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for embedded open-source software in Bender devices

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BENDER

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STM32L4_HAL_Driver v1.13.0

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4 OpenSSL - Support information

Civetweb supports *HTTPS* connections using the OpenSSL transport layer security (TLS) library. OpenSSL is a free, open source library (see http://www.openssl.org/). While there are other TLS libraries beside OpenSSL (like gnuTLS and wolfSSL), new TLS features in CivetWeb are tested only using OpenSSL.

Getting started

– Install OpenSSL on your system. There are OpenSSL install packages for all major Linux distributions as well as a setup for Windows.
– The default build configuration of the civetweb web server will load the required OpenSSL libraries, if a HTTPS certificate has been configured.

Civetweb Configuration

The configuration file must contain an https port, identified by a letter 's' attached to the port number. To serve http and https from their standard ports use the following line in the configuration file 'civetweb.conf':

```
<pre> listening_ports 80, 443s </pre>
```

To serve only https use:

```
<pre> listening_ports 443s </pre>
```

Furthermore the SSL certificate file must be set:

```
<pre> ssl_certificate d:\civetweb\certificate\server.pem </pre> <pre> ss-
l_certificate d:\civetweb\certificate\server.pem </pre>
```

Creating a self signed certificate

OpenSSL provides a command line interface, that can be used to create the certificate file required by civetweb (server.pem). One can use the following steps in Windows (in Linux replace "copy" by "cp" and "type" by "cat"):

```
<pre> openssl genrsa -des3 -out server.key 1024 openssl req -new -key serv-
er.key -out server.csr copy server.key server.key.orig openssl rsa -in serv-
er.key.orig -out server.key openssl x509 -req -days 3650 -in server.csr -
signkey server.key -out server.crt copy server.crt server.pem type serv-
er.key >> server.pem </pre>
```

The server.pem file created must contain a 'CERTIFICATE' section as well as a 'RSA PRIVATE KEY' section. It should look like this (x represents BASE64 encoded data):

```
<pre> -----BEGIN CERTIFICATE-----
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxx -----END CERTIFI-
CATE----- -----BEGIN RSA PRIVATE KEY-----
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

```
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx -----END RSA PRIVATE KEY-----
</pre>
```

Some additional useful OpenSSL commands can be found here: https://geekflare.com/openssl-commands-certificates/ Certificates may contain [subject alternative names (SAN)](https://en.wikipedia.org/wiki/Subject_Alternative_Name) to support multiple websites: https://geekflare.com/san-ssl-certificate/

Including a certificate from a certificate authority

CivetWeb requires one certificate file in PEM format. If you got multiple files from your certificate authority, you need to copy their content together into one file. Make sure the file has one section BEGIN RSA PRIVATE KEY / END RSA PRIVATE KEY, and at least one section BEGIN CERTIFICATE / END CERTIFICATE. In case you received a file with a section BEGIN PRIVATE KEY / END PRIVATE KEY, you may get a suitable file by adding the letters RSA manually.

Set the "ssl_certificate" configuration parameter to the file name (including path) of the resulting *.pem file.

The file must look like the file in the section "Creating a self signed certificate", but it will have several BEGIN CERTIFICATE / END CERTIFICATE sections.

Common Problems

In case the OpenSSL configuration is not set up correctly, the server will not start. Configure an error log file in 'civetweb.conf' to get more information:

```
<pre> error_log_file error.log </pre>
```

Check the content of 'error.log':

```
<pre> load_dll: cannot load libeay32.*/libcrypto.*/ssleay32.*/libssl.* </pre>
```

This error message means, the SSL library has not been installed (correctly). For Windows you might use the pre-built binaries. A link is available at the OpenSSL project home page (http://www.openssl.org/related/binaries.html). Choose the windows system folder as installation directory - this is the default location.

```
<pre> set_ssl_option: cannot open server.pem: error:PEM routines:*:PEM_read_bio:no start line set_ssl_option: cannot open server.pem: error:PEM routines:*:PEM_read_bio:bad end line </pre>
```

These error messages indicate, that the format of the ssl_certificate file does not match the expectations of the SSL library. The PEM file must contain both, a 'CERTIFICATE' and a 'RSA PRIVATE KEY' section. It should be a strict ASCII file without byte-order marks. The instructions above may be used to create a valid ssl_certificate file.

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