Meinberg NTP Time Server Monitor Guide

Whitham D. Reeve

Abbreviations in this article:
DNS: Domain Name Server
GPS: Global Positioning System
IP: Internet Protocol
LAN: Local Area Network
PC: Personal Computer
NTP: Network Time Protocol
UTC: Coordinated Universal Time

1. Introduction

This guide describes how to setup and use the *Meinberg NTP Timer Server Monitor* application software and includes example client PC clock analyses derived from it. The Meinberg NTP Time Server Monitor is separate and independent of the Network Time Protocol (NTP). NTP is a program that runs as a service on a Windows PC and, once configured, helps the PC keep accurate time without user intervention. The Meinberg monitor program provides a means to reconfigure NTP and to easily view its operating statistics.

This is not a quick-start guide; it is written for readers who appreciate detailed instructions and descriptions and who would like to customize their NTP installation. No prior experience with NTP is needed. Readers wishing to get started quickly will find that the default installation of the NTP protocol works adequately but they should eventually install the Meinberg monitor and use this guide to customize their installations. The detailed installation procedures for the monitor software and the associated Network Time Protocol (NTP) are covered in ***Network Time Protocol and Meinberg NTP Time Server Monitor ~ Installation Guide*** {ReeveNTP}. A brief discussion of clock accuracy and stability and the Network Time Protocol may be found at {ReeveTime}.

Note: References in brackets [ ] and internet links in braces { } are provided in **section 6**.

2. Meinberg NTP Time Server Monitor

When installed on a PC, NTP runs as a background process or service and does not have a windows-type user interface. As a Windows service, it is accessible through the service management facilities built into all modern Windows operating systems, but user actions are limited to starting and stopping the service (figure 4). NTP also may be controlled using a command line interface (figure 5), and this method provides more flexibility in terms of access to operating statistics.

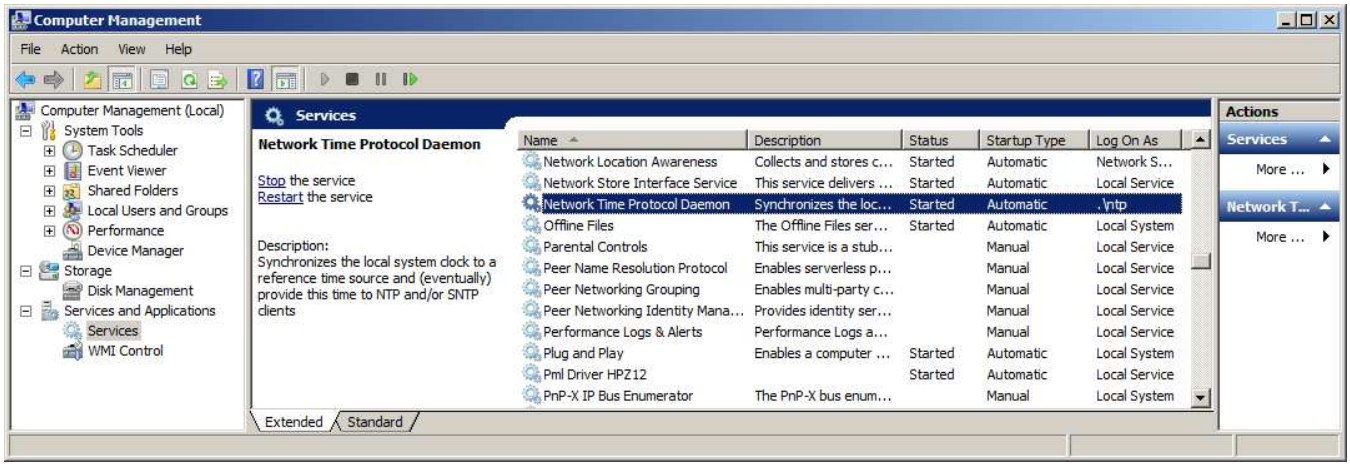


Figure 4 ~ As a Windows service, NTP can be started and stopped though the Computer Management window.

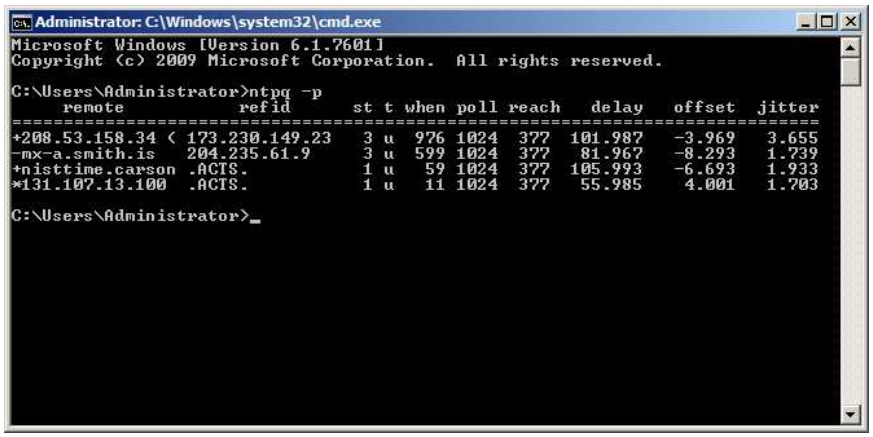


Figure 5 ~ The NTP Service can be accessed through the Windows command line interface.

To make NTP easier to use, the Meinberg NTP Time Server Monitor allows the user to control, monitor and analyze NTP actions through a tabular Windows interface. After everything is properly installed (see [ReeveNTP]) open the monitor by clicking the Desktop shortcut or start the monitor from Start – Programs – Meinberg – NTP Timer Server Monitor. The monitor always opens to the NTP Service tab. The monitor has several other tabs, which will be described in the following paragraphs. Although the monitor has a Help menu, there are no underlying help files nor is there an online help forum.

Basic operation: The Meinberg monitor should be setup to start automatically when Windows starts or reboots (described below). The monitor will start minimized to the Taskbar. To view the monitor window double-click its Taskbar icon (figure 6). To minimize back to the Taskbar, click on the Minimize icon; do not click the Close icon. If you inadvertently click Close, NTP will continue to work as configured but the monitor will not gather statistics. The monitor may be restarted from the Start menu.

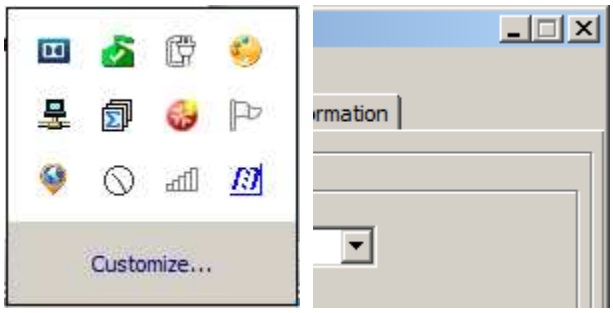


Figure 6 ~ Left: The Meinberg monitor icon in the Taskbar is shown here in the lower-right corner. Double-clicking the icon opens the Full window. Right: To re-minimize the window, click the Minimize button in the upper-right corner of the monitor window. Clicking the Close button closes the monitor, preventing it from obtaining statistics.

NTP Service tab: The NTP Service tab provides basic Service Information and controls (figure 6). The NTP service can be started, stopped and restarted using the buttons in the Service Configuration frame. Clicking the Settings button opens the NTP Service Settings window, where the path to the NTP configuration file can be changed (figure 7). Generally, the path and other settings in this window should be left alone except, perhaps, for experimentation.

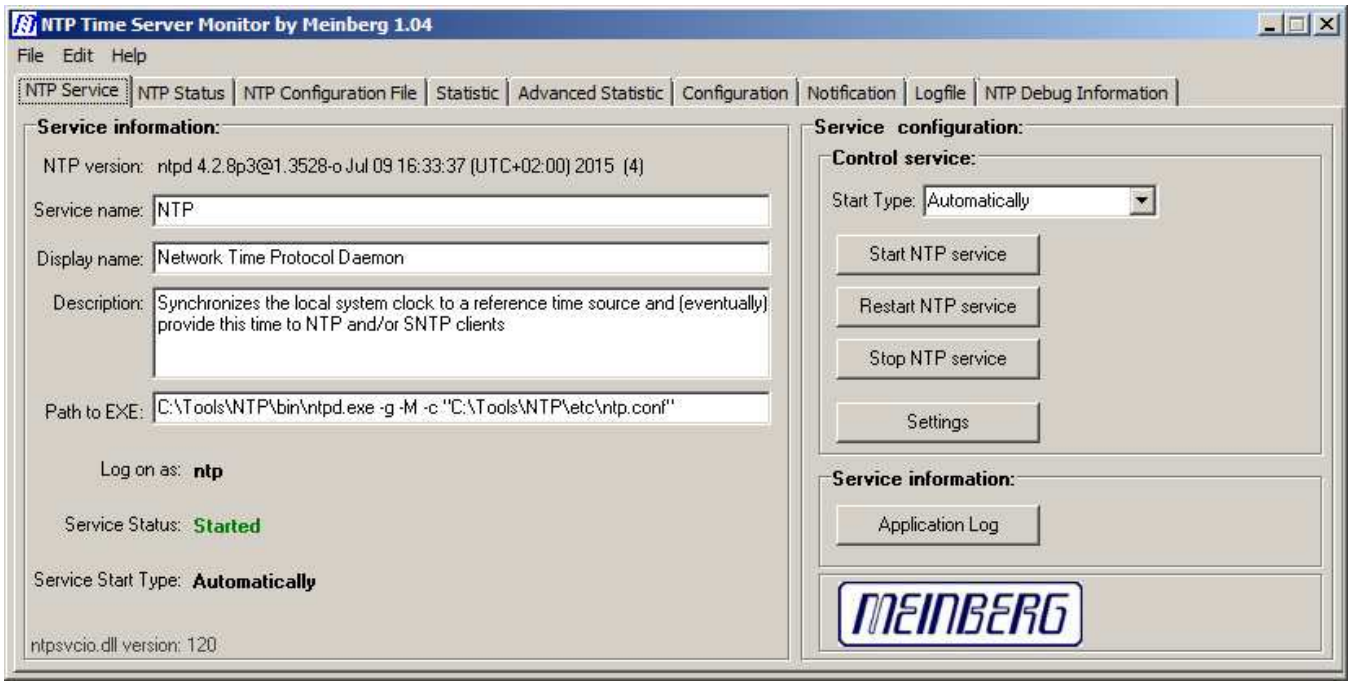


Figure 6 ~ The NTP Service tab provides detailed information about version, path and Service Status. It should appear similar to the screen shown here except that the path in the Service Information frame will depend on where you installed NTP. The Service Status in the lower part of the Service Information frame should be ***Started*** at this point. Check the Service configuration in the right frame. If necessary set the *Start Type* to *Automatically*. This will start the NTP service whenever the PC is started or rebooted.

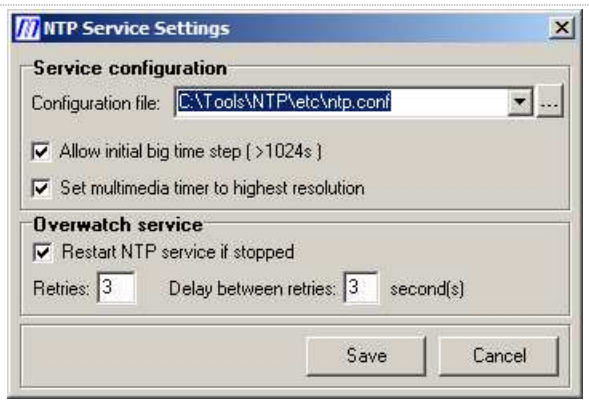
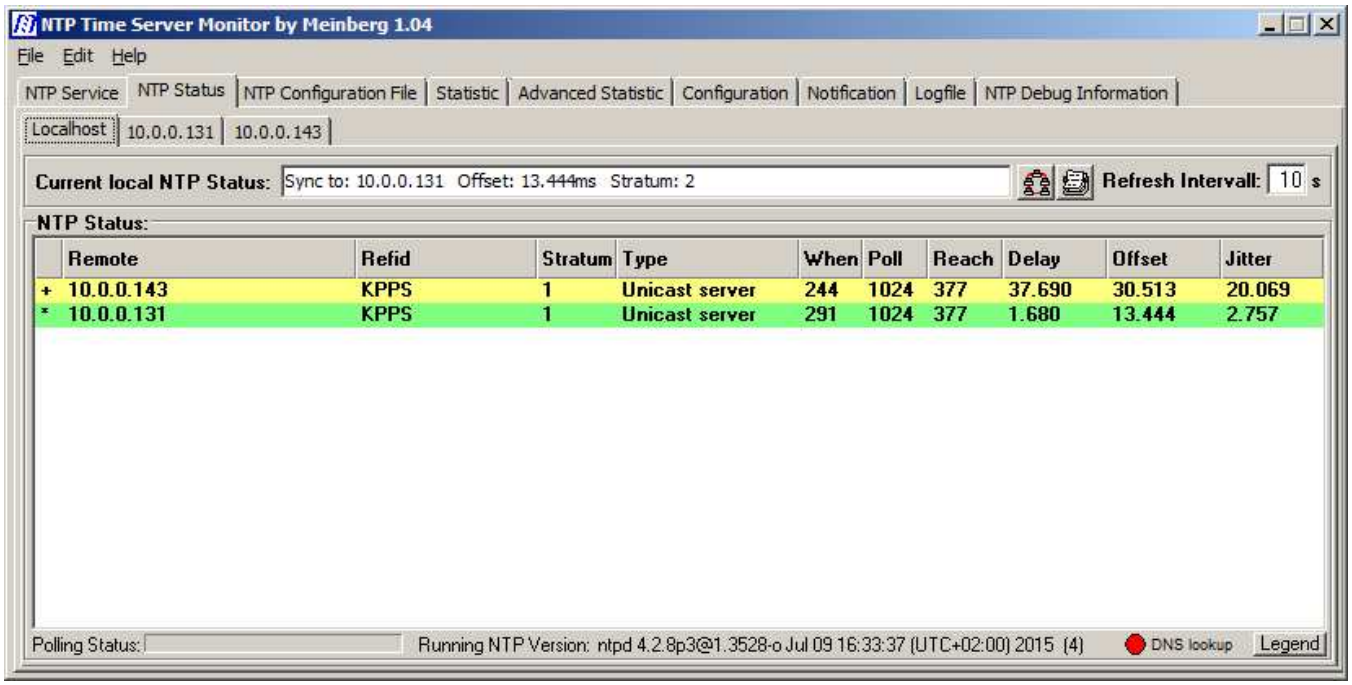


Figure 7 ~ The NTP Service Settings tab with default values.

NTP Status tab: The NTP Status tab shows the status of all time servers that have been configured in NTP (figure 8). If the servers also have been setup in the Configuration tab (described below), the monitor assigns an individual tab for each one. When NTP is started, it queries the configured servers, learns the environment and slowly adjusts the PC clock. NTP learns about the PC clock average drift rate and stores and periodically updates the information in a "driftfile". NTP uses this file is used to quickly synchronize the PC clock after a shutdown. The learning process requires some time and can be monitored by looking at the When, Poll and Reach columns in the NTP Status tab, which are described in the following paragraphs. The information presented in this tab is updated at regular intervals as specified in the Refresh Interval on the right side of the window.



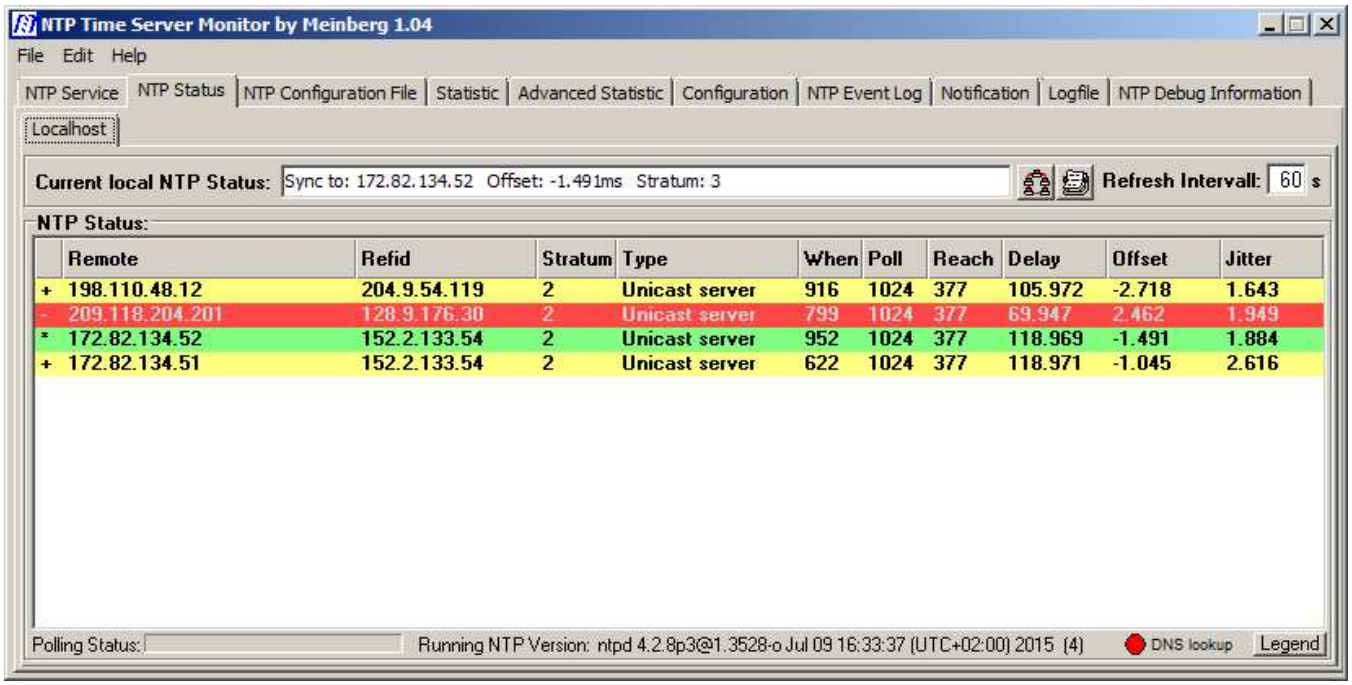


Figure 8 ~ Top: Two local GpsNtp-Pi time servers (IP addresses 10.0.0.131 and 10.0.0.143) have been setup. Only one server is selected at any given time and it is the one with the best performance as determined by NTP. The status of the selected server is shown in the field *Current local NTP Status*. In this case, the PC time-of-day clock is 13.444 ms faster than UTC. The refresh interval for the displayed data is 10 s and can be changed by the user. Bottom: Four servers from the United States NTP pool are setup. The "*" character (and green bar) indicates the selected time server and the "+" character (and yellow bar) indicates servers acceptable for synchronization. The "-" (and red bar) indicates a server that has been found to be unacceptable for synchronization. The symbols are fixed but the colors may be changed by the user in the Configuration tab. The refresh interval for the displayed data is 60 s.

The When column shows the number of seconds since the last poll. The Poll column shows the poll interval in seconds. For a stable clock the polling interval starts out at a small value and increases in steps by a factor of 2 to

longer intervals. The Reach column shows the status of the poll connection attempts between the NTP client and server. The values are in octal starting at 000 and ending at 377. The NTP Status tab will have a sub-tab for each time server specified in the Configuration tab.

The Reach field is a buffer containing eight 1-bit flags, one for each of the last eight connection attempts, or polls, between the NTP client and server. It is not a sequential counter. NTP at the client assigns a buffer to each remote server. A successful connection is signified by logic 1 and a failure by logic 0. Each time a new poll is sent, the register is shifted one bit to the left as a new bit enters from the right. Therefore, successful and failed polls can be tracked over eight poll intervals. The maximum value of an 8-bit octal number is 377 (11 111 111 in binary notation), so a Reach of 377 indicates that the last eight polls were successful.

NTP uses the User Datagram Protocol (UDP) for message transmission. UDP generally has lower latency (delay) but no packet delivery guarantees. This means that any dropped packets are not retransmitted and the associated polls fail. NTP logs each failure in the buffer and waits for the next poll period. For example, if a poll fails the buffer will be 11 111 110, which corresponds to a Reach of 376. If the next seven polls are successful, seven logic 1s are shifted into the buffer, one for each poll, shifting the 0 representing the failed poll to the left and eventually out of the buffer. The table below shows the progression of a single failed poll through the Reach buffer.

Poll number	Poll status	Buffer contents	Octal equivalent
1 ... 8	Successful	11 111 111	377
9	Failed	11 111 11**0**	376
10	Successful	11 111 1**0**1	376
11	Successful	11 111 **0**11	373
12	Successful	11 11**0** 111	367
13	Successful	11 1**0**1 111	357
14	Successful	11 **0**11 111	337
15	Successful	1**0** 111 111	277
16	Successful	**0**1 111 111	177
17 ...	Successful	11 111 111	377

As indicated above, the 0 representing the failed poll is moved one bit to the left every time NTP polls the time server. If the polling interval is 1024 s, the 0 will stay in the buffer for over 7 000 s (almost 2 h). If the eight polls after a failed poll are successful, the Reach value jumps from 177 to 377 with no intervening steps. If additional polls fail, another 0 bit will be inserted into the buffer. A Reach value of octal 000 (binary 00 000 000) indicates that the last eight polls failed; if the Reach stays at 000 for an extended period of time, it means the remote time server is not reachable. Thus the Reach buffer can take on any value depending on the reliability of the polling process. In this way, the Reach is a measure of the “reachability” of the NTP server.

It should be noted that NTP is designed to work in networks that drop packets associated with polls, so variations in the Reach value usually indicate connection (network) problems and not NTP problems. If NTP is unable to connect with a time server for an extended time period, it falls back to the driftfile (described previously) to adjust the PC clock.

The Delay, Offset and Jitter columns represent NTP's measurements. The delay is the roundtrip messaging delay in ms between the client PC and time server. The delay can be quite variable depending on, for example, the PC's CPU load and the network between the client and time server. Generally, NTP can cope with the variability even in extreme cases. The Offset is the difference in ms between UTC (actually the remote time server time, which presumably has no time error with UTC) and the client PC time-of-day clock. Jitter is a measure of the amount of PC clock's variation in ms from an average value. A client PC using a wireless LAN will experience much more jitter than a wired LAN because of the wide variations in packet delay and the heavy buffering in wireless networks.

NTP can be setup to use local time servers, a pool of servers or combination. Various time server pools can be configured such as by country (for example United States), continent (for example, North America), or custom. There are almost 4 000 pooled time servers (the majority in Europe); more detail may be found at {NTPPool}.

NTP Configuration File tab: This tab is a simple text editor that provides direct access to the ntp.conf file, which is a file holding all configuration details for NTP including the time servers to be used (figure 9). The configuration can be changed by editing this file. The Save Configuration and Discard Changes buttons near the bottom-right are grayed out until a change is made. Generally, it is not advisable to change this file without a clear understanding of the effects of those changes.

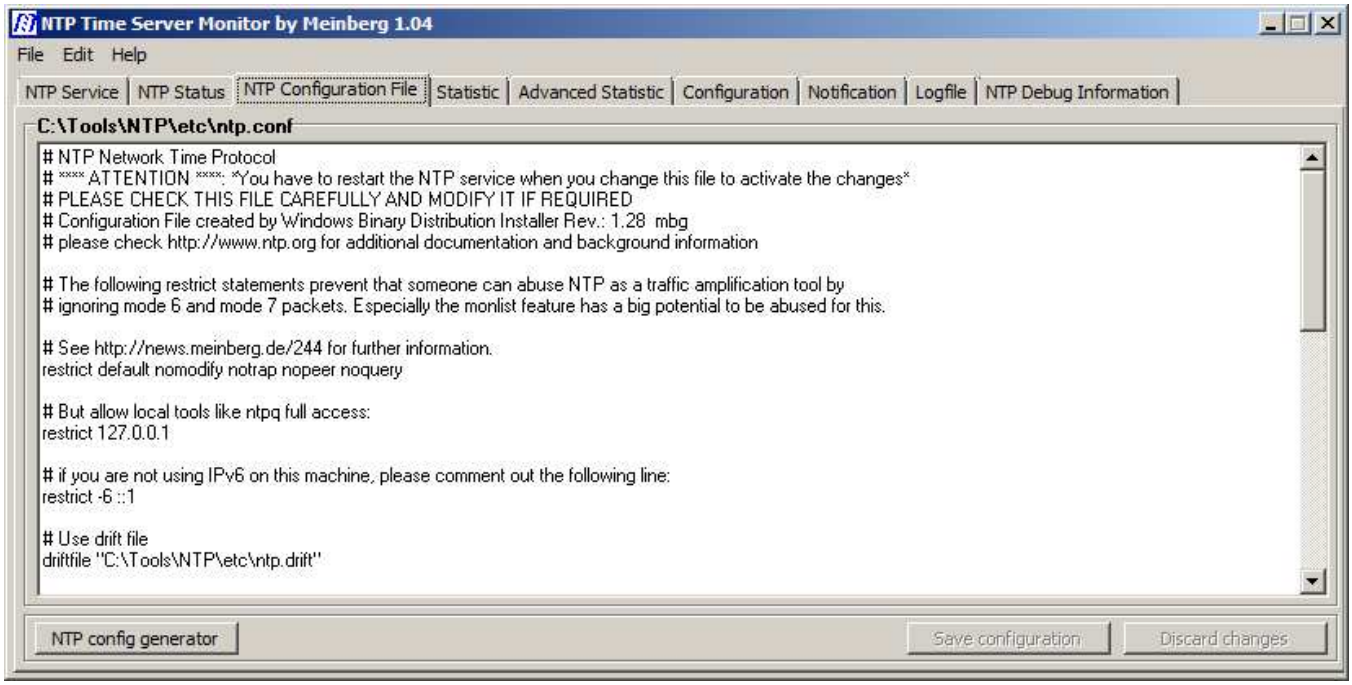


Figure 9 ~ The NTP Configuration File tab provides access to the text file that holds NTP's configuration details. Do not change anything without first learning what the changes may do. Lines with the "#" character are comment lines and not executed.

Statistic tab: This tab displays the statistics of the NTP messaging loop between the NTP client and time server and thus shows how the local clock is being disciplined by NTP (figure 10). The statistics are stored in a text file called loopstats.YYYYMMDD, where YYYY is the year, MM is the month and DD is the day. The loopstats file is located in the NTP/etc/ folder and provides parameters in seven columns of text data (it may be opened in any

text editor). Below is an example of two lines in a loopstats file from a Windows 7 laptop and the definition of each column:

```
 (1)    (2)           (3)       (4)       (5)       (6)   (7)
57316 24169.425 -0.000132117 -54.251 0.000976563 0.023818 10
57316 26304.284  0.001448079 -54.250 0.001070791 0.022281 10
```

Column	Line 1 above	Description
(1)	57316	Date in Modified Julian Day (MJD)
(2)	24169.425	Time in seconds past midnight UTC
(3)	-0.000132117	Clock offset from time server in seconds (plotted by monitor)
(4)	-54.251	Frequency offset in parts per million (plotted by monitor)
(5)	0.000976563	Root mean square (rms) jitter in seconds
(6)	0.023818	Allan Deviation in parts per million (also called wander)
(7)	10	Clock discipline time constant in $\log_2$(poll interval in s)

The loopstats file is updated each time NTP polls the time server, and one complete file is produced each day. Since NTP itself determines how often it needs to poll, the updates throughout a day may not be at the same interval. The most current file (today) will show only the statistics accumulated at the time it is viewed but it will be complete at end of the UTC day. The Meinberg monitor only plots the clock offset and frequency offset values in the loopstats file. To view these plots in the Meinberg monitor Statistic tab, use the drop-down in the left frame below *Available Logfiles* to select the file location in the NTP folder (...\NTP\etc\) and then select the desired file.

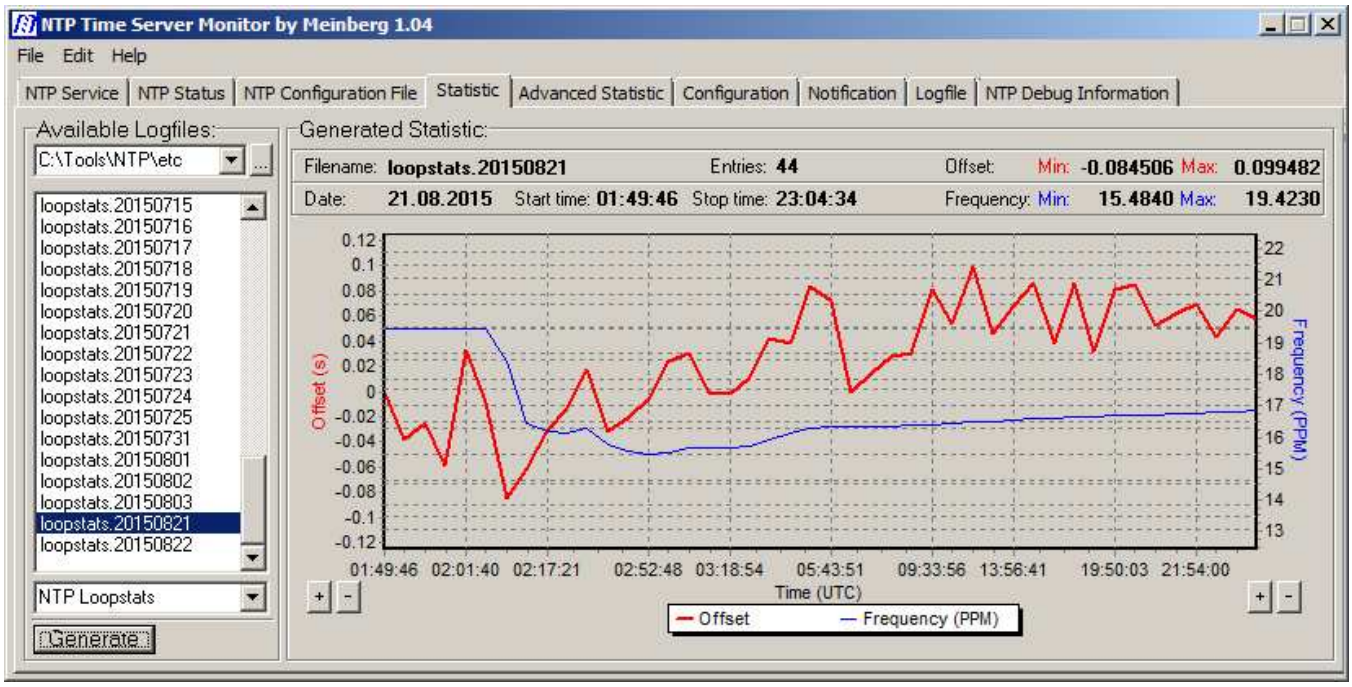


Figure 10 ~ The Statistic tab shows only plots the clock and frequency offset fields in the loopstats file, but this is enough information for a user to quickly determine the clock operation.

Advanced statistic tab: The Advanced Statistics tab has sub-tabs for Selected Peer, Stratum value, Delay and Polling interval (figure 11). These data are gathered from NTP by the monitor and are in the same folder as the

monitor program. However, the data in a given sub-tab is available only if it has been selected in the monitor Configuration tab described next.

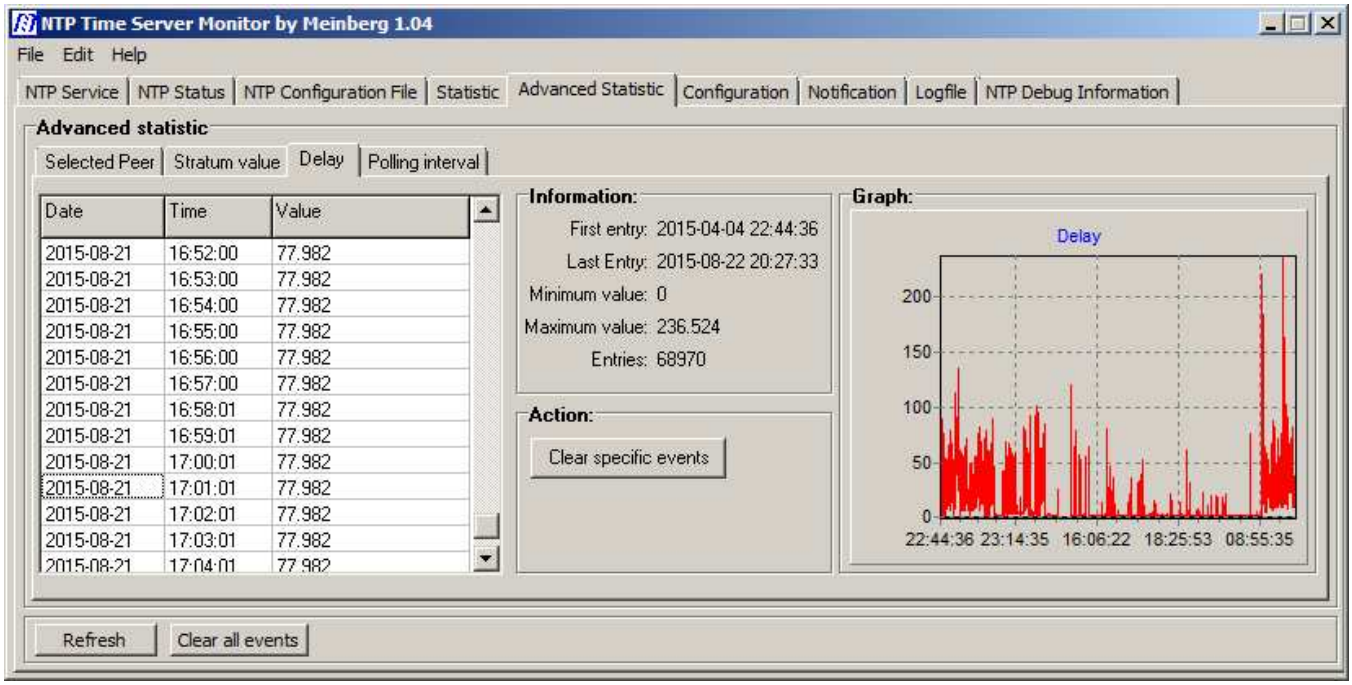


Figure 11 ~ Advanced Statistic tab. The Delay sub-tab has been selected, which shows the messaging delay between the time server and client. The Polling interval tab shows the rate at which NTP on the client polls a server.

Only Delay and Polling interval are of interest for most analyses. They show the roundtrip messaging delay in ms between the time server and client and the interval that is used by NTP for polling. The plot on the right is automatically produced for the current 24 h period from the data selected by the sub-tab. The plots are produced from the *ntsmadvlog.txt* file, which is kept in the same folder as the monitor program.

Configuration tab: The Configuration tab applies to the monitor program itself and is used to setup the logging and other displays (figure 12). The checkbox settings in the Configuration tab determine how the monitor displays the time server status in the NTP Status tab. In order to display separate tabs for each configured time server, they need to be listed in the External NTP server field and separated by a comma. If Enable Coloring is checked, the colors may be changed by clicking the adjacent button. The Status polling interval determines how often the monitor queries NTP to determine server status. The default is 10 s and lengthening it to, say, 60 s will cause a small reduction in LAN traffic. If Enable DNS lookup is checked, the Current local NTP Status field and the Remote in the NTP status table in the NTP Status tab will show the time server's host name instead of IP address (figure 13).

The Statistic frame displays the path to the logs that the monitor keeps. The path shown is the path setup during monitor installation. The Advanced Statistic frame at the bottom allows customization of the corresponding parameters that may be plotted in the Advanced Statistic tab (see previous tab description). For most setups, only the *Log delay value* and *Log polling interval* are checked but there is no harm in checking all of them.

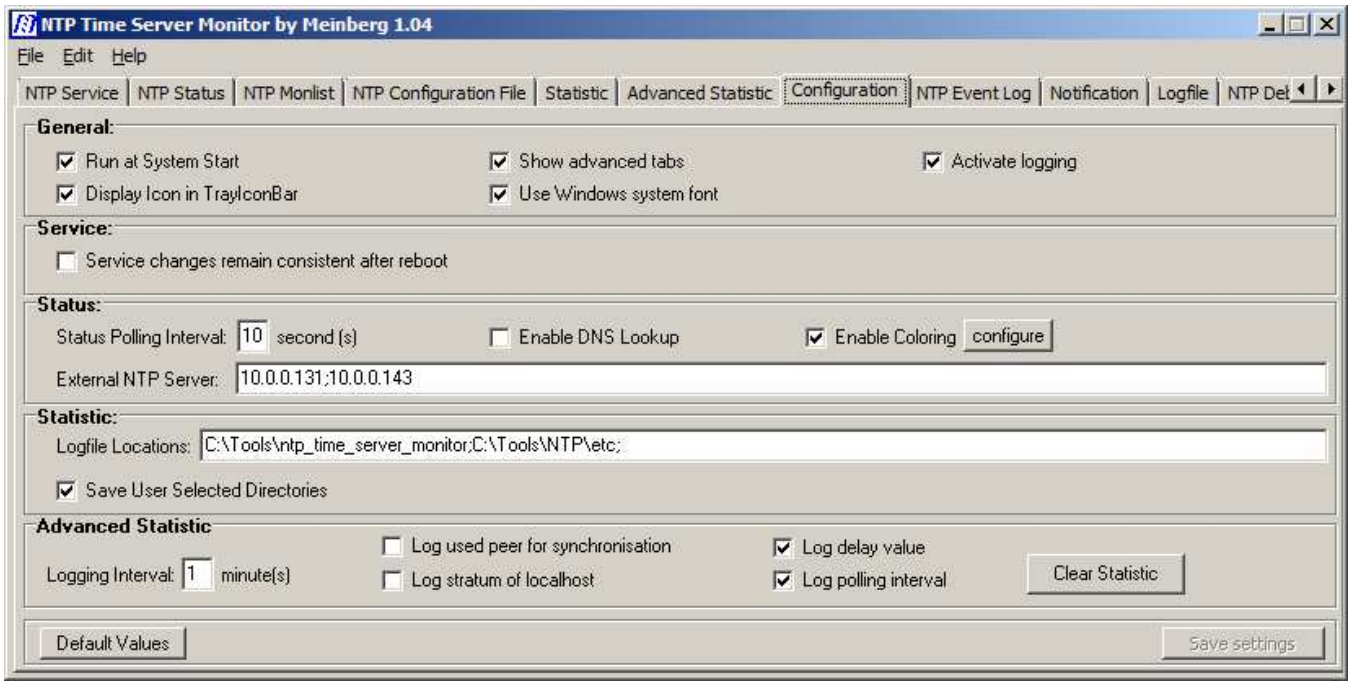


Figure 12 ~ Configuration tab with the *Activate logging*, *Log delay value* and *Log polling interval* boxes checked. The General settings shown here provide the most information.

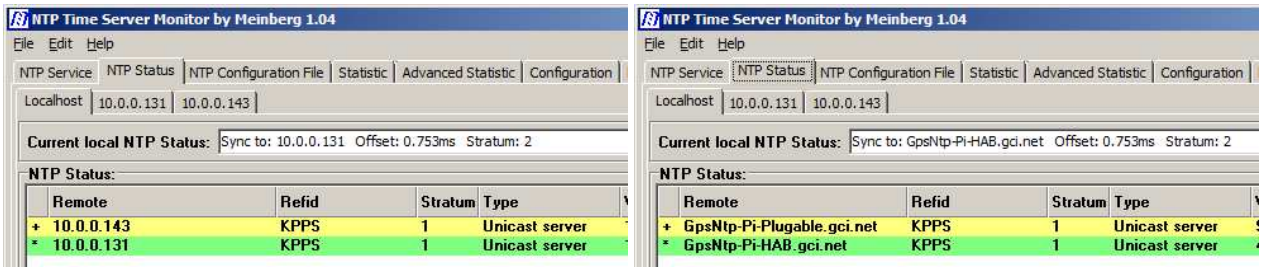


Figure 13 ~ The NTP servers can be displayed in the NTP Status tab by their IP address or host name by unchecking or checking the Enable DNS lookup in the Configuration tab Status frame.

NTP Event Log: The NTP Event Log tab is visible only when the *Service Information – Application Log* button in the lower-right corner of the NTP Service tab is pressed. At that time the *NTP Event Log* tab will open with data associated with NTP's time-keeping activities (figure 14). The logs shown are produced only when NTP is stopped and then started or restarted such as from the NTP Service tab. The event log is not on-going. As a troubleshooting aid, various data filters may be used to find specific types of log entries such as Information, Warning or Errors.

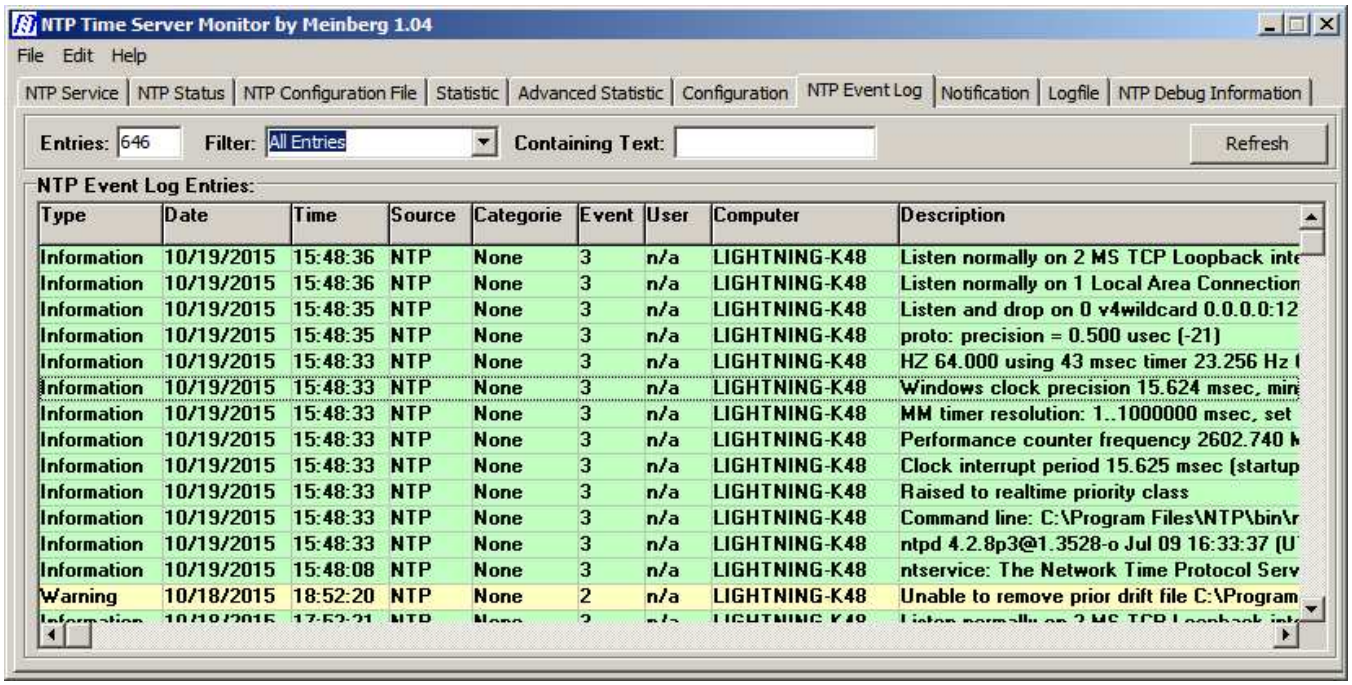


Figure 14 ~ NTP Event Log Entries include useful troubleshooting information as well informational entries such as clock precision (6th entry from the top in the above example).

Notification tab: The Notification tab may be used to setup email alerts (figure 15). This feature may be used the time quality on a particular PC is critical and notification is needed to correct synchronization problems.

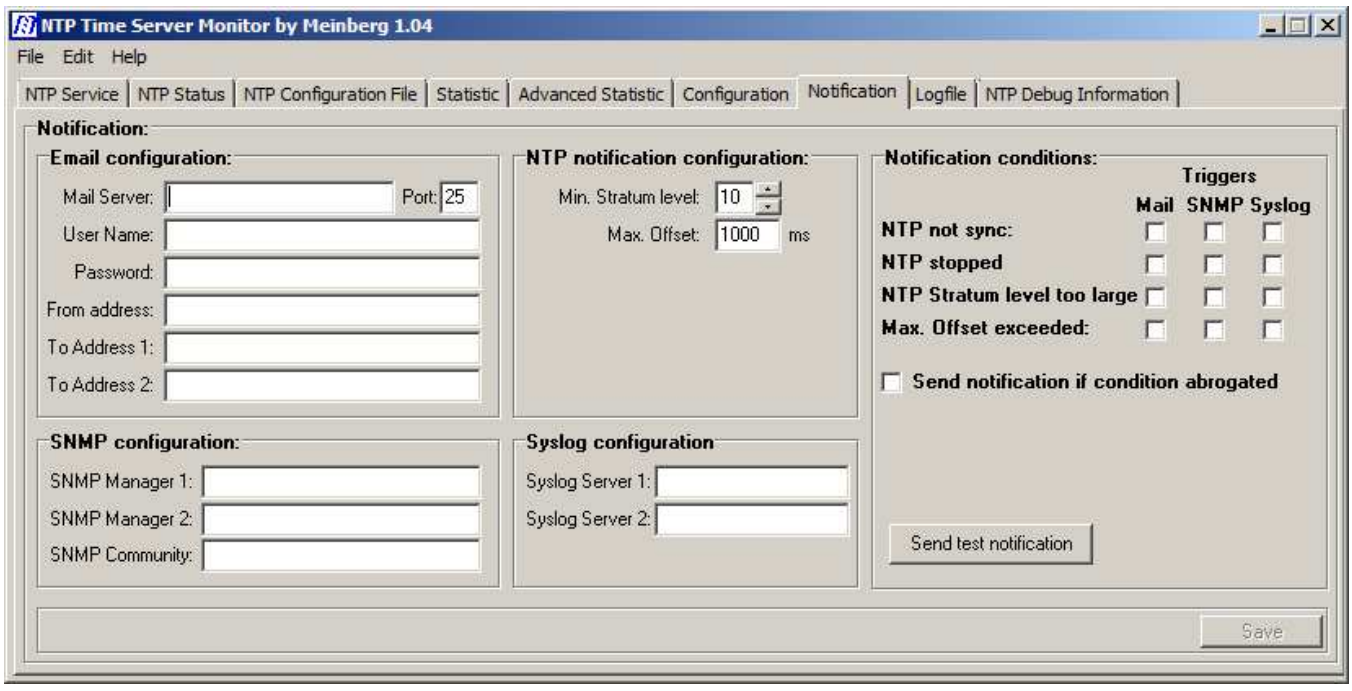


Figure 15 ~ Notification tab. The user can setup email notification (left frame) and select the types of conditions that will be annunciated (right frame).

Logfile tab: The Logfile tab displays the basic logs for the monitor such as when the NTP service or monitor was started or stopped (figure 16). This log is the text file *ntsmlog.txt*, which is kept in the same folder as the monitor software.

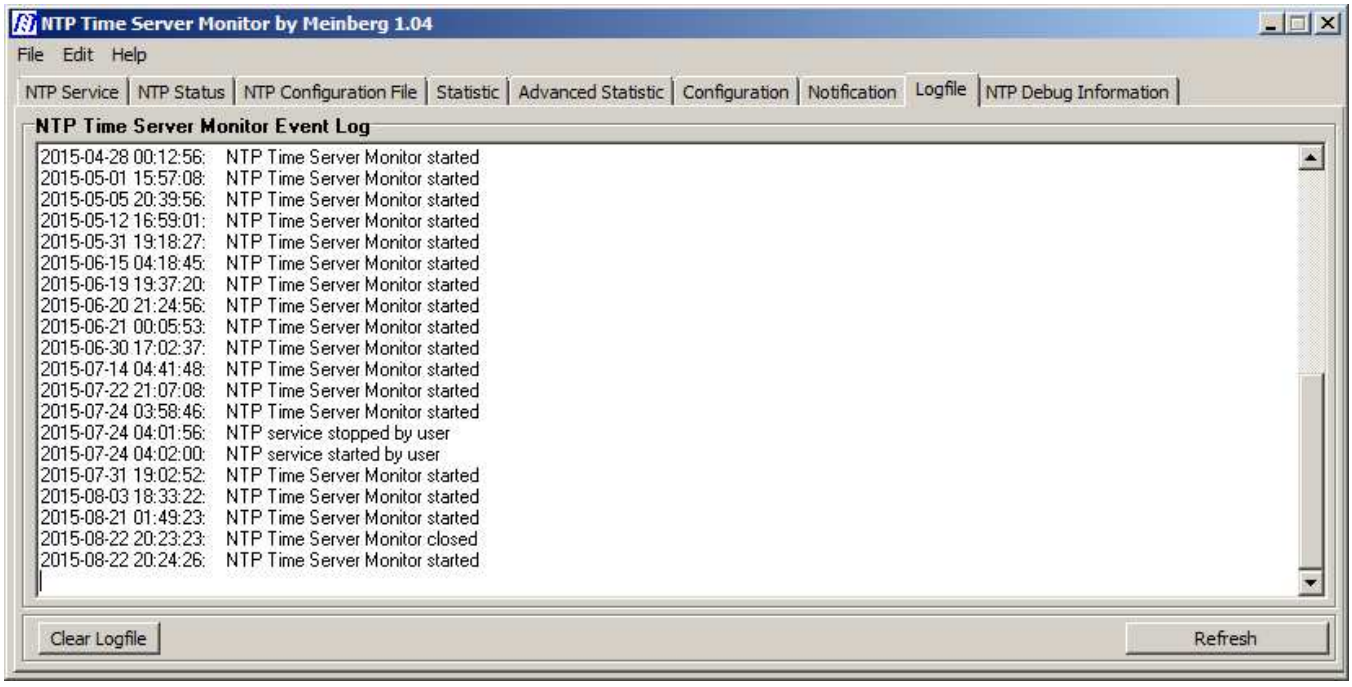


Figure 16 ~ Logfile tab simply shows a chronological list of activities associated with the monitor.

NTP Debug Information tab: The debug information tab (figure 17) is only visible if *Show advanced tab* is selected in the Configuration tab.

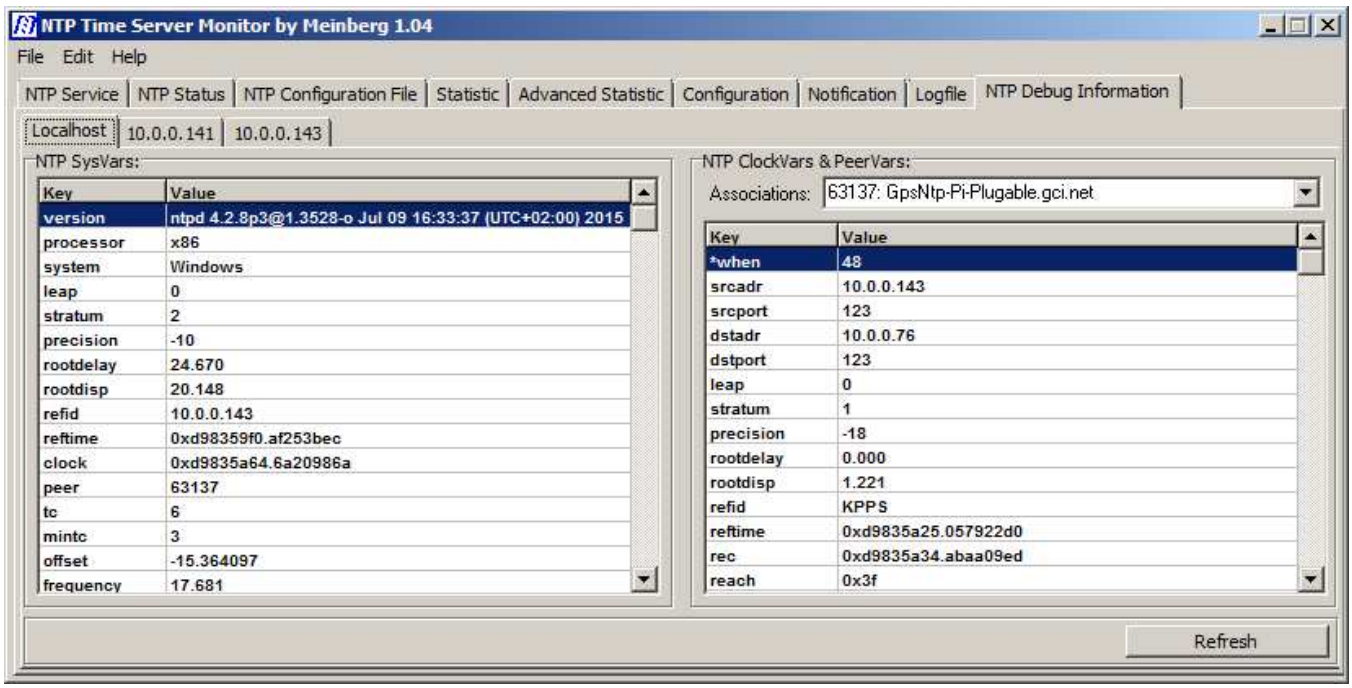


Figure 17 ~ NTP Debug Information tab. This tab normally is used for troubleshooting the NTP installation and is not documented to any useful extent.

3. Viewing NTP Logs and Time-Keeping Plots

NTP and the Meinberg monitor keep many logs and statistics, but they are not enabled by default. Go to the Meinberg monitor Configuration tab (figure 18). If necessary check the boxes to *Activate Logging* in the General section near the top and select the individual logs in the Advanced Statistic near the bottom. If changes were made, select the NTP Service tab and click the *Restart NTP service* button.

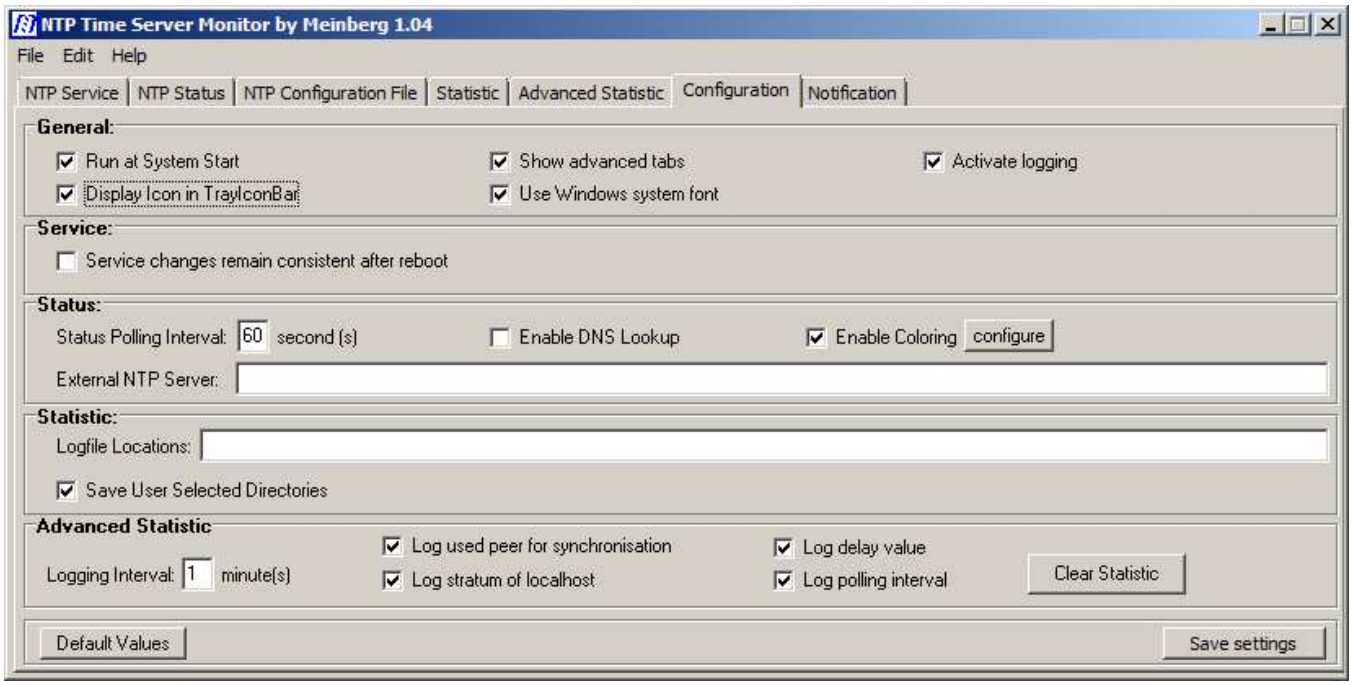
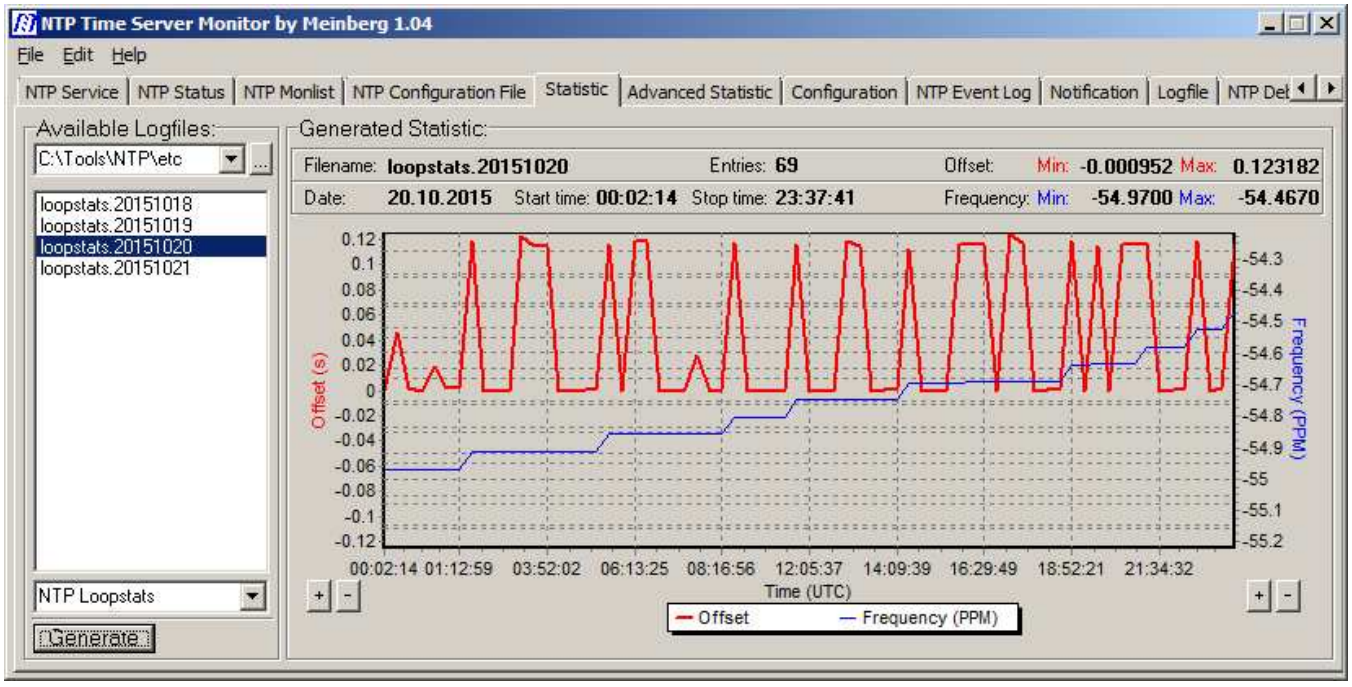


Figure 18 ~ Setup logging in Configuration tab.

It will be necessary to wait until sufficient data have been accumulated so that meaningful statistics can be computed, and this typically requires several hours after installation. A similar process is required after rebooting the PC or starting after a period of shutdown. Plots can then be viewed on the Statistic and Advanced Statistic tabs (figure 19). The statistics can be cleared at any time in the Advanced Statistic area of the Configuration tab.

Of particular interest are the loopstats produced by NTP. It may be necessary to navigate to the \NTP\etc folder in the *Available Logfiles* field in the left frame of the Statistic tab. Among other things, the loopstats provide a measure of the PC clock's offset in seconds and frequency offset in parts per million. These plots are auto-scaled and because of this sometimes will appear smoother and sometimes more jagged than expected. Basic plot parameters and the minimum and maximum values during the plotted period are shown above the plot.

To view a plot, select a particular loopstats file and then click Generate in the left frame. This will produce a plot in the right frame for that particular file. If part of the current day (today) is being plotted, it will be necessary to click Generate to update the plot later as more data is accumulated.



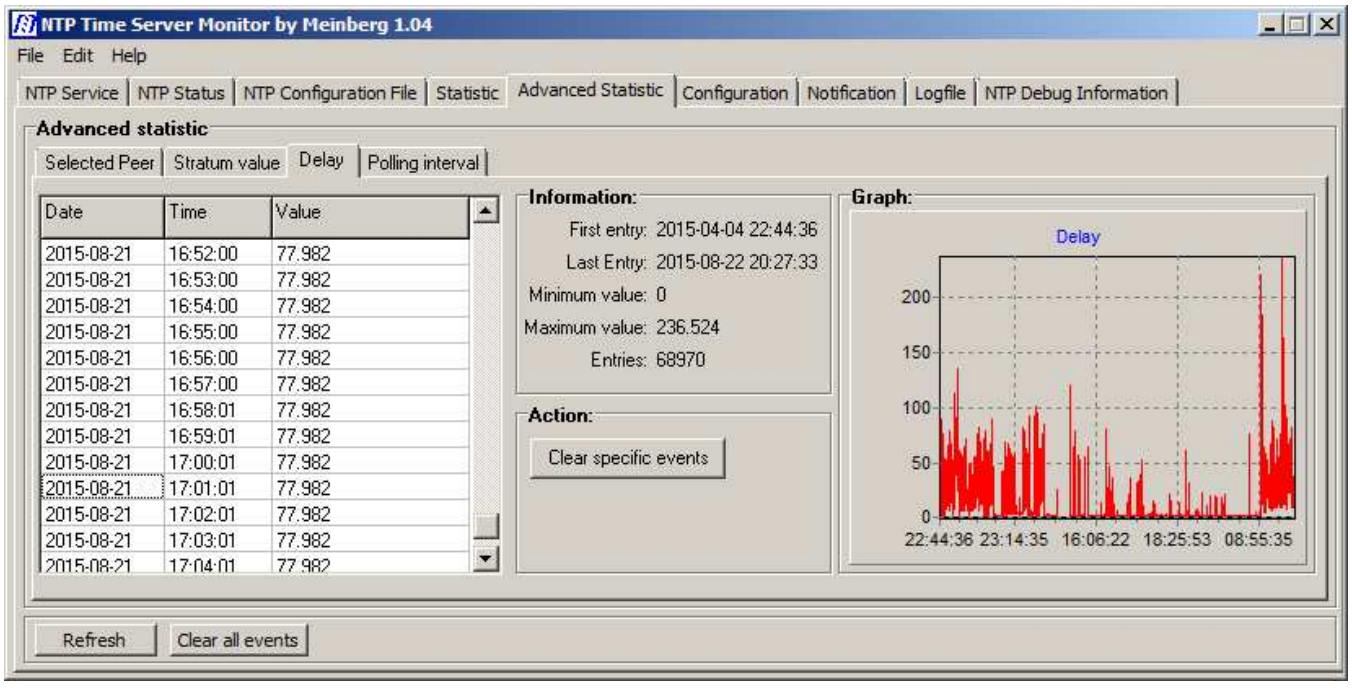


Figure 19 ~ Top: The Statistics tab provides a plot of two parameters from the loopstats log, clock offset and frequency offset. It will be noted from the frequency plot that NTP is attempting to slowly steer the frequency error so that the clock offset tends toward zero. This can be seen where, over a 24 h period, the frequency error is slowly stepped in a positive direction from about –55.0 to –54.5 ppm. The clock offset probably will never reach zero because of the PC clock's behavior. For example, a process may start that loads the CPU and thus increases its temperature or a nearby heater or cooler may start, any of which could affect the PC clock crystal and its frequency and NTP's steering attempts. Bottom:

Advanced Statistics tab provides plots of the Selected Peer, Stratum value, Delay and Polling Interval over the most recent 24 h period. Generally, only the Delay and Polling Interval are of interest. They indicate the measured time characteristics s of the NTP messages that are exchanged between an NTP server and client. Note the Delay plot, which shows variability ranging from near 0 to over 250 ms presumably caused by buffering in the local wireless router and the variable latency in the Wi-Fi connection.

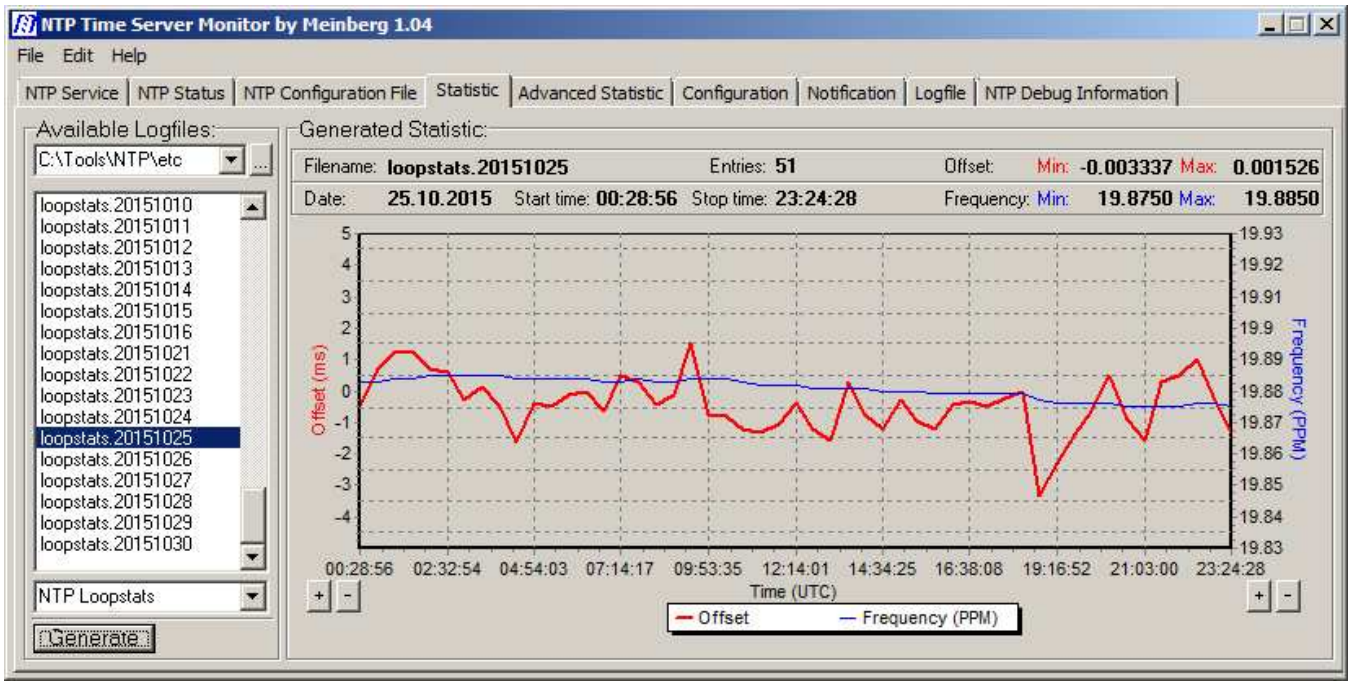
It will be noticed from the plots that NTP normally does not make large frequency steps. This is particularly important in telecommunications networks, but for relatively simple PC time-keeping, NTP can be setup to make large or quick steps upon initial startup. The *iburst* flag on a server in the NTP configuration file is one method to increase the server polling rate and thus faster steps on startup.

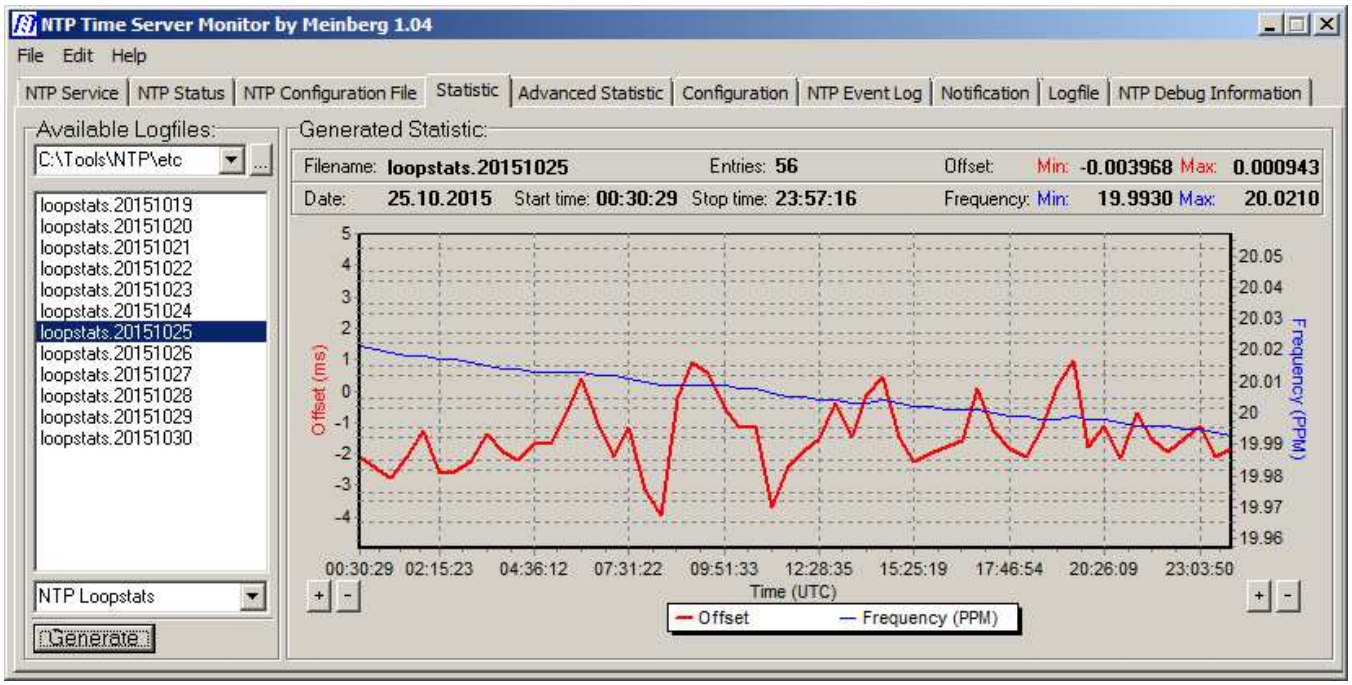
A PC that synchronizes via a wireless LAN will show much more variation (jitter) than a PC on a wired LAN. This is particularly obvious when the PC is using a local (external) time server such as the GpsNtp-Pi because the local connections usually are more stable than, say, the public internet. The statistics for several PCs on the same LAN and with the same type of connection should be roughly comparable but will not be identical due to each PC's clock characteristics and environment.

4. Measurements

Loopstats statistics from three PCs were used to observe the effects of different time server configurations. Each PC was setup using two local GpsNtp-Pi time servers, a remote time server pool (United States server pool) and a combination and then run for 3 full days. A screenshot of the Statistic tab plot for each setup was captured at the end of the 3rd day as follows: GpsNtp-Pi for 25 October (figure 20), United States time server pool for 29 October (figure 21) and combination for 2 November (figure 22). The minimum and maximum clock offset and frequency offset statistics are summarized (table 1).

During each set of measurements, the NTP Status tab was randomly checked to see which server was selected. For the case where only the local GpsNtp-Pi time servers were used, the one with the wired (Ethernet) LAN interface always was chosen as the best available. In the combination measurements where a GpsNTp-Pi server was used in parallel with a server pool, the GpsNtp-Pi with the wired LAN interface always was chosen as the best available. The GpsNtp-Pi with the wireless (Wi-Fi) interface always was shown as acceptable but never used. In the three PCs analyzed above, NTP kept the clock within 10 ms of UTC, an order of magnitude better than NTP's goal of 128 ms.


NTP Time Server Monitor by Meinberg 1.04
File Edit Help
NTP Service | NTP Status | NTP Configuration File | Statistic | Advanced Statistic | Configuration | Notification | Logfile | NTP Debug Information
Available Logfiles:
C:\Tools\NTP\etc
loopstats.20151010
loopstats.20151011
loopstats.20151012
loopstats.20151013
loopstats.20151014
loopstats.20151015
loopstats.20151016
loopstats.20151021
loopstats.20151022
loopstats.20151023
loopstats.20151024
loopstats.20151025
loopstats.20151026
loopstats.20151027
loopstats.20151028
loopstats.20151029
loopstats.20151030
NTP Loopstats
Generate
Generated Statistic:
Filename: loopstats.20151025 Entries: 51 Offset: Min: -0.003337 Max: 0.001526
Date: 25.10.2015 Start time: 00:28:56 Stop time: 23:24:28 Frequency: Min: 19.8750 Max: 19.8850
Offset (ms)
Frequency (PPM)
00:28:56 02:32:54 04:54:03 07:14:17 09:53:35 12:14:01 14:34:25 16:38:08 19:16:52 21:03:00 23:24:28
Time (UTC)
Offset
Frequency (PPM)


NTP Time Server Monitor by Meinberg 1.04
File Edit Help
NTP Service | NTP Status | NTP Configuration File | Statistic | Advanced Statistic | Configuration | NTP Event Log | Notification | Logfile | NTP Debug Information
Available Logfiles:
C:\Tools\NTP\etc
loopstats.20151019
loopstats.20151020
loopstats.20151021
loopstats.20151022
loopstats.20151023
loopstats.20151024
loopstats.20151025
loopstats.20151026
loopstats.20151027
loopstats.20151028
loopstats.20151029
loopstats.20151030
NTP Loopstats
Generate
Generated Statistic:
Filename: loopstats.20151025 Entries: 56 Offset: Min: -0.003968 Max: 0.000943
Date: 25.10.2015 Start time: 00:30:29 Stop time: 23:57:16 Frequency: Min: 19.9930 Max: 20.0210
Offset (ms)
Frequency (PPM)
00:30:29 02:15:23 04:36:12 07:31:22 09:51:33 12:28:35 15:25:19 17:46:54 20:26:09 23:03:50
Time (UTC)
Offset
Frequency (PPM)

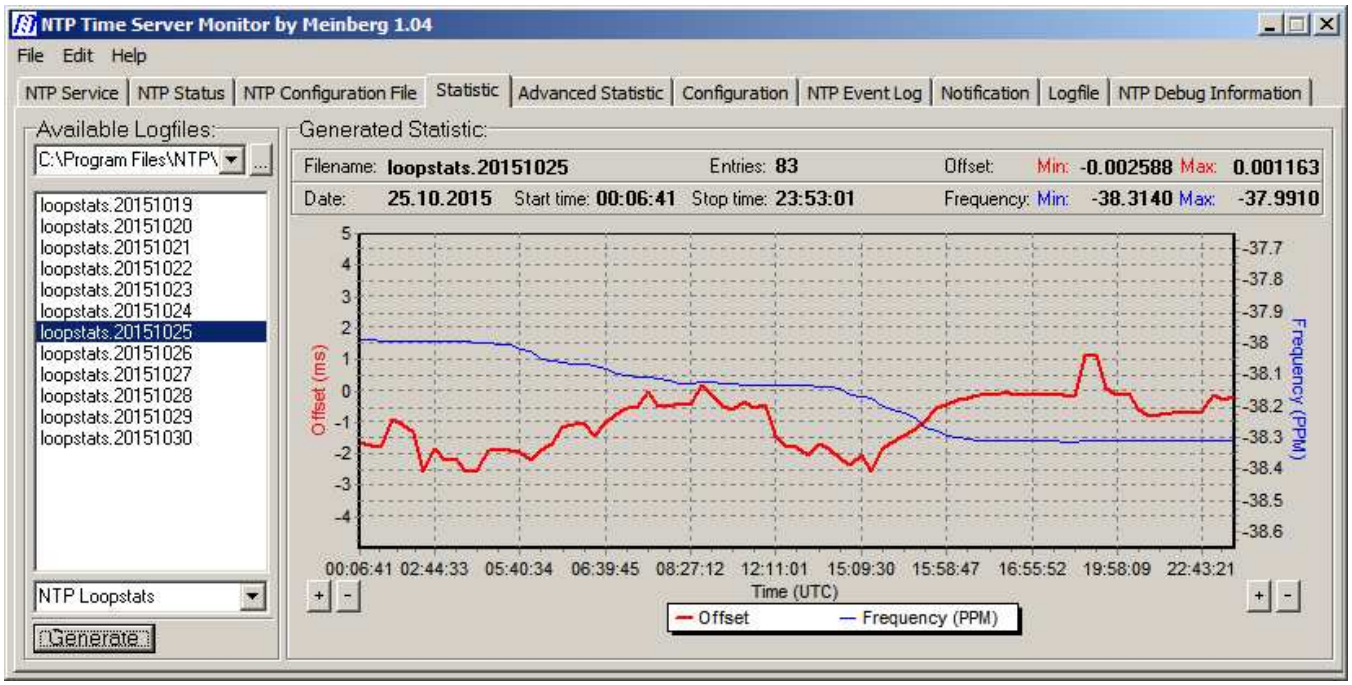
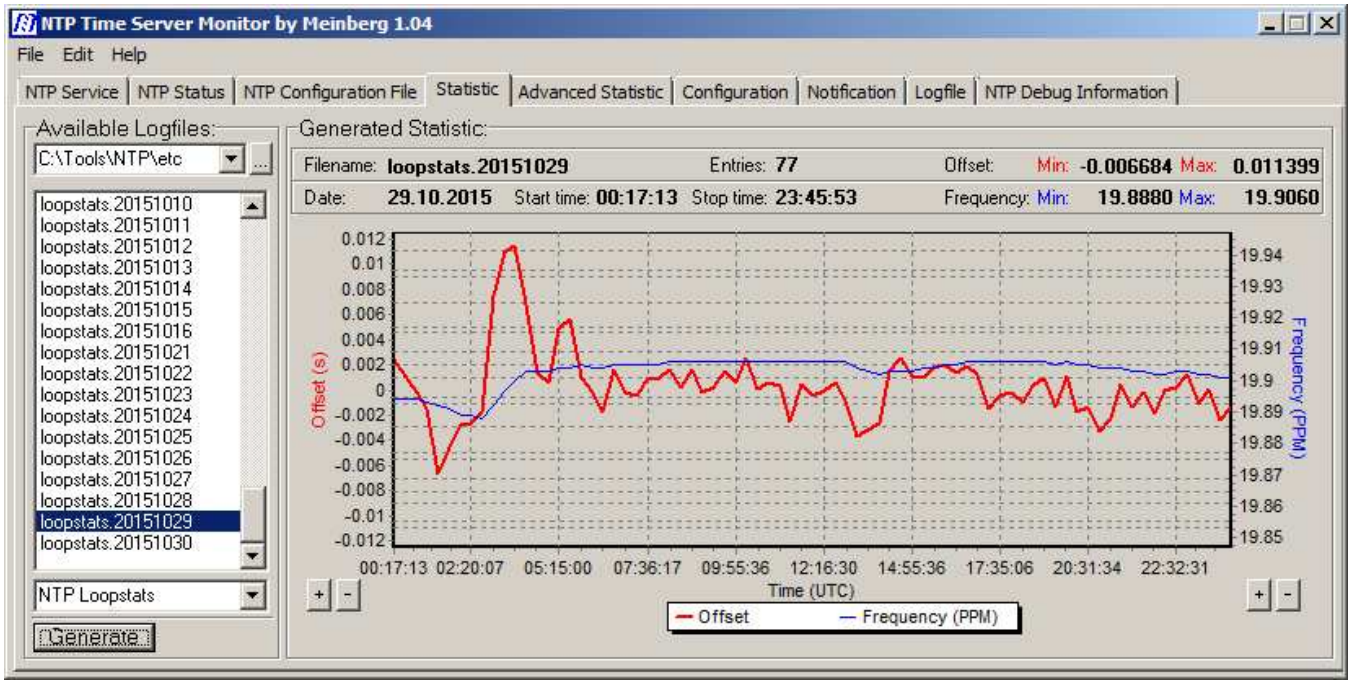


Figure 20 ~ Clock adjustment and frequency offset plots of same day (25 October 2015) data from three PCs that use the same GpsNtp-Pi time servers. In all plots the vertical axes are autoscaled and the minimum and maximum values in each plot are shown at the upper-right. Top: Windows 7 PC (named W7 A61eLab) with access to time servers via a Wi-Fi repeater. Middle: Windows 7 PC (named W7 A61eRx) with access to time servers via wired LAN. Bottom: Windows XP PC (named WXP SG41) with access to time servers via a Wi-Fi repeater (same as the access used in the top plots). Note that the left clock offset scale in the upper two plots is seconds and in bottom plot is milliseconds but the magnitude of the variations throughout the day are approximately the same.



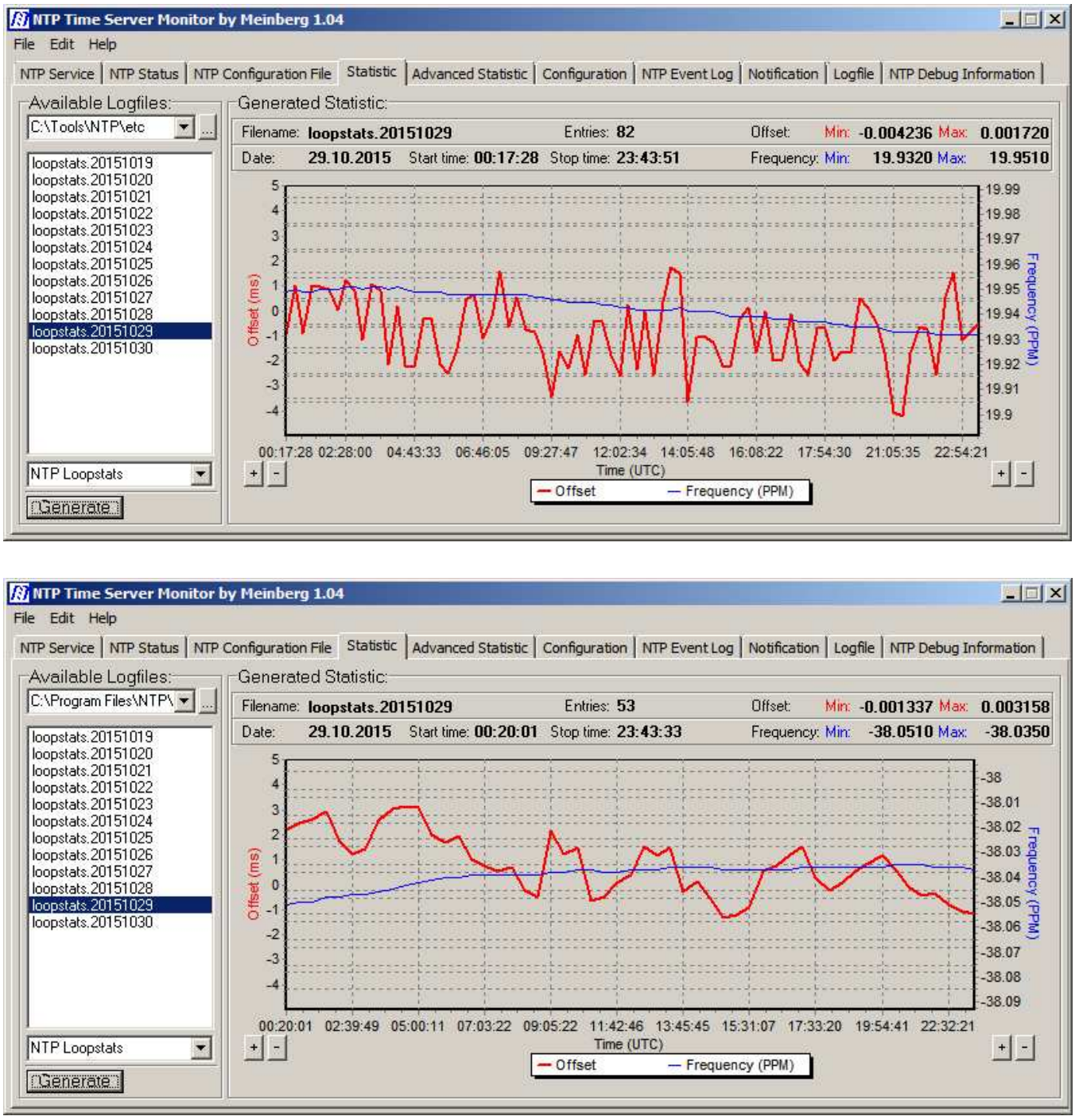
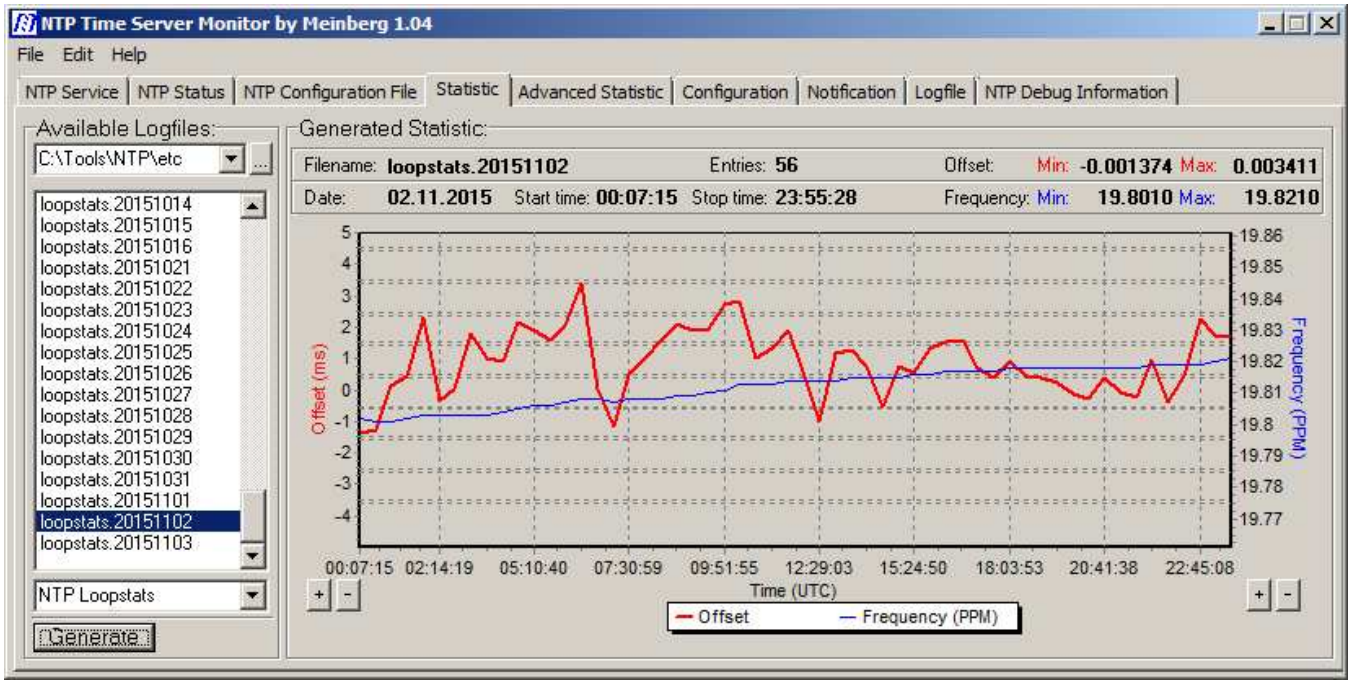
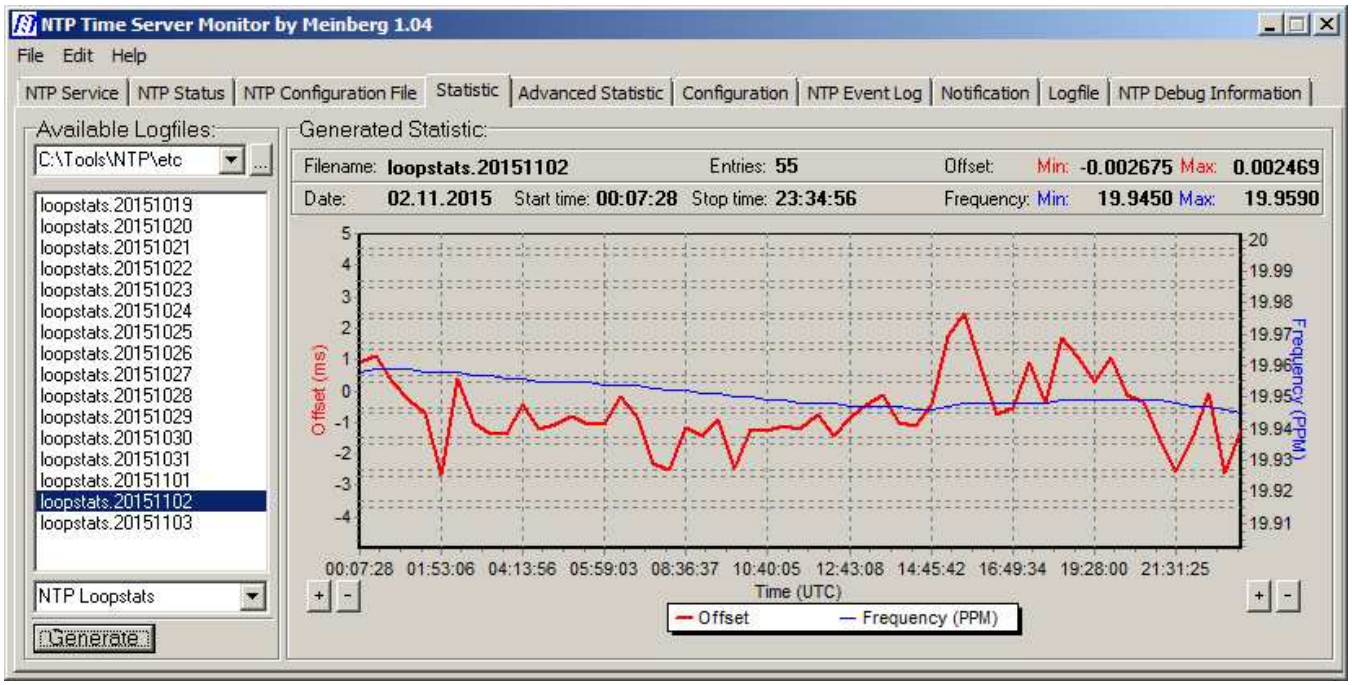


Figure 21 ~ Clock and frequency offset plots of same day (29 October 2015) data from three PCs that use the same United States time server pool. Top: Windows 7 PC (named W7 A61eLab) with access to time servers via a Wi-Fi repeater. This PC had been turned on for only a few minutes prior to 000 on 22 October. Fairly rapid initial changes can be seen in both clock and frequency offsets, but they then stabilized within about 10 minutes. Middle: Windows 7 PC (named W7 A61eRx) with access to time servers via wired LAN. Bottom: Windows XP PC (named WXP SG41) with access to time servers via a Wi-Fi repeater (same as top plots). Note that the left clock offset scale in the upper two plots is seconds and in bottom plot is milliseconds but the magnitude of the variations throughout the day are approximately the same.


NTP Time Server Monitor by Meinberg 1.04
File Edit Help
NTP Service | NTP Status | NTP Configuration File | Statistic | Advanced Statistic | Configuration | Notification | Logfile | NTP Debug Information
Available Logfiles:
C:\Tools\NTP\etc
loopstats.20151014
loopstats.20151015
loopstats.20151016
loopstats.20151021
loopstats.20151022
loopstats.20151023
loopstats.20151024
loopstats.20151025
loopstats.20151026
loopstats.20151027
loopstats.20151028
loopstats.20151029
loopstats.20151030
loopstats.20151031
loopstats.20151101
loopstats.20151102
loopstats.20151103
NTP Loopstats
Generate
Generated Statistic:
Filename: loopstats.20151102 Entries: 56 Offset: Min: -0.001374 Max: 0.003411
Date: 02.11.2015 Start time: 00:07:15 Stop time: 23:55:28 Frequency: Min: 19.8010 Max: 19.8210
Offset (ms)
Frequency (PPM)
00:07:15 02:14:19 05:10:40 07:30:59 09:51:55 12:29:03 15:24:50 18:03:53 20:41:38 22:45:08
Time (UTC)
Offset
Frequency (PPM)


NTP Time Server Monitor by Meinberg 1.04
File Edit Help
NTP Service | NTP Status | NTP Configuration File | Statistic | Advanced Statistic | Configuration | NTP Event Log | Notification | Logfile | NTP Debug Information
Available Logfiles:
C:\Tools\NTP\etc
loopstats.20151019
loopstats.20151020
loopstats.20151021
loopstats.20151022
loopstats.20151023
loopstats.20151024
loopstats.20151025
loopstats.20151026
loopstats.20151027
loopstats.20151028
loopstats.20151029
loopstats.20151030
loopstats.20151031
loopstats.20151101
loopstats.20151102
loopstats.20151103
NTP Loopstats
Generate
Generated Statistic:
Filename: loopstats.20151102 Entries: 55 Offset: Min: -0.002675 Max: 0.002469
Date: 02.11.2015 Start time: 00:07:28 Stop time: 23:34:56 Frequency: Min: 19.9450 Max: 19.9590
Offset (ms)
Frequency (PPM)
00:07:28 01:53:06 04:13:56 05:59:03 08:36:37 10:40:05 12:43:08 14:45:42 16:49:34 19:28:00 21:31:25
Time (UTC)
Offset
Frequency (PPM)

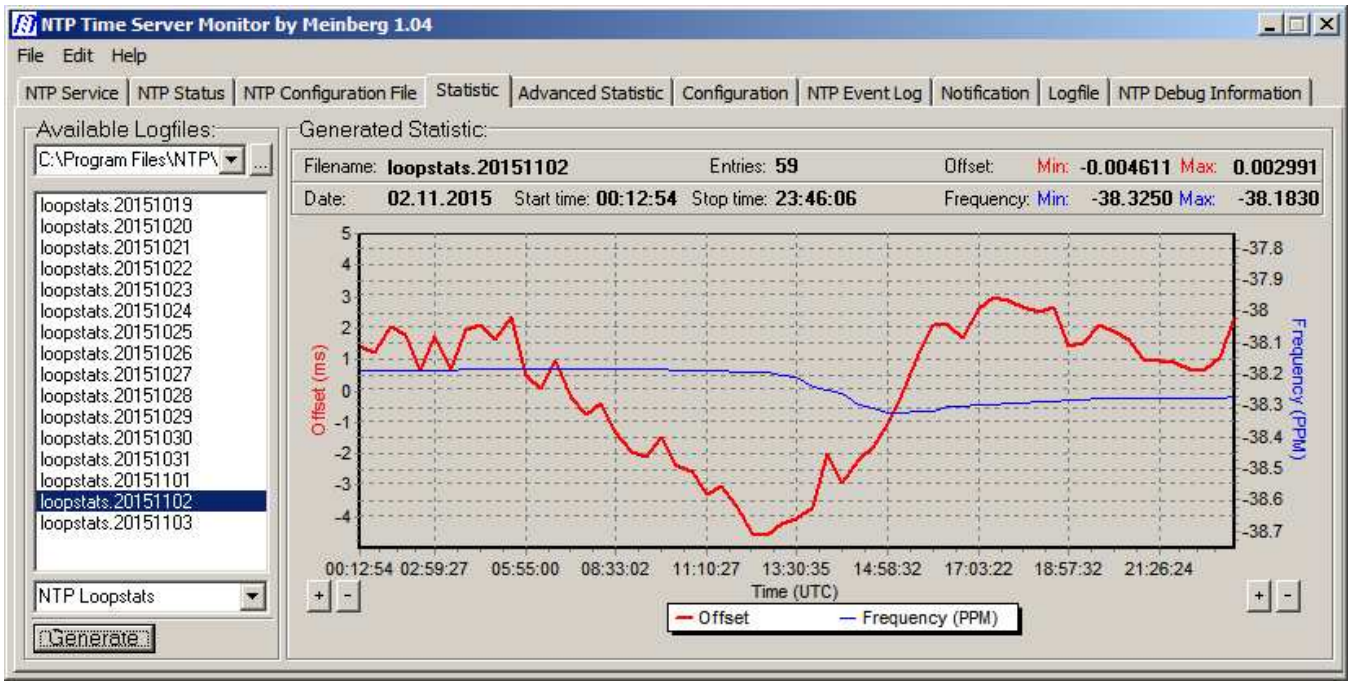


Figure 22 ~ Clock and frequency offset plots of same day (2 November 2015) data from three PCs that use a combination of GpsNtp-Pi and United States time server pool. Top: Windows 7 PC (W7 A61eLab) with access to time servers via a Wi-Fi repeater. This PC had been turned on for only a few minutes prior to 000 on 22 October. Fairly rapid initial changes can be seen in both clock and frequency offsets, but they then stabilized within about 10 minutes. Middle: Windows 7 PC (W7 A61eRx) with access to time servers via wired LAN. Bottom: Windows XP PC (WXP SG41) with access to time servers via a Wi-Fi repeater (same as top plots). Note that the left clock offset scale in the upper two plots is seconds and in bottom plot is milliseconds but the magnitude of the variations throughout the day are approximately the same.

Table 1 ~ Summary of minimum and maximum clock offsets and frequency offsets for three PCs using various NTP time servers. The clock offsets were marginally better when the GpsNtp-Pi time server was used. When the combination of GpsNtp-Pi and server pool was used, NTP always selected the GpsNtp-Pi as the best server; therefore, two clock offset averages are calculated from the data, one for all measurements and another only where GpsNtp-Pi was involved.

Client PC	Clock offset Min. (ms)	Clock offset Max. (ms)	Pk-Pk Clock Adj. (ms)	Frequency offset Min. (Hz)	Frequency offset Max. (Hz)
GpsNtp-Pi only					
W7 A61e (Lab)	–3.337	1.526	4.863	19.8750	19.8850
W7 A61e (Rx)	–3.968	0.943	4.911	19.9930	20.0210
WXP SG41 (Lab)	–2.588	1.163	3.751	–38.3140	–37.9910
US Pool only					
W7 A61e (Lab)	–6.684	11.399	18.083	19.8880	19.9060
W7 A61e (Rx)	–4.236	1.720	5.956	19.9320	19.9510
WXP SG41 (Lab)	–1.337	3.158	4.495	–38.0510	–38.0350
Combination					
W7 A61e (Lab)	–1.374	3.411	4.785	19.8010	19.8210
W7 A61e (Rx)	–2.675	2.469	5.144	19.9450	19.9590
WXP SG41 (Lab)	–4.611	2.991	7.602	–38.3250	–38.1830
Average (all)	–3.423	3.198	6.621		
Average (GpsNtp-Pi)	3.092	2.084	5.176		

5. Additional Comments

As noted above, the Meinberg monitor plots only the clock offset and frequency offset; it does not plot the other parameters in the loopstats files – jitter and wander (Allan Deviation, or ADEV). The loopstats files are saved as a space-separated text files and may be viewed with an ordinary text editor or imported into a spreadsheet for plotting. However, the NTP Plotter software available from {NTPPlot} conveniently plots all parameters in the loopstats file as a line graph or histogram.

6. References and Web Links

[Reeve12-1] Reeve, W., Maintain Your Time, 2012, available here: http://www.reeve.com/Documents/Articles%20Papers/MaintainTime_Reeve.pdf

{Reeve12-2} Reeve, W., Is Time Broken (or, Will It Be Y2K All Over Again)?, 2012, available here: http://www.reeve.com/Documents/Articles%20Papers/IsTimeBroken_Reeve.pdf

{Reeve12-3} Reeve, W., Time Differences in Charted Solar Observations at High Frequencies, 2012, available here: http://www.reeve.com/Documents/Articles%20Papers/TimeDifference_Reeve.pdf

{ReeveGps} Reeve, W., GpsNtp-Pi: GPS Network Time Server on Raspberry Pi, 2015, available here: http://www.reeve.com/Documents/Articles%20Papers/Reeve_GpsNtp-Pi.pdf

[ReeveNTP] Reeve, W., Network Time Protocol and Meinberg NTP Time Server Monitor ~ Installation Guide, 2015, available here: http://www.reeve.com/Documents/Articles%20Papers/Reeve_NTP-MeinMon_Install.pdf

{ReeveSynch} Reeve, W., Telecommunications Synchronization Overview, August 2002, available here: http://www.reeve.com/Documents/Synchronization.pdf

{ReeveTime} Reeve, W., Time Keeping, 2015, available here: http://www.reeve.com/Documents/Articles%20Papers/Reeve_TimeKeeping.pdf

{GpsNtp-Pi} http://www.reeve.com/RadioScience/Raspberry%20Pi/GpsNtp-Pi.htm

{NTPOrg} http://www.ntp.org/

{NTPPlot} http://www.satsignal.eu/software/net.htm

{NTPPool} http://www.pool.ntp.org/en/

{TinyBen} http://www.satsignal.eu/software/disk.html#TinyBen

Document Information

Author: Whitham D. Reeve, Anchorage, Alaska USA

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0.2 (Split from NTP and Meinberg monitor installation doc, 20 Oct 2015)
0.3 (Add'l analyses, 23 Oct 2015)
0.4 (Cleanup, 28 Oct 2015)
0.5 (Added DNS option and final images, 2 Nov 2015)
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