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# **uts-server - RFC 3161 Timestamp Server**

***Release 0.1.8***

**Apr 22, 2017**



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### Runtime dependencies

List of dependencies uts-server relies on to run:

- `OpenSSL`.
- `civetweb`.
- on none GNU LibC, *argp-standalone* <<https://www.lysator.liu.se/~nisse/misc/argp-standalone-1.3.tar.gz>>

### Build dependencies

List of dependencies needed to build uts-server:

- `CMake`
- either `gcc` or `clang`



## CHAPTER 2

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### Compilation

---

uts-server is compiled using cmake:

```
# If civetweb is already present on the system
$ cmake .
$ make

# If civetweb is not present.
# this will get the master branch of civetweb from upstream and compile it.
# Only for developpment/testing purposes
$ cmake . -DBUNDLE_CIVETWEB=ON
$ make

# Compile with debug flags
# Only for developpment/testing purposes
$ cmake . -DDEBUG=ON
$ make

# Compile statically
# (in some cases, it might be necessary to still
# link some libraries like dl or gcc_s or pthread, if necessary,
# add -DLINK_DL=ON and/or -DLINK_GCC_S=ON and/or -DLINK_PTHREAD=ON)
$ cmake . -DSTATIC=ON # -DLINK_DL=ON -DLINK_GCC_S=ON -DLINK_PTHREAD=ON
$ make
```

**Warning:** The BUNDLE\_CIVETWEB exists only for developpment/testing purposes.

Please compile civetweb externally for building a production binary.

Using this option outside of developpment/testing is a bad idea for the following reasons:

- having an external download in a build process is a bad idea
- recovering the master branch ensures that the build may break randomly
- a build process should be reproducible which is not the case with this option





### Debian

The installation requires installing the following packages:

```
# build dependencies
$ apt-get install libssl-dev cmake clang
```

### CentOS/RHEL

The installation requires installing the following packages:

```
# build dependencies
$ yum install cmake gcc gcc-c++ openssl-devel
```

### FreeBSD

The installation requires installing the following packages:

```
# build dependencies
$ pkg add argp-standalone cmake
```

### OpenBSD

The installation requires installing the following packages:

```
# build dependencies
$ pkg_add gcc g++ argp-standalone cmake

# for the test scripts
$ pkg_add python curl
```

To build you must egcc and eg++ (not the old 4.2 gcc in the base system)

```
# set compilers
$ export CC=/usr/local/bin/egcc
$ export CXX=/usr/local/bin/ec++

# then build normally
$ cmake . -DBUNDLE_CIVETWEB=ON && make
```

---

### Configuration Parameters

---

#### **Section [ main ]**

Main configuration section (mostly http configuration).

Parameter	Description	Example Value
access_control_allow_origin	Comma separated list of IP subnets to accept/deny Ex: -0.0.0.0/0,+192.168.0.0/16 (deny all accesses, only allow 192.168.0.0/16 subnet)	-0.0.0.0/0,+192.168/16
enable_keep_alive	Allows clients to reuse TCP connection for subsequent HTTP requests, which improves performance.	no
listening_ports	Comma-separated list of IP:port tuples to listen on. If the port is SSL, a letter s must be appended. Ex: listening_ports = 80,443s	127.0.0.1:2020
log_level	Loglevel (debug, info, notice, warn, err, emerg, crit)	info
num_threads	Number of worker threads.	50
request_timeout_ms	Timeout for network read and network write operations. In milliseconds.	30000
run_as_user	Switch to given user credentials after startup. Required to run on privileged ports as non root user.	uts-server
ssl_ca_file	Path to a .pem file containing trusted certificates. The file may contain more than one certificate.	/etc/uts-server/ca.pem
ssl_ca_path	Name of a directory containing trusted CA certificates.	/etc/ssl/ca/
ssl_certificate	Path to the SSL certificate file . PEM format must contain private key and certificate.	/etc/uts-server/cert.pem
ssl_cipher_list	List of enabled ciphers for ssl. See <a href="https://www.openssl.org/docs/manmaster/apps/ciphers.html">https://www.openssl.org/docs/manmaster/apps/ciphers.html</a> or 'man ciphers' for more detailed.	ALL:!eNULL:!SSLv3
ssl_default_verify_paths	Loads default trusted certificates locations set at OpenSSL compile time.	yes
ssl_protocol_version	Sets the minimal accepted version of SSL/TLS protocol according to the table: <ul style="list-style-type: none"> <li>• SSL2+SSL3+TLS1.0+TLS1.1+TLS1.2 -&gt; 0</li> <li>• SSL3+TLS1.0+TLS1.1+TLS1.2 -&gt; 1</li> <li>• TLS1.0+TLS1.1+TLS1.2 -&gt; 2</li> <li>• TLS1.1+TLS1.2 -&gt; 3</li> <li>• TLS1.2 -&gt; 4</li> </ul>	3
ssl_short_trust	Enables the use of short lived certificates	no
ssl_verify_depth	Sets maximum depth of certificate chain. If client's certificate chain is longer than the depth set here connection is refused.	9
ssl_verify_peer	Enable client's certificate verification by the server.	yes
tcp_nodelay	Enable TCP_NODELAY socket option	0

## Section [ oids ]

Section for declaring OID mapping. Just add <name> = <OID> pairs.

Parameter	Description	Example Value
tsa_policy1		1.2.3.4.1
tsa_policy2		1.2.3.4.5.6
tsa_policy3		1.2.3.4.5.7

## Section [ tsa ]

TSA configuration parameters.

Parameter	Description	Example Value
accuracy	Time-Stamp accuracy. (optional)	secs:1, millisecs:500, microsecs:100
certs	Certificate chain to include in reply. (optional)	\$dir/cacert.pem
clock_precision_digits	Number of decimals for Time-Stamp. (optional)	0
crypto_device	OpenSSL engine to use for signing.	builtin
default_policy	Policy if request did not specify it. (optional)	tsa_policy1
digests	Acceptable message digests. (mandatory) See <a href="https://www.openssl.org/docs/manmaster/apps/dgst.html">https://www.openssl.org/docs/manmaster/apps/dgst.html</a> or 'man dgst' to get the list of available digests	md5, sha1, sha224, sha256, sha384, sha512
dir	TSA root directory.	/etc/uts-server/pki
ess_cert_id_chain	Must the ESS cert id chain be included? (optional, default: no)	no
ordering	Is ordering defined for timestamps? (optional, default: no)	yes
other_policies	Acceptable policies. (optional)	tsa_policy2, tsa_policy3
signer_cert	The TSA signing certificat. (optional)	\$dir/tsacert.pem
signer_key	The TSA private key. (optional)	\$dir/private/tsakey.pem
tsa_name	Must the TSA name be included in the reply? (optional, default: no)	yes



## CHAPTER 5

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### Full Configuration File

---

```
# Section for declaring OID mapping. Just add <name> = <OID> pairs.
[ oids ]

tsa_policy1 = 1.2.3.4.1
tsa_policy2 = 1.2.3.4.5.6
tsa_policy3 = 1.2.3.4.5.7

# Main configuration section (mostly http configuration).
[ main ]

# Comma-separated list of IP:port tuples to listen on.
# If the port is SSL, a letter s must be appended.
#
# Ex: listening_ports = 80,443s
listening_ports = 127.0.0.1:2020

# Allows clients to reuse TCP connection for subsequent
# HTTP requests, which improves performance.
enable_keep_alive = no

# Number of worker threads.
num_threads = 50

# Switch to given user credentials after startup.
# Required to run on privileged ports as non root user.
#run_as_user = uts-server

# Limit download speed for clients.
#
# Throttle is a comma-separated list of key=value pairs:
#
# - *                -> limit speed for all connections
#
# - x.x.x.x/mask -> limit speed for specified subnet
#
```

```
# The value is a floating-point number of bytes per second,
# optionally followed by a k or m character
# meaning kilobytes and megabytes respectively.
#
# A limit of 0 means unlimited rate.
#
# Ex: throttle = *=1k,10.10.0.0/16=10m,10.20.0.0/16=0
throttle = *=0

# Timeout for network read and network write operations.
# In milliseconds.
request_timeout_ms = 30000

# Path to the SSL certificate file .
# PEM format must contain private key and certificate.
#ssl_certificate = /etc/uts-server/cert.pem

# Enable client's certificate verification by the server.
#ssl_verify_peer = yes

# Name of a directory containing trusted CA certificates.
#ssl_ca_path = /etc/ssl/ca/

# Path to a .pem file containing trusted certificates.
# The file may contain more than one certificate.
#ssl_ca_file = /etc/uts-server/ca.pem

# Sets maximum depth of certificate chain.
# If client's certificate chain is longer
# than the depth set here connection is refused.
#ssl_verify_depth = 9

# Loads default trusted certificates
# locations set at OpenSSL compile time.
#ssl_default_verify_paths = yes

# List of enabled ciphers for ssl.
# See https://www.openssl.org/docs/manmaster/apps/ciphers.html
# or 'man ciphers' for more detailed.
#ssl_cipher_list = ALL:!eNULL:!SSLv3

# Sets the minimal accepted version of SSL/TLS protocol
# according to the table:
#
# - SSL2+SSL3+TLS1.0+TLS1.1+TLS1.2 -> 0
#
# - SSL3+TLS1.0+TLS1.1+TLS1.2      -> 1
#
# - TLS1.0+TLS1.1+TLS1.2          -> 2
#
# - TLS1.1+TLS1.2                 -> 3
#
# - TLS1.2                        -> 4
#ssl_protocol_version = 3

# Enables the use of short lived certificates
#ssl_short_trust = no
```



```
# Comma separated list of IP subnets to accept/deny
#
# Ex: -0.0.0.0/0,+192.168.0.0/16
# (deny all accesses, only allow 192.168.0.0/16 subnet)
#access_control_allow_origin = -0.0.0.0/0,+192.168/16

# Enable TCP_NODELAY socket option on client connections.
tcp_nodelay = 0

# Loglevel (debug, info, notice, warn, err, emerg, crit)
log_level = info

# TSA configuration parameters.
[ tsa ]

# TSA root directory.
dir = /etc/uts-server/pki

# OpenSSL engine to use for signing.
#crypto_device = builtin

# The TSA signing certificat. (optional)
signer_cert = $dir/tsacert.pem

# Certificate chain to include in reply. (optional)
certs = $dir/cacert.pem

# The TSA private key. (optional)
signer_key = $dir/private/tsakey.pem

# Policy if request did not specify it. (optional)
default_policy = tsa_policy1

# Acceptable policies. (optional)
other_policies = tsa_policy2, tsa_policy3

# Acceptable message digests. (mandatory)
# See https://www.openssl.org/docs/manmaster/apps/dgst.html
# or 'man dgst' to get the list of available digests
digests = md5, sha1, sha224, sha256, sha384, sha512

# Time-Stamp accuracy. (optional)
accuracy = secs:1, millisecs:500, microsecs:100

# Number of decimals for Time-Stamp. (optional)
clock_precision_digits = 0

# Is ordering defined for timestamps? (optional, default: no)
ordering = yes

# Must the TSA name be included in the reply? (optional, default: no)
tsa_name = yes

# Must the ESS cert id chain be included? (optional, default: no)
ess_cert_id_chain = no
```



## Usage

```
$ ./uts-server --help
Usage: uts-server [OPTION...] -c CONFFILE [-d] [-D] [-p <pidfile>]

UTS micro timestamp server (RFC 3161)

  -c, --conffile=CONFFILE    Path to configuration file
  -d, --daemonize             Launch as a daemon
  -D, --debug                 STDOUT debugging
  -p, --pidfile=PIDFILE      Path to pid file
  -?, --help                 Give this help list
      --usage                 Give a short usage message
  -V, --version               Print program version

Mandatory or optional arguments to long options are also mandatory or optional
for any corresponding short options.

Report bugs to Pierre-Francois Carpentier <carpentier.pf@gmail.com>.
```

## Running uts-sever

To debug problems with uts-server, run it in the foreground in debug mode:

```
# In debug mode with verbose debugging on stdout
$ ./uts-server -c <path/to/conf> -D
```

To run it as a daemon:

```
# In daemon mode
$ ./uts-server -c <path/to/conf> -d -p <path/to/pidfile>
```



### 0.1.8

- [impr] add OpenBSD support
- [impr] add LibreSSL support

### 0.1.7

- [doc ] add warnings to explicitly state the BUNDLE\_CIVETWEB option as test/dev only
- [impr] add option for easily linking lib pthread (mainly for static linking)

### 0.1.6

- [fix ] option declaration for LINK\_GCC\_S

### 0.1.5

- [impr] add support for a static build

### 0.1.4

- [impr] more portable code

## 0.1.3

- [impr] add support for FreeBSD

## 0.1.2

- [fix ] adding support for OpenSSL 1.1 (with compatibility with 1.0)

## 0.1.1

- [fix ] correct compilation issues in older gcc/clang caused by missing -D\_XOPEN\_SOURCE, missing -std and missing headers
- [impr] exit at the first TS\_RESP\_CTX (OpenSSL TS response context) initialization failed.

## 0.1.0

- [impr] adding various goodies (init scripts)
- [impr] safer crypto algorithm in configuration file
- [impr] removing useless default\_tsa parameter in configuration file

## 0.0.3

- [fix ] memleak on configuration parameters loading

## 0.0.2

- [fix ] Fix loading of certificate in case of relative path

## 0.0.1

- First version

## Time-Stamp script combining curl and openssl

```
#!/bin/sh

RCol='\33[0m'      # Text Reset

# Regular          Bold          Underline          High Intensity
↪BoldHigh Intens
Bla='\33[0;30m';    BBlu='\33[1;30m';    UBlu='\33[4;30m';    IBla='\33[0;90m';
↪BIBlu='\33[1;90m';
Red='\33[0;31m';    BRed='\33[1;31m';    URed='\33[4;31m';    IRed='\33[0;91m';
↪BIRed='\33[1;91m';
Gre='\33[0;32m';    BGre='\33[1;32m';    UGre='\33[4;32m';    IGre='\33[0;92m';
↪BIGre='\33[1;92m';
Yel='\33[0;33m';    BYel='\33[1;33m';    UYel='\33[4;33m';    IYel='\33[0;93m';
↪BIYel='\33[1;93m';
Blu='\33[0;34m';    BBlu='\33[1;34m';    UBlu='\33[4;34m';    IBlu='\33[0;94m';
↪BIBlu='\33[1;94m';
Pur='\33[0;35m';    BPur='\33[1;35m';    UPur='\33[4;35m';    IPur='\33[0;95m';
↪BIPur='\33[1;95m';
Cya='\33[0;36m';    BCya='\33[1;36m';    UCya='\33[4;36m';    ICya='\33[0;96m';
↪BICya='\33[1;96m';
Whi='\33[0;37m';    BWhi='\33[1;37m';    UWhi='\33[4;37m';    IWhi='\33[0;97m';
↪BIWhi='\33[1;97m';

SYSLOG=1

help() {
    cat <<EOF

usage: `basename $0` -i <input file> -u <ts server url> \
    -o <output ts file> -O <openssl options> -C <curl options>
```

```
HTTP timestamping client using openssl and curl (RFC 3161)

arguments:

* mandatory:
  -i <input file>:      the input file to timestamp
  -u <ts server url>:   the timestamp server url

* optionnal:
  -l                : enable logging to syslog
  -o <output ts file>: output timestamp file name (default: <input file>.ts)
  -O <openssl options>: openssl additionnal options (man ts for more details)
  -C <curl options>:  curl additionnal options (man curl for more details)

EOF
  exit 1
}

simple_logger(){
  [ $SYSLOG -eq 0 ] && logger -t `basename $0` -p user.$1 $2
}

clean(){
  rm -f -- "$TMPREQ"
}

clean_exit(){
  clean
  exit 1
}

exit_error(){
  msg=$1
  simple_logger err "error, $msg"
  printf "${BIRed}[ERROR]    ${IYel}%s${RCol}\n" "$msg"
  clean_exit
}

info(){
  msg=$1
  simple_logger debug "$msg"
  printf "${BIBlu}[INFO]      ${RCol}%s${RCol}\n" "$msg"
}

success(){
  msg=$1
  simple_logger info "$msg"
  printf "${BIGre}[SUCCESS]  ${RCol}%s${RCol}\n" "$msg"
}

trap clean_exit HUP INT TERM
TMPREQ=`mktemp`

REMOVE_TS=0

while getopts ":lhru:i:o:O:C:" opt; do
  case $opt in
    h) help;;
```



```

1)  SYSLOG=0;;
u)  TS_URL="$OPTARG";;
i)  INPUT_FILE="`readlink -f $OPTARG`";;
o)  OUTPUT_FILE="`readlink -f $OPTARG`";;
O)  OPENSSSL_OPTS="$OPTARG";;
C)  CURL_OPTS="$OPTARG";;
r)  REMOVE_TS=1;;
\?) echo "Invalid option: -$OPTARG" >&2; help; exit 1;;
:)  echo "Option -$OPTARG requires an argument." >&2; help; exit 1;;
esac
done

# If no output file specified, output to <input file>.ts
[ -z "$OUTPUT_FILE" ]    && OUTPUT_FILE="${INPUT_FILE}.tsr"

# Check that input file exists
[ -f "$INPUT_FILE" ]    || exit_error "Input file '$INPUT_FILE' doesn't exist"
# Check that output file doesn't exist
if [ $REMOVE_TS -eq 1 ]
then
    [ -f "$OUTPUT_FILE" ] && rm -f "$OUTPUT_FILE"
else
    ! [ -f "$OUTPUT_FILE" ] || exit_error "Output timestamp file '$OUTPUT_FILE'
    ↳ already exists"
fi
# Check that url is not empty
! [ -z "$TS_URL" ]      || exit_error "Missing timestamp server url"

info "Generating timestamp on file '$INPUT_FILE', to '$OUTPUT_FILE', using server '
    ↳ $TS_URL'"

# Building the timestamp request with openssl
openssl ts $OPENSSSL_OPTS \
    -query -data "$INPUT_FILE" \
    -out "$TMPREQ" || exit_error "Request generation failed"

# Submitting the timestamp request to the RFC 3161 server with curl
curl "$TS_URL" $CURL_OPTS \
    -H "Content-Type: application/timestamp-query" \
    -f -g \
    --data-binary @$TMPREQ \
    -o "$OUTPUT_FILE" 2>/dev/null || exit_error "Timestamp query failed"

openssl ts -verify -data "$INPUT_FILE" -in "$OUTPUT_FILE" 2>&1 | grep -q "asn1_
    ↳ encoding routines" && exit_error \
    "Reponse doesn't appear to be a timestamp response"

success "Timestamp of file '$INPUT_FILE' using server '$TS_URL' succeed, ts written_
    ↳ to '$OUTPUT_FILE'"

clean

```



## CHAPTER 9

---

uts-server

---

Micro [RFC 3161 Time-Stamp](#) server written in C.

---

**Doc** [Uts-Server documentation on ReadTheDoc](#)

**Dev** [Uts-Server source code on GitHub](#)

**License** MIT

**Author** Pierre-Francois Carpentier - copyright © 2016

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### License

Released under the MIT Public License

### What is RFC 3161?

An RFC 3161 time-stamp is basically a cryptographic signature with a date attached.

Roughly, it works as follow:

1. A client application sends an hash of the data it wants to time-stamp to a Time-Stamp authority server.
2. The Time-Stamp authority server retrieves the current date, concatenates it with the hash and uses its private key to create the time-stamp (kind of like a signature).
3. The Time-Stamp authority server returns the generated time-stamp to the client application.

Then a client can verify the piece of data with the time-stamp using the Certificate Authority of the time-stamp key pair (X509 certificates).

It gives a cryptographic proof of a piece of data content, like a file, at a given time.

Some use cases:

- time-stamp log files at rotation time.
- time-stamp file at upload to prove it was delivered in due time or not.

## Quick (and dirty) Testing

Here a few steps to quickly trying out uts-server, for production setup, please compile civetweb externally and create proper CA and certificates:

```
# Building with civetweb embedded (will recover civetweb from github).
# Note: the BUNDLE_CIVETWEB option is only here for fast testing purpose
# The recommended way to deploy uts-server in production is to build civetweb
# separately and to link against it.
$ cmake . -DBUNDLE_CIVETWEB=ON
$ make

# Create some test certificates.
$ ./tests/cfg/pki/create_tsa_certs

# Launching the time-stamp server with test configuration in debug mode.
$ ./uts-server -c tests/cfg/uts-server.cnf -D

# In another shell, launching a time-stamp script on the README.md file.
$ ./goodies/timestamp-file.sh -i README.rst -u http://localhost:2020 -r -O "-cert";

# Verify the time-stamp.
$ openssl ts -verify -in README.rst.tsr -data README.rst -CAfile ./tests/cfg/pki/
->tsaca.pem

# Display the time-stamp content.
$ openssl ts -reply -in README.rst.tsr -text
```

## Powered by