

HTTP Time Protocol  
User's Guide  
0.4.10

ROY KEENE  
EDDY VERVEST

01 January 2005

---

# Contents

<b>1</b>	<b>Overview</b>	<b>5</b>
1.1	Introduction . . . . .	5
1.2	Basic Operating Principles . . . . .	5
1.3	Contact Information . . . . .	5
<b>2</b>	<b>Installation</b>	<b>7</b>
2.1	From Source . . . . .	7
2.1.1	Dependencies . . . . .	7
2.1.2	Compiling . . . . .	7
2.2	From Binary Package . . . . .	7
2.2.1	RPM . . . . .	7
2.2.2	Slackware Package . . . . .	8
2.2.3	Windows ZIP File . . . . .	8
2.2.4	Other Packaging Systems . . . . .	8
<b>3</b>	<b>Configuration</b>	<b>9</b>
3.1	Configuration for HTPD . . . . .	9
3.1.1	Configuration Information . . . . .	9
3.1.2	Directives . . . . .	9
3.2	Configuration for HTPDATE . . . . .	10
3.2.1	Configuration Information . . . . .	10
3.2.2	Directives . . . . .	11
<b>4</b>	<b>Usage</b>	<b>13</b>
4.1	Using HTPD . . . . .	13
4.1.1	Synopsis . . . . .	13
4.1.2	General Notes . . . . .	13
4.1.3	Windows Notes . . . . .	13
4.1.4	UNIX Notes . . . . .	14
4.2	Using HTPDATE . . . . .	14
4.2.1	Synopsis . . . . .	14
4.2.2	General Notes . . . . .	14

---

<b>A Terminology and Calculations</b>	<b>15</b>
A.1 Terminology . . . . .	15
A.1.1 Slew Time . . . . .	15
A.1.2 Step Time . . . . .	15
A.2 Calculations . . . . .	15
A.2.1 Multiple Source Calculations . . . . .	15
A.2.2 Network Transmission Time Calculations . . . . .	15
A.2.3 Sleep Time Calculations . . . . .	16
<b>B License</b>	<b>17</b>
B.1 GNU GENERAL PUBLIC LICENSE . . . . .	17

# 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 ( $\pm 3$ seconds) 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

- ROY KEENE
  - email: [htp@rkeene.org](mailto:htp@rkeene.org)
  - web: <http://www.rkeene.org/oss/http/>
- EDDY VERVEST
  - email: [Eddy@clevervest.com](mailto:Eddy@clevervest.com)
  - web: <http://www.clevervest.com/http/>



## 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 http-0.4.10-1.i386.rpm1
```

---

<sup>1</sup>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 http-0.4.10-i486-1rsk.tgz
```

### 2.2.3 Windows ZIP File

Installation on Windows from the provided ZIP file should be as simple as running the included `INSTALL.BAT` from the `http-0.4.10.zip` file.

### 2.2.4 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  $\pm 3$ seconds the clock will be “slewed” to the correct value. Otherwise the clock will be “stepped” to the correct value.

#### 4.1.3 Windows<sup>1</sup> 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:

---

<sup>1</sup>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.

The provided executables for Windows expect to be installed to `C:\Program Files\HTP\`, installing them to any other place will cause them to be unable to find their configuration files.

#### 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  $\pm 3$ seconds 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. Slew 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

## License

### B.1 GNU GENERAL PUBLIC LICENSE

Version 2, June 1991 Copyright (C) 1989, 1991 Free Software Foundation, Inc.

59 Temple Place - Suite 330, Boston, MA 02111-1307, USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

**Preamble** The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software—to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation’s software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too. When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things. To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it. For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights. We protect your rights with two steps:

1. Copyright the software, and
2. Offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author’s protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors’ reputations. Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that re-distributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone’s free use or not licensed at all. The precise terms and conditions for copying, distribution and modification follow.

**TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION**

1. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you". Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.
2. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program. You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
3. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 2 above, provided that you also meet all of these conditions:
  - (a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.
  - (b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.
  - (c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it. Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program. In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

4. You may copy and distribute the Program (or a work based on it, under Section 3) in object code or executable form under the terms of Sections 2 and 3 above provided that you also do one of the following:

- (a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 2 and 3 above on a medium customarily used for software interchange; or,
- (b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 2 and 3 above on a medium customarily used for software interchange; or,
- (c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for non-commercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable. If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

- 5. You may not copy, modify, sub-license, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sub-license or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.
- 6. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.
- 7. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.
- 8. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program. If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances. It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people

have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice. This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

9. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.
10. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.
11. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.
12. **NO WARRANTY.** BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
13. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS