Bogota, Lima, Quito, Eastern Time (US & Canada)
▼Administration	Automatically adjust for daylight savings time
Router Status	O Use default NETGEAR NTP server
Logs	Set your preferred NTP center
Attached Devices	Seryou pretened WIF Server
Backup Settings	Primary NTP server: 192.168.8
Set Password	
NTP Settings	
Router Update	
Advanced Setup	

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.

