HTTP Time Protocol
User's Guide
0.4.6

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Chapter 1

Overview

1.1 Introduction

The HTTP Time Protocol ("HTP") was initially a Perl script by Eddy Vervest. Eddy then wrote a simple version in C which was extended and maintained by Roy Keene. This document deals exclusively with the C version, but many principles also apply to the original (and still maintained) version in Perl.

HTP was designed to be an easy way to set and maintain the clock even in heavily firewalled systems. Towards this end it uses a very common and often allowed protocol (HTTP/1.1, RFC 2616) and requires only minimal configuration.

HTP was also designed to be very portable, it currently works on (almost?) every known UNIX as well as Windows. It attempts to take full advantage of the operating system's time adjustment capabilities and will "slew" the clock if the system supports it and a relatively small (±3seconds) change is required.

1.2 Basic Operating Principles

The HTTP Time Protocol ("HTP") system operates on the fact that all RFC 2616 compliant web servers must report their time in a specific format for every request. Since there are an abundant number of public web servers, it should be possible to get an accurate clock value by doing some simple statistical analysis of many servers current time values (and adjusting for network latency.)

HTP works best when there are many servers to choose from. Outliers past one standard deviation shall be ignored and the rest will be averaged together in a manner to avoid counter overflows.

1.3 Contact Information

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Chapter 2

Installation

2.1 From Source

2.1.1 Dependencies

1. A C compiler (tested primarily with GCC)
2. Libconfig `http://www.rkeene.org/oss/libconfig/`

2.1.2 Compiling

The HTTP Time Protocol (HTP) system uses the GNU "autoconf" configuration mechanism. Installation should be as simple as:

```
./configure
make
make install
```

The default installation location is with a prefix of "/usr/local", which means that all files installed will go under the "/usr/local" tree somewhere. This can be changed with the "–prefix" option to the `configure` script.

2.2 From Binary Package

2.2.1 RPM

Installation from RPM should be as simple as:

```
rpm -Uvh htp-0.4.6-1.i386.rpm
```
[1]

[1] This RPM is for the i386 architecture, you should use the appropriate RPM for your architecture. The supplied RPM is for RedHat on i386, 3rd party RPMs may be available for other systems.

2.2.2 Slackware Package

Installation from a Slackware package should be as simple as:

```
installpkg htp-0.4.6-i486-1rsk.tgz
```

2.2.3 Other Packaging Systems

There should be no special requirements on other package management systems, however you normally install a software package should work fine assuming a properly formed package is available.

Chapter 3

Configuration

The HTTP Time Protocol (HTP) system uses "libconfig" to handle its configuration. Thus, any configuration option may appear in the global configuration file, a local configuration file, the environment, or as a command line option.

Any option in the configuration file may be specified on the command line by prefixing it with "–".

Any option in the configuration file may be specified in the environment by setting an environment variable with "HTPD_" (or "HTPDATE_") prefixed to its name.

3.1 Configuration for HTPD

3.1.1 Configuration Information

Global Configuration File

The global configuration file for HTPD is "htpd.conf" in your `SYSCONFDIR` (usually, "/usr/local/etc" or "/etc".)

Configuration File Format

The HTPD configuration file format is very simple. Every directive must appear on a line by itself with whitespace separating its value. For example:

```
Host www.google.com
Host www.oc9.org
Host www.kernel.org
```

3.1.2 Directives

Host

The Host directive (also "–host" and "-H" from the command line, and "HTPD_HOST" from the environment) specifies which hosts HTPD should query for the time. The value may be in the format of:

host[:port]

Where "host" is the IP address or hostname of the target and "port" is the TCP port number to connect on. If the optional port parameter is omitted port number 80 is assumed.

ProxyHost

The ProxyHost directive (also "–proxyhost" and "-P" from the command line, and HTPD_PROXYHOST from the environment) specifies an HTTP proxy to send queries through. It may be in the format of:

host[:port]

If the optional "port" parameter is omitted, the port number 8080 is assumed.

ProxyUser

The ProxyUser directive (also "–proxyuser" and "-U" from the command line, and HTPD_PROXYUSER from the environment) specifies a username for an authenticating HTTP proxy. You must also define a ProxyHost and a ProxyPass.

ProxyPass

The ProxyPass directive (also "–proxypass" and "-p" from the command line, and HTPD_PROXYPASS from the environment) specifies a password for an authenticating HTTP proxy. You must also define a ProxyHost and ProxyUser.

MaxSleep

The MaxSleep directive (also "–maxsleep" and "-M" from the command line, and HTPD_MAXSLEEP from the environment) specifies the maximum amount of time that HTPD should wait between querying selected servers for the current time. The actual amount between queries is determined by the amount that HTPD adjusts the clock, but will always fall within the $[MINSLEEP, MAXSLEEP]$ range.

MinSleep

The MinSleep directive (also "–minsleep" and "-m" from the command line, and HTPD_MINSLEEP from the environment) specifies the minimum amount of time that HTPD should wait between querying selected servers for the current time. See the MaxSleep option for more information.

3.2 Configuration for HTPDATE

3.2.1 Configuration Information

Global Configuration File

The global configuration file for HTPDATE is "htpdate.conf" in your `SYSCONFDIR` (usually, "/usr/local/etc" or "/etc".)

Configuration File Format

The HTPDATE configuration file format is very simple. Every directive must appear on a line by itself with whitespace separating its value (if applicable.) For example:

```
QueryOnly
ProxyHost 10.9.3.1:8091
ProxyUser joe
ProxyPass bob
```

3.2.2 Directives

QueryOnly

The QueryOnly directive (also "–queryonly" and "-n" from the command line, and HTPDATE_QUERYONLY from the environment) indicates that HTPDATE should not attempt to adjust the clock. Instead HTPDATE will just report the calculated time. Note that this means the "delta" is 0.0 since there is no difference between what the clock was set to and what it was prior to setting the clock.

AdjustTime

The AdjustTime directive (also "–adjusttime" and "-a" from the command line, and HTPDATE_ADJUSTTIME from the environment) indicates that HTPDATE should attempt to "slew" the time instead of "stepping" the time to the calculated value.

ProxyHost

The ProxyHost directive (also "–proxyhost" and "-P" from the command line, and HTPDATE_PROXYHOST from the environment) specifies an HTTP proxy to send queries through. It may be in the format of:

host[:port]

If the optional "port" parameter is omitted, the port number 8080 is assumed.

ProxyUser

The ProxyUser directive (also "–proxyuser" and "-U" from the command line, and HTPDATE_PROXYUSER from the environment) specifies a username for an authenticating HTTP proxy. You must also define a ProxyHost and a ProxyPass.

ProxyPass

The ProxyPass directive (also "–proxypass" and "-p" from the command line, and HTPDATE_PROXYPASS from the environment) specifies a password for an authenticating HTTP proxy. You must also define a ProxyHost and ProxyUser.

Chapter 4

Usage

4.1 Using HTPD

4.1.1 Synopsis

```
htpd [-rkh] [-M time] [-m time] [-P proxy] [-U user] [-p pass] [-H host] ...
```

- `-k` (also `--Stop`) asks `htpd` to stop running.
- `-r` (also `--Remove`) asks `htpd` to stop running and not start at boot.
- `-h` gives basic usage information.
- `-M time` (also `--MaxSleep time`) sets the maximum amount of time to delay between polling the specified servers for the time.
- `-m time` (also `--MinSleep time`) sets the minimum amount of time to delay between polling the specified servers for the time.
- `-P proxy` (also `--ProxyHost proxy`) sets the HTTP/1.1 proxy server to send HTP requests through.
- `-U user` (also `--ProxyUser user`) specifies the username for an HTTP/1.1 authenticating proxy.
- `-p pass` (also `--ProxyPass pass`) specifies the password for an HTTP/1.1 authenticating proxy.
- `-H host` (also `--Host host`) adds an additional host to the list of servers to query for the time. This option may be used more than once.

4.1.2 General Notes

HTPD will attempt to keep the clock in sync by periodically polling the specified servers. If possible and the time difference is less than ±3seconds the clock will be "slewed" to the correct value. Otherwise the clock will be "stepped" to the correct value.

4.1.3 Windows[1] Notes

Under Windows HTPD uses the Windows services system to control startup and termination. To "register" the service simply run "htpd" once, after that it should start at boot. To stop HTPD run:

[1] Windows is a trademark of the Microsoft Corporation.

```
htpd -k
```

To remove the HTPD service and prevent it from starting at boot simply run:

```
htpd -r
```

It should be noted that Windows currently does not support any type of smooth clock adjustment ("slewing"). All adjustments on Windows are done by steps.

4.1.4 UNIX Notes

Under UNIX HTPD uses a Bourne shell script and pid files to control startup and termination. Your distribution may implement this shell script as part of its SystemV init process to allow HTPD to startup at boot time.

4.2 Using HTPDATE

4.2.1 Synopsis

```
htpdate [-qah] [-P proxy] [-U user] [-p pass] host ...
```

- `-q` (also `--QueryOnly`) instructs `htpdate` to only query the specified servers for their time value.
- `-a` (also `--AdjustTime`) instructs `htpdate` to attempt to do a smooth adjustment ("slew") of the time to the new value.
- `-P proxy` (also `--ProxyHost proxy`) sets the HTTP/1.1 proxy server to send HTP requests through.
- `-U user` (also `--ProxyUser user`) specifies the username for an HTTP/1.1 authenticating proxy.
- `-p pass` (also `--ProxyPass pass`) specifies the password for an HTTP/1.1 authenticating proxy.
- `-h` gives basic usage information
- `host ...` is a list of hosts to query for time using HTTP/1.1.

4.2.2 General Notes

HTPDATE always "steps" the clock unless the "-a" ("–AdjustTime") option is specified, in which case it "slews" it if the difference is less than ±3seconds and the system supports it.

Appendix A

Terminology and Calculations

A.1 Terminology

A.1.1 Slew Time

In the context of network time protocol implementations the term "slew time" means to adjust gradually over time. Slewing time prevents applications from noticing a sudden jump in time. This is often accomplished by speeding up or slowing down the system clock.

A.1.2 Step Time

In the context of network time protocol implementations the term "step time" means to adjust time instantly to the new value. This is also known as "single shot adjustments."

A.2 Calculations

A.2.1 Multiple Source Calculations

HTP uses a simple standard deviation to remove outliers that would cause the average time to be heavily influenced by a single inaccurate clock. This calculation is performed by sorting the time values linearly and excluding all values past one standard deviation ($\pm 34\%$). The remaining values are averaged using simple averaging.

$$timeval = \frac{\sum_{k=meanidx-count*34\%}^{meanidx+count*34\%} [timeval_k])}{count * 68\%}$$

A.2.2 Network Transmission Time Calculations

HTP uses a simple method of correcting for network transmission times. Times are corrected after querying each server so that each time will represent an offset from a base time. After all servers are queried and the time values are averaged together total time spent performing all these operations is added to the average base time. All calculations are done with microsecond resolution if possible.

A.2.3 Sleep Time Calculations

HTPD uses a simple algorithm to determine how long to wait between polling servers for the current time. This calculation is based upon the previous amount of sleep and the time difference between the system clock prior to adjustment and after adjustment. All calculations and comparisons take the absolute value of *delta* prior to use.

If the delta is 0.5 seconds or less the sleep time is doubled:

$$sleeptime = sleeptime * 2$$

If the delta is 1.0 seconds or less and greater than 0.5 seconds, the sleep time is decreased nominally:

$$sleeptime = sleeptime - 60$$

Otherwise the sleep time is decreased based inversely proportional to the delta:

$$sleeptime = \frac{sleeptime}{delta}$$

This algorithm rewards accurate times (delta values of 0.5s seconds or less), and punishes inaccurate values. Any *sleeptime* outside of the range of $[MINSLEEP, MAXSLEEP]$ is adjusted to fit within the range.

Appendix B

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