

How to Add a GPS Time Source to ntpd

<https://blog.rapid7.com/2015/07/27/adding-a-gps-time-source-to-ntpd/>

USB GPS dongles have come down significantly in price in recent years and I picked one up to play with recently.

Apart from using a GPS module to report your latitude, longitude, altitude and time for mapping applications, it's also possible to feed the time information to ntpd as a back-up time source or as a highly accurate time source depending on the GPS module you end up getting.

The module that I use in this blog post is a Columbus v800 which was reasonably cheap (around 35USD of ebay), I had originally bought it for recording my GPS tracks on long haul flights on my laptop.

To add the USB GPS time source to ntpd, first install ntpd and the needed GPS related daemons and tools.

On a recent Ubuntu machine I did the following, this should work on a recent Debian machine as well.

```
apt-get install ntpd gpsd gpsd-clients
```

Once the tools are installed, edit /etc/default/gpsd and modify the line that reads:

```
GPSD_OPTIONS=""
```

To this:

```
GPSD_OPTIONS="-n"
```

The above change will make the GPS look for satellites as soon as it starts up. Gpsd presents data to the user in a number of ways; in this case gpsd is already writing information out to a shared memory segment that ntpd understands as it usually follows the NMEA standard - some more information can be found here <http://www.catb.org/gpsd/NMEA.html>.

Once gpsd is restarted, verify that you are receiving data by running the cgps command from a terminal window. If it works, this would be the type of output that is expected:

Time: 2015-07-27T15:28:16.000Z	PRN: Elev: Azim: SNR: Used:
Latitude: 53.344605 N	27 83 295 18 Y
Longitude: 6.248771 W	16 53 174 26 Y
Altitude: 76.2 m	19 47 279 00 Y
Speed: 0.0 kph	18 41 088 35 Y
Heading: 0.0 deg (true)	22 35 138 31 Y
Climb: 0.0 m/min	21 29 061 29 Y
Status: 3D FIX (33 secs)	7 25 298 16 Y
Longitude Err: +/- 21 m	26 25 160 22 Y
Latitude Err: +/- 42 m	4 14 230 00 Y
Altitude Err: +/- 50 m	30 13 329 19 N
Course Err: n/a	20 07 032 18 N
Speed Err: +/- 309 kph	15 06 042 24 N
Time offset: 0.305	
Grid Square: IO63vi	

```

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```

2015-07-27-162817_916x706_scrot

Hit ctrl-c and exit from this application. Once the GPS module is functioning as expected, ntpd must be configured to use GPS dongle as a time source.

Add the following to /etc/ntp.conf

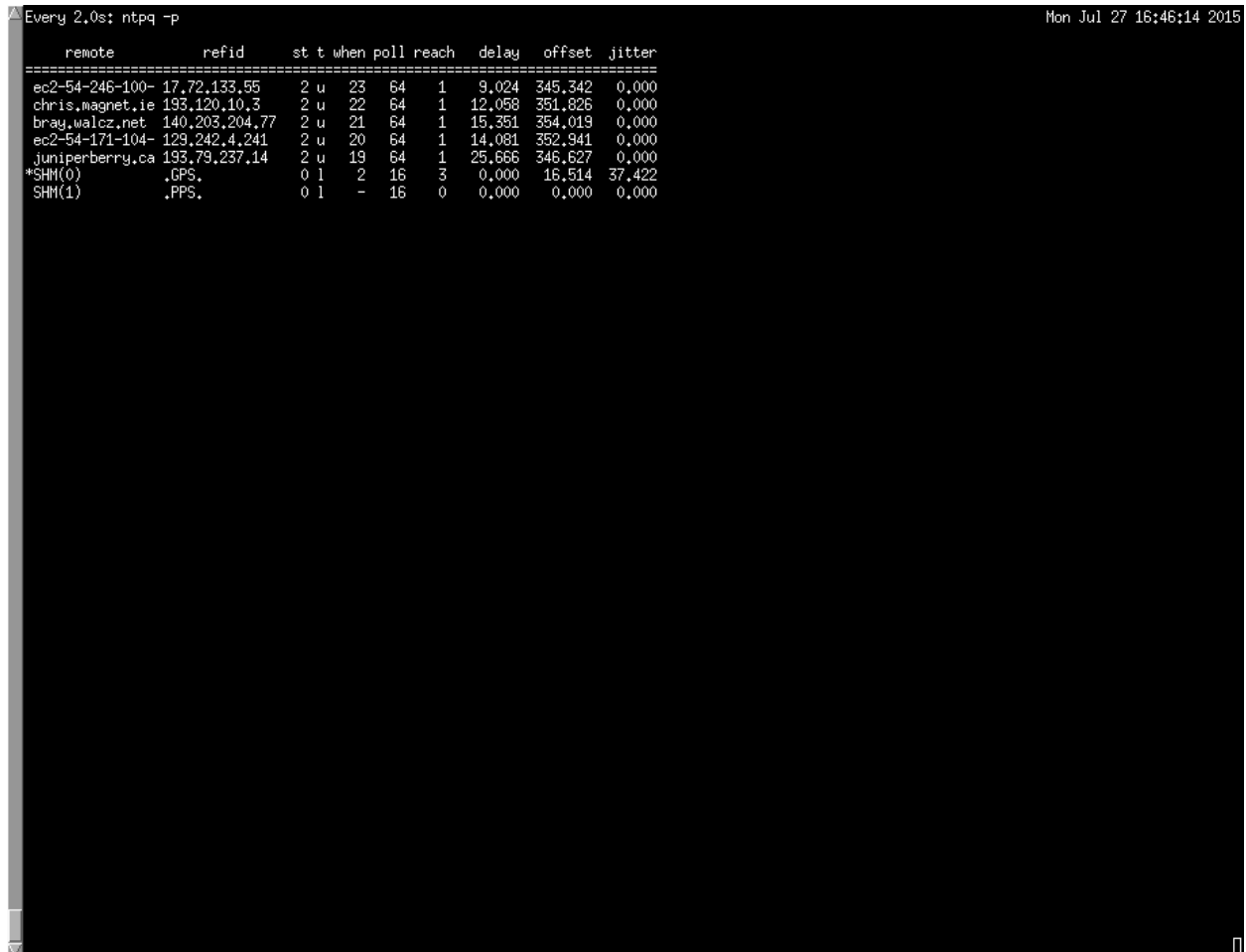
```
# GPS Serial data reference
server 127.127.28.0 minpoll 4 maxpoll 4
fudge 127.127.28.0 time1 0.0 refid GPS

# GPS PPS reference
server 127.127.28.1 minpoll 4 maxpoll 4 prefer
fudge 127.127.28.1 refid PPS
```

The above adds two sources - the GPS time source from the serial data reference, a generic time source available on almost all GPS dongles; and the PPS reference, not always available on the cheaper GPS dongles but it is far more accurate if it is available. See <http://www.catb.org/gpsd/hardware.html> for a list of recommended GPS modules that have PPS output.

Once the above lines have been added to `ntp.conf`, `ntpd` should be restarted. To further understand the configuration see <http://doc.ntp.org/4.2.6/drivers/driver28.html>

To verify that the GPS module is indeed feeding `ntpd`, run the command `ntpq -p` in a terminal



```
Every 2.0s: ntpq -p                                     Mon Jul 27 16:46:14 2015
```

remote	refid	st	t	when	poll	reach	delay	offset	jitter
ec2-54-246-100-	17.72.133.55	2	u	23	64	1	9.024	345.342	0.000
chris.wagnet.ie	193.120.10.3	2	u	22	64	1	12.058	351.826	0.000
bray.walcz.net	140.203.204.77	2	u	21	64	1	15.351	354.019	0.000
ec2-54-171-104-	129.242.4.241	2	u	20	64	1	14.081	352.941	0.000
juniperberry.ca	193.79.237.14	2	u	19	64	1	25.666	346.627	0.000
*SHM(0)	.GPS.	0	l	2	16	3	0.000	16.514	37.422
SHM(1)	.PPS.	0	l	-	16	0	0.000	0.000	0.000

2015-07-27-164615_916x706_scrot

Here the GPS time source is selected as the primary time source as it has a small offset and no delay. Over time the V800 GPS module introduces jitter which is either large or not consistent with the other time servers, `ntpd` then flags this particular time source as being a falseticker and as a result it is not used.

There is not much advantage of using this particular GPS device as a time source due to its lack of a PPS time source and high or random jitter. However if the network is unreliable and drops out the `gps` time source will be promoted back to a valid time source as the networked time servers are not accessible.

This may be useful for applications where having accurate time important and the network connection is either unreliable or non-existent.