CryptoAuthLib

v3.7.6

Chapter 1

CryptoAuthLib - Microchip CryptoAuthentication Library

1.1 Introduction

This library implements the APIs required to communicate with Microchip Security device. The family of devices supported currently are:

CryptoAuth	CryptoAuth2
ATECC608B	ECC204
ATECC608A	ECC206
ATECC508A	SHA104
ATECC108A	SHA105
ATSHA204A	SHA106
ATSHA206A	RNG90

The best place to start is with the `Microchip Trust Platform`

Online API documentation is at `https://microchiptech.github.io/cryptoauthlib/`

Latest software and examples can be found at:

- `https://www.microchip.com/design-centers/security-ics/trust-platform`
- `http://www.microchip.com/SWLibraryWeb/product.aspx?product=CryptoAuth←Lib`

Prerequisite hardware to run CryptoAuthLib examples:

- `CryptoAuth Trust Platform Development Kit`

Alternatively a Microchip MCU and Adapter Board:

- `ATSAMR21 Xplained Pro` or `ATSAMD21 Xplained Pro`

- CryptoAuthentication SOIC Socket Board to accept SOIC parts
- ATECC608B mikroBUS evaluation board
- ECC204 mikroBUS evaluation board
- SHA104/SHA105 mikroBUS evaluation board
- TA010 mikroBUS evaluation board

For most development, using socketed top-boards is preferable until your configuration is well tested, then you can commit it to a CryptoAuth Xplained Pro Extension, for example. Keep in mind that once you lock a device, it will not be changeable.

1.2 Examples

- Install the Trust Platform Design Suite to access Use Case examples for the different Security Solutions (ATECC608, SHA104/105, ECC204, TA010, TA100. . .)

1.3 Configuration

In order to properly configured the library there must be a header file in your project named `atca_config.h` at minimum this needs to contain defines for the hal and device types being used. Most integrations have an configuration mechanism for generating this file. See the `atca_config.h.in` template which is configured by CMake for Linux, MacOS, & Windows projects.

An example of the configuration:

```
/* Cryptoauthlib Configuration File */
#ifndef ATCA_CONFIG_H
#define ATCA_CONFIG_H
/* Include HALS */
#define ATCA_HAL_I2C
/* Included device support */
#define ATCA_ATECC608_SUPPORT
/* \brief How long to wait after an initial wake failure for the POST to
 *         complete.
 * If Power-on self test (POST) is enabled, the self test will run on waking
 * from sleep or during power-on, which delays the wake reply.
 */
#ifndef ATCA_POST_DELAY_MSEC
#define ATCA_POST_DELAY_MSEC 25
#endif
#endif // ATCA_CONFIG_H
```

There are two major compiler defines that affect the operation of the library.

- ATCA_NO_POLL can be used to revert to a non-polling mechanism for device responses. Normally responses are polled for after sending a command, giving quicker response times. However, if ATCA_NO_POLL is defined, then the library will simply delay the max execution time of a command before reading the response.
- ATCA_NO_HEAP can be used to remove the use of malloc/free from the main library. This can be helpful for smaller MCUs that don't have a heap implemented. If just using the basic API, then there shouldn't be any code changes required. The lower-level API will no longer use the new/delete functions and the init/release functions should be used directly.

Some specific options are available in the fully documented configuration files `lib/calib/calib_config.h`, `atca_configuration.h`, `lib/crypto/crypto_config.h`, `lib/host/atca_host_config.h` which is also the place where features can be selected. We provide some configurations focused on specific use cases and the checks are enabled by default.

1.4 Release notes

See Release Notes

1.5 Host Device Support

CryptoAuthLib will run on a variety of platforms from small micro-controllers to desktop host systems. See hal readme

Porting requires a time delay function of millisecond resolution (hal_delay_ms) which can be implemented via loop, timer, or rtos sleep/wait and a communication interface.

1.6 CryptoAuthLib Architecture

Cryptoauthlib API documentation is at `https://microchiptech.github.io/cryptoauthlib/`

The library is structured to support portability to:

- multiple hardware/microcontroller platforms
- multiple environments including bare-metal, RTOS and Windows/Linux/MacOS
- multiple chip communication protocols (I2C, SPI, and SWI)

All platform dependencies are contained within the HAL (hardware abstraction layer).

1.7 Directory Structure

```
lib - primary library source code
lib/atcacert - certificate data and i/o methods
lib/calib - the Basic Cryptoauth API
lib/crypto - Software crypto implementations external crypto libraries support (primarily SHA1 and SHA2)
lib/hal - hardware abstraction layer code for supporting specific platforms
lib/host - support functions for common host-side calculations
lib/jwt - json web token functions
test - Integration test and examples. See test/cmd-processor.c for main() implementation.
For production code, test directories should be excluded by not compiling it
into a project, so it is up to the developer to include or not as needed.  Test
code adds significant bulk to an application - it's not intended to be included
in production code.
```

1.8 Tests

There is a set of integration tests found in the test directory which will at least partially demonstrate the use of the objects. Some tests may depend upon a certain device being configured in a certain way and may not work for all devices or specific configurations of the device. See test readme

1.9 Using CryptoAuthLib (Microchip CryptoAuth Library)

The best place to start is with the `Microchip Trust Platform`

Also application examples are included as part of the Harmony 3 framework and can be copied from the Harmony Content Manager or found with the Harmony 3 Framework `Cryptoauthlib_apps`

1.9.1 Incorporating CryptoAuthLib in a Linux project using USB HID devices

The Linux HID HAL files use the Linux udev development software package.

To install the udev development package under Ubuntu Linux, please type the following command at the terminal window:

```
sudo apt-get install libudev-dev
```

This adds the udev development development software package to the Ubuntu Linux installation.

The Linux HID HAL files also require a udev rule to be added to change the permissions of the USB HID Devices. Please add a new udev rule for the Microchip CryptoAuth USB devices.

```
cd /etc/udev/rules.d
sudo touch mchp-cryptoauth.rules
```

Edit the mchp-cryptoauth.rules file and add the following line to the file:

```
SUBSYSTEM=="hidraw", ATTRS{idVendor}=="03eb", ATTRS{idProduct}=="2312", MODE="0666"
```

Chapter 2

License

Replace mbedTLS ECDH Functions with hardware acceleration & hardware key security.

mbedTLS Interface Functions that enable mbedtls objects to use cryptoauthlib functions

Replace mbedTLS ECDSA Functions with hardware acceleration & hardware key security.

Copyright

Chapter 3

IP Protection with Symmetric Authentication

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The IP protection can be easily integrated to the existing projects.The user project should include symmetric_authentication.c & symmetric_authentication.h files which contains the api

- **symmetric_authenticate()** - For Performing the authentication between host & device.

3.1 User Considerations

- The user should take care on how the master key should be stored on the MCU side.
- The api's in the file doesn't do the provisioning of the chip and user should take care of the provisioning.

With the provisioned cryptoauthentication device and after doing the cryptoauthlib initialisation,user should only be calling the function symmetric_authenticate() with its necessary parameters for the authentication. The returned authentication status should be used in the application.

3.2 Examples

For more information about IP protection and its example project refer `Microchip github`

Chapter 4

PKCS11 Application Information

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4.1 Setting up cryptoauthlib as a PKCS11 Provider for your system (LINUX)

These instructions are for building, installing and configuring cryptoauthlib as a pkcs11 provider. These instructions are for commonly available Linux systems with package managers.

4.1.1 Update libp11 on the system. The version should be at minimum 0.4.10

- Install the build dependendencies for the system:
```
# Debian like systems
$ sudo apt-get build-dep libengine-pkcs11-openssl1.1
# RPM based systems
$ yum-builddep engine-pkcs11
```
- Change to a sane directory
```
cd ~
```
- Get the latest version of libp11
```
$ git clone https://github.com/OpenSC/libp11.git
```
- Rerun the build configuration tools:
```
$ cd libp11
$ ./bootstrap
$ ./configure
```
- Build the library:
```
$ make
```
- Install the library:
```
$ sudo make install
```

4.1.2 Build and Install cryptoauthlib with PKCS11 support

- Install the build dependendencies for the system:
```
# Debian like systems
$ sudo apt-get install cmake libudev-dev
# RPM based systems
$ yum install cmake
$ yum install libudev-devel
```
- Change to a sane directory
```
cd ~
```
- Get the latest version of cryptoauthlib with PKCS11 support
```
$ git clone https://github.com/MicrochipTech/cryptoauthlib
```
- Rerun the build configuration tools:
```
$ cd cryptoauthlib
$ cmake -DATCA_PKCS11=ON .
```
- Build the library:
```
$ make
```
- Install the library:
```
$ sudo make install
```

4.1.3 Configuring the cryptoauthlib PKCS11 library

By default the following files will be created.

- /etc/cryptoauthlib/cryptoauthlib.conf
```
# Cryptoauthlib Configuration File
filestore = /var/lib/cryptoauthlib
```
- /var/lib/cryptoauthlib/slot.conf.tmpl
```
# Reserved Configuration for a device
# The objects in this file will be created and marked as undeletable
# These are processed in order. Configuration parameters must be comma
# delimited and may not contain spaces
interface = i2c,0xB0
freeslots = 1,2,3
# Slot 0 is the primary private key
object = private,device,0
# Slot 10 is the certificate data for the device's public key
#object = certificate,device,10
# Slot 12 is the intermedate/signer certificate data
#object = certificate,signer,12
# Slot 15 is a public key
object = public,root,15
```

4.1.3.1 cryptoauthlib.conf

This file provides the basic configuation information for the library. The only variable is "filestore" which is where cryptoauthlib will find device specific configuration and where it will store object files from pkcs11 operations.

4.1.3.2 slot.conf.tmpl

This is a template for device configuration files that cryptoauthlib will use to map devices and their resources into pkcs11 tokens and objects.

A device file must be named <pkcs11_slot_number>.conf

For a single device:
```
$ cd /var/lib/cryptoauthlib
$ cp slot.conf.tmpl 0.conf
```

Then edit 0.conf to match the device configuration being used.

4.1.3.2.1 interface Allows values: 'hid', 'i2c' If using i2c specify the address in hex for the device. This is in the device format (upper 7 bits define the address) so will not appear the same as the i2cdetect address (lower 7 bits)

4.1.3.2.2 freeslots This is a list of slots that may be used by the library when a pkcs11 operation that creates new objects is used. When the library is initialized it will scan for files of the form <pkcs11_slot_num>.<device_slot_num>.conf which defines the object using that device resource.

4.1.4 Using p11-kit-proxy

This is an optional step but is very helpful for using multiple pkcs11 libraries in a system. Detailed setup can be found at p11-glue

```
# Debian like systems
$ sudo apt-get install p11-kit
# RPM based systems
$ yum install p11-kit
```

- Create or edit the global configuration file `/etc/pkcs11/pkcs11.conf`. The directory `/etc/pkcs11` may require creation first.

```
# This setting controls whether to load user configuration from the
# ~/.config/pkcs11 directory. Possible values:
#    none: No user configuration
#    merge: Merge the user config over the system configuration (default)
#    only: Only user configuration, ignore system configuration
user-config: merge
```

- Create a module configuration file.
  - User module name (only available for a single user): `~/.config/pkcs11/modules/cryptoauthlib.module`
  - Global module name (available to the whole system): `/usr/share/p11-kit/modules/cryptoauthlib.modu`

```
module: /usr/lib/libcryptoauth.so
critical: yes
trust-policy: yes
managed: yes
log-calls: no
```

For more details on the configuration files see the configuration documentation.

4.1.5 Without using p11-kit-proxy

OpenSSL (via the libp11 project above) and p11tool support p11-kit-proxy natively so do not require additional set up if it is being used. If p11-kit-proxy is not being used then OpenSSL will have to be manually configured to use libp11 and cryptoauthlib

This requires editing the default openssl.cnf file. To locate the file being used by the system run the following command:

```
$ openssl version -a | grep OPENSSLDIR:
OPENSSLDIR: "/usr/lib/ssl"
```

This gives the default path where openssl is compiled to find the openssl.cnf file

In this case the file to edit will be /usr/lib/ssl/openssl.cnf

This line must be placed at the top, before any sections are defined:

```
openssl_conf = openssl_init
```

This should be added to the bottom of the file:

```
[openssl_init]
engines=engine_section
[engine_section]
pkcs11 = pkcs11_section
[pkcs11_section]
engine_id = pkcs11
# Wherever the engine installed by libp11 is. For example it could be:
# /usr/lib/arm-linux-gnueabihf/engines-1.1/libpkcs11.so
dynamic_path = /usr/lib/ssl/engines/libpkcs11.so
MODULE_PATH = /usr/lib/libcryptoauth.so
init = 0
```

4.1.6 Testing

To use p11tool it has to be installed:
```
# Debian like systems
$ sudo apt-get install gnutls-bin
# RPM based systems
$ yum install gnutls-utils
```

Note: If not using p11-kit-proxy then the provider has to be specified in p11tool calls:
```
$ p11tool --provider=/usr/lib/libcryptoauth.so
```

- Get the public key for a private key (as defined by the 0.conf file cited above):
```
$ p11tool --export-pubkey "pkcs11:token=0123EE;object=device;type=private"
warning: --login was not specified and it may be required for this operation.
warning: no --outfile was specified and the public key will be printed on screen.
-----BEGIN PUBLIC KEY-----
MFkwEwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAE9wzUq1EUAoNrG01rXYjNd35mxKuA
Ojw/klIrNEBciSLLOTLjs/gvFS7N8AFXDK18vpxxu6ykzF2LRd7RY8yEFw==
-----END PUBLIC KEY-----
```

- Get the public key and decode it using OpenSSL
```
$ p11tool --export-pubkey "pkcs11:token=0123EE;object=device;type=private" | openssl pkey -pubin -text
-noout
warning: --login was not specified and it may be required for this operation.
warning: no --outfile was specified and the public key will be printed on screen.
Public-Key: (256 bit)
pub:
    04:f7:0c:d4:ab:51:14:02:83:6b:1b:4d:6b:5d:88:
    cd:77:7e:66:c4:ab:80:3a:3c:3f:92:52:2b:34:40:
    5c:89:22:cb:39:32:e3:b3:f8:2f:15:2e:cd:f0:01:
    57:0c:ad:7c:be:9c:71:bb:ac:a4:cc:5d:8b:45:de:
    d1:63:cc:84:17
ASN1 OID: prime256v1
NIST CURVE: P-256
```

- Create a CSR for the private key
```
$ openssl req -engine pkcs11 -key "pkcs11:token=0123EE;object=device;type=private" -keyform engine
-new -out new_device.csr -subj "/CN=NEW CSR EXAMPLE"
engine "pkcs11" set.
$ cat new_device.csr
-----BEGIN CERTIFICATE REQUEST-----
MIHVMHwCAQAwGjEYMBYGA1UEAwwPTkVXIENTUiBFWEFNUExFMFkwEwYHKoZIzj0C
AQYIKoZIzj0DAQcDQgAE9wzUq1EUAoNrG01rXYjNd35mxKuAOjw/klIrNEBciSLL
OTLjs/gvFS7N8AFXDK18vpxxu6ykzF2LRd7RY8yEF6AAMAoGCCqGSM49BAMCA0kA
MEYCIQDUPeLfPcOwtZxYJDYXPdl2UhpReVn6kK2lKCCX6byM8QIhAIfqfnggtcCi
W21xLAzabr8A4mHyfIIQ1ofYBg8QO9jZ
-----END CERTIFICATE REQUEST-----
```

- Verify the newly created csr
```
$ openssl req -in new_device.csr -verify -text -noout
verify OK
Certificate Request:
    Data:
        Version: 1 (0x0)
        Subject: CN = NEW CSR EXAMPLE
        Subject Public Key Info:
            Public Key Algorithm: id-ecPublicKey
                Public-Key: (256 bit)
                pub:
                    04:f7:0c:d4:ab:51:14:02:83:6b:1b:4d:6b:5d:88:
                    cd:77:7e:66:c4:ab:80:3a:3c:3f:92:52:2b:34:40:
                    5c:89:22:cb:39:32:e3:b3:f8:2f:15:2e:cd:f0:01:
                    57:0c:ad:7c:be:9c:71:bb:ac:a4:cc:5d:8b:45:de:
                    d1:63:cc:84:17
                ASN1 OID: prime256v1
                NIST CURVE: P-256
        Attributes:
            a0:00
    Signature Algorithm: ecdsa-with-SHA256
         30:46:02:21:00:d4:3d:e2:df:3d:c3:b0:b5:9c:58:24:36:17:
         3d:d9:76:52:1a:51:79:59:fa:90:ad:a5:28:20:97:e9:bc:8c:
         f1:02:21:00:87:ea:7e:78:20:b5:c0:a2:5b:6d:71:2c:0c:da:
         6e:bf:00:e2:61:f2:7c:82:10:d6:87:d8:06:0f:10:3b:d8:d9
```

Chapter 5

Application Support

This directory is for application specific implementation of various use cases.

Methods in this directory provide a simple API to perform potentially complex combinations of calls to the main library or API.

app_info_ip_prot

app_info_pkcs11

app_info_secure_boot

Chapter 6

Secure boot using ATECC608

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The SecureBoot command is a new feature on the ATECC608A device compared to earlier CryptoAuthentication devices from Microchip. This feature helps the MCU to identify fraudulent code installed on it. When this feature is implemented, the MCU can send a firmware digest and signature to the ATECC608. The ATECC608 validates this information (ECDSA verify) and responds to host with a yes or no answer.

The ATECC608 provides options to reduce the firmware verification time by storing the signature or digest after a good full verification (FullStore mode of the SecureBoot command).

- When the ATECC608 stores the digest (SecureBootMode is FullDig), the host only needs to send the firmware digest, which is compared to the stored copy. This skips the comparatively lengthy ECDSA verify, speeding up the secure boot process.
- When the ATECC608 stores the signature (SecureBootMode is FullSig), the host only needs to send the firmware digest, which is verified against the stored signature using ECDSA. This saves time by not needing to send the signature in the command over the bus.

The ATECC608 also provides wire protection features for the SecureBoot command, which can be used to encrypt the digest being sent from the host to the ATECC608 and add a MAC to the verify result coming back to the host so it can't be forced to a success state. This feature makes use of a shared secret between the host and ATECC608, called the IO protection key.

The secure boot feature can be easily integrated to an existing project. The project should include the following files from the secure_boot folder:

- secure_boot.c
- secure_boot.h
- secure_boot_memory.h
- io_protection_key.h

The project should also implement the following platform-specific APIs:

- secure_boot_init_memory()
- secure_boot_read_memory()

- secure_boot_deinit_memory()
- secure_boot_mark_full_copy_completion()
- secure_boot_check_full_copy_completion()
- io_protection_get_key()
- io_protection_set_key()

The project can set the secure boot configuration with the following defines:

- SECURE_BOOT_CONFIGURATION
- SECURE_BOOT_DIGEST_ENCRYPT_ENABLED
- SECURE_BOOT_UPGRADE_SUPPORT

The secure boot process is performed by initializing CryptoAuthLib and calling the secure_boot_process() function.

6.1 Implementation Considerations

- Need to perform SHA256 calculations on the host. CryptoAuthLib provides a software implementation in lib/crypto/atca_crypto_sw_sha2.c
- When using the wire protection features:
  - The host needs to be able to generate a nonce (number used once). This is the NumIn parameter to the Nonce command that is sent before the SecureBoot command. The ATECC608 can not be used to generate NumIn, but it should come from a good random or non-repeating source in the host.
  - If the host has any protected internal memory, it should be used to store its copy of the IO protection key.
- Secure boot depends on proper protections of the boot loader code in the host. If the code can be easily changed, then the secure boot process can be easily skipped. Boot loader should ideally be stored in an immutable (unchangeable) location like a boot ROM or write-protected flash.
- Note that these APIs don't provision the ATECC608. They assume the ATECC608 has already been configured and provisioned with the necessary keys for secure boot.

6.2 Examples

For more information about secure boot, please see the example implementation project and documentation at: https://github.com/MicrochipTech/cryptoauth_usecase_secureboot

Chapter 7

Contribution Guidelines

While this is an open source project there are a few considerations that make it somewhat unique in how it is managed. The first issue is that the development workflow is a hybrid between internal development and CI/CD systems and external develop and associated CI/CD systems.

- This project contains a mixture of licenses depending on the section. The vast majority is under a Microchip proprietary license that is restrictive.
- Contributors must be aware of the specific license they are working under and must be aware that by submitting the patch that they agree to the terms of the license covering the target file.
- Sources contained in the third_party path are covered by true open source licenses and as such are not bound by Microchip's license restrictions.
- Third party contributions for HALs must be licensed under MIT, BSD (3 clause), or Apache 2.0 license and are placed in third_party/hal/<platform>
- Pull requests (PR) must attest to reviewing of these rules, that licensing terms have been reviewed, the submitter has approval to submit the changes under the target license terms.

Chapter 8

openssl directory - Purpose

This directory contains the interfacing and wrapper functions to integrate openssl as the software crypto library.

Chapter 9

atcab

9.1 atcab API reference

Hardware Feature	atcab_
SHA256	[atcab_sha_start]
SHA256	[atcab_sha_update]
SHA256	[atcab_sha_end]

Chapter 10

Python CryptoAuthLib module

10.1 Introduction

This module provides a thin python ctypes layer to evaluate the cryptoauthlib interface to Microchip Crypto↩ Authentication devices.

10.1.1 Code Examples

Code examples for python are available on github as part of `CryptoAuthTools` under the `python/examples` directory

10.2 Installation

10.2.1 CryptoAuthLib python module can be installed through Python's pip tool:

```
pip install cryptoauthlib
```

10.2.2 To upgrade your installation when new releases are made:

```
pip install -U cryptoauthlib
```

10.2.3 If you ever need to remove your installation:

```
pip uninstall cryptoauthlib
```

10.3 What does python CryptoAuthLib package do?

CryptoAuthLib module gives access to most functions available as part of standard cryptoauthlib (which is written in 'C'). These python functions for the most part are very similar to 'C' functions. The module in short acts as a wrapper over the 'C' cryptoauth library functions.

Microchip cryptoauthlib product page: Link

10.4 Supported hardware

- AT88CK101
- CryptoAuthentication SOIC XPRO Starter Kit (DM320109)

10.5 Supported devices

The family of devices supported currently are:

- ATSHA204A
- ATECC108A
- ATECC508A
- ATECC608A

10.6 Using cryptoauthlib python module

The following is a 'C' code made using cryptoauthlib 'C' library.

```
#include "cryptoauthlib.h"
void main()
{
    ATCA_STATUS status;
    uint8_t revision[4];
    uint8_t randomnum[32];
    status = atcab_init(cfg_ateccx08a_kitcdc_default);
    if (status != ATCA_SUCCESS)
    {
        printf("Error");
        exit();
    }
    status = atcab_info(revision);
    if (status != ATCA_SUCCESS)
    {
        printf("Error");
        exit();
    }
    status = atcab_random(randomnum);
    if (status != ATCA_SUCCESS)
    {
        printf("Error");
        exit();
    }
}
```

The same code in python would be:

```
from cryptoauthlib import *
ATCA_SUCCESS = 0x00
revision = bytearray(4)
randomnum = bytearray(32)
# Locate and load the compiled library
load_cryptoauthlib()
assert ATCA_SUCCESS == atcab_init(cfg_ateccx08a_kithid_default())
assert ATCA_SUCCESS == atcab_info(revision)
print(''.join(['%02X ' % x for x in revision]))
assert ATCA_SUCCESS == atcab_random(randomnum)
print(''.join(['%02X ' % x for x in randomnum]))
```

In the above python code, "import cryptoauthlib" imports the python module. load_cryptoauthlib() function loads the compiled library. The load_cryptoauthlib() is a function that you will not see in the 'C' library, this is a python specific utility function and is required for python scripts to locate and load the compiled library.

10.7 In Summary

10.7.1 Step I: Import the module

```
from cryptoauthlib import *
```

10.7.2 Step II: Initilize the module

```
load_cryptoauthlib()
assert ATCA_SUCCESS == atcab_init(cfg_ateccx08a_kithid_default())
```

10.7.3 Step III: Use Cryptoauthlib APIs

Call library APIs of your choice

10.8 Code portability

Microchip's CryptoAuthentication products can now be evaluated with the power and flexibility of python. Once the evaluation stage is done the python code can be ported to 'C' code.

As seen above the python API maintains a 1 to 1 equivalence to the 'C' API in order to easy the transition between the two.

10.9 Cryptoauthlib module API documentation

10.9.1 help() command

All of the python function's documentation can be viewed through python's built in help() function.

For example, to get the documentation of atcab_info() function:

```
»> help(cryptoauthlib.atcab_info)
Help on function atcab_info in module cryptoauthlib.atcab:
atcab_info(revision)
Used to get the device revision number. (DevRev)
Args:
    revision            4-byte bytearray receiving the revision number
                        from the device. (Expects bytearray)
Returns:
    Status code
```

10.9.2 dir() command

The dir command without arguments, return the list of names in the current local scope. With an argument, attempt to return a list of valid attributes for that object. For example dir(cryptoauthlib) will return all the methods available in the cryptoauthlib module.

10.10 Code Examples

Code examples for python are available on github as part of `CryptoAuthTools` under the python/examples directory

10.11 Tests

Module tests can be located in the `python/tests` of the main cryptoauthlib repository. The `README.md` has details for how to run the tests. The module tests are not comprehensive for the entire functionality of cryptoauthlib but rather are meant to test the python module code only against the library to ensure the interfaces are correct and ctypes structures match the platform.

10.12 Release notes

See Release Notes

Chapter 11

Python CryptoAuthLib Module Testing

11.1 Introduction

These tests are designed to only test the python interface to the library and are not designed to test the library itself which is covered by the main cryptoauthlib tests

11.1.1 Running

The best way to run the test suite is to use `tox` which can be easily installed with pip:

```
$ pip install tox
```

From the python folder:

```
:~/cryptoauthlib/python $ tox
```

It is possible to directly run tests but requires more setup

1) Install pytest

```
$ pip install pytest
```

2) Modify the PYTHONPATH environment variable

Windows:

```
cryptoauthlib/python> set PYTHONPATH=<path_to>/cryptoauthlib/python
```

Linux:

```
$ export PYTHONPATH=${PYTHONPATH}:<path_to>/cryptoauthlib/python
```

3) Run the tests

```
$ pytest -vv
```

11.1.2 Test options

There are additional options that can be invoked with the tests that define what tests will be run

1) –with-lib will attempt to run tests against the compiled c library. These tests are good for detecting possible platform incompabilities between the C compiler and the expectations of python

2) –with-device will attempt to invoke some tests with a real attached device These tests are restricted to only the minimum required to verify the python to library connectivity and are only meant to detect situations can can not be determined from the library tests alone.

Chapter 12

Microchip Cryptoauthlib Release Notes

12.1 Release v3.7.6 (09/26/2026)

12.1.1 New Features

- In PKCS11 module, added support for RSA key types, certificates and algorithms
- Added SHA384 and SHA512 support for host side software crypto (lib/crypto/) operations
- Modified WPC application to support ECC204 and TA010 devices
- See [talib/CHANGES.md] for details on talib module changes

12.1.2 Fixes

- Shared library build (libcryptoauth.so) sets ABI version number (libcryptoauth.so.x)
- Fixed atcacert_read_cert() API failure when certificate elements read from config zone for ECC204 and TA010 devices
- Resolved kit protocol compilation failure for PIC18 device (XC8) builds
- PKCS11 layer fixes/updates
  - Fixed C_DestroyObject failure when deleting a key pair
  - Fixed C_DeriveKey API usage sequence

12.2 Release v3.7.5 (06/26/2024)

12.2.1 New Features

- In PKCS11 module, added ECCP384,ECCP521,ECCP224 elliptic curves support for ECC key operations, in addition to the existing ECCP256 support
- Enhanced certificate related tests to include coverage for ECC204 and TA010 devices
- Added a new ATCA_HEAP internal macro check in place of ATCA_NO_HEAP for dynamic memory usages
- Added an additional test to validate AES-CBC encrypt/decrypt APIs using CAVP's AES multiblock message test (MMT) sample vectors
- See [talib/CHANGES.md] for details on talib module changes

12.2.2 Fixes

- Fixed atcacert_get_comp_cert() API to support certificates with expiry dates beyond year 2031
- Fixed atcacert_read_cert() API to consider serial number as source while processing extracted certificates
- Fixed atcacert_write_cert() API to support X509 certificates with an odd byte length, without any additional padding
- Fixed calib_execute_send() to consider correct data buffer when ATCA_HAL_LEGACY_API is used
- PKCS11 layer fixes/updates
  - Fixed certificate chain/key export failures in ECC608 Trust devices
  - Fixed memory leak during C_Finalize API call usage in a multi-slot configuration

12.2.3 API Changes

- Added atcacert_generate_sn() API in atcacert module to generate certificate serial number from a valid serial number source

12.3 Release v3.7.4 (03/08/2024)

12.3.1 New Features

- Updated wolfSSL interface `atcac` wrapper APIs usage for AES GCM encrypt/decrypt similar to MbedTLS and openSSL library wrapper APIs
- Added package.yml file to support MPLAB Harmony metadata package format

12.3.2 Fixes

- Fixed calib_wakeup_i2c API to follow specified i2c wakeup sequence for ECC608 devices
- PKCS11 layer fixes/updates
  - Lock usage optimization in pkcs11_find_continue API
  - pkcs11_digest API updates for SHA context memory allocation
  - pkcs11_token_set_pin API updates to write data based on generated GCM key size
- Fixed atcacert_get_comp_cert API to remove a redundant atcacert_date_enc_compcert call
- Resolved build warnings/issues in Windows, Linux and 8-bit (XC8) platforms
- wolfSSL's atcac_pk_init_pem wrapper API updates to use wc_ PEM to DER functions
- Fixed broken links in README.md files

12.4 Release v3.7.3 (01/31/2024)

12.4.1 New Features

- In PKCS11 module, added cache support to store `Key id` attribute of key type objects into stack memory and use it for subsequent accesses

12.4.2 Fixes

- Fixed calib_sha_hmac_finish api to set mode value correctly for ECC204, TA010 and ECC608 devices
- Fixed memory leak in MbedTLS configuration
- Fixed build errors when a project is generated with PKCS11 Component enabled in MPLAB Harmony Configurator (MHC)

12.5 Release v3.7.2 (01/19/2024)

12.5.1 New Features

- See [talib/CHANGES.md] for details on talib module changes

12.5.2 Fixes

- Updated PKCS11 token info to list TA101 device details
- Fixed compilation errors when ECC508 device is enabled
- See [talib/CHANGES.md] for details on talib module fixes

12.5.3 API Changes

- Added sign and verfy API in talib module to support `1024 bytes ED25519 mode`

12.6 Release v3.7.1 (12/15/2023)

12.6.1 New Features

- PKCS11 module enhancements for x509 public key certificates
  - Added more certificate attributes to x509 public key certificates. These attributes include certificate start date, certificate end date, subject, subject key, DER encoded certificate issuer name, DER encoded certificate serial number and hash of the issuer public key.
  - Added cache support to store these certificates into stack memory and utilize it for parsing the above specified certificate attributes.
- See [talib/CHANGES.md] for details on talib module changes

12.6.2 Fixes

- Updated atcab_read_config_zone to support SHA106
- For Linux platforms, i2c baud rate is always set to 100 khz as the default configuration
- Resolved build errors when ATCA_USE_SHARED_MUTEX is disabled
- Resolved build error with ATCA_JWT_EN

12.6.3 API Changes

- Added atcacert_get_subject api to get the subject name from public x509 certificates
- Added atcacert_get_issuer api to get the issuer name from public x509 certificates
- Updated the atcacert_def_s structure to include x509 full certificates support

12.7 Release v3.7.0 (09/08/2023)

12.7.1 New Features

- Added unified buffer implementation to enable multipart buffer use with APIs that support them.
- See [talib/CHANGES.md] for details on talib module changes

12.7.2 Fixes

- Made `atcac` structures referencing third party libraries opaque to the user so installed header files are usable by applications without also including the third party headers.

12.7.3 API Changes

- The software crypto structures are generally no longer typedef'd so they must be declared with the `struct` keyword. New typedefs were added by appending the suffix `_t` which allows for the same mechanism for declaring these structure in code if building a standalone application (such as in embedded projects). If dynamically linking with the library and using a third party crypto library one will need to use the `_new` & `_free` APIs to allocate these structures for use with the `atcac` interfaces.

12.8 Release v3.6.1 (07/14/2023)

12.8.1 New Features

- Added support for PIC18 memory model with a MAX_PACKET_SIZE setting.
- PKCS11 Improvement to support context reservation automatically for operations that span multiple pkcs11 calls such as login/logout, encrypt/decrypt, etc. This prevents concurrent processes from interupting init-update-finish operations in PKCS11
- Added support for data element transfers between trust anchor devices

12.8.2 Fixes

- PKCS11: resolved issues with configuration directory parsing to ensure configurations parse in the correct order and any extraneous files get properly rejected.
- PKCS11: improved public key loading logic for trust anchor handles to use the most appropriate mechanism based on handle configuration.
- Fixed minimal kit host implementation in support bridging to SPI by using select and deselect control commands

12.9 Release v3.6.0 (04/04/2023)

12.9.1 New Features

- Compliance certified to CERT-C Level 2 & MISRA 2012. Compliance reports can be requested from your FAE or account manager
- Added talib_handle helper functions to determine if a handle access type is allowed in the given auth session

12.9.2 Fixes

- pkcs11 public key for private keys requiring the token to be logged in will make a best effort to return a value by detecting various storage methods.
- pkcs11 encrypt/decrypt update calls return the maximum possible bytes per the selected algorithm.
- pkcs7 would return the wrong padding for `length % 16 == 0`
- hmac counter kdf method will default to digest length specified in bits

12.9.3 API Changes

- ATCA_STATUS enum is now an integer and all APIs return type ATCA_STATUS
- atcacert API return type is now `ATCA_STATUS` rather than `int`
- atcac_sw_sha... API return type is now `ATCA_STATUS` rather than `int`
- _atcab_exit has been removed (includes _calib_exit and _talib_exit)
- _gDevice has been renamed to g_atcab_device_ptr (one should be using `atcab_get_device()`)

12.10 Release v3.5.1 (03/26/2023)

12.10.1 New Features

- Add support for SHA104, SHA105, & SHA106

12.11 Release v3.5.0 (03/14/2023)

12.11.1 New Features

- Add support for ECC204, TA010 and framework for future devices

12.12 Release v3.4.3 (12/23/2022)

12.12.1 New Features

- Add key load mode flags for FCE config command

12.12.2 Fixes

- WPC certificate reconstruction buffer length was too short
- ECC204 block Read/Write did not write remaining bytes if the provided buffer was not padded to a 32 byte bounary
- TA100 lock CRC was being passed with the native endianness.
- ECC204 nonce command was missing the mode bit to emit a random number when called with the intention of producing random bytes

12.13 Release v3.4.2 (12/04/2022)

12.13.1 Fixes

- PKCS11: Correct init/deinit failures from initialization mutex options. These would manifest as a segmentation fault on deinit, unterminated authorization sessions, or library already initialized return codes based on the configuration and inititialization data.
- PKCS11: Added configuration option to always terminate authorization sessions on library initialization to work around applications that may fail to call C_CloseSession or C_Finalize before exiting.
- PKCS11: Fix failures in C_DigestInit resulting from failing to check the session state before checking the requested digest mechanism type.
- PKCS11: Modify how the library returns public key information based on access levels of the private key (generate from the private key if allowed, read from a linked public key, and finally return data unavailable). For the vast majority of situtations this prevents openssl & libp11 from crashing with segmentation faults if the user fails to provide a pkcs11 URI with pin value specified. These segmentation faults were confirmed to also exist with other PKCS11 libraries - the fundamental problem should be taken up with the maintainers of openssl, libp11, and pkcs11-provider (experimental OpenSSL 3.0 PKCS11 support).
- Modified CBC update/finish APIs (added as an experimental API in v3.4.0) to match standard expectations of how the APIs would function. Updated algorithm tests to reflect this usage.
- PKCS11: Updated encrypt/decrypt in cbc/cbcpad modes to use the updated algorithm implementations
- talib full element read & write functions now account for the maximum packet size based on session state.

12.14 Release v3.4.1 (11/11/2022)

12.14.1 Fixes

- test_atcacert_build_start_signer modified to verify the structure fields since the structure is no longer packed
- Python ctypes_to_bytes routine to work for all python versions
- Pkcs11 signature rules to match section 5.2 of the specification
- Compilation error when PKCS11 monotonic counter is enabled
- Compiletion error when no HALs are specified during configuration
- Align ECC204 and cryptoauth counter APIs

12.15 Release v3.4.0 (10/27/2022)

12.15.1 New Features

- Added framework for fine grain library configuration including configuration check header files `<api>_config_check.h` see lib/atca_config_check.h for the top level header
- Added WPC application files with reference message generation/parsing and library configuration file to optimize to the smallest footprint
- TA100 read/write apis updated to segment incoming buffer into partial read/write operations if it exceeds the maximum supported packet size
- Added PKCS7 padding algorithm for use with AES-CBC
- Expose PKCS11 configuration options to CMake configuration

12.15.2 Fixes

- Improve ECC204 apis to match cryptoauthlib apis and abstract the device differences
- Support for strict C99 compliance and clean up warnings from -Wall and pedantic levels
- Add rsa2048 key size support to talib_rsaenc command
- Fix for ta100 devupdate to set the proper auth session exit flags so the library will properly reconnect when the ta100 reboots
- Fix ECC608 verify failure when ReqRandom bit is set for a stored public key by using tempkey in this situation rather than the message digest buffer. See the ECC608 datasheet for more details of this special condition
- Improve ta100 auth session handling of long messages by reporting the message size exceeds the wrapped message limit earlier in the packet creation process
- Fixes and Improvements for PKCS11 interface based on compliance testing

12.16 Release v3.3.3 (10/06/2021)

12.16.1 New features

- Added Zephyr support and zephyr driver api HALs for I2C & SPI. Adding cryptoauthlib to a zephyr project CMakeLists.txt is now possible - use subdirectory(cryptoauthlib/lib). One can also include the repo in the west manifest
- Added SWI device support for linux platforms using hardware uarts
- Added contributing guidelines and PR process documentation
- SWI bitbang driver for harmony - supports Atmel SWI and ECC204 protocols

12.16.2 Fixes

- Wolfssl build errors when generating MHC projects containing wolfssl
- Removed zero length aad limitation in CCM implementation
- Changed ECC204 zone identifiers and slot types to align with cryptoauthlib standard forms
- XC8/XC16 build warnings
- Several pkcs11 fixes - token_init deadlock, null num_in for private key writes, fsecret key length parsing, object_create failing, etc
- Null pointer access violation in atcab_release when using a native hal and double free in openssl implementation of atcac_pk_verify

12.17 Release v3.3.2 (06/20/2021)

12.17.1 New features

- All memory allocations now go through the hal_ platform definitions. In harmony these are the OSAL_ fuctions which work with any of the supported RTOS'.
- Enable multiple intefaces in the Harmony 3 test project through the user interface.
- Kit protocol over UART has been added. This can be paired with the included hosting application
- Simple kit protocol hosting application has been added. It is available in app/kit_host and through Harmony 3. This is a preview release of the application.

12.17.2 Fixes

- Enable ATSHA206A api in the python extension
- Made the linux i2c configuration default to 100khz so they should work again without having to make modifications to the baud rate field.
- Fix pkcs11 static configuration option when used with the trust platform configuration file
- Fix PKCS11 ec_point return value when pValue is null (libp11 checks the size in this manner before requesting it for real).
- Fix warnings generated by missing end of file newlines.
- Removed legacy (empty) START header references.

12.18 Release v3.3.1 (04/23/2021)

12.18.1 New features

- Core support for kit protocol over serial ports (i.e. tty/COM ports)
- PKCS11 support for TA100 auth sessions

12.18.2 Fixes

- Fix mbedtls integration combinations that would produce unexpected behavior. All variations of sign/verify _ALT now work as expected given a configured key (for example if a key is configured as a stored public and VERIFY_ALT is enabled then library will perform a stored key verify rather than an external public key load and verify)
- Added mbedtls integration tests to confirm that integrations are working on a target platform as expected. These generally bootstrap using NIST example vectors before using the validated functions/algorithms to test the remaining integration.
- Clean up warnings when run with very strict settings (-Wall -Wextra -pedantic -Werror)
- Fix false wake errors when baud rate switching for I2C
- Fix for I2C errors that could be created on the bus when there are devices on the bus that support general calls - this fix should also correct linux zero length kernel messages when enabled.
- Fix ESP32 HAL to work with the updated HAL structure.

12.19 Release v3.3.0 (01/22/2021)

12.19.1 API Updates

- HAL API has been signifiantly revised to improve portability. This update simplies the requirements of each HAL to only the physical transport mechanisms. Please see the hal porting and library upgrading notes: https://github.com/MicrochipTech/cryptoauthlib/wiki/Upgrading-to-v3.3
- Internal structures have been updated by removing obsolete elements and combining mandatory fields. This saves significant memory in both program and data regions.
- Inclusive language update: all remaining legacy language elements have been updated. Where this impacts the external API there is the option ATCA_ENABLE_DEPRECATED to use the previous names.

12.19.2 New features

- ECC204 support has been added with one wire HAL support.
- ECC204, SHA206, one wire and single wire (uart and gpio) hals have been added to the Harmony 3 configurator.
- PKCS11 support for symmetric (AES & HMAC) keys has been added and enabled for additional mechanisms such as HMAC signing and AES encrypt/decrypt

12.19.3 Fixes

- pkcs11_token_init had several conditions that were corrected
- fix to detect differences in i2c clock rate specifications between flexcom and sercom configurators in Harmony 3 and the emit the correct value for the cryptoauthlib interface config structure.

12.20 Release v3.2.5 (11/30/2020)

12.20.1 New features

- TA100 ShareKey API to drive the sharekey process (requires NDA, consult with your FAE or submit a request through your myMicrochip account)
- Additional software crypto library interface functions for asymmetric cryptography (sign, verify, ecdh, etc)
- XC8 & XC16 compiler support
- AES CCM & CBC-MAC upper layer API using AES-ECB primatives

12.20.2 Fixes

- TA100 AES-GCM auth session tx packet length when command data is included
- PKCS11 Pin length check rejecting valid pin lengths
- aes-gcm nist vector test failed with mbedtls crypto backend due to aad update not being executed when aad length was zero

12.21 Release v3.2.4 (10/17/2020)

12.21.1 New features

- Additional TA100 command support (requires NDA, consult with your FAE or submit a request through your myMicrochip account)
- Library build and install on linux now also installs the headers that were used to build the library including all configuration files like atca_config.h - customer applications building against the library will need to add the include/cryptoauthlib to their include search paths

12.21.2 Fixes

- Fixed errors produced when -fno-common was used during build of the library by resolving the variable declaration and exporting macros (tested with static/dynamic linkage on linux & windows platforms)
- Added a timeout during i2c plib commands in the Harmony3 hals to prevent system lockups from failed peripheral transfers that don't return errors.

12.22 Release v3.2.3 (09/12/2020)

12.22.1 New features

- Additional TA100 command support (requires NDA, consult with your FAE or submit a request through your myMicrochip account)

12.22.2 Fixes

- Security patch for USB HALs. Removed deprecated HALs and removed enumeration from the hidapi HAL.
- Fix device matching logic to support older kits when using "auto detect" settings in the interface configuration
- Fix SPI HAL generation errors for SAMG55 & SAM71 (flexcom) devices
- Added a timeout for Harmony I2C calls to prevent infinite loops on peripheral failures. If a loop exists inside the peripheral library then it may still cause processor spins until a watchdog reset.

12.23 Release v3.2.2 (07/28/2020)

12.23.1 New Features

- ATECC608B support added

12.23.2 Fixes

- Consistent null pointer checks between calib & talib apis. Tracing enabled for most all status changes
- Fix for pkcs11 ecdh with the legacy slot write mode and encrypted read to pull the read key id from the correct slot (private key slot | 0x01)
- call the proper api from atcab_init_ext so it works with device structures that are not the global instance

12.24 Release v3.2.1 (06/29/2020)

12.24.1 Fixes

- PKCS11 configuration option to set token label to the device serial number
- Fix OSX CLANG macro error
- Add missing c++ wrapper macros to calib_basic.h
- Ensure atcab_init_ext calls atcab_release_ext rather than atcab_release

12.25 Release v3.2.0 (06/10/2020)

12.25.1 New features

- TA100 device support (requires NDA, consult with your FAE or submit a request through your myMicrochip account)
- Extension of the existing API to support device context retention to allow multiple independent contexts to be maintained. The application still needs to ensure concurrency protections are used in the application to guard bus communication.
- PKCS11 support has been moved into the main library and will be maintained together.
- TNG/TFLEX support has been added to PKCS11 so enabling a TNG part in pkcs11 can be done by specifying the part number: `device = ATECC608A-TNGTLS`
- Several cryptographic library integrations have been added to enable additional host/mcu side functionality. This includes replacing cryptoauthlib software implementations of sha1 & sha256 with your preferred library. For example using WolfSSL in Harmony 3 will also enable hardware acceleration of those cryptographic functions. Cryptographic libraries enabled: WolfSSL, mbedTLS, & OpenSSL
- Changes to atcacert ("compressed" certificate processing) to enable exact certificate size retrival which will help with some use cases that had issues with the max possible size answers.
- Consolidation of HALs into device families rather than exact processor model This should reduce the amount of effort required to port the library to a specific platform if the framework is one that is already known.

12.25.2 Known issues

- Power modes/states for the TA100 are not automatically controlled by the library so the application has to manually change the power state when lower power modes are required. A command such as the info command will wake the TA100 from sleep but will produce an error. Try another command after the specified time to ensure communication is restored. This behavior is detailed in the datasheet.
- Several TA100 commands and features are planned for the next released of the library such as import/export, transfer, and devupdate.

12.26 Release v3.1.1 (03/06/2020)

- Update Trust Flex certificates. Add compile time options to reduce code space by selectively including the trust certificates that are required
- Python updates: add sha206 apis. Fix atcab_kdf parameters
- Fix compiler warnings in test application files and sha206 api

12.27 Release v3.1.0 (02/05/2020)

- The library is now semantic versioned along with the legacy date versioning. Python will continue to be released with the date version. Version APIs have been updated.
- Configuration is done via a configuration file atca_config.h rather than global compiler options. You have to add this file to your project to support this version of the library.
- Harmony 3 support has been added. Update harmony configurator (and content loader) or manually clone crytoauthlib into your harmony directory.
- Additional Compiler support has been added for IAR-ARM and ARMCC

12.28 Release 11/22/2019

- Patches for CVE-2019-16128 & CVE-2019-16129: Ensure reported packet length is valid for the packet being processed.
- Improvement to encrypted read operations to allow supply of a host nonce (prevent replay of a read sequence to the host). Default API is changed but can be reverted by setting the option ATCA_USE_CONSTANT_HOST_NONCE
- Added Azure compatible TNGTLS and TNGLORA certificates. Use the TNG client API to retrieve the proper certificate based on the device.
- Misc Python updates (updated APIs for encrypted reads to match the C-API change) atcacert_cert_element_t now initializes properly

12.29 Release 08/30/2019

- Added big-endian architecture support
- Fixes to atcah_gen_dig() and atcah_nonce()

12.30 Release 05/17/2019

- Added support for TNG devices (cert transforms, new API)
- atcab_write_pub_key() now works when the data zone is unlocked

12.31 Release 03/04/2019

- mbed TLS wrapper added
- Minor bug fixes

12.32 Release 01/25/2019

- Python JWT support
- Python configuration structures added
- Restructure of secure boot app

12.33 Release 01/04/2019

- Added GCM functions
- Split AES modes into separate files
- Bug fix in SWI START driver

12.34 Release 10/25/2018

- Added basic certificate functions to the python wrapper.
- Added Espressif ESP32 I2C driver.
- Made generic Atmel START drivers to support most MCUs in START.
- Added AES-CTR mode functions.
- Python wrapper functions now return single values with AtcaReference.
- Added mutex support to HAL and better support for freeRTOS.

12.35 Release 08/17/2018

- Better support for multiple kit protocol devices

12.36 Release 07/25/2018

- Clean up python wrapper

12.37 Release 07/18/2018

- Added ATCA_NO_HEAP define to remove use of malloc/free.
- Moved PEM functions to their own file in atcacert.
- Added wake retry to accomodate power on self test delay.
- Added ca_cert_def member to atcacert_def_s so cert chains can be traversed as a linked list.

12.38 Release 03/29/2018

- Added support for response polling by default, which will make commands return faster (define ATCA_NO_POLL to use old delay method).
- Removed atcatls related files as they were of limited value.
- Test framework generates a prompt before locking test configuration.
- Test framework puts device to sleep between tests.
- Fixed mode parameter issue in atcah_gen_key_msg().
- ATECC608A health test error code added.

12.39 Release 01/15/2018

- Added AES-128 CBC implementation using AES command
- Added AES-128 CMAC implementation using AES command

12.40 Release 11/22/2017

- Added support for FLEXCOM6 on SAMG55 driver

12.41 Release 11/17/2017

- Added library support for the ATECC608A device
- Added support for Counter command
- atca_basic functions and tests now split into multiple files based on command
- Added support for multiple base64 encoding rules
- Added support for JSON Web Tokens (jwt)
- Fixed atcab_write_enc() function to encrypt the data even when the device is unlocked
- Fixed atcab_base64encode_() for the extra newline
- Updated atcab_ecdh_enc() to work more consistently

12.42 Release 07/01/2017

- Removed assumption of SN[0:1]=0123, SN[8]=EE. SN now needs to be passed in for functions in atca_host and atca_basic functions will now read the config zone for the SN if needed.
- Renamed atcab_gendig_host() to atcab_gendig() since it's not a host function. Removed original atcab_gendig(), which had limited scope.
- Fixed atcah_hmac() for host side HMAC calculations. Added atcab_hmac().
- Removed unnecessary ATCADeviceType parameters from some atca_basic functions.
- Added atcacert_create_csr() to create a signed CSR.
- New HAL implementation for Kit protocol over HID on Linux. Please see the Incorporating CryptoAuthLib in a Linux project using USB HID devices section in this file for more information.
- Added atcacert_write_cert() for writing certificates to the device.
- Added support for dynamic length certificate serial numbers in atcacert.
- Added atcab_write() for lower level write commands.
- Fixed atcah_write_auth_mac(), which had wrong OpCode.
- Added atcab_verify() command for lower level verify commands.
- Added atcab_verify_stored() for verifying data with a stored public key.

- Removed atcab_write_bytes_slot(). Use atcab_write_bytes_zone() instead.
- Modified atcab_write_bytes_zone() and atcab_read_bytes_zone() to specify a slot
- Added atcab_verify_validate() and atcab_verify_invalidate()
- Improvements to host functions to handle more cases.
- Added atcab_updateextra(), atcab_derive_key()
- Added support for more certificate formats.
- Added general purpose hardware SHA256 functions. See atcab_hw_sha2_256().
- Removed device specific config read/write. Generic now handles both.
- Removed unnecessary response parameter from lock commands.
- Enhanced and added unit tests.
- Encrypted read and write functions now handle keys with SlotConfig.NoMac set
- atcab_cmp_config_zone() handles all devices now.
- Fixed some edge cases in atcab_read_bytes_zone().
- Updated atSHA() to work with all devices.
- Fixed atcacert_get_device_locs() when using stored sn.

12.43 Release 01/08/2016

- New HAL implementations for
  - Single Wire interface for SAMD21 / SAMR21
  - SAMV71 I2C HAL implementation
  - XMega A3Bu HAL implementation
- Added atcab_version() method to return current version string of libary to application
- New Bus and Discovery API
  - returns a list of ATCA device configurations for each CryptoAuth device found
  - currently implemented on SAMD21/R21 I2C, SAMV71
  - additional discovery implementations to come
- TLS APIs solidified and documented
- Added missing doxygen documentation for some CryptoAuthLib methods
- Stubs for HAL SPI removed as they are unused for SHA204A and ECC508A support
- bug fixes
- updated atcab_sha() to accept a variable length message that is > 64 bytes and not a multiple of 64 bytes (the SHA block size).
- refactored Cert I/O and Cert Data tests to be smaller
- 'uncrustify' source formatting
- published on GitHub

12.44 Release 9/19/2015

- Kit protocol over HID on Windows
- Kit protocol over CDC on Linux
- TLS integration with ATECC508A
- Certificate I/O and reconstruction
- New SHA2 implementation
- Major update to API docs, Doxygen files found in cryptoauthlib/docs
- load cryptoauthlib/docs/index.html with your browser

Chapter 13

Security Policy

We take the security of cryptoauthlib very seriously. Please submit security vulnerabilities to the Microchip Product Security Incident Response Team (PSIRT) which is responsible for receiving and responding to reports of potential security vulnerabilities in our products, as well as in any related hardware, software, firmware, and tools. Please see below for instructions on how to submit your report.

13.1 Supported Versions

The previous API version is maintained for a year after a new version is released.

Version	Supported	Notes
3.7.x	:heavy_check_mark:	
3.6.x	:heavy_check_mark:	Support Ends September 8 2024
3.5.x	:heavy_check_mark:	Support Ends April 4 2024
3.4.x	:heavy_check_mark:	Support Ends March 14 2024
3.3.x	:x:	
3.2.x	:x:	
< 3.2	:x:	

13.2 Reporting a Vulnerability

How to Report Potential Product Security Vulnerabilities

Once a report is received, the PSIRT will take the necessary steps to review the issue and determine what actions might be required to address any potential impacts to our products. Microchip PSIRT follows a coordinated vulnerability responsible disclosure policy that is available for review.

Please use the above instructions to securely submit your findings - We ask that you refrain from reporting vulnerabilities through the public github issues system.

Chapter 14

Deprecated List

Global atcab_init_device (ATCADevice ca_device)

This function is not recommended for use generally. Use of _ext is recommended instead. You can use atcab←_init_ext to obtain an initialized instance and associated it with the global structure - but this shouldn't be a required process except in extremely unusual circumstances.

Global atidle (ATCAIface ca_iface)

This function does not have defined behavior when ATCA_HAL_LEGACY_API is undefined.

Global atsleep (ATCAIface ca_iface)

This function does not have defined behavior when ATCA_HAL_LEGACY_API is undefined.

Global atwake (ATCAIface ca_iface)

This function does not have defined behavior when ATCA_HAL_LEGACY_API is undefined.

Chapter 15

Module Index

15.1 Modules

Here is a list of all modules:

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Here is a list of all documented namespaces with brief descriptions:

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Chapter 20

Module Documentation

20.1 TNG API (tng_)

These methods provide some convenience functions (mostly around certificates) for TNG devices, which currently include ATECC608A-MAHTN-T.

20.1.0.1 TNG Functions

This folder has a number of convenience functions for working with TNG devices (currently ATECC608A-MAHTN-T).

These devices have standard certificates that can be easily read using the functions in tng_atcacert_client.h

Functions

- const atcacert_def_t ∗ tng_map_get_device_cert_def (int index)

  Helper function to iterate through all trust cert definitions.
- ATCA_STATUS tng_get_device_cert_def (const atcacert_def_t ∗∗cert_def)

  Get the TNG device certificate definition.
- ATCA_STATUS tng_get_device_cert_def_ext (ATCADevice device, const atcacert_def_t ∗∗cert_def)

  Get the TNG device certificate definition.
- ATCA_STATUS tng_get_device_pubkey (uint8_t ∗public_key)

  Uses GenKey command to calculate the public key from the primary device public key.

- const uint8_t **g_tflxtls_cert_template_4_device** [500]
- const atcacert_def_t **g_tflxtls_cert_def_4_device**
- const atcacert_cert_element_t **g_tflxtls_cert_elements_4_device** [ ]

- ATCA_DLL const atcacert_def_t **g_tnglora_cert_def_1_signer**

- ATCA_DLL const atcacert_def_t **g_tnglora_cert_def_2_device**

- const uint8_t **g_cryptoauth_root_ca_002_cert** [ ]
- const size_t **g_cryptoauth_root_ca_002_cert_size**

- #define **CRYPTOAUTH_ROOT_CA_002_PUBLIC_KEY_OFFSET** 266

- ATCA_DLL const atcacert_def_t **g_tnglora_cert_def_4_device**
- SHARED_LIB_EXPORT const uint8_t **g_tnglora_cert_template_4_device** [ ]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tnglora_cert_elements_4_device** [ ]
- #define **TNGLORA_CERT_TEMPLATE_4_DEVICE_SIZE** 552

- ATCA_DLL const atcacert_def_t **g_tngtls_cert_def_1_signer**
- SHARED_LIB_EXPORT const uint8_t **g_tngtls_cert_template_1_signer** [ ]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tngtls_cert_elements_1_signer** [ ]
- #define **TNGTLS_CERT_TEMPLATE_1_SIGNER_SIZE** 520

- ATCA_DLL const atcacert_def_t **g_tngtls_cert_def_2_device**
- SHARED_LIB_EXPORT const uint8_t **g_tngtls_cert_template_2_device** [ ]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tngtls_cert_elements_2_device** [ ]
- #define **TNGTLS_CERT_TEMPLATE_2_DEVICE_SIZE** 505
- #define **TNGTLS_CERT_ELEMENTS_2_DEVICE_COUNT** 2

- ATCA_DLL const atcacert_def_t **g_tngtls_cert_def_3_device**
- ATCA_DLL const uint8_t **g_tngtls_cert_template_3_device** [ ]
- ATCA_DLL const atcacert_cert_element_t **g_tngtls_cert_elements_3_device** [ ]
- #define **TNGTLS_CERT_TEMPLATE_3_DEVICE_SIZE** 546

- int tng_atcacert_max_device_cert_size (size_t ∗max_cert_size)

  Return the maximum possible certificate size in bytes for a TNG device certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.
- int tng_atcacert_read_device_cert (uint8_t ∗cert, size_t ∗cert_size, const uint8_t ∗signer_cert)

  Reads the device certificate for a TNG device.
- int tng_atcacert_device_public_key (uint8_t ∗public_key, uint8_t ∗cert)

  Reads the device public key.
- int tng_atcacert_max_signer_cert_size (size_t ∗max_cert_size)

  Return the maximum possible certificate size in bytes for a TNG signer certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.
- int tng_atcacert_read_signer_cert (uint8_t ∗cert, size_t ∗cert_size)

  Reads the signer certificate for a TNG device.
- int tng_atcacert_signer_public_key (uint8_t ∗public_key, uint8_t ∗cert)

  Reads the signer public key.
- int tng_atcacert_root_cert_size (size_t ∗cert_size)

  Get the size of the TNG root cert.
- int tng_atcacert_root_cert (uint8_t ∗cert, size_t ∗cert_size)

  Get the TNG root cert.
- int tng_atcacert_root_public_key (uint8_t ∗public_key)

  Gets the root public key.

20.1.1 Detailed Description

These methods provide some convenience functions (mostly around certificates) for TNG devices, which currently include ATECC608A-MAHTN-T.

20.1.2 Function Documentation

20.1.2.1 tng_atcacert_device_public_key()

```
int tng_atcacert_device_public_key (
            uint8_t * public_key,
            uint8_t * cert )
```

Reads the device public key.

Parameters

out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve.
in	*cert*	If supplied, the device public key is used from this certificate. If set to NULL, the device public key is read from the device.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.2 tng_atcacert_max_device_cert_size()

```
int tng_atcacert_max_device_cert_size (
            size_t * max_cert_size )
```

Return the maximum possible certificate size in bytes for a TNG device certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.

Parameters

out	*max_cert_size*	Maximum certificate size will be returned here in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.3 tng_atcacert_max_signer_cert_size()

```
int tng_atcacert_max_signer_cert_size (
            size_t * max_cert_size )
```

Return the maximum possible certificate size in bytes for a TNG signer certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.

Parameters

out	*max_cert_size*	Maximum certificate size will be returned here in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.4 tng_atcacert_read_device_cert()

```
int tng_atcacert_read_device_cert (
            uint8_t * cert,
            size_t * cert_size,
            const uint8_t * signer_cert )
```

Reads the device certificate for a TNG device.

Parameters

out	*cert*	Buffer to received the certificate (DER format).
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.
in	*signer_cert*	If supplied, the signer public key is used from this certificate. If set to NULL, the signer public key is read from the device.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.5 tng_atcacert_read_signer_cert()

```
int tng_atcacert_read_signer_cert (
            uint8_t * cert,
            size_t * cert_size )
```

Reads the signer certificate for a TNG device.

Parameters

out	*cert*	Buffer to received the certificate (DER format).
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.6 tng_atcacert_root_cert()

```
int tng_atcacert_root_cert (
            uint8_t * cert,
            size_t * cert_size )
```

Get the TNG root cert.

Parameters

out	*cert*	Buffer to received the certificate (DER format).
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.7 tng_atcacert_root_cert_size()

```
int tng_atcacert_root_cert_size (
            size_t * cert_size )
```

Get the size of the TNG root cert.

Parameters

out	*cert_size*	Certificate size will be returned here in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.8 tng_atcacert_root_public_key()

```
int tng_atcacert_root_public_key (
            uint8_t * public_key )
```

Gets the root public key.

Parameters

out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.9 tng_atcacert_signer_public_key()

```
int tng_atcacert_signer_public_key (
            uint8_t * public_key,
            uint8_t * cert )
```

Reads the signer public key.

Parameters

out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve.
in	*cert*	If supplied, the signer public key is used from this certificate. If set to NULL, the signer public key is read from the device.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.1.2.10 tng_get_device_cert_def()

```
ATCA_STATUS tng_get_device_cert_def (
            const atcacert_def_t ** cert_def )
```

Get the TNG device certificate definition.

Parameters

out	*cert_def*	TNG device certificate defnition is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.1.2.11 tng_get_device_cert_def_ext()

```
ATCA_STATUS tng_get_device_cert_def_ext (
            ATCADevice device,
            const atcacert_def_t ** cert_def )
```

Get the TNG device certificate definition.

Parameters

in	*device*	Pointer to the device context pointer
out	*cert_def*	TNG device certificate defnition is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.1.2.12 tng_get_device_pubkey()

```
ATCA_STATUS tng_get_device_pubkey (
            uint8_t * public_key )
```

Uses GenKey command to calculate the public key from the primary device public key.

Parameters

out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.1.2.13 tng_map_get_device_cert_def()

```
const atcacert_def_t * tng_map_get_device_cert_def (
            int index )
```

Helper function to iterate through all trust cert definitions.

Parameters

in	*index*	Map index

Returns

non-null value if success, otherwise NULL

20.2 Basic Crypto API methods (atcab_)

These methods provide the most convenient, simple API to CryptoAuth chips.

Macros

- #define **atcab_get_addr**(...) calib_get_addr(__VA_ARGS__)
- #define **atca_execute_command**(...) calib_execute_command(__VA_ARGS__)
- #define **SHA_CONTEXT_MAX_SIZE** (109)

Functions

- ATCA_STATUS atcab_version (char ∗ver_str)

  basic API methods are all prefixed with atcab_ (CryptoAuthLib Basic) the fundamental premise of the basic API is it is based on a single interface instance and that instance is global, so all basic API commands assume that one global device is the one to operate on.
- ATCA_STATUS atcab_init_ext (ATCADevice ∗device, ATCAIfaceCfg ∗cfg)

  Creates and initializes a ATCADevice context.
- ATCA_STATUS atcab_init (ATCAIfaceCfg ∗cfg)

  Creates a global ATCADevice object used by Basic API.
- ATCA_STATUS atcab_init_device (ATCADevice ca_device)

  Initialize the global ATCADevice object to point to one of your choosing for use with all the atcab_ basic API.
- ATCA_STATUS atcab_release_ext (ATCADevice ∗device)

  release (free) the an ATCADevice instance.
- ATCA_STATUS atcab_release (void)

  release (free) the global ATCADevice instance. This must be called in order to release or free up the interface.
- ATCADevice atcab_get_device (void)

  Get the global device object.
- ATCADeviceType atcab_get_device_type_ext (ATCADevice device)

  Get the selected device type of rthe device context.
- ATCADeviceType atcab_get_device_type (void)

  Get the current device type configured for the global ATCADevice.
- uint8_t atcab_get_device_address (ATCADevice device)

  Get the current device address based on the configured device and interface.
- bool atcab_is_ca_device (ATCADeviceType dev_type)

  Check whether the device is cryptoauth device.
- bool atcab_is_ca2_device (ATCADeviceType dev_type)

  Check whether the device is cryptoauth device.
- bool atcab_is_ta_device (ATCADeviceType dev_type)

  Check whether the device is Trust Anchor device.
- ATCA_STATUS **atcab_pbkdf2_sha256_ext** (ATCADevice device, const uint32_t iter, const uint16_t slot, const uint8_t ∗salt, const size_t salt_len, uint8_t ∗result, size_t result_len)
- ATCA_STATUS **atcab_pbkdf2_sha256** (const uint32_t iter, const uint16_t slot, const uint8_t ∗salt, const size_t salt_len, uint8_t ∗result, size_t result_len)
- ATCA_STATUS atcab_wakeup (void)

wakeup the CryptoAuth device
- ATCA_STATUS atcab_idle (void)

idle the CryptoAuth device
- ATCA_STATUS atcab_sleep (void)

invoke sleep on the CryptoAuth device
- ATCA_STATUS atcab_get_zone_size (uint8_t zone, uint16_t slot, size_t *size)

Gets the size of the specified zone in bytes.
- ATCA_STATUS atcab_get_zone_size_ext (ATCADevice device, uint8_t zone, uint16_t slot, size_t *size)

Gets the size of the specified zone in bytes.
- ATCA_STATUS atcab_aes (uint8_t mode, uint16_t key_id, const uint8_t *aes_in, uint8_t *aes_out)

Compute the AES-128 encrypt, decrypt, or GFM calculation.
- ATCA_STATUS atcab_aes_encrypt (uint16_t key_id, uint8_t key_block, const uint8_t *plaintext, uint8_↩ t *ciphertext)

Perform an AES-128 encrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_encrypt_ext (ATCADevice device, uint16_t key_id, uint8_t key_block, const uint8_t *plaintext, uint8_t *ciphertext)

Perform an AES-128 encrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_decrypt (uint16_t key_id, uint8_t key_block, const uint8_t *ciphertext, uint8_↩ t *plaintext)

Perform an AES-128 decrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_decrypt_ext (ATCADevice device, uint16_t key_id, uint8_t key_block, const uint8_t *ciphertext, uint8_t *plaintext)

Perform an AES-128 decrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_gfm (const uint8_t *h, const uint8_t *input, uint8_t *output)

Perform a Galois Field Multiply (GFM) operation.
- ATCA_STATUS atcab_aes_gcm_init (atca_aes_gcm_ctx_t *ctx, uint16_t key_id, uint8_t key_block, const uint8_t *iv, size_t iv_size)

Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.
- ATCA_STATUS atcab_aes_gcm_init_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, uint16_t key_id, uint8_t key_block, const uint8_t *iv, size_t iv_size)

Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.
- ATCA_STATUS atcab_aes_gcm_init_rand (atca_aes_gcm_ctx_t *ctx, uint16_t key_id, uint8_t key_block, size_t rand_size, const uint8_t *free_field, size_t free_field_size, uint8_t *iv)

Initialize context for AES GCM operation with a IV composed of a random and optional fixed(free) field, which is common when starting an encrypt operation.
- ATCA_STATUS atcab_aes_gcm_aad_update (atca_aes_gcm_ctx_t *ctx, const uint8_t *aad, uint32_t aad↩ _size)

Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.
- ATCA_STATUS atcab_aes_gcm_aad_update_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, const uint8_t *aad, uint32_t aad_size)

Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.
- ATCA_STATUS atcab_aes_gcm_encrypt_update (atca_aes_gcm_ctx_t *ctx, const uint8_t *plaintext, uint32_t plaintext_size, uint8_t *ciphertext)

Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_encrypt_update_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, const uint8_t *plaintext, uint32_t plaintext_size, uint8_t *ciphertext)

Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_encrypt_finish (atca_aes_gcm_ctx_t *ctx, uint8_t *tag, size_t tag_size)

Complete a GCM encrypt operation returning the authentication tag.
- ATCA_STATUS atcab_aes_gcm_encrypt_finish_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, uint8↩ _t *tag, size_t tag_size)

Complete a GCM encrypt operation returning the authentication tag.

- ATCA_STATUS atcab_aes_gcm_decrypt_update (atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗ciphertext, uint32_t ciphertext_size, uint8_t ∗plaintext)

    Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

- ATCA_STATUS atcab_aes_gcm_decrypt_update_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗ciphertext, uint32_t ciphertext_size, uint8_t ∗plaintext)

    Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

- ATCA_STATUS atcab_aes_gcm_decrypt_finish (atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗tag, size_t tag_size, bool ∗is_verified)

    Complete a GCM decrypt operation verifying the authentication tag.

- ATCA_STATUS atcab_aes_gcm_decrypt_finish_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗tag, size_t tag_size, bool ∗is_verified)

    Complete a GCM decrypt operation verifying the authentication tag.

- ATCA_STATUS atcab_checkmac (uint8_t mode, uint16_t key_id, const uint8_t ∗challenge, const uint8_t ∗response, const uint8_t ∗other_data)

    Compares a MAC response with input values.

- ATCA_STATUS atcab_checkmac_with_response_mac (uint8_t mode, const uint8_t ∗challenge, const uint8_t ∗response, const uint8_t ∗other_data, uint8_t ∗mac)

    Compares a MAC response with input values.SHA105 device can generate optional mac Output response mac mode only supports in SHA105 device.

- ATCA_STATUS atcab_counter (uint8_t mode, uint16_t counter_id, uint32_t ∗counter_value)

    Compute the Counter functions.

- ATCA_STATUS atcab_counter_increment (uint16_t counter_id, uint32_t ∗counter_value)

    Increments one of the device's monotonic counters.

- ATCA_STATUS atcab_counter_read (uint16_t counter_id, uint32_t ∗counter_value)

    Read one of the device's monotonic counters.

- ATCA_STATUS atcab_derivekey (uint8_t mode, uint16_t key_id, const uint8_t ∗mac)

    Executes the DeviveKey command for deriving a new key from a nonce (TempKey) and an existing key.

- ATCA_STATUS atcab_derivekey_ext (ATCADevice device, uint8_t mode, uint16_t key_id, const uint8_t ∗mac)

    Executes the DeviveKey command for deriving a new key from a nonce (TempKey) and an existing key.

- ATCA_STATUS atcab_ecdh_base (uint8_t mode, uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, uint8_t ∗out_nonce)

    Base function for generating premaster secret key using ECDH.

- ATCA_STATUS atcab_ecdh (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms)

    ECDH command with a private key in a slot and the premaster secret is returned in the clear.

- ATCA_STATUS atcab_ecdh_enc (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗read_key, uint16_t read_key_id, const uint8_t num_in[(20)])

    ECDH command with a private key in a slot and the premaster secret is read from the next slot.

- ATCA_STATUS atcab_ecdh_ioenc (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗io_key)

    ECDH command with a private key in a slot and the premaster secret is returned encrypted using the IO protection key.

- ATCA_STATUS atcab_ecdh_tempkey (const uint8_t ∗public_key, uint8_t ∗pms)

    ECDH command with a private key in TempKey and the premaster secret is returned in the clear.

- ATCA_STATUS atcab_ecdh_tempkey_ioenc (const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗io_key)

    ECDH command with a private key in TempKey and the premaster secret is returned encrypted using the IO protection key.

- ATCA_STATUS atcab_gendig (uint8_t zone, uint16_t key_id, const uint8_t ∗other_data, uint8_t other_data_size)

    Issues a GenDig command, which performs a SHA256 hash on the source data indicated by zone with the contents of TempKey. See the CryptoAuth datasheet for your chip to see what the values of zone correspond to.

- ATCA_STATUS atcab_gendivkey (const uint8_t *other_data)

  Issues a GenDivKey command to generate the equivalent diversified key as that programmed into the client side device.
- ATCA_STATUS atcab_genkey_base (uint8_t mode, uint16_t key_id, const uint8_t *other_data, uint8_↩
t *public_key)

  Issues GenKey command, which can generate a private key, compute a public key, nd/or compute a digest of a public key.
- ATCA_STATUS atcab_genkey (uint16_t key_id, uint8_t *public_key)

  Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.
- ATCA_STATUS atcab_genkey_ext (ATCADevice device, uint16_t key_id, uint8_t *public_key)

  Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.
- ATCA_STATUS atcab_get_pubkey (uint16_t key_id, uint8_t *public_key)

  Uses GenKey command to calculate the public key from an existing private key in a slot.
- ATCA_STATUS atcab_get_pubkey_ext (ATCADevice device, uint16_t key_id, uint8_t *public_key)

  Uses GenKey command to calculate the public key from an existing private key in a slot.
- ATCA_STATUS atcab_hmac (uint8_t mode, uint16_t key_id, uint8_t *digest)

  Issues a HMAC command, which computes an HMAC/SHA-256 digest of a key stored in the device, a challenge, and other information on the device.
- ATCA_STATUS atcab_info_base (uint8_t mode, uint16_t param2, uint8_t *out_data)

  Issues an Info command, which return internal device information and can control GPIO and the persistent latch.
- ATCA_STATUS atcab_info (uint8_t *revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS atcab_info_ext (ATCADevice device, uint8_t *revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS atcab_info_lock_status (uint16_t param2, uint8_t *is_locked)

  Use the Info command to get the lock status.
- ATCA_STATUS atcab_info_chip_status (uint8_t *chip_status)

  Use the Info command to get the chip status.
- ATCA_STATUS atcab_info_set_latch (bool state)

  Use the Info command to set the persistent latch state for an ATECC608 device.
- ATCA_STATUS atcab_info_get_latch (bool *state)

  Use the Info command to get the persistent latch current state for an ATECC608 device.
- ATCA_STATUS atcab_kdf (uint8_t mode, uint16_t key_id, const uint32_t details, const uint8_t *message, uint8_t *out_data, uint8_t *out_nonce)

  Executes the KDF command, which derives a new key in PRF, AES, or HKDF modes.
- ATCA_STATUS atcab_lock (uint8_t mode, uint16_t summary_crc)

  The Lock command prevents future modifications of the Configuration and/or Data and OTP zones. If the device is so configured, then this command can be used to lock individual data slots. This command fails if the designated area is already locked.
- ATCA_STATUS atcab_lock_config_zone (void)

  Unconditionally (no CRC required) lock the config zone.
- ATCA_STATUS atcab_lock_config_zone_ext (ATCADevice device)

  Unconditionally (no CRC required) lock the config zone.
- ATCA_STATUS atcab_lock_config_zone_crc (uint16_t summary_crc)

  Lock the config zone with summary CRC.
- ATCA_STATUS atcab_lock_data_zone (void)

  Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.
- ATCA_STATUS atcab_lock_data_zone_ext (ATCADevice device)

  Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.
- ATCA_STATUS atcab_lock_data_zone_crc (uint16_t summary_crc)

Lock the data zone (slots and OTP) with summary CRC.

- ATCA_STATUS atcab_lock_data_slot (uint16_t slot)

  Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).
- ATCA_STATUS atcab_lock_data_slot_ext (ATCADevice device, uint16_t slot)

  Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).
- ATCA_STATUS atcab_mac (uint8_t mode, uint16_t key_id, const uint8_t *challenge, uint8_t *digest)

  Executes MAC command, which computes a SHA-256 digest of a key stored in the device, a challenge, and other information on the device.
- ATCA_STATUS atcab_nonce_base (uint8_t mode, uint16_t zero, const uint8_t *num_in, uint8_t *rand_out)

  Executes Nonce command, which loads a random or fixed nonce/data into the device for use by subsequent commands.
- ATCA_STATUS atcab_nonce (const uint8_t *num_in)

  Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.
- ATCA_STATUS atcab_nonce_load (uint8_t target, const uint8_t *num_in, uint16_t num_in_size)

  Execute a Nonce command in pass-through mode to load one of the device's internal buffers with a fixed value.
- ATCA_STATUS atcab_nonce_rand (const uint8_t *num_in, uint8_t *rand_out)

  Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.
- ATCA_STATUS atcab_nonce_rand_ext (ATCADevice device, const uint8_t *num_in, uint8_t *rand_out)

  Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.
- ATCA_STATUS atcab_challenge (const uint8_t *num_in)

  Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.
- ATCA_STATUS atcab_challenge_seed_update (const uint8_t *num_in, uint8_t *rand_out)

  Execute a Nonce command to generate a random challenge combining a host nonce (num_in) and a device random number.
- ATCA_STATUS atcab_priv_write (uint16_t key_id, const uint8_t priv_key[36], uint16_t write_key_id, const uint8_t write_key[32], const uint8_t num_in[(20)])

  Executes PrivWrite command, to write externally generated ECC private keys into the device.
- ATCA_STATUS atcab_random (uint8_t *rand_out)

  Executes Random command, which generates a 32 byte random number from the device.
- ATCA_STATUS atcab_random_ext (ATCADevice device, uint8_t *rand_out)

  Executes Random command, which generates a 32 byte random number from the device.
- ATCA_STATUS atcab_read_zone (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint8_t *data, uint8_t len)

  Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.
- ATCA_STATUS atcab_read_zone_ext (ATCADevice device, uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint8_t *data, uint8_t len)

  Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.
- ATCA_STATUS atcab_is_locked (uint8_t zone, bool *is_locked)

  Executes Read command, which reads the configuration zone to see if the specified zone is locked.
- ATCA_STATUS atcab_is_config_locked (bool *is_locked)

  This function check whether configuration zone is locked or not.
- ATCA_STATUS atcab_is_config_locked_ext (ATCADevice device, bool *is_locked)

  This function check whether configuration zone is locked or not.
- ATCA_STATUS atcab_is_data_locked (bool *is_locked)

  This function check whether data/setup zone is locked or not.

- ATCA_STATUS atcab_is_data_locked_ext (ATCADevice device, bool ∗is_locked)

  This function check whether data/setup zone is locked or not.
- ATCA_STATUS atcab_is_slot_locked (uint16_t slot, bool ∗is_locked)

  This function check whether slot/handle is locked or not.
- ATCA_STATUS atcab_is_slot_locked_ext (ATCADevice device, uint16_t slot, bool ∗is_locked)

  This function check whether slot/handle is locked or not.
- ATCA_STATUS atcab_is_private_ext (ATCADevice device, uint16_t slot, bool ∗is_private)

  Check to see if the key is a private key or not.
- ATCA_STATUS **atcab_is_private** (uint16_t slot, bool ∗is_private)
- ATCA_STATUS **atcab_read_bytes_zone_ext** (ATCADevice device, uint8_t zone, uint16_t slot, size_t offset, uint8_t ∗data, size_t length)
- ATCA_STATUS atcab_read_bytes_zone (uint8_t zone, uint16_t slot, size_t offset, uint8_t ∗data, size_t length)

  Used to read an arbitrary number of bytes from any zone configured for clear reads.
- ATCA_STATUS atcab_read_serial_number (uint8_t ∗serial_number)

  This function returns serial number of the device.
- ATCA_STATUS atcab_read_serial_number_ext (ATCADevice device, uint8_t ∗serial_number)

  This function returns serial number of the device.
- ATCA_STATUS atcab_read_pubkey (uint16_t slot, uint8_t ∗public_key)

  Executes Read command to read an ECC P256 public key from a slot configured for clear reads.
- ATCA_STATUS atcab_read_pubkey_ext (ATCADevice device, uint16_t slot, uint8_t ∗public_key)

  Executes Read command to read an ECC P256 public key from a slot configured for clear reads.
- ATCA_STATUS atcab_read_sig (uint16_t slot, uint8_t ∗sig)

  Executes Read command to read a 64 byte ECDSA P256 signature from a slot configured for clear reads.
- ATCA_STATUS atcab_read_config_zone (uint8_t ∗config_data)

  Executes Read command to read the complete device configuration zone.
- ATCA_STATUS atcab_read_config_zone_ext (ATCADevice device, uint8_t ∗config_data)

  Executes Read command to read the complete device configuration zone.
- ATCA_STATUS atcab_cmp_config_zone (uint8_t ∗config_data, bool ∗same_config)

  Compares a specified configuration zone with the configuration zone currently on the device.
- ATCA_STATUS atcab_read_enc (uint16_t key_id, uint8_t block, uint8_t ∗data, const uint8_t ∗enc_key, const uint16_t enc_key_id, const uint8_t num_in[(20)])

  Executes Read command on a slot configured for encrypted reads and decrypts the data to return it as plaintext.
- ATCA_STATUS atcab_secureboot (uint8_t mode, uint16_t param2, const uint8_t ∗digest, const uint8_↩ t ∗signature, uint8_t ∗mac)

  Executes Secure Boot command, which provides support for secure boot of an external MCU or MPU.
- ATCA_STATUS atcab_secureboot_mac (uint8_t mode, const uint8_t ∗digest, const uint8_t ∗signature, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes Secure Boot command with encrypted digest and validated MAC response using the IO protection key.
- ATCA_STATUS atcab_selftest (uint8_t mode, uint16_t param2, uint8_t ∗result)

  Executes the SelfTest command, which performs a test of one or more of the cryptographic engines within the ATECC608 chip.
- ATCA_STATUS atcab_sha_base (uint8_t mode, uint16_t length, const uint8_t ∗data_in, uint8_t ∗data_out, uint16_t ∗data_out_size)

  Executes SHA command, which computes a SHA-256 or HMAC/SHA-256 digest for general purpose use by the host system.
- ATCA_STATUS atcab_sha_start (void)

  Executes SHA command to initialize SHA-256 calculation engine.
- ATCA_STATUS atcab_sha_update (const uint8_t ∗message)

  Executes SHA command to add 64 bytes of message data to the current context.
- ATCA_STATUS atcab_sha_end (uint8_t ∗digest, uint16_t length, const uint8_t ∗message)

  Executes SHA command to complete SHA-256 or HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_read_context (uint8_t ∗context, uint16_t ∗context_size)

Executes SHA command to read the SHA-256 context back. Only for ATECC608 with SHA-256 contexts. HMAC not supported.

- ATCA_STATUS atcab_sha_write_context (const uint8_t ∗context, uint16_t context_size)

  Executes SHA command to write (restore) a SHA-256 context into the the device. Only supported for ATECC608 with SHA-256 contexts.
- ATCA_STATUS atcab_sha (uint16_t length, const uint8_t ∗message, uint8_t ∗digest)

  Use the SHA command to compute a SHA-256 digest.
- ATCA_STATUS atcab_hw_sha2_256 (const uint8_t ∗data, size_t data_size, uint8_t ∗digest)

  Use the SHA command to compute a SHA-256 digest.
- ATCA_STATUS atcab_hw_sha2_256_init (atca_sha256_ctx_t ∗ctx)

  Initialize a SHA context for performing a hardware SHA-256 operation on a device. Note that only one SHA operation can be run at a time.
- ATCA_STATUS atcab_hw_sha2_256_update (atca_sha256_ctx_t ∗ctx, const uint8_t ∗data, size_t data_size)

  Add message data to a SHA context for performing a hardware SHA-256 operation on a device.
- ATCA_STATUS atcab_hw_sha2_256_finish (atca_sha256_ctx_t ∗ctx, uint8_t ∗digest)

  Finish SHA-256 digest for a SHA context for performing a hardware SHA-256 operation on a device.
- ATCA_STATUS atcab_sha_hmac_init (atca_hmac_sha256_ctx_t ∗ctx, uint16_t key_slot)

  Executes SHA command to start an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_update (atca_hmac_sha256_ctx_t ∗ctx, const uint8_t ∗data, size_t data↩ _size)

  Executes SHA command to add an arbitrary amount of message data to a HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_finish (atca_hmac_sha256_ctx_t ∗ctx, uint8_t ∗digest, uint8_t target)

  Executes SHA command to complete a HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac (const uint8_t ∗data, size_t data_size, uint16_t key_slot, uint8_t ∗digest, uint8_t target)

  Use the SHA command to compute an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_ext (ATCADevice device, const uint8_t ∗data, size_t data_size, uint16_t key_slot, uint8_t ∗digest, uint8_t target)

  Use the SHA command to compute an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sign_base (uint8_t mode, uint16_t key_id, uint8_t ∗signature)

  Executes the Sign command, which generates a signature using the ECDSA algorithm.
- ATCA_STATUS atcab_sign (uint16_t key_id, const uint8_t ∗msg, uint8_t ∗signature)

  Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_sign_ext (ATCADevice device, uint16_t key_id, const uint8_t ∗msg, uint8_t ∗signature)

  Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_sign_internal (uint16_t key_id, bool is_invalidate, bool is_full_sn, uint8_t ∗signature)

  Executes Sign command to sign an internally generated message.
- ATCA_STATUS atcab_updateextra (uint8_t mode, uint16_t new_value)

  Executes UpdateExtra command to update the values of the two extra bytes within the Configuration zone (bytes 84 and 85).
- ATCA_STATUS atcab_verify (uint8_t mode, uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗public↩ _key, const uint8_t ∗other_data, uint8_t ∗mac)

  Executes the Verify command, which takes an ECDSA [R,S] signature and verifies that it is correctly generated from a given message and public key. In all cases, the signature is an input to the command.
- ATCA_STATUS atcab_verify_extern (const uint8_t ∗message, const uint8_t ∗signature, const uint8_↩ t ∗public_key, bool ∗is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_verify_extern_ext (ATCADevice device, const uint8_t ∗message, const uint8_↩ t ∗signature, const uint8_t ∗public_key, bool ∗is_verified)

Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

- ATCA_STATUS atcab_verify_extern_mac (const uint8_t ∗message, const uint8_t ∗signature, const uint8_t ∗public_key, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. This function is only available on the ATECC608.
- ATCA_STATUS atcab_verify_stored (const uint8_t ∗message, const uint8_t ∗signature, uint16_t key_id, bool ∗is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_verify_stored_ext (ATCADevice device, const uint8_t ∗message, const uint8_t ∗signature, uint16_t key_id, bool ∗is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_verify_stored_with_tempkey (const uint8_t ∗signature, uint16_t key_id, bool ∗is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. keyConfig.reqrandom bit should be set and the message to be signed should be already loaded into TempKey for all devices.
- ATCA_STATUS atcab_verify_stored_mac (const uint8_t ∗message, const uint8_t ∗signature, uint16_t key_id, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with a public key stored in the device. This function is only available on the ATECC608.
- ATCA_STATUS atcab_verify_validate (uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗other_data, bool ∗is_verified)

  Executes the Verify command in Validate mode to validate a public key stored in a slot.
- ATCA_STATUS atcab_verify_invalidate (uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗other_data, bool ∗is_verified)

  Executes the Verify command in Invalidate mode which invalidates a previously validated public key stored in a slot.
- ATCA_STATUS atcab_write (uint8_t zone, uint16_t address, const uint8_t ∗value, const uint8_t ∗mac)

  Executes the Write command, which writes either one four byte word or a 32-byte block to one of the EEPROM zones on the device. Depending upon the value of the WriteConfig byte for this slot, the data may be required to be encrypted by the system prior to being sent to the device. This command cannot be used to write slots configured as ECC private keys.
- ATCA_STATUS atcab_write_zone (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, const uint8_t ∗data, uint8_t len)

  Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.
- ATCA_STATUS atcab_write_zone_ext (ATCADevice device, uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, const uint8_t ∗data, uint8_t len)

  Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.
- ATCA_STATUS **atcab_write_bytes_zone_ext** (ATCADevice device, uint8_t zone, uint16_t slot, size_t offset_bytes, const uint8_t ∗data, size_t length)
- ATCA_STATUS atcab_write_bytes_zone (uint8_t zone, uint16_t slot, size_t offset_bytes, const uint8_t ∗data, size_t length)

  Executes the Write command, which writes data into the configuration, otp, or data zones with a given byte offset and length. Offset and length must be multiples of a word (4 bytes).
- ATCA_STATUS atcab_write_pubkey (uint16_t slot, const uint8_t ∗public_key)

  Uses the write command to write a public key to a slot in the proper format.
- ATCA_STATUS atcab_write_pubkey_ext (ATCADevice device, uint16_t slot, const uint8_t ∗public_key)

  Uses the write command to write a public key to a slot in the proper format.
- ATCA_STATUS atcab_write_config_zone (const uint8_t ∗config_data)

  Executes the Write command, which writes the configuration zone.

- ATCA_STATUS atcab_write_config_zone_ext (ATCADevice device, const uint8_t *config_data)

    Executes the Write command, which writes the configuration zone.
- ATCA_STATUS atcab_write_enc (uint16_t key_id, uint8_t block, const uint8_t *data, const uint8_t *enc_key, const uint16_t enc_key_id, const uint8_t num_in[(20)])

    Executes the Write command, which performs an encrypted write of a 32 byte block into given slot.
- ATCA_STATUS atcab_write_config_counter (uint16_t counter_id, uint32_t counter_value)

    Initialize one of the monotonic counters in device with a specific value.

Variables

- ATCADevice **g_atcab_device_ptr**

- ATCA_STATUS atcab_bin2hex (const uint8_t *bin, size_t bin_size, char *hex, size_t *hex_size)

    Convert a binary buffer to a hex string for easy reading.
- ATCA_STATUS atcab_bin2hex_ (const uint8_t *bin, size_t bin_size, char *hex, size_t *hex_size, bool is_pretty, bool is_space, bool is_upper)

    Function that converts a binary buffer to a hex string suitable for easy reading.
- ATCA_STATUS atcab_hex2bin (const char *ascii_hex, size_t ascii_hex_len, uint8_t *binary, size_t *bin_len)

    Function that converts a hex string to binary buffer.
- ATCA_STATUS **atcab_hex2bin_** (const char *hex, size_t hex_size, uint8_t *bin, size_t *bin_size, bool is_space)
- ATCA_STATUS packHex (const char *ascii_hex, size_t ascii_hex_len, char *packed_hex, size_t *packed_len)

    Remove spaces from a ASCII hex string.
- bool isDigit (char c)

    Checks to see if a character is an ASCII representation of a digit ((c ge '0') and (c le '9'))
- bool isBlankSpace (char c)

    Checks to see if a character is blank space.
- bool isAlpha (char c)

    Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))
- bool isHexAlpha (char c)

    Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))
- bool isHex (char c)

    Returns true if this character is a valid hex character or if this is blankspace (The character can be included in a valid hexstring).
- bool isHexDigit (char c)

    Returns true if this character is a valid hex character.
- bool isBase64 (char c, const uint8_t *rules)

    Returns true if this character is a valid base 64 character or if this is space (A character can be included in a valid base 64 string).
- bool isBase64Digit (char c, const uint8_t *rules)

    Returns true if this character is a valid base 64 character.
- const uint8_t * **atcab_b64rules_default** (void)
- const uint8_t * **atcab_b64rules_mime** (void)
- const uint8_t * **atcab_b64rules_urlsafe** (void)
- ATCA_STATUS atcab_base64decode_ (const char *encoded, size_t encoded_size, uint8_t *data, size_t *data_size, const uint8_t *rules)

    Decode base64 string to data with ruleset option.
- ATCA_STATUS atcab_base64encode (const uint8_t *byte_array, size_t array_len, char *encoded, size_t *encoded_len)

    Encode data as base64 string.

- ATCA_STATUS atcab_base64encode_ (const uint8_t *data, size_t data_size, char *encoded, size_t *encoded_size, const uint8_t *rules)

  Encode data as base64 string with ruleset option.
- ATCA_STATUS atcab_base64decode (const char *encoded, size_t encoded_len, uint8_t *byte_array, size_t *array_len)

  Decode base64 string to data.
- ATCA_STATUS atcab_reversal (const uint8_t *bin, size_t bin_size, uint8_t *dest, size_t *dest_size)

  To reverse the input data.
- int **atcab_memset_s** (void *dest, size_t destsz, int ch, size_t count)

  Guaranteed to perform memory writes regardless of optimization level. Matches memset_s signature.
- size_t **atcab_pointer_delta** (const void *start, const void *end)

  Helper function to calculate the number of bytes between two pointers.
- char **lib_toupper** (char c)

  Converts a character to uppercase.
- char **lib_tolower** (char c)

  Converts a character to lowercase.
- #define **IS_ADD_SAFE_UINT16_T**(a, b) (((UINT16_MAX - (a)) >= (b)) ? true : false)
- #define **IS_ADD_SAFE_UINT32_T**(a, b) (((UINT32_MAX - (a)) >= (b)) ? true : false)
- #define **IS_ADD_SAFE_UINT64_T**(a, b) (((UINT64_MAX - (a)) >= (b)) ? true : false)
- #define **IS_ADD_SAFE_SIZE_T**(a, b) (((SIZE_MAX - (a)) >= (b)) ? true : false)
- #define **IS_MUL_SAFE_UINT16_T**(a, b) ((((a) <= UINT16_MAX / (b))) ? true : false)
- #define **IS_MUL_SAFE_UINT32_T**(a, b) ((((a) <= UINT32_MAX / (b))) ? true : false)
- #define **IS_MUL_SAFE_UINT64_T**(a, b) ((((a) <= UINT64_MAX / (b))) ? true : false)
- #define **IS_MUL_SAFE_SIZE_T**(a, b) ((((a) <= SIZE_MAX / (b))) ? true : false)

20.2.1 Detailed Description

These methods provide the most convenient, simple API to CryptoAuth chips.

20.2.2 Function Documentation

20.2.2.1 atcab_aes()

```
ATCA_STATUS atcab_aes (
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * aes_in,
            uint8_t * aes_out )
```

Compute the AES-128 encrypt, decrypt, or GFM calculation.

Parameters

in	*mode*	The mode for the AES command.
in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*aes_in*	Input data to the AES command (16 bytes).
out	*aes_out*	Output data from the AES command is returned here (16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.2 atcab_aes_decrypt()

```
ATCA_STATUS atcab_aes_decrypt (
            uint16_t key_id,
            uint8_t key_block,
            const uint8_t * ciphertext,
            uint8_t * plaintext )
```

Perform an AES-128 decrypt operation with a key in the device.

Parameters

in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*key_block*	Index of the 16-byte block to use within the key location for the actual key.
in	*ciphertext*	Input ciphertext to be decrypted (16 bytes).
out	*plaintext*	Output plaintext is returned here (16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.3 atcab_aes_decrypt_ext()

```
ATCA_STATUS atcab_aes_decrypt_ext (
            ATCADevice device,
            uint16_t key_id,
            uint8_t key_block,
            const uint8_t * ciphertext,
            uint8_t * plaintext )
```

Perform an AES-128 decrypt operation with a key in the device.

Parameters

in	*device*	Device context pointer
in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*key_block*	Index of the 16-byte block to use within the key location for the actual key.
in	*ciphertext*	Input ciphertext to be decrypted (16 bytes).
out	*plaintext*	Output plaintext is returned here (16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.4 atcab_aes_encrypt()

```
ATCA_STATUS atcab_aes_encrypt (
            uint16_t key_id,
            uint8_t key_block,
            const uint8_t * plaintext,
            uint8_t * ciphertext )
```

Perform an AES-128 encrypt operation with a key in the device.

Parameters

in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*key_block*	Index of the 16-byte block to use within the key location for the actual key.
in	*plaintext*	Input plaintext to be encrypted (16 bytes).
out	*ciphertext*	Output ciphertext is returned here (16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.5 atcab_aes_encrypt_ext()

```
ATCA_STATUS atcab_aes_encrypt_ext (
            ATCADevice device,
            uint16_t key_id,
            uint8_t key_block,
            const uint8_t * plaintext,
            uint8_t * ciphertext )
```

Perform an AES-128 encrypt operation with a key in the device.

Parameters

in	*device*	Device context pointer
in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*key_block*	Index of the 16-byte block to use within the key location for the actual key.
in	*plaintext*	Input plaintext to be encrypted (16 bytes).
out	*ciphertext*	Output ciphertext is returned here (16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.6 atcab_aes_gcm_aad_update()

```
ATCA_STATUS atcab_aes_gcm_aad_update (
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * aad,
            uint32_t aad_size )
```

Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.

This can be called multiple times. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function. When there is AAD to include, this should be called before atcab_aes_gcm_encrypt_update() or atcab_aes_gcm_decrypt_update().

Parameters

in	*ctx*	AES GCM context
in	*aad*	Additional authenticated data to be added
in	*aad_size*	Size of aad in bytes

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.7 atcab_aes_gcm_aad_update_ext()

```
ATCA_STATUS atcab_aes_gcm_aad_update_ext (
            ATCADevice device,
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * aad,
            uint32_t aad_size )
```

Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.

This can be called multiple times. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function. When there is AAD to include, this should be called before atcab_aes_gcm_encrypt_update() or atcab_aes_gcm_decrypt_update().

Parameters

in	*device*	Device context
in	*ctx*	AES GCM context
in	*aad*	Additional authenticated data to be added
in	*aad_size*	Size of aad in bytes

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.8 atcab_aes_gcm_decrypt_finish()

```
ATCA_STATUS atcab_aes_gcm_decrypt_finish (
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * tag,
            size_t tag_size,
            bool * is_verified )
```

Complete a GCM decrypt operation verifying the authentication tag.

Parameters

in	*ctx*	AES GCM context structure.
in	*tag*	Expected authentication tag.
in	*tag_size*	Size of tag in bytes (12 to 16 bytes).
out	*is_verified*	Returns whether or not the tag verified.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.9 atcab_aes_gcm_decrypt_finish_ext()

```
ATCA_STATUS atcab_aes_gcm_decrypt_finish_ext (
            ATCADevice device,
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * tag,
            size_t tag_size,
            bool * is_verified )
```

Complete a GCM decrypt operation verifying the authentication tag.

Parameters

in	*device*	Device context
in	*ctx*	AES GCM context structure.
in	*tag*	Expected authentication tag.
in	*tag_size*	Size of tag in bytes (12 to 16 bytes).
out	*is_verified*	Returns whether or not the tag verified.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.10 atcab_aes_gcm_decrypt_update()

```
ATCA_STATUS atcab_aes_gcm_decrypt_update (
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * ciphertext,
            uint32_t ciphertext_size,
            uint8_t * plaintext )
```

Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

Parameters

in	*ctx*	AES GCM context structure.
in	*ciphertext*	Ciphertext to be decrypted.
in	*ciphertext_size*	Size of ciphertext in bytes.
out	*plaintext*	Decrypted data is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.11 atcab_aes_gcm_decrypt_update_ext()

```
ATCA_STATUS atcab_aes_gcm_decrypt_update_ext (
            ATCADevice device,
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * ciphertext,
            uint32_t ciphertext_size,
            uint8_t * plaintext )
```

Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

Parameters

in	*device*	Device context
in	*ctx*	AES GCM context structure.
in	*ciphertext*	Ciphertext to be decrypted.
in	*ciphertext_size*	Size of ciphertext in bytes.
out	*plaintext*	Decrypted data is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.12 atcab_aes_gcm_encrypt_finish()

```
ATCA_STATUS atcab_aes_gcm_encrypt_finish (
            atca_aes_gcm_ctx_t * ctx,
            uint8_t * tag,
            size_t tag_size )
```

Complete a GCM encrypt operation returning the authentication tag.

Parameters

in	*ctx*	AES GCM context structure.
out	*tag*	Authentication tag is returned here.
in	*tag_size*	Tag size in bytes (12 to 16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.13 atcab_aes_gcm_encrypt_finish_ext()

```
ATCA_STATUS atcab_aes_gcm_encrypt_finish_ext (
            ATCADevice device,
            atca_aes_gcm_ctx_t * ctx,
            uint8_t * tag,
            size_t tag_size )
```

Complete a GCM encrypt operation returning the authentication tag.

Parameters

in	*device*	Device context
in	*ctx*	AES GCM context structure.
out	*tag*	Authentication tag is returned here.
in	*tag_size*	Tag size in bytes (12 to 16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.14 atcab_aes_gcm_encrypt_update()

```
ATCA_STATUS atcab_aes_gcm_encrypt_update (
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * plaintext,
            uint32_t plaintext_size,
            uint8_t * ciphertext )
```

Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

Parameters

in	*ctx*	AES GCM context structure.
in	*plaintext*	Plaintext to be encrypted (16 bytes).
in	*plaintext_size*	Size of plaintext in bytes.
out	*ciphertext*	Encrypted data is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.15 atcab_aes_gcm_encrypt_update_ext()

```
ATCA_STATUS atcab_aes_gcm_encrypt_update_ext (
            ATCADevice device,
            atca_aes_gcm_ctx_t * ctx,
            const uint8_t * plaintext,
            uint32_t plaintext_size,
            uint8_t * ciphertext )
```

Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

Parameters

in	*device*	Device context
in	*ctx*	AES GCM context structure.
in	*plaintext*	Plaintext to be encrypted (16 bytes).
in	*plaintext_size*	Size of plaintext in bytes.
out	*ciphertext*	Encrypted data is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.16 atcab_aes_gcm_init()

```
ATCA_STATUS atcab_aes_gcm_init (
            atca_aes_gcm_ctx_t * ctx,
            uint16_t key_id,
            uint8_t key_block,
            const uint8_t * iv,
            size_t iv_size )
```

Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.

Parameters

in	*ctx*	AES GCM context to be initialized.
in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*key_block*	Index of the 16-byte block to use within the key location for the actual key.
in	*iv*	Initialization vector.
in	*iv_size*	Size of IV in bytes. Standard is 12 bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.17 atcab_aes_gcm_init_ext()

```
ATCA_STATUS atcab_aes_gcm_init_ext (
            ATCADevice device,
            atca_aes_gcm_ctx_t * ctx,
            uint16_t key_id,
            uint8_t key_block,
            const uint8_t * iv,
            size_t iv_size )
```

Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.

Parameters

in	*device*	Device context
in	*ctx*	AES GCM context to be initialized.
in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*key_block*	Index of the 16-byte block to use within the key location for the actual key.
in	*iv*	Initialization vector.
in	*iv_size*	Size of IV in bytes. Standard is 12 bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.18 atcab_aes_gcm_init_rand()

```
ATCA_STATUS atcab_aes_gcm_init_rand (
            atca_aes_gcm_ctx_t * ctx,
            uint16_t key_id,
            uint8_t key_block,
            size_t rand_size,
            const uint8_t * free_field,
            size_t free_field_size,
            uint8_t * iv )
```

Initialize context for AES GCM operation with a IV composed of a random and optional fixed(free) field, which is common when starting an encrypt operation.

Parameters

in	*ctx*	AES CTR context to be initialized.
in	*key_id*	Key location. Can either be a slot number or ATCA_TEMPKEY_KEYID for TempKey.
in	*key_block*	Index of the 16-byte block to use within the key location for the actual key.
in	*rand_size*	Size of the random field in bytes. Minimum and recommended size is 12 bytes. Max is 32 bytes.
in	*free_field*	Fixed data to include in the IV after the random field. Can be NULL if not used.
in	*free_field_size*	Size of the free field in bytes.
out	*iv*	Initialization vector is returned here. Its size will be rand_size and free_field_size combined.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.19 atcab_aes_gfm()

```
ATCA_STATUS atcab_aes_gfm (
            const uint8_t * h,
            const uint8_t * input,
            uint8_t * output )
```

Perform a Galois Field Multiply (GFM) operation.

Parameters

in	*h*	First input value (16 bytes).
in	*input*	Second input value (16 bytes).
out	*output*	GFM result is returned here (16 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.20 atcab_base64decode()

```
ATCA_STATUS atcab_base64decode (
            const char * encoded,
            size_t encoded_len,
            uint8_t * byte_array,
            size_t * array_len )
```

Decode base64 string to data.

Parameters

in	*encoded*	Base64 string to be decoded.
in	*encoded_len*	Size of the base64 string in bytes.
out	*byte_array*	Decoded data will be returned here.
in,out	*array_len*	As input, the size of the byte_array buffer. As output, the length of the decoded data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.21 atcab_base64decode_()

```
ATCA_STATUS atcab_base64decode_ (
            const char * encoded,
            size_t encoded_size,
            uint8_t * data,
            size_t * data_size,
            const uint8_t * rules )
```

Decode base64 string to data with ruleset option.

Parameters

in	*encoded*	Base64 string to be decoded.
in	*encoded_size*	Size of the base64 string in bytes.
out	*data*	Decoded data will be returned here.
in,out	*data_size*	As input, the size of the byte_array buffer. As output, the length of the decoded data.
in	*rules*	base64 ruleset to use

20.2.2.22 atcab_base64encode()

```
ATCA_STATUS atcab_base64encode (
            const uint8_t * byte_array,
            size_t array_len,
```

```
            char * encoded,
            size_t * encoded_len )
```

Encode data as base64 string.

Parameters

in	*byte_array*	Data to be encode in base64.
in	*array_len*	Size of byte_array in bytes.
in	*encoded*	Base64 output is returned here.
in,out	*encoded_len*	As input, the size of the encoded buffer. As output, the length of the encoded base64 character string.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.23 atcab_base64encode_()

```
ATCA_STATUS atcab_base64encode_ (
            const uint8_t * data,
            size_t data_size,
            char * encoded,
            size_t * encoded_size,
            const uint8_t * rules )
```

Encode data as base64 string with ruleset option.

Parameters

in	*data*	The input byte array that will be converted to base 64 encoded characters
in	*data_size*	The length of the byte array
in	*encoded*	The output converted to base 64 encoded characters.
in,out	*encoded_size*	Input: The size of the encoded buffer, Output: The length of the encoded base 64 character string
in	*rules*	ruleset to use during encoding

20.2.2.24 atcab_bin2hex()

```
ATCA_STATUS atcab_bin2hex (
            const uint8_t * bin,
            size_t bin_size,
            char * hex,
            size_t * hex_size )
```

Convert a binary buffer to a hex string for easy reading.

Parameters

in	*bin*	Input data to convert.
in	*bin_size*	Size of data to convert.
out	*hex*	Buffer that receives hex string.
in,out	*hex_size*	As input, the size of the hex buffer. As output, the size of the output hex.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.25 atcab_bin2hex_()

```
ATCA_STATUS atcab_bin2hex_ (
            const uint8_t * bin,
            size_t bin_size,
            char * hex,
            size_t * hex_size,
            bool is_pretty,
            bool is_space,
            bool is_upper )
```

Function that converts a binary buffer to a hex string suitable for easy reading.

Parameters

in	*bin*	Input data to convert.
in	*bin_size*	Size of data to convert.
out	*hex*	Buffer that receives hex string.
in,out	*hex_size*	As input, the size of the hex buffer. As output, the size of the output hex.
in	*is_pretty*	Indicates whether new lines should be added for pretty printing.
in	*is_space*	Convert the output hex with space between it.
in	*is_upper*	Convert the output hex to upper case.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.26 atcab_challenge()

```
ATCA_STATUS atcab_challenge (
            const uint8_t * num_in )
```

Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.

Parameters

in	*num←_in*	Data to be loaded into TempKey (32 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.27 atcab_challenge_seed_update()

```
ATCA_STATUS atcab_challenge_seed_update (
            const uint8_t * num_in,
            uint8_t * rand_out )
```

Execute a Nonce command to generate a random challenge combining a host nonce (num_in) and a device random number.

Parameters

in	*num_in*	Host nonce to be combined with the device random number (20 bytes).
out	*rand_out*	Internally generated 32-byte random number that was used in the nonce/challenge calculation is returned here. Can be NULL if not needed.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.28 atcab_checkmac()

```
ATCA_STATUS atcab_checkmac (
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * challenge,
            const uint8_t * response,
            const uint8_t * other_data )
```

Compares a MAC response with input values.

Parameters

in	*mode*	Controls which fields within the device are used in the message
in	*key_id*	Key location in the CryptoAuth device to use for the MAC
in	*challenge*	Challenge data (32 bytes)
in	*response*	MAC response data (32 bytes)
in	*other_data*	OtherData parameter (13 bytes)

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.29 atcab_checkmac_with_response_mac()

```
ATCA_STATUS atcab_checkmac_with_response_mac (
            uint8_t mode,
            const uint8_t * challenge,
            const uint8_t * response,
            const uint8_t * other_data,
            uint8_t * mac )
```

Compares a MAC response with input values.SHA105 device can generate optional mac Output response mac mode only supports in SHA105 device.

Parameters

in	*mode*	Controls which fields within the device are used in the message
in	*challenge*	Challenge data (32 bytes)
in	*response*	MAC response data (32 bytes)
in	*other_data*	OtherData parameter (13 bytes)
out	*mac*	MAC response (32 bytes)

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.30 atcab_cmp_config_zone()

```
ATCA_STATUS atcab_cmp_config_zone (
            uint8_t * config_data,
            bool * same_config )
```

Compares a specified configuration zone with the configuration zone currently on the device.

This only compares the static portions of the configuration zone and skips those that are unique per device (first 16 bytes) and areas that can change after the configuration zone has been locked (e.g. LastKeyUse).

Parameters

in	*config_data*	Full configuration data to compare the device against.
out	*same_config*	Result is returned here. True if the static portions on the configuration zones are the same.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.31 atcab_counter()

```
ATCA_STATUS atcab_counter (
            uint8_t mode,
            uint16_t counter_id,
            uint32_t * counter_value )
```

Compute the Counter functions.

Parameters

in	*mode*	the mode used for the counter
in	*counter_id*	The counter to be used
out	*counter_value*	pointer to the counter value returned from device

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.32 atcab_counter_increment()

```
ATCA_STATUS atcab_counter_increment (
            uint16_t counter_id,
            uint32_t * counter_value )
```

Increments one of the device's monotonic counters.

Parameters

in	*counter_id*	Counter to be incremented
out	*counter_value*	New value of the counter is returned here. Can be NULL if not needed.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.33 atcab_counter_read()

```
ATCA_STATUS atcab_counter_read (
            uint16_t counter_id,
            uint32_t * counter_value )
```

Read one of the device's monotonic counters.

Parameters

in	*counter_id*	Counter to be read
out	*counter_value*	Counter value is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.34 atcab_derivekey()

```
ATCA_STATUS atcab_derivekey (
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * mac )
```

Executes the DeviceKey command for deriving a new key from a nonce (TempKey) and an existing key.

Parameters

in	*mode*	Bit 2 must match the value in TempKey.SourceFlag
in	*key_id*	Key slot to be written
in	*mac*	Optional 32 byte MAC used to validate operation. NULL if not required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.35 atcab_derivekey_ext()

```
ATCA_STATUS atcab_derivekey_ext (
            ATCADevice device,
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * mac )
```

Executes the DeviceKey command for deriving a new key from a nonce (TempKey) and an existing key.

Parameters

in	*device*	Device context
in	*mode*	Bit 2 must match the value in TempKey.SourceFlag
in	*key_id*	Key slot to be written
in	*mac*	Optional 32 byte MAC used to validate operation. NULL if not required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.36 atcab_ecdh()

```
ATCA_STATUS atcab_ecdh (
            uint16_t key_id,
            const uint8_t * public_key,
            uint8_t * pms )
```

ECDH command with a private key in a slot and the premaster secret is returned in the clear.

Parameters

in	*key_id*	Slot of private key for ECDH computation
in	*public_key*	Public key input to ECDH calculation. X and Y integers in big-endian format. 64 bytes for P256 key.
out	*pms*	Computed ECDH premaster secret is returned here. 32 bytes.

Returns

ATCA_SUCCESS on success

20.2.2.37 atcab_ecdh_base()

```
ATCA_STATUS atcab_ecdh_base (
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * public_key,
            uint8_t * pms,
            uint8_t * out_nonce )
```

Base function for generating premaster secret key using ECDH.

Parameters

in	*mode*	Mode to be used for ECDH computation
in	*key_id*	Slot of key for ECDH computation
in	*public_key*	Public key input to ECDH calculation. X and Y integers in big-endian format. 64 bytes for P256 key.
out	*pms*	Computed ECDH pre-master secret is returned here (32 bytes) if returned directly. Otherwise NULL.
out	*out_nonce*	Nonce used to encrypt pre-master secret. NULL if output encryption not used.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.38 atcab_ecdh_enc()

```
ATCA_STATUS atcab_ecdh_enc (
            uint16_t key_id,
            const uint8_t * public_key,
            uint8_t * pms,
            const uint8_t * read_key,
            uint16_t read_key_id,
            const uint8_t num_in[(20)] )
```

ECDH command with a private key in a slot and the premaster secret is read from the next slot.

This function only works for even numbered slots with the proper configuration.

Parameters

in	*key_id*	Slot of key for ECDH computation
in	*public_key*	Public key input to ECDH calculation. X and Y integers in big-endian format. 64 bytes for P256 key.
out	*pms*	Computed ECDH premaster secret is returned here (32 bytes).
in	*read_key*	Read key for the premaster secret slot (key_id|1).
in	*read_key_id*	Read key slot for read_key.
in	*num_in*	20 byte host nonce to inject into Nonce calculation

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.39 atcab_ecdh_ioenc()

```
ATCA_STATUS atcab_ecdh_ioenc (
            uint16_t key_id,
            const uint8_t * public_key,
            uint8_t * pms,
            const uint8_t * io_key )
```

ECDH command with a private key in a slot and the premaster secret is returned encrypted using the IO protection key.

Parameters

in	*key_id*	Slot of key for ECDH computation
in	*public_key*	Public key input to ECDH calculation. X and Y integers in big-endian format. 64 bytes for P256 key.
out	*pms*	Computed ECDH premaster secret is returned here (32 bytes).
in	*io_key*	IO protection key.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.40 atcab_ecdh_tempkey()

```
ATCA_STATUS atcab_ecdh_tempkey (
            const uint8_t * public_key,
            uint8_t * pms )
```

ECDH command with a private key in TempKey and the premaster secret is returned in the clear.

Parameters

in	*public_key*	Public key input to ECDH calculation. X and Y integers in big-endian format. 64 bytes for P256 key.
out	*pms*	Computed ECDH premaster secret is returned here (32 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.41 atcab_ecdh_tempkey_ioenc()

```
ATCA_STATUS atcab_ecdh_tempkey_ioenc (
            const uint8_t * public_key,
            uint8_t * pms,
            const uint8_t * io_key )
```

ECDH command with a private key in TempKey and the premaster secret is returned encrypted using the IO protection key.

Parameters

in	*public_key*	Public key input to ECDH calculation. X and Y integers in big-endian format. 64 bytes for P256 key.
out	*pms*	Computed ECDH premaster secret is returned here (32 bytes).
in	*io_key*	IO protection key.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.42 atcab_gendig()

```
ATCA_STATUS atcab_gendig (
            uint8_t zone,
            uint16_t key_id,
            const uint8_t * other_data,
            uint8_t other_data_size )
```

Issues a GenDig command, which performs a SHA256 hash on the source data indicated by zone with the contents of TempKey. See the CryptoAuth datasheet for your chip to see what the values of zone correspond to.

Parameters

in	*zone*	Designates the source of the data to hash with TempKey.
in	*key_id*	Indicates the key, OTP block, or message order for shared nonce mode.
in	*other_data*	Four bytes of data for SHA calculation when using a NoMac key, 32 bytes for "Shared Nonce" mode, otherwise ignored (can be NULL).
in	*other_data_size*	Size of other_data in bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.43 atcab_gendivkey()

```
ATCA_STATUS atcab_gendivkey (
            const uint8_t * other_data )
```

Issues a GenDivKey command to generate the equivalent diversified key as that programmed into the client side device.

Parameters

in	*device*	Device context pointer
in	*other_data*	Must match data used when generating the diversified key in the client device

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.44 atcab_genkey()

```
ATCA_STATUS atcab_genkey (
            uint16_t key_id,
            uint8_t * public_key )
```

Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.

Parameters

in	*key_id*	Slot number where an ECC private key is configured. Can also be ATCA_TEMPKEY_KEYID to generate a private key in TempKey.
out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve. Set to NULL if public key isn't required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.45 atcab_genkey_base()

```
ATCA_STATUS atcab_genkey_base (
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * other_data,
            uint8_t * public_key )
```

Issues GenKey command, which can generate a private key, compute a public key, nd/or compute a digest of a public key.

Parameters

in	*mode*	Mode determines what operations the GenKey command performs.
in	*key_id*	Slot to perform the GenKey command on.
in	*other_data*	OtherData for PubKey digest calculation. Can be set to NULL otherwise.
out	*public_key*	If the mode indicates a public key will be calculated, it will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve. Set to NULL if public key isn't required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.46 atcab_genkey_ext()

```
ATCA_STATUS atcab_genkey_ext (
            ATCADevice device,
            uint16_t key_id,
            uint8_t * public_key )
```

Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.

Parameters

in	*device*	Device context
in	*key_id*	Slot number where an ECC private key is configured. Can also be ATCA_TEMPKEY_KEYID to generate a private key in TempKey.
out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve. Set to NULL if public key isn't required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.47 atcab_get_device()

```
ATCADevice atcab_get_device (
            void  )
```

Get the global device object.

Returns

instance of global ATCADevice

20.2.2.48 atcab_get_device_address()

```
uint8_t atcab_get_device_address (
            ATCADevice device )
```

Get the current device address based on the configured device and interface.

Returns

the device address if applicable else 0xFF

20.2.2.49 atcab_get_device_type()

```
ATCADeviceType atcab_get_device_type (
            void  )
```

Get the current device type configured for the global ATCADevice.

Returns

Device type if basic api is initialized or ATCA_DEV_UNKNOWN.

20.2.2.50 atcab_get_device_type_ext()

```
ATCADeviceType atcab_get_device_type_ext (
            ATCADevice device )
```

Get the selected device type of rthe device context.

Parameters

in	*device*	Device context pointer

Returns

Device type if basic api is initialized or ATCA_DEV_UNKNOWN.

20.2.2.51 atcab_get_pubkey()

```
ATCA_STATUS atcab_get_pubkey (
            uint16_t key_id,
            uint8_t * public_key )
```

Uses GenKey command to calculate the public key from an existing private key in a slot.

Parameters

in	*key_id*	Slot number of the private key.
out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve. Set to NULL if public key isn't required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.52 atcab_get_pubkey_ext()

```
ATCA_STATUS atcab_get_pubkey_ext (
            ATCADevice device,
            uint16_t key_id,
            uint8_t * public_key )
```

Uses GenKey command to calculate the public key from an existing private key in a slot.

Parameters

in	*key_id*	Slot number of the private key.
out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve. Set to NULL if public key isn't required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.53 atcab_get_zone_size()

```
ATCA_STATUS atcab_get_zone_size (
            uint8_t zone,
            uint16_t slot,
            size_t * size )
```

Gets the size of the specified zone in bytes.

Parameters

in	*zone*	Zone to get size information from. Config(0), OTP(1), or Data(2) which requires a slot.
in	*slot*	If zone is Data(2), the slot to query for size.
out	*size*	Zone size is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.54 atcab_get_zone_size_ext()

```
ATCA_STATUS atcab_get_zone_size_ext (
            ATCADevice device,
            uint8_t zone,
            uint16_t slot,
            size_t * size )
```

Gets the size of the specified zone in bytes.

Parameters

in	*device*	Device context
in	*zone*	Zone to get size information from. Config(0), OTP(1), or Data(2) which requires a slot.
in	*slot*	If zone is Data(2), the slot to query for size.
out	*size*	Zone size is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.55 atcab_hex2bin()

```
ATCA_STATUS atcab_hex2bin (
            const char * ascii_hex,
```

```
            size_t ascii_hex_len,
            uint8_t * binary,
            size_t * bin_len )
```

Function that converts a hex string to binary buffer.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ascii_hex*	Input buffer to convert
in	*ascii_hex_len*	Length of buffer to convert
out	*binary*	Buffer that receives binary
in,out	*bin_len*	As input, the size of the bin buffer. As output, the size of the bin data.

20.2.2.56 atcab_hmac()

```
ATCA_STATUS atcab_hmac (
            uint8_t mode,
            uint16_t key_id,
            uint8_t * digest )
```

Issues a HMAC command, which computes an HMAC/SHA-256 digest of a key stored in the device, a challenge, and other information on the device.

Parameters

in	*mode*	Controls which fields within the device are used in the message.
in	*key← _id*	Which key is to be used to generate the response. Bits 0:3 only are used to select a slot but all 16 bits are used in the HMAC message.
out	*digest*	HMAC digest is returned in this buffer (32 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.57 atcab_hw_sha2_256()

```
ATCA_STATUS atcab_hw_sha2_256 (
            const uint8_t * data,
            size_t data_size,
            uint8_t * digest )
```

Use the SHA command to compute a SHA-256 digest.

Parameters

in	*data*	Message data to be hashed.
in	*data_size*	Size of data in bytes.
out	*digest*	Digest is returned here (32 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.58 atcab_hw_sha2_256_finish()

```
ATCA_STATUS atcab_hw_sha2_256_finish (
            atca_sha256_ctx_t * ctx,
            uint8_t * digest )
```

Finish SHA-256 digest for a SHA context for performing a hardware SHA-256 operation on a device.

Parameters

in	*ctx*	SHA256 context
out	*digest*	SHA256 digest is returned here (32 bytes)

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.59 atcab_hw_sha2_256_init()

```
ATCA_STATUS atcab_hw_sha2_256_init (
            atca_sha256_ctx_t * ctx )
```

Initialize a SHA context for performing a hardware SHA-256 operation on a device. Note that only one SHA operation can be run at a time.

Parameters

in	*ctx*	SHA256 context

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.60 atcab_hw_sha2_256_update()

```
ATCA_STATUS atcab_hw_sha2_256_update (
            atca_sha256_ctx_t * ctx,
            const uint8_t * data,
            size_t data_size )
```

Add message data to a SHA context for performing a hardware SHA-256 operation on a device.

Parameters

in	*ctx*	SHA256 context
in	*data*	Message data to be added to hash.
in	*data_size*	Size of data in bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.61 atcab_idle()

```
ATCA_STATUS atcab_idle (
            void )
```

idle the CryptoAuth device

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.62 atcab_info()

```
ATCA_STATUS atcab_info (
            uint8_t * revision )
```

Use the Info command to get the device revision (DevRev).

Parameters

out	*revision*	Device revision is returned here (4 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.63 atcab_info_base()

```
ATCA_STATUS atcab_info_base (
            uint8_t mode,
            uint16_t param2,
            uint8_t * out_data )
```

Issues an Info command, which return internal device information and can control GPIO and the persistent latch.

Parameters

in	*mode*	Selects which mode to be used for info command.
in	*param2*	Selects the particular fields for the mode.
out	*out_data*	Response from info command (4 bytes). Can be set to NULL if not required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.64 atcab_info_chip_status()

```
ATCA_STATUS atcab_info_chip_status (
            uint8_t * chip_status )
```

Use the Info command to get the chip status.

Parameters

out	*chip_status*	returns chip status here

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.65 atcab_info_ext()

```
ATCA_STATUS atcab_info_ext (
            ATCADevice device,
            uint8_t * revision )
```

Use the Info command to get the device revision (DevRev).

Parameters

in	*device*	Device context
out	*revision*	Device revision is returned here (4 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.66 atcab_info_get_latch()

```
ATCA_STATUS atcab_info_get_latch (
            bool * state )
```

Use the Info command to get the persistent latch current state for an ATECC608 device.

Parameters

out	*state*	The state is returned here. Set (true) or Cler (false).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.67 atcab_info_lock_status()

```
ATCA_STATUS atcab_info_lock_status (
            uint16_t param2,
            uint8_t * is_locked )
```

Use the Info command to get the lock status.

Parameters

in	*param2*	selects the zone and slot
out	*is_locked*	returns lock status here

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.68 atcab_info_set_latch()

```
ATCA_STATUS atcab_info_set_latch (
            bool state )
```

Use the Info command to set the persistent latch state for an ATECC608 device.

Parameters

out	*state*	Persistent latch state. Set (true) or clear (false).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.69 atcab_init()

```
ATCA_STATUS atcab_init (
            ATCAIfaceCfg * cfg )
```

Creates a global ATCADevice object used by Basic API.

Parameters

in	*cfg*	Logical interface configuration. Some predefined configurations can be found in atca_cfgs.h

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.70 atcab_init_device()

```
ATCA_STATUS atcab_init_device (
            ATCADevice ca_device )
```

Initialize the global ATCADevice object to point to one of your choosing for use with all the atcab_ basic API.

Deprecated This function is not recommended for use generally. Use of _ext is recommended instead. You can use atcab_init_ext to obtain an initialized instance and associated it with the global structure - but this shouldn't be a required process except in extremely unusual circumstances.

Parameters

in	*ca_device*	ATCADevice instance to use as the global Basic API crypto device instance

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.71 atcab_init_ext()

```
ATCA_STATUS atcab_init_ext (
            ATCADevice * device,
            ATCAIfaceCfg * cfg )
```

Creates and initializes a ATCADevice context.

Parameters

out	*device*	Pointer to the device context pointer
in	*cfg*	Logical interface configuration. Some predefined configurations can be found in atca_cfgs.h

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.72 atcab_is_ca2_device()

```
bool atcab_is_ca2_device (
            ATCADeviceType dev_type )
```

Check whether the device is cryptoauth device.

Returns

True if device is cryptoauth device or False.

20.2.2.73 atcab_is_ca_device()

```
bool atcab_is_ca_device (
            ATCADeviceType dev_type )
```

Check whether the device is cryptoauth device.

Returns

True if device is cryptoauth device or False.

20.2.2.74 atcab_is_config_locked()

```
ATCA_STATUS atcab_is_config_locked (
            bool * is_locked )
```

This function check whether configuration zone is locked or not.

Parameters

out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.75 atcab_is_config_locked_ext()

```
ATCA_STATUS atcab_is_config_locked_ext (
            ATCADevice device,
            bool * is_locked )
```

This function check whether configuration zone is locked or not.

Parameters

in	*device*	Device context
out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.76 atcab_is_data_locked()

```
ATCA_STATUS atcab_is_data_locked (
            bool * is_locked )
```

This function check whether data/setup zone is locked or not.

Parameters

out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.77 atcab_is_data_locked_ext()

```
ATCA_STATUS atcab_is_data_locked_ext (
            ATCADevice device,
            bool * is_locked )
```

This function check whether data/setup zone is locked or not.

Parameters

in	*device*	Device context
out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.78 atcab_is_locked()

```
ATCA_STATUS atcab_is_locked (
            uint8_t zone,
            bool * is_locked )
```

Executes Read command, which reads the configuration zone to see if the specified zone is locked.

Parameters

in	*zone*	The zone to query for locked (use LOCK_ZONE_CONFIG or LOCK_ZONE_DATA).
out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.79 atcab_is_private_ext()

```
ATCA_STATUS atcab_is_private_ext (
            ATCADevice device,
            uint16_t slot,
            bool * is_private )
```

Check to see if the key is a private key or not.

This function will issue the Read command as many times as is required to read the requested data.

Parameters

in	*slot*	Slot number to read from if zone is ATCA_ZONE_DATA(2). Ignored for all other zones.
out	*is_private*	Returned valud if successful. True if key is private.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.80 atcab_is_slot_locked()

```
ATCA_STATUS atcab_is_slot_locked (
            uint16_t slot,
            bool * is_locked )
```

This function check whether slot/handle is locked or not.

Parameters

in	*slot*	Slot to query for locked
out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.81 atcab_is_slot_locked_ext()

```
ATCA_STATUS atcab_is_slot_locked_ext (
            ATCADevice device,
            uint16_t slot,
            bool * is_locked )
```

This function check whether slot/handle is locked or not.

Parameters

in	*device*	Device context
in	*slot*	Slot to query for locked
out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.82 atcab_is_ta_device()

```
bool atcab_is_ta_device (
            ATCADeviceType dev_type )
```

Check whether the device is Trust Anchor device.

Returns

True if device is Trust Anchor device or False.

20.2.2.83 atcab_kdf()

```
ATCA_STATUS atcab_kdf (
            uint8_t mode,
            uint16_t key_id,
            const uint32_t details,
            const uint8_t * message,
            uint8_t * out_data,
            uint8_t * out_nonce )
```

Executes the KDF command, which derives a new key in PRF, AES, or HKDF modes.

Generally this function combines a source key with an input string and creates a result key/digest/array.

Parameters

in	*mode*	Mode determines KDF algorithm (PRF,AES,HKDF), source key location, and target key locations.
in	*key_id*	Source and target key slots if locations are in the EEPROM. Source key slot is the LSB and target key slot is the MSB.
in	*details*	Further information about the computation, depending on the algorithm (4 bytes).
in	*message*	Input value from system (up to 128 bytes). Actual size of message is 16 bytes for AES algorithm or is encoded in the MSB of the details parameter for other algorithms.
out	*out_data*	Output of the KDF function is returned here. If the result remains in the device, this can be NULL.
out	*out_nonce*	If the output is encrypted, a 32 byte random nonce generated by the device is returned here. If output encryption is not used, this can be NULL.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.84 atcab_lock()

```
ATCA_STATUS atcab_lock (
            uint8_t mode,
            uint16_t summary_crc )
```

The Lock command prevents future modifications of the Configuration and/or Data and OTP zones. If the device is so configured, then this command can be used to lock individual data slots. This command fails if the designated area is already locked.

Parameters

in	*mode*	Zone, and/or slot, and summary check (bit 7).
in	*summary_crc*	CRC of the config or data zones. Ignored for slot locks or when mode bit 7 is set.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.85 atcab_lock_config_zone()

```
ATCA_STATUS atcab_lock_config_zone (
            void )
```

Unconditionally (no CRC required) lock the config zone.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.86 atcab_lock_config_zone_crc()

```
ATCA_STATUS atcab_lock_config_zone_crc (
            uint16_t summary_crc )
```

Lock the config zone with summary CRC.

The CRC is calculated over the entire config zone contents. 48 bytes for TA100, 88 bytes for ATSHA devices, 128 bytes for ATECC devices. Lock will fail if the provided CRC doesn't match the internally calculated one.

Parameters

in	*summary_crc*	Expected CRC over the config zone.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.87 atcab_lock_config_zone_ext()

```
ATCA_STATUS atcab_lock_config_zone_ext (
            ATCADevice device )
```

Unconditionally (no CRC required) lock the config zone.

Parameters

in	*device*	Device context

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.88 atcab_lock_data_slot()

```
ATCA_STATUS atcab_lock_data_slot (
            uint16_t slot )
```

Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).

Parameters

in	*slot*	Slot to be locked in data zone.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.89 atcab_lock_data_slot_ext()

```
ATCA_STATUS atcab_lock_data_slot_ext (
            ATCADevice device,
            uint16_t slot )
```

Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).

Parameters

in	*device*	Device context
in	*slot*	Slot to be locked in data zone.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.90 atcab_lock_data_zone()

```
ATCA_STATUS atcab_lock_data_zone (
            void )
```

Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.

ConfigZone must be locked and DataZone must be unlocked for the zone to be successfully locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.91 atcab_lock_data_zone_crc()

```
ATCA_STATUS atcab_lock_data_zone_crc (
            uint16_t summary_crc )
```

Lock the data zone (slots and OTP) with summary CRC.

The CRC is calculated over the concatenated contents of all the slots and OTP at the end. Private keys (Key↩Config.Private=1) are skipped. Lock will fail if the provided CRC doesn't match the internally calculated one.

Parameters

in	*summary_crc*	Expected CRC over the data zone.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.92 atcab_lock_data_zone_ext()

```
ATCA_STATUS atcab_lock_data_zone_ext (
            ATCADevice device )
```

Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.

Parameters

in	*device*	Device context ConfigZone must be locked and DataZone must be unlocked for the zone to be successfully locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.93 atcab_mac()

```
ATCA_STATUS atcab_mac (
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * challenge,
            uint8_t * digest )
```

Executes MAC command, which computes a SHA-256 digest of a key stored in the device, a challenge, and other information on the device.

Parameters

in	*mode*	Controls which fields within the device are used in the message
in	*key_id*	Key in the CryptoAuth device to use for the MAC
in	*challenge*	Challenge message (32 bytes). May be NULL if mode indicates a challenge isn't required.
out	*digest*	MAC response is returned here (32 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.94 atcab_nonce()

```
ATCA_STATUS atcab_nonce (
            const uint8_t * num_in )
```

Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.

Parameters

in	*num←↩ _in*	Data to be loaded into TempKey (32 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.95 atcab_nonce_base()

```
ATCA_STATUS atcab_nonce_base (
            uint8_t mode,
            uint16_t zero,
            const uint8_t * num_in,
            uint8_t * rand_out )
```

Executes Nonce command, which loads a random or fixed nonce/data into the device for use by subsequent commands.

Parameters

in	*mode*	Controls the mechanism of the internal RNG or fixed write.
in	*zero*	Param2, normally 0, but can be used to indicate a nonce calculation mode (bit 15).
in	*num_in*	Input value to either be included in the nonce calculation in random modes (20 bytes) or to be written directly (32 bytes or 64 bytes(ATECC608)) in pass-through mode.
out	*rand_out*	If using a random mode, the internally generated 32-byte random number that was used in the nonce calculation is returned here. Can be NULL if not needed.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.96 atcab_nonce_load()

```
ATCA_STATUS atcab_nonce_load (
            uint8_t target,
            const uint8_t * num_in,
            uint16_t num_in_size )
```

Execute a Nonce command in pass-through mode to load one of the device's internal buffers with a fixed value.

For the ATECC608, available targets are TempKey (32 or 64 bytes), Message Digest Buffer (32 or 64 bytes), or the Alternate Key Buffer (32 bytes). For all other devices, only TempKey (32 bytes) is available.

Parameters

in	*target*	Target device buffer to load. Can be NONCE_MODE_TARGET_TEMPKEY, NONCE_MODE_TARGET_MSGDIGBUF, or NONCE_MODE_TARGET_ALTKEYBUF.
in	*num_in*	Data to load into the buffer.
in	*num_in_size*	Size of num_in in bytes. Can be 32 or 64 bytes depending on device and target.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.97 atcab_nonce_rand()

```
ATCA_STATUS atcab_nonce_rand (
            const uint8_t * num_in,
            uint8_t * rand_out )
```

Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.

Parameters

in	*num_in*	Host nonce to be combined with the device random number (20 bytes).
out	*rand_out*	Internally generated 32-byte random number that was used in the nonce/challenge calculation is returned here. Can be NULL if not needed.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.98 atcab_nonce_rand_ext()

```
ATCA_STATUS atcab_nonce_rand_ext (
            ATCADevice device,
            const uint8_t * num_in,
            uint8_t * rand_out )
```

Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.

Parameters

in	*device*	Device context
in	*num_in*	Host nonce to be combined with the device random number (20 bytes).
out	*rand_out*	Internally generated 32-byte random number that was used in the nonce/challenge calculation is returned here. Can be NULL if not needed.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.99 atcab_priv_write()

```
ATCA_STATUS atcab_priv_write (
            uint16_t key_id,
            const uint8_t priv_key[36],
            uint16_t write_key_id,
            const uint8_t write_key[32],
            const uint8_t num_in[(20)] )
```

Executes PrivWrite command, to write externally generated ECC private keys into the device.

Parameters

in	*key_id*	Slot to write the external private key into.
in	*priv_key*	External private key (36 bytes) to be written. The first 4 bytes should be zero for P256 curve.
in	*write_key_id*	Write key slot. Ignored if write_key is NULL.
in	*write_key*	Write key (32 bytes). If NULL, perform an unencrypted PrivWrite, which is only available when the data zone is unlocked.
in	*num_in*	20 byte host nonce to inject into Nonce calculation

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.100 atcab_random()

```
ATCA_STATUS atcab_random (
            uint8_t * rand_out )
```

Executes Random command, which generates a 32 byte random number from the device.

Parameters

out	*rand_out*	32 bytes of random data is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.101 atcab_random_ext()

```
ATCA_STATUS atcab_random_ext (
            ATCADevice device,
            uint8_t * rand_out )
```

Executes Random command, which generates a 32 byte random number from the device.

Parameters

in	*device*	Device context pointer
out	*rand_out*	32 bytes of random data is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.102 atcab_read_bytes_zone()

```
ATCA_STATUS atcab_read_bytes_zone (
            uint8_t zone,
            uint16_t slot,
            size_t offset,
            uint8_t * data,
            size_t length )
```

Used to read an arbitrary number of bytes from any zone configured for clear reads.

This function will issue the Read command as many times as is required to read the requested data.

Parameters

in	*zone*	Zone to read data from. Option are ATCA_ZONE_CONFIG(0), ATCA_ZONE_OTP(1), or ATCA_ZONE_DATA(2).
in	*slot*	Slot number to read from if zone is ATCA_ZONE_DATA(2). Ignored for all other zones.
in	*offset*	Byte offset within the zone to read from.
out	*data*	Read data is returned here.
in	*length*	Number of bytes to read starting from the offset.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.103 atcab_read_config_zone()

```
ATCA_STATUS atcab_read_config_zone (
            uint8_t * config_data )
```

Executes Read command to read the complete device configuration zone.

Parameters

out	*config_data*	Configuration zone data is returned here. 88 bytes for ATSHA devices, 128 bytes for ATECC devices and 48 bytes for Trust Anchor devices.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.104 atcab_read_config_zone_ext()

```
ATCA_STATUS atcab_read_config_zone_ext (
            ATCADevice device,
            uint8_t * config_data )
```

Executes Read command to read the complete device configuration zone.

Parameters

in	*device*	device context
out	*config_data*	Configuration zone data is returned here. 88 bytes for ATSHA devices, 128 bytes for ATECC devices and 48 bytes for Trust Anchor devices.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.105 atcab_read_enc()

```
ATCA_STATUS atcab_read_enc (
            uint16_t key_id,
            uint8_t block,
            uint8_t * data,
            const uint8_t * enc_key,
            const uint16_t enc_key_id,
            const uint8_t num_in[(20)] )
```

Executes Read command on a slot configured for encrypted reads and decrypts the data to return it as plaintext.

Data zone must be locked for this command to succeed. Can only read 32 byte blocks.

Parameters

in	*key_id*	The slot ID to read from.

Parameters

in	*block*	Index of the 32 byte block within the slot to read.
out	*data*	Decrypted (plaintext) data from the read is returned here (32 bytes).
in	*enc_key*	32 byte ReadKey for the slot being read.
in	*enc_key←↩ _id*	KeyID of the ReadKey being used.
in	*num_in*	20 byte host nonce to inject into Nonce calculation

returns ATCA_SUCCESS on success, otherwise an error code.

20.2.2.106 atcab_read_pubkey()

```
ATCA_STATUS atcab_read_pubkey (
            uint16_t slot,
            uint8_t * public_key )
```

Executes Read command to read an ECC P256 public key from a slot configured for clear reads.

This function assumes the public key is stored using the ECC public key format specified in the datasheet.

Parameters

in	*slot*	Slot number to read from. Only slots 8 to 15 are large enough for a public key.
out	*public_key*	Public key is returned here (64 bytes). Format will be the 32 byte X and Y big-endian integers concatenated.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.107 atcab_read_pubkey_ext()

```
ATCA_STATUS atcab_read_pubkey_ext (
            ATCADevice device,
            uint16_t slot,
            uint8_t * public_key )
```

Executes Read command to read an ECC P256 public key from a slot configured for clear reads.

This function assumes the public key is stored using the ECC public key format specified in the datasheet.

Parameters

in	*device*	Device context pointer
in	*slot*	Slot number to read from. Only slots 8 to 15 are large enough for a public key.
out	*public_key*	Public key is returned here (64 bytes). Format will be the 32 byte X and Y big-endian integers concatenated.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.108 atcab_read_serial_number()

```
ATCA_STATUS atcab_read_serial_number (
            uint8_t * serial_number )
```

This function returns serial number of the device.

Parameters

out	*serial_number*	9 byte serial number is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.109 atcab_read_serial_number_ext()

```
ATCA_STATUS atcab_read_serial_number_ext (
            ATCADevice device,
            uint8_t * serial_number )
```

This function returns serial number of the device.

Parameters

in	*device*	Device context
out	*serial_number*	9 byte serial number is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.110 atcab_read_sig()

```
ATCA_STATUS atcab_read_sig (
            uint16_t slot,
            uint8_t * sig )
```

Executes Read command to read a 64 byte ECDSA P256 signature from a slot configured for clear reads.

Parameters

in	*slot*	Slot number to read from. Only slots 8 to 15 are large enough for a signature.
out	*sig*	Signature will be returned here (64 bytes). Format will be the 32 byte R and S big-endian integers concatenated.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.111 atcab_read_zone()

```
ATCA_STATUS atcab_read_zone (
            uint8_t zone,
            uint16_t slot,
            uint8_t block,
            uint8_t offset,
            uint8_t * data,
            uint8_t len )
```

Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.

When reading a slot or OTP, data zone must be locked and the slot configuration must not be secret for a slot to be successfully read.

Parameters

in	*zone*	Zone to be read from device. Options are ATCA_ZONE_CONFIG, ATCA_ZONE_OTP, or ATCA_ZONE_DATA.
in	*slot*	Slot number for data zone and ignored for other zones.
in	*block*	32 byte block index within the zone.
in	*offset*	4 byte work index within the block. Ignored for 32 byte reads.
out	*data*	Read data is returned here.
in	*len*	Length of the data to be read. Must be either 4 or 32.

returns ATCA_SUCCESS on success, otherwise an error code.

20.2.2.112 atcab_read_zone_ext()

```
ATCA_STATUS atcab_read_zone_ext (
            ATCADevice device,
            uint8_t zone,
            uint16_t slot,
            uint8_t block,
            uint8_t offset,
            uint8_t * data,
            uint8_t len )
```

Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.

When reading a slot or OTP, data zone must be locked and the slot configuration must not be secret for a slot to be successfully read.

Parameters

in	*device*	Device context
in	*zone*	Zone to be read from device. Options are ATCA_ZONE_CONFIG, ATCA_ZONE_OTP, or ATCA_ZONE_DATA.
in	*slot*	Slot number for data zone and ignored for other zones.
in	*block*	32 byte block index within the zone.
in	*offset*	4 byte work index within the block. Ignored for 32 byte reads.
out	*data*	Read data is returned here.
in	*len*	Length of the data to be read. Must be either 4 or 32.

returns ATCA_SUCCESS on success, otherwise an error code.

20.2.2.113 atcab_release()

```
ATCA_STATUS atcab_release (
            void )
```

release (free) the global ATCADevice instance. This must be called in order to release or free up the interface.

Returns

Returns ATCA_SUCCESS .

20.2.2.114 atcab_release_ext()

```
ATCA_STATUS atcab_release_ext (
            ATCADevice * device )
```

release (free) the an ATCADevice instance.

Parameters

in	*device*	Pointer to the device context pointer

Returns

Returns ATCA_SUCCESS .

20.2.2.115 atcab_reversal()

```
ATCA_STATUS atcab_reversal (
            const uint8_t * bin,
            size_t bin_size,
            uint8_t * dest,
            size_t * dest_size )
```

To reverse the input data.

Parameters

in	*bin*	Input data to reverse.
in	*bin_size*	Size of data to reverse.
out	*dest*	Buffer to store reversed binary data.
in	*dest_size*	The size of the dest buffer.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.116 atcab_secureboot()

```
ATCA_STATUS atcab_secureboot (
            uint8_t mode,
            uint16_t param2,
            const uint8_t * digest,
            const uint8_t * signature,
            uint8_t * mac )
```

Executes Secure Boot command, which provides support for secure boot of an external MCU or MPU.

Parameters

in	*mode*	Mode determines what operations the SecureBoot command performs.
in	*param2*	Not used, must be 0.
in	*digest*	Digest of the code to be verified (32 bytes).
in	*signature*	Signature of the code to be verified (64 bytes). Can be NULL when using the FullStore mode.
out	*mac*	Validating MAC will be returned here (32 bytes). Can be NULL if not required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.117 atcab_secureboot_mac()

```
ATCA_STATUS atcab_secureboot_mac (
            uint8_t mode,
            const uint8_t * digest,
            const uint8_t * signature,
            const uint8_t * num_in,
            const uint8_t * io_key,
            bool * is_verified )
```

Executes Secure Boot command with encrypted digest and validated MAC response using the IO protection key.

Parameters

in	*mode*	Mode determines what operations the SecureBoot command performs.
in	*digest*	Digest of the code to be verified (32 bytes). This is the plaintext digest (not encrypted).
in	*signature*	Signature of the code to be verified (64 bytes). Can be NULL when using the FullStore mode.
in	*num_in*	Host nonce (20 bytes).
in	*io_key*	IO protection key (32 bytes).
out	*is_verified*	Verify result is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.118 atcab_selftest()

```
ATCA_STATUS atcab_selftest (
            uint8_t mode,
            uint16_t param2,
            uint8_t * result )
```

Executes the SelfTest command, which performs a test of one or more of the cryptographic engines within the ATECC608 chip.

Parameters

in	*mode*	Functions to test. Can be a bit field combining any of the following: SELFTEST_MODE_RNG, SELFTEST_MODE_ECDSA_VERIFY, SELFTEST_MODE_ECDSA_SIGN, SELFTEST_MODE_ECDH, SELFTEST_MODE_AES, SELFTEST_MODE_SHA, SELFTEST_MODE_ALL.
in	*param2*	Currently unused, should be 0.
out	*result*	Results are returned here as a bit field.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.119 atcab_sha()

```
ATCA_STATUS atcab_sha (
            uint16_t length,
            const uint8_t * message,
            uint8_t * digest )
```

Use the SHA command to compute a SHA-256 digest.

Parameters

in	*length*	Size of message parameter in bytes.
in	*message*	Message data to be hashed.
out	*digest*	Digest is returned here (32 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.120 atcab_sha_base()

```
ATCA_STATUS atcab_sha_base (
            uint8_t mode,
            uint16_t length,
            const uint8_t * data_in,
            uint8_t * data_out,
            uint16_t * data_out_size )
```

Executes SHA command, which computes a SHA-256 or HMAC/SHA-256 digest for general purpose use by the host system.

Only the Start(0) and Compute(1) modes are available for ATSHA devices.

Parameters

in	*mode*	SHA command mode Start(0), Update/Compute(1), End(2), Public(3), HMACstart(4), HMACend(5), Read_Context(6), or Write_Context(7). Also message digest target location for the ATECC608.
in	*length*	Number of bytes in the message parameter or KeySlot for the HMAC key if Mode is HMACstart(4) or Public(3).
in	*data_in*	Message bytes to be hashed or Write_Context if restoring a context on the ATECC608. Can be NULL if not required by the mode.
out	*data_out*	Data returned by the command (digest or context).
in,out	*data_out_size*	As input, the size of the data_out buffer. As output, the number of bytes returned in data_out.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.121 atcab_sha_end()

```
ATCA_STATUS atcab_sha_end (
            uint8_t * digest,
            uint16_t length,
            const uint8_t * message )
```

Executes SHA command to complete SHA-256 or HMAC/SHA-256 operation.

Parameters

out	*digest*	Digest from SHA-256 or HMAC/SHA-256 will be returned here (32 bytes).
in	*length*	Length of any remaining data to include in hash. Max 64 bytes.
in	*message*	Remaining data to include in hash. NULL if length is 0.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.122 atcab_sha_hmac()

```
ATCA_STATUS atcab_sha_hmac (
            const uint8_t * data,
            size_t data_size,
            uint16_t key_slot,
            uint8_t * digest,
            uint8_t target )
```

Use the SHA command to compute an HMAC/SHA-256 operation.

Parameters

in	*data*	Message data to be hashed.
in	*data_size*	Size of data in bytes.
in	*key_slot*	Slot key id to use for the HMAC calculation
out	*digest*	Digest is returned here (32 bytes).
in	*target*	Where to save the digest internal to the device. For ATECC608, can be SHA_MODE_TARGET_TEMPKEY, SHA_MODE_TARGET_MSGDIGBUF, or SHA_MODE_TARGET_OUT_ONLY. For all other devices, SHA_MODE_TARGET_TEMPKEY is the only option.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.123 atcab_sha_hmac_ext()

```
ATCA_STATUS atcab_sha_hmac_ext (
            ATCADevice device,
            const uint8_t * data,
            size_t data_size,
            uint16_t key_slot,
            uint8_t * digest,
            uint8_t target )
```

Use the SHA command to compute an HMAC/SHA-256 operation.

Parameters

in	*device*	Device context pointer
in	*data*	Message data to be hashed.
in	*data_size*	Size of data in bytes.
in	*key_slot*	Slot key id to use for the HMAC calculation
out	*digest*	Digest is returned here (32 bytes).
in	*target*	Where to save the digest internal to the device. For ATECC608, can be SHA_MODE_TARGET_TEMPKEY, SHA_MODE_TARGET_MSGDIGBUF, or SHA_MODE_TARGET_OUT_ONLY. For all other devices, SHA_MODE_TARGET_TEMPKEY is the only option.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.124 atcab_sha_hmac_finish()

```
ATCA_STATUS atcab_sha_hmac_finish (
            atca_hmac_sha256_ctx_t * ctx,
            uint8_t * digest,
            uint8_t target )
```

Executes SHA command to complete a HMAC/SHA-256 operation.

Parameters

in	*ctx*	HMAC/SHA-256 context
out	*digest*	HMAC/SHA-256 result is returned here (32 bytes).
in	*target*	Where to save the digest internal to the device. For ATECC608, can be SHA_MODE_TARGET_TEMPKEY, SHA_MODE_TARGET_MSGDIGBUF, or SHA_MODE_TARGET_OUT_ONLY. For all other devices, SHA_MODE_TARGET_TEMPKEY is the only option.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.125 atcab_sha_hmac_init()

```
ATCA_STATUS atcab_sha_hmac_init (
            atca_hmac_sha256_ctx_t * ctx,
            uint16_t key_slot )
```

Executes SHA command to start an HMAC/SHA-256 operation.

Parameters

in	*ctx*	HMAC/SHA-256 context
in	*key_slot*	Slot key id to use for the HMAC calculation

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.126 atcab_sha_hmac_update()

```
ATCA_STATUS atcab_sha_hmac_update (
            atca_hmac_sha256_ctx_t * ctx,
            const uint8_t * data,
            size_t data_size )
```

Executes SHA command to add an arbitrary amount of message data to a HMAC/SHA-256 operation.

Parameters

in	*ctx*	HMAC/SHA-256 context
in	*data*	Message data to add
in	*data_size*	Size of message data in bytes

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.127 atcab_sha_read_context()

```
ATCA_STATUS atcab_sha_read_context (
            uint8_t * context,
            uint16_t * context_size )
```

Executes SHA command to read the SHA-256 context back. Only for ATECC608 with SHA-256 contexts. HMAC not supported.

Parameters

out	*context*	Context data is returned here.
in,out	*context_size*	As input, the size of the context buffer in bytes. As output, the size of the returned context data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.128 atcab_sha_start()

```
ATCA_STATUS atcab_sha_start (
            void )
```

Executes SHA command to initialize SHA-256 calculation engine.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.129 atcab_sha_update()

```
ATCA_STATUS atcab_sha_update (
            const uint8_t * message )
```

Executes SHA command to add 64 bytes of message data to the current context.

Parameters

in	*message*	64 bytes of message data to add to add to operation.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.130 atcab_sha_write_context()

```
ATCA_STATUS atcab_sha_write_context (
            const uint8_t * context,
            uint16_t context_size )
```

Executes SHA command to write (restore) a SHA-256 context into the the device. Only supported for ATECC608 with SHA-256 contexts.

Parameters

in	*context*	Context data to be restored.
in	*context_size*	Size of the context data in bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.131 atcab_sign()

```
ATCA_STATUS atcab_sign (
            uint16_t key_id,
            const uint8_t * msg,
            uint8_t * signature )
```

Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

Parameters

in	*key_id*	Slot of the private key to be used to sign the message.
in	*msg*	32-byte message to be signed. Typically the SHA256 hash of the full message.
out	*signature*	Signature will be returned here. Format is R and S integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.132 atcab_sign_base()

```
ATCA_STATUS atcab_sign_base (
            uint8_t mode,
            uint16_t key_id,
            uint8_t * signature )
```

Executes the Sign command, which generates a signature using the ECDSA algorithm.

Parameters

in	*mode*	Mode determines what the source of the message to be signed.
in	*key_id*	Private key slot used to sign the message.
out	*signature*	Signature is returned here. Format is R and S integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.133 atcab_sign_ext()

```
ATCA_STATUS atcab_sign_ext (
            ATCADevice device,
            uint16_t key_id,
            const uint8_t * msg,
            uint8_t * signature )
```

Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

Parameters

in	*device*	Device context pointer
in	*key_id*	Slot of the private key to be used to sign the message.
in	*msg*	32-byte message to be signed. Typically the SHA256 hash of the full message.
out	*signature*	Signature will be returned here. Format is R and S integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.134 atcab_sign_internal()

```
ATCA_STATUS atcab_sign_internal (
            uint16_t key_id,
            bool is_invalidate,
            bool is_full_sn,
            uint8_t * signature )
```

Executes Sign command to sign an internally generated message.

Parameters

in	*key_id*	Slot of the private key to be used to sign the message.
in	*is_invalidate*	Set to true if the signature will be used with the Verify(Invalidate) command. false for all other cases.
in	*is_full_sn*	Set to true if the message should incorporate the device's full serial number.
out	*signature*	Signature is returned here. Format is R and S integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.135 atcab_sleep()

```
ATCA_STATUS atcab_sleep (
            void )
```

invoke sleep on the CryptoAuth device

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.136 atcab_updateextra()

```
ATCA_STATUS atcab_updateextra (
            uint8_t mode,
            uint16_t new_value )
```

Executes UpdateExtra command to update the values of the two extra bytes within the Configuration zone (bytes 84 and 85).

Can also be used to decrement the limited use counter associated with the key in slot NewValue.

Parameters

in	*mode*	Mode determines what operations the UpdateExtra command performs.
in	*new_value*	Value to be written.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.137 atcab_verify()

```
ATCA_STATUS atcab_verify (
            uint8_t mode,
            uint16_t key_id,
            const uint8_t * signature,
            const uint8_t * public_key,
```

```
const uint8_t * other_data,
uint8_t * mac )
```

Executes the Verify command, which takes an ECDSA [R,S] signature and verifies that it is correctly generated from a given message and public key. In all cases, the signature is an input to the command.

For the Stored, External, and ValidateExternal Modes, the contents of TempKey (or Message Digest Buffer in some cases for the ATECC608) should contain the 32 byte message.

Parameters

in	*mode*	Verify command mode and options
in	*key_id*	Stored mode, the slot containing the public key to be used for the verification. ValidateExternal mode, the slot containing the public key to be validated. External mode, KeyID contains the curve type to be used to Verify the signature. Validate or Invalidate mode, the slot containing the public key to be (in)validated.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*public_key*	If mode is External, the public key to be used for verification. X and Y integers in big-endian format. 64 bytes for P256 curve. NULL for all other modes.
in	*other_data*	If mode is Validate, the bytes used to generate the message for the validation (19 bytes). NULL for all other modes.
out	*mac*	If mode indicates a validating MAC, then the MAC will will be returned here. Can be NULL otherwise.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.138 atcab_verify_extern()

```
ATCA_STATUS atcab_verify_extern (
            const uint8_t * message,
            const uint8_t * signature,
            const uint8_t * public_key,
            bool * is_verified )
```

Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

Parameters

in	*message*	32 byte message to be verified. Typically the SHA256 hash of the full message.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*public_key*	The public key to be used for verification. X and Y integers in big-endian format. 64 bytes for P256 curve.
out	*is_verified*	Boolean whether or not the message, signature, public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.139 atcab_verify_extern_ext()

```
ATCA_STATUS atcab_verify_extern_ext (
            ATCADevice device,
            const uint8_t * message,
            const uint8_t * signature,
            const uint8_t * public_key,
            bool * is_verified )
```

Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

Parameters

in	*device*	Device context pointer
in	*message*	32 byte message to be verified. Typically the SHA256 hash of the full message.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*public_key*	The public key to be used for verification. X and Y integers in big-endian format. 64 bytes for P256 curve.
out	*is_verified*	Boolean whether or not the message, signature, public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.140 atcab_verify_extern_mac()

```
ATCA_STATUS atcab_verify_extern_mac (
            const uint8_t * message,
            const uint8_t * signature,
            const uint8_t * public_key,
            const uint8_t * num_in,
            const uint8_t * io_key,
            bool * is_verified )
```

Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. This function is only available on the ATECC608.

Parameters

in	*message*	32 byte message to be verified. Typically the SHA256 hash of the full message.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.

Parameters

in	*public_key*	The public key to be used for verification. X and Y integers in big-endian format. 64 bytes for P256 curve.
in	*num_in*	System nonce (32 byte) used for the verification MAC.
in	*io_key*	IO protection key for verifying the validation MAC.
out	*is_verified*	Boolean whether or not the message, signature, public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.141 atcab_verify_invalidate()

```
ATCA_STATUS atcab_verify_invalidate (
            uint16_t key_id,
            const uint8_t * signature,
            const uint8_t * other_data,
            bool * is_verified )
```

Executes the Verify command in Invalidate mode which invalidates a previously validated public key stored in a slot.

This command can only be run after GenKey has been used to create a PubKey digest of the public key to be invalidated in TempKey (mode=0x10).

Parameters

in	*key_id*	Slot containing the public key to be invalidated.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*other_data*	19 bytes of data used to build the verification message.
out	*is_verified*	Boolean whether or not the message, signature, validation public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.142 atcab_verify_stored()

```
ATCA_STATUS atcab_verify_stored (
            const uint8_t * message,
            const uint8_t * signature,
            uint16_t key_id,
            bool * is_verified )
```

Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

Parameters

in	*message*	32 byte message to be verified. Typically the SHA256 hash of the full message.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*key_id*	Slot containing the public key to be used in the verification.
out	*is_verified*	Boolean whether or not the message, signature, public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.143 atcab_verify_stored_ext()

```
ATCA_STATUS atcab_verify_stored_ext (
            ATCADevice device,
            const uint8_t * message,
            const uint8_t * signature,
            uint16_t key_id,
            bool * is_verified )
```

Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

Parameters

in	*device*	Device context pointer
in	*message*	32 byte message to be verified. Typically the SHA256 hash of the full message.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*key_id*	Slot containing the public key to be used in the verification.
out	*is_verified*	Boolean whether or not the message, signature, public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.144 atcab_verify_stored_mac()

```
ATCA_STATUS atcab_verify_stored_mac (
            const uint8_t * message,
            const uint8_t * signature,
            uint16_t key_id,
            const uint8_t * num_in,
            const uint8_t * io_key,
            bool * is_verified )
```

Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with a public key stored in the device. This function is only available on the ATECC608.

Parameters

in	*message*	32 byte message to be verified. Typically the SHA256 hash of the full message.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*key_id*	Slot containing the public key to be used in the verification.
in	*num_in*	System nonce (32 byte) used for the verification MAC.
in	*io_key*	IO protection key for verifying the validation MAC.
out	*is_verified*	Boolean whether or not the message, signature, public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.145 atcab_verify_stored_with_tempkey()

```
ATCA_STATUS atcab_verify_stored_with_tempkey (
            const uint8_t * signature,
            uint16_t key_id,
            bool * is_verified )
```

Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. keyConfig.reqrandom bit should be set and the message to be signed should be already loaded into TempKey for all devices.

Please refer to TEST(atca_cmd_basic_test, verify_stored_on_reqrandom_set) in atca_tests_verify.c for proper use of this api

Parameters

in	*device*	Device context pointer
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*key_id*	Slot containing the public key to be used in the verification.
out	*is_verified*	Boolean whether or not the message, signature, public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.146 atcab_verify_validate()

```
ATCA_STATUS atcab_verify_validate (
            uint16_t key_id,
            const uint8_t * signature,
            const uint8_t * other_data,
            bool * is_verified )
```

Executes the Verify command in Validate mode to validate a public key stored in a slot.

This command can only be run after GenKey has been used to create a PubKey digest of the public key to be validated in TempKey (mode=0x10).

Parameters

in	*key_id*	Slot containing the public key to be validated.
in	*signature*	Signature to be verified. R and S integers in big-endian format. 64 bytes for P256 curve.
in	*other_data*	19 bytes of data used to build the verification message.
out	*is_verified*	Boolean whether or not the message, signature, validation public key verified.

Returns

ATCA_SUCCESS on verification success or failure, because the command still completed successfully.

20.2.2.147 atcab_version()

```
ATCA_STATUS atcab_version (
            char * ver_str )
```

basic API methods are all prefixed with atcab_ (CryptoAuthLib Basic) the fundamental premise of the basic API is it is based on a single interface instance and that instance is global, so all basic API commands assume that one global device is the one to operate on.

returns a version string for the CryptoAuthLib release. The format of the version string returned is "yyyymmdd"

Parameters

out	*ver_str*	ptr to space to receive version string

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.148 atcab_wakeup()

```
ATCA_STATUS atcab_wakeup (
            void )
```

wakeup the CryptoAuth device

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.149 atcab_write()

```
ATCA_STATUS atcab_write (
            uint8_t zone,
            uint16_t address,
            const uint8_t * value,
            const uint8_t * mac )
```

Executes the Write command, which writes either one four byte word or a 32-byte block to one of the EEPROM zones on the device. Depending upon the value of the WriteConfig byte for this slot, the data may be required to be encrypted by the system prior to being sent to the device. This command cannot be used to write slots configured as ECC private keys.

Parameters

in	*zone*	Zone/Param1 for the write command.
in	*address*	Address/Param2 for the write command.
in	*value*	Plain-text data to be written or cipher-text for encrypted writes. 32 or 4 bytes depending on bit 7 in the zone.
in	*mac*	MAC required for encrypted writes (32 bytes). Set to NULL if not required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.150 atcab_write_bytes_zone()

```
ATCA_STATUS atcab_write_bytes_zone (
            uint8_t zone,
            uint16_t slot,
            size_t offset_bytes,
            const uint8_t * data,
            size_t length )
```

Executes the Write command, which writes data into the configuration, otp, or data zones with a given byte offset and length. Offset and length must be multiples of a word (4 bytes).

Config zone must be unlocked for writes to that zone. If data zone is unlocked, only 32-byte writes are allowed to slots and OTP and the offset and length must be multiples of 32 or the write will fail.

Parameters

in	*zone*	Zone to write data to: ATCA_ZONE_CONFIG(0), ATCA_ZONE_OTP(1), or ATCA_ZONE_DATA(2).
in	*slot*	If zone is ATCA_ZONE_DATA(2), the slot number to write to. Ignored for all other zones.
in	*offset_bytes*	Byte offset within the zone to write to. Must be a multiple of a word (4 bytes).
in	*data*	Data to be written.
in	*length*	Number of bytes to be written. Must be a multiple of a word (4 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.151 atcab_write_config_counter()

```
ATCA_STATUS atcab_write_config_counter (
            uint16_t counter_id,
            uint32_t counter_value )
```

Initialize one of the monotonic counters in device with a specific value.

The monotonic counters are stored in the configuration zone using a special format. This encodes a binary count value into the 8 byte encoded value required. Can only be set while the configuration zone is unlocked.

Parameters

in	*counter_id*	Counter to be written.
in	*counter_value*	Counter value to set.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.152 atcab_write_config_zone()

```
ATCA_STATUS atcab_write_config_zone (
            const uint8_t * config_data )
```

Executes the Write command, which writes the configuration zone.

First 16 bytes are skipped as they are not writable. LockValue and LockConfig are also skipped and can only be changed via the Lock command.

This command may fail if UserExtra and/or Selector bytes have already been set to non-zero values.

Parameters

in	*config_data*	Data to the config zone data. This should be 88 bytes for SHA devices and 128 bytes for ECC devices.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.153 atcab_write_config_zone_ext()

```
ATCA_STATUS atcab_write_config_zone_ext (
            ATCADevice device,
            const uint8_t * config_data )
```

Executes the Write command, which writes the configuration zone.

First 16 bytes are skipped as they are not writable. LockValue and LockConfig are also skipped and can only be changed via the Lock command.

This command may fail if UserExtra and/or Selector bytes have already been set to non-zero values.

Parameters

in	*device*	Device context
in	*config_data*	Data to the config zone data. This should be 88 bytes for SHA devices and 128 bytes for ECC devices.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.154 atcab_write_enc()

```
ATCA_STATUS atcab_write_enc (
            uint16_t key_id,
            uint8_t block,
            const uint8_t * data,
            const uint8_t * enc_key,
            const uint16_t enc_key_id,
            const uint8_t num_in[(20)] )
```

Executes the Write command, which performs an encrypted write of a 32 byte block into given slot.

The function takes clear text bytes and encrypts them for writing over the wire. Data zone must be locked and the slot configuration must be set to encrypted write for the block to be successfully written.

Parameters

in	*key_id*	Slot ID to write to.
in	*block*	Index of the 32 byte block to write in the slot.
in	*data*	32 bytes of clear text data to be written to the slot
in	*enc_key*	WriteKey to encrypt with for writing
in	*enc_key_id*	The KeyID of the WriteKey
in	*num_in*	20 byte host nonce to inject into Nonce calculation

returns ATCA_SUCCESS on success, otherwise an error code.

20.2.2.155 atcab_write_pubkey()

```
ATCA_STATUS atcab_write_pubkey (
            uint16_t slot,
            const uint8_t * public_key )
```

Uses the write command to write a public key to a slot in the proper format.

Parameters

in	*slot*	Slot number to write. Only slots 8 to 15 are large enough to store a public key.
in	*public_key*	Public key to write into the slot specified. X and Y integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.156 atcab_write_pubkey_ext()

```
ATCA_STATUS atcab_write_pubkey_ext (
            ATCADevice device,
            uint16_t slot,
            const uint8_t * public_key )
```

Uses the write command to write a public key to a slot in the proper format.

Parameters

in	*device*	Device context
in	*slot*	Slot number to write. Only slots 8 to 15 are large enough to store a public key.
in	*public_key*	Public key to write into the slot specified. X and Y integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.157 atcab_write_zone()

```
ATCA_STATUS atcab_write_zone (
            uint8_t zone,
            uint16_t slot,
            uint8_t block,
            uint8_t offset,
```

```
const uint8_t * data,
uint8_t len )
```

Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.

Parameters

in	*zone*	Device zone to write to (0=config, 1=OTP, 2=data).
in	*slot*	If writing to the data zone, it is the slot to write to, otherwise it should be 0.
in	*block*	32-byte block to write to.
in	*offset*	4-byte word within the specified block to write to. If performing a 32-byte write, this should be 0.
in	*data*	Data to be written.
in	*len*	Number of bytes to be written. Must be either 4 or 32.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.158 atcab_write_zone_ext()

```
ATCA_STATUS atcab_write_zone_ext (
            ATCADevice device,
            uint8_t zone,
            uint16_t slot,
            uint8_t block,
            uint8_t offset,
            const uint8_t * data,
            uint8_t len )
```

Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.

Parameters

in	*device*	Device context
in	*zone*	Device zone to write to (0=config, 1=OTP, 2=data).
in	*slot*	If writing to the data zone, it is the slot to write to, otherwise it should be 0.
in	*block*	32-byte block to write to.
in	*offset*	4-byte word within the specified block to write to. If performing a 32-byte write, this should be 0.
in	*data*	Data to be written.
in	*len*	Number of bytes to be written. Must be either 4 or 32.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.2.2.159 isAlpha()

```
bool isAlpha (
            char c )
```

Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))

Parameters

in	*c*	character to check

Returns

True if the character is a hex

20.2.2.160 isBase64()

```
bool isBase64 (
            char c,
            const uint8_t * rules )
```

Returns true if this character is a valid base 64 character or if this is space (A character can be included in a valid base 64 string).

Parameters

in	*c*	character to check
in	*rules*	base64 ruleset to use

Returns

True if the character can be included in a valid base 64 string

20.2.2.161 isBase64Digit()

```
bool isBase64Digit (
            char c,
            const uint8_t * rules )
```

Returns true if this character is a valid base 64 character.

Parameters

in	*c*	character to check
in	*rules*	base64 ruleset to use

Returns

True if the character can be included in a valid base 64 string

20.2.2.162 isBlankSpace()

```
bool isBlankSpace (
            char c )
```

Checks to see if a character is blank space.

Parameters

in	*c*	character to check

Returns

True if the character is blankspace

20.2.2.163 isDigit()

```
bool isDigit (
            char c )
```

Checks to see if a character is an ASCII representation of a digit ((c ge '0') and (c le '9'))

Parameters

in	*c*	character to check

Returns

True if the character is a digit

20.2.2.164 isHex()

```
bool isHex (
            char c )
```

Returns true if this character is a valid hex character or if this is blankspace (The character can be included in a valid hexstring).

Parameters

in	*c*	character to check

Returns

True if the character can be included in a valid hexstring

20.2.2.165 isHexAlpha()

```
bool isHexAlpha (
            char c )
```

Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))

Parameters

in	*c*	character to check

Returns

True if the character is a hex

20.2.2.166 isHexDigit()

```
bool isHexDigit (
            char c )
```

Returns true if this character is a valid hex character.

Parameters

in	*c*	character to check

Returns

True if the character can be included in a valid hexstring

20.2.2.167 packHex()

```
ATCA_STATUS packHex (
            const char * ascii_hex,
            size_t ascii_hex_len,
            char * packed_hex,
            size_t * packed_len )
```

Remove spaces from a ASCII hex string.

Parameters

in	*ascii_hex*	Initial hex string to remove blankspace from
in	*ascii_hex_len*	Length of the initial hex string
in	*packed_hex*	Resulting hex string without blankspace
in,out	*packed_len*	In: Size to packed_hex buffer Out: Number of bytes in the packed hex string

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.3 Configuration (cfg_)

Logical device configurations describe the CryptoAuth device type and logical interface.

Logical device configurations describe the CryptoAuth device type and logical interface.

20.4 ATCADevice (atca_)

ATCADevice object - composite of command and interface objects.

Data Structures

- struct atca_device

  atca_device is the C object backing ATCADevice. See the atca_device.h file for details on the ATCADevice methods

Macros

- #define **ATSHA204A** (0U)

  The supported Device type in Cryptoauthlib library.
- #define **ATECC108A** (1U)
- #define **ATECC508A** (2U)
- #define **ATECC608A** (3U)
- #define **ATECC608B** (3U)
- #define **ATECC608** (3U)
- #define **ATSHA206A** (4U)
- #define **TA100** (0x10U)
- #define **TA101** (0x11U)
- #define **ECC204** (0x20U)
- #define **TA010** (0x21U)
- #define **ECC206** (0x22U)
- #define **RNG90** (0x23U)
- #define **SHA104** (0x24U)
- #define **SHA105** (0x25U)
- #define **SHA106** (0x26U)
- #define **ATCA_DEV_UNKNOWN** (0x7EU)
- #define **ATCA_DEV_INVALID** (0x7FU)

Typedefs

- typedef void(∗ **ctx_cb**) (void ∗ctx)

  Callback function to clean up the session context.
- typedef struct atca_device ∗ **ATCADevice**
- typedef uint8_t **ATCADeviceType**

Enumerations

- enum ATCADeviceState { **ATCA_DEVICE_STATE_UNKNOWN** = 0 , **ATCA_DEVICE_STATE_SLEEP** , **ATCA_DEVICE_STATE_IDLE** , **ATCA_DEVICE_STATE_ACTIVE** }

  ATCADeviceState says about device state.

Functions

- ATCADevice newATCADevice (ATCAIfaceCfg ∗cfg)

  constructor for a Microchip CryptoAuth device
- void deleteATCADevice (ATCADevice ∗ca_dev)

  destructor for a device NULLs reference after object is freed
- ATCA_STATUS initATCADevice (ATCAIfaceCfg ∗cfg, ATCADevice ca_dev)

  Initializer for an Microchip CryptoAuth device.
- ATCAIface atGetIFace (ATCADevice dev)

  returns a reference to the ATCAIface interface object for the device
- ATCA_STATUS releaseATCADevice (ATCADevice ca_dev)

  Release any resources associated with the device.

20.4.1 Detailed Description

ATCADevice object - composite of command and interface objects.

20.4.2 Function Documentation

20.4.2.1 atGetIFace()

```
ATCAIface atGetIFace (
            ATCADevice dev )
```

returns a reference to the ATCAIface interface object for the device

Parameters

in	*dev*	reference to a device

Returns

reference to the ATCAIface object for the device

20.4.2.2 deleteATCADevice()

```
void deleteATCADevice (
            ATCADevice * ca_dev )
```

destructor for a device NULLs reference after object is freed

Parameters

in	*ca_dev*	pointer to a reference to a device

20.4.2.3 initATCADevice()

```
ATCA_STATUS initATCADevice (
            ATCAIfaceCfg * cfg,
            ATCADevice ca_dev )
```

Initializer for an Microchip CryptoAuth device.

Parameters

in	*cfg*	pointer to an interface configuration object
in,out	*ca_dev*	As input, pre-allocated structure to be initialized. mCommands and mIface members should point to existing structures to be initialized.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.4.2.4 newATCADevice()

```
ATCADevice newATCADevice (
            ATCAIfaceCfg * cfg )
```

constructor for a Microchip CryptoAuth device

Parameters

in	*cfg*	Interface configuration object

Returns

Reference to a new ATCADevice on success. NULL on failure.

20.4.2.5 releaseATCADevice()

```
ATCA_STATUS releaseATCADevice (
            ATCADevice ca_dev )
```

Release any resources associated with the device.

Parameters

in	*ca_dev*	Device to release

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5 ATCAIface (atca_)

Abstract interface to all CryptoAuth device types. This interface connects to the HAL implementation and abstracts the physical details of the device communication from all the upper layers of CryptoAuthLib.

Data Structures

- struct devtype_names_t
- struct ATCAIfaceCfg
- struct ATCAHAL_t

    HAL Driver Structure.
- struct atca_iface

    atca_iface is the context structure for a configured interface

Macros

- #define **ATCA_IFACECFG_NAME**(x) (x)
- #define **ATCA_IFACECFG_I2C_ADDRESS**(c) (c)->cfg.atcai2c.address
- #define **ATCA_IFACECFG_I2C_BAUD**(c) (c)->cfg.atcai2c.baud
- #define **ATCA_IFACECFG_VALUE**(c, v) (c)->cfg.v

Typedefs

- typedef struct atca_iface ∗ **ATCAIface**
- typedef struct atca_iface **atca_iface_t**

    atca_iface is the context structure for a configured interface

Enumerations

- enum ATCAIfaceType {
  ATCA_I2C_IFACE = 0 , ATCA_SWI_IFACE = 1 , ATCA_UART_IFACE = 2 , ATCA_SPI_IFACE = 3 ,
  ATCA_HID_IFACE = 4 , ATCA_KIT_IFACE = 5 , ATCA_CUSTOM_IFACE = 6 , ATCA_I2C_GPIO_IFACE = 7 ,
  ATCA_SWI_GPIO_IFACE = 8 , ATCA_SPI_GPIO_IFACE = 9 , **ATCA_UNKNOWN_IFACE** = 0xFE }
- enum **ATCAKitType** {
  ATCA_KIT_AUTO_IFACE , **ATCA_KIT_I2C_IFACE** , **ATCA_KIT_SWI_IFACE** , **ATCA_KIT_SPI_IFACE** ,
  ATCA_KIT_UNKNOWN_IFACE }

Functions

- ATCA_STATUS initATCAIface (ATCAIfaceCfg ∗cfg, ATCAIface ca_iface)

  Initializer for ATCAIface objects.
- ATCA_STATUS atinit (ATCAIface ca_iface)

  Performs the HAL initialization by calling intermediate HAL wrapper function. If using the basic API, the atcab_init() function should be called instead.
- ATCA_STATUS atsend (ATCAIface ca_iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  Sends the data to the device by calling intermediate HAL wrapper function.
- ATCA_STATUS atreceive (ATCAIface ca_iface, uint8_t word_address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  Receives data from the device by calling intermediate HAL wrapper function.
- ATCA_STATUS atcontrol (ATCAIface ca_iface, uint8_t option, void ∗param, size_t paramlen)

  Perform control operations with the underlying hal driver.
- ATCA_STATUS atwake (ATCAIface ca_iface)

  Wakes up the device by calling intermediate HAL wrapper function. The atcab_wakeup() function should be used instead.
- ATCA_STATUS atidle (ATCAIface ca_iface)

  Puts the device into idle state by calling intermediate HAL wrapper function. The atcab_idle() function should be used instead.
- ATCA_STATUS atsleep (ATCAIface ca_iface)

  Puts the device into sleep state by calling intermediate HAL wrapper function. The atcab_sleep() function should be used instead.
- ATCAIfaceCfg ∗ atgetifacecfg (ATCAIface ca_iface)

  Returns the logical interface configuration for the device.
- void ∗ atgetifacehaldat (ATCAIface ca_iface)

  Returns the HAL data pointer for the device.
- bool ifacetype_is_kit (ATCAIfaceType iface_type)

  Check if the given interface is a "kit protocol" one.
- bool atca_iface_is_kit (ATCAIface ca_iface)

  Check if the given interface is configured as a "kit protocol" one where transactions are atomic.
- bool atca_iface_is_swi (ATCAIface ca_iface)

  Check if the given interface is configured as a SWI.
- int **atca_iface_get_retries** (ATCAIface ca_iface)

  Retrive the number of retries for a configured interface.
- uint16_t **atca_iface_get_wake_delay** (ATCAIface ca_iface)

  Retrive the wake/retry delay for a configured interface/device.
- uint8_t **ifacecfg_get_address** (ATCAIfaceCfg ∗cfg)

  Retrieves the device address given an interface configuration.
- ATCA_STATUS ifacecfg_set_address (ATCAIfaceCfg ∗cfg, uint8_t address, ATCAKitType kitiface)

  Change the address of the selected device.
- ATCA_STATUS releaseATCAIface (ATCAIface ca_iface)

  Instruct the HAL driver to release any resources associated with this interface.
- void deleteATCAIface (ATCAIface ∗ca_iface)

  Instruct the HAL driver to release any resources associated with this interface, then delete the object.
- ATCADeviceType **iface_get_device_type_by_name** (const char ∗name)

  Get the ATCADeviceType for a string that looks like a part number.

20.5.1 Detailed Description

Abstract interface to all CryptoAuth device types. This interface connects to the HAL implementation and abstracts the physical details of the device communication from all the upper layers of CryptoAuthLib.

20.5.2 Enumeration Type Documentation

20.5.2.1 ATCAIfaceType

```
enum ATCAIfaceType
```

Enumerator

ATCA_I2C_IFACE	Native I2C Driver
ATCA_SWI_IFACE	SWI or 1-Wire over UART/USART
ATCA_UART_IFACE	Kit v1 over UART/USART
ATCA_SPI_IFACE	Native SPI Driver
ATCA_HID_IFACE	Kit v1 over HID
ATCA_KIT_IFACE	Kit v2 (Binary/Bridging)
ATCA_CUSTOM_IFACE	Custom HAL functions provided during interface init
ATCA_I2C_GPIO_IFACE	I2C "Bitbang" Driver
ATCA_SWI_GPIO_IFACE	SWI or 1-Wire using a GPIO
ATCA_SPI_GPIO_IFACE	SWI or 1-Wire using a GPIO

20.5.3 Function Documentation

20.5.3.1 atca_iface_is_kit()

```
bool atca_iface_is_kit (
            ATCAIface ca_iface )
```

Check if the given interface is configured as a "kit protocol" one where transactions are atomic.

Returns

true if the interface is considered a kit

20.5.3.2 atca_iface_is_swi()

```
bool atca_iface_is_swi (
            ATCAIface ca_iface )
```

Check if the given interface is configured as a SWI.

Returns

true if the interface is considered a kit

20.5.3.3 atcontrol()

```
ATCA_STATUS atcontrol (
            ATCAIface ca_iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations with the underlying hal driver.

Parameters

in	*ca_iface*	Device to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.4 atgetifacecfg()

```
ATCAIfaceCfg * atgetifacecfg (
            ATCAIface ca_iface )
```

Returns the logical interface configuration for the device.

Parameters

in	*ca_iface*	Device interface.

Returns

Logical interface configuration.

20.5.3.5 atgetifacehaldat()

```
void * atgetifacehaldat (
            ATCAIface ca_iface )
```

Returns the HAL data pointer for the device.

Parameters

in	*ca_iface*	Device interface.

Returns

HAL data pointer.

20.5.3.6 atidle()

```
ATCA_STATUS atidle (
            ATCAIface ca_iface )
```

Puts the device into idle state by calling intermediate HAL wrapper function. The atcab_idle() function should be used instead.

Deprecated This function does not have defined behavior when ATCA_HAL_LEGACY_API is undefined.

Parameters

in	*ca_iface*	Device to interact with.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.7 atinit()

```
ATCA_STATUS atinit (
            ATCAIface ca_iface )
```

Performs the HAL initialization by calling intermediate HAL wrapper function. If using the basic API, the atcab_init() function should be called instead.

Parameters

in	*ca_iface*	Device to interact with.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.8 atreceive()

```
ATCA_STATUS atreceive (
            ATCAIface ca_iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

Receives data from the device by calling intermediate HAL wrapper function.

Parameters

in	*ca_iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.9 atsend()

```
ATCA_STATUS atsend (
            ATCAIface ca_iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

Sends the data to the device by calling intermediate HAL wrapper function.

Parameters

in	*ca_iface*	Device to interact with.
in	*word_address*	device transaction type
in	*txdata*	Data to be transmitted to the device.
in	*txlength*	Number of bytes to be transmitted to the device.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.10 atsleep()

```
ATCA_STATUS atsleep (
            ATCAIface ca_iface )
```

Puts the device into sleep state by calling intermediate HAL wrapper function. The atcab_sleep() function should be used instead.

Deprecated This function does not have defined behavior when ATCA_HAL_LEGACY_API is undefined.

Parameters

in	*ca_iface*	Device to interact with.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.11 atwake()

```
ATCA_STATUS atwake (
            ATCAIface ca_iface )
```

Wakes up the device by calling intermediate HAL wrapper function. The atcab_wakeup() function should be used instead.

Deprecated This function does not have defined behavior when ATCA_HAL_LEGACY_API is undefined.

Parameters

in	*ca_iface*	Device to interact with.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.12 deleteATCAIface()

```
void deleteATCAIface (
            ATCAIface * ca_iface )
```

Instruct the HAL driver to release any resources associated with this interface, then delete the object.

Parameters

in	*ca_iface*	Device interface.

20.5.3.13 ifacecfg_set_address()

```
ATCA_STATUS ifacecfg_set_address (
            ATCAIfaceCfg * cfg,
            uint8_t address,
            ATCAKitType kitiface )
```

Change the address of the selected device.

Parameters

in	*cfg*	Interface configuration structure to update
in	*address*	Desired address
in	*kitiface*	Optional parameter to set the kit iface type

20.5.3.14 ifacetype_is_kit()

```
bool ifacetype_is_kit (
            ATCAIfaceType iface_type )
```

Check if the given interface is a "kit protocol" one.

Returns

true if the interface type is considered a kit

20.5.3.15 initATCAIface()

```
ATCA_STATUS initATCAIface (
            ATCAIfaceCfg * cfg,
            ATCAIface ca_iface )
```

Initializer for ATCAIface objects.

Parameters

in	*cfg*	Logical configuration for the interface
in	*ca_iface*	Interface structure to initialize.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.5.3.16 releaseATCAIface()

```
ATCA_STATUS releaseATCAIface (
            ATCAIface ca_iface )
```

Instruct the HAL driver to release any resources associated with this interface.

Parameters

in	*ca_iface*	Device interface.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.6 Certificate manipulation methods (atcacert_)

These methods provide convenient ways to perform certification I/O with CryptoAuth chips and perform certificate manipulation in memory.

Data Structures

- struct atcacert_tm_utc_s
- struct atcacert_device_loc_s
- struct atcacert_cert_loc_s
- struct atcacert_cert_element_s
- struct atcacert_def_s
- struct atcacert_build_state_s

Macros

- #define **FALSE** (0)
- #define **TRUE** (1)
- #define ATCACERT_E_SUCCESS ATCA_SUCCESS
- #define ATCACERT_E_ERROR ATCA_GEN_FAIL
- #define ATCACERT_E_BAD_PARAMS ATCA_BAD_PARAM

- #define ATCACERT_E_BUFFER_TOO_SMALL ATCA_SMALL_BUFFER
- #define ATCACERT_E_UNIMPLEMENTED ATCA_UNIMPLEMENTED
- #define ATCACERT_E_DECODING_ERROR 4
- #define ATCACERT_E_INVALID_DATE 5
- #define ATCACERT_E_UNEXPECTED_ELEM_SIZE 7
- #define ATCACERT_E_ELEM_MISSING 8
- #define ATCACERT_E_ELEM_OUT_OF_BOUNDS 9
- #define ATCACERT_E_BAD_CERT 10
- #define **ATCACERT_E_WRONG_CERT_DEF** 11
- #define ATCACERT_E_VERIFY_FAILED 12
- #define ATCACERT_E_INVALID_TRANSFORM 13
- #define DATEFMT_ISO8601_SEP (0U)

  ISO8601 full date YYYY-MM-DDThh:mm:ssZ.
- #define **DATEFMT_RFC5280_UTC** (1U)

  RFC 5280 (X.509) 4.1.2.5.1 UTCTime format YYMMDDhhmmssZ.
- #define **DATEFMT_POSIX_UINT32_BE** (2U)

  POSIX (aka UNIX) date format. Seconds since Jan 1, 1970. 32 bit unsigned integer, big endian.
- #define **DATEFMT_POSIX_UINT32_LE** (3U)

  POSIX (aka UNIX) date format. Seconds since Jan 1, 1970. 32 bit unsigned integer, little endian.
- #define **DATEFMT_RFC5280_GEN** (4U)

  RFC 5280 (X.509) 4.1.2.5.2 GeneralizedTime format YYYYMMDDhhmmssZ.
- #define **DATEFMT_INVALID** (0xFFU)
- #define **DATEFMT_ISO8601_SEP_SIZE** (20)
- #define **DATEFMT_RFC5280_UTC_SIZE** (13)
- #define **DATEFMT_POSIX_UINT32_BE_SIZE** (4)
- #define **DATEFMT_POSIX_UINT32_LE_SIZE** (4)
- #define **DATEFMT_RFC5280_GEN_SIZE** (15)
- #define **DATEFMT_MAX_SIZE** DATEFMT_ISO8601_SEP_SIZE
- #define **ATCACERT_DATE_FORMAT_SIZES_COUNT** 5
- #define **ATCACERT_COMP_CERT_MAX_SIZE** 72u
- #define **atcacert_date_enc_posix_uint32_be** atcacert_date_enc_posix_be
- #define **atcacert_date_dec_posix_uint32_be** atcacert_date_dec_posix_be
- #define **atcacert_date_enc_posix_uint32_le** atcacert_date_enc_posix_le
- #define **atcacert_date_dec_posix_uint32_le** atcacert_date_dec_posix_le

Typedefs

- typedef struct atcacert_tm_utc_s atcacert_tm_utc_t
- typedef uint8_t **atcacert_date_format_t**
- typedef enum atcacert_cert_type_e atcacert_cert_type_t
- typedef enum atcacert_cert_sn_src_e atcacert_cert_sn_src_t
- typedef enum atcacert_device_zone_e atcacert_device_zone_t
- typedef enum atcacert_transform_e **atcacert_transform_t**

  How to transform the data from the device to the certificate.
- typedef enum atcacert_std_cert_element_e atcacert_std_cert_element_t
- typedef struct ATCA_PACKED atcacert_device_loc_s atcacert_device_loc_t
- typedef struct ATCA_PACKED atcacert_cert_loc_s atcacert_cert_loc_t
- typedef struct ATCA_PACKED atcacert_cert_element_s atcacert_cert_element_t
- typedef struct atcacert_def_s atcacert_def_t
- typedef struct atcacert_build_state_s atcacert_build_state_t

Enumerations

- enum atcacert_cert_type_e { CERTTYPE_X509 , CERTTYPE_CUSTOM , CERTTYPE_X509_FULL_STORED }
- enum atcacert_cert_sn_src_e {
SNSRC_STORED = 0x0 , SNSRC_STORED_DYNAMIC = 0x7 , SNSRC_DEVICE_SN = 0x8 , SNSRC_SIGNER_ID = 0x9 ,
SNSRC_PUB_KEY_HASH = 0xA , SNSRC_DEVICE_SN_HASH = 0xB , SNSRC_PUB_KEY_HASH_POS = 0xC , SNSRC_DEVICE_SN_HASH_POS = 0xD ,
SNSRC_PUB_KEY_HASH_RAW = 0xE , SNSRC_DEVICE_SN_HASH_RAW = 0xF }
- enum atcacert_device_zone_e {
DEVZONE_CONFIG = 0x00 , DEVZONE_OTP = 0x01 , DEVZONE_DATA = 0x02 , DEVZONE_GENKEY = 0x03 ,
DEVZONE_NONE = 0x07 }
- enum atcacert_transform_e {
TF_NONE , TF_REVERSE , TF_BIN2HEX_UC , TF_BIN2HEX_LC ,
TF_HEX2BIN_UC , TF_HEX2BIN_LC , TF_BIN2HEX_SPACE_UC , TF_BIN2HEX_SPACE_LC ,
TF_HEX2BIN_SPACE_UC , TF_HEX2BIN_SPACE_LC }

  How to transform the data from the device to the certificate.
- enum atcacert_std_cert_element_e {
STDCERT_PUBLIC_KEY , **STDCERT_SIGNATURE** , **STDCERT_ISSUE_DATE** , **STDCERT_EXPIRE_DATE** ,
STDCERT_SIGNER_ID , **STDCERT_CERT_SN** , **STDCERT_AUTH_KEY_ID** , **STDCERT_SUBJ_KEY_ID** ,
STDCERT_NUM_ELEMENTS }

Functions

- ATCA_STATUS atcacert_read_device_loc (const atcacert_device_loc_t ∗device_loc, uint8_t ∗data)

  Read the data from a device location.
- ATCA_STATUS atcacert_read_device_loc_ext (ATCADevice device, const atcacert_device_loc_t ∗device_loc, uint8_t ∗data)

  Read the data from a device location.
- ATCA_STATUS atcacert_read_cert (const atcacert_def_t ∗cert_def, const uint8_t ca_public_key[64], uint8_t ∗cert, size_t ∗cert_size)

  Reads the certificate specified by the certificate definition from the ATECC508A device.
- ATCA_STATUS atcacert_read_cert_ext (ATCADevice device, const atcacert_def_t ∗cert_def, const uint8_t ca_public_key[64], uint8_t ∗cert, size_t ∗cert_size)

  Reads the certificate specified by the certificate definition from the ATECC508A device.
- ATCA_STATUS atcacert_write_cert (const atcacert_def_t ∗cert_def, const uint8_t ∗cert, size_t cert_size)

  Take a full certificate and write it to the ATECC508A device according to the certificate definition.
- ATCA_STATUS atcacert_write_cert_ext (ATCADevice device, const atcacert_def_t ∗cert_def, const uint8_t ∗cert, size_t cert_size)

  Take a full certificate and write it to the ATECC508A device according to the certificate definition.
- ATCA_STATUS atcacert_create_csr (const atcacert_def_t ∗csr_def, uint8_t ∗csr, size_t ∗csr_size)

  Creates a CSR specified by the CSR definition from the ATECC508A device. This process involves reading the dynamic CSR data from the device and combining it with the template found in the CSR definition, then signing it. Return the CSR int der format.
- ATCA_STATUS atcacert_create_csr_pem (const atcacert_def_t ∗csr_def, char ∗csr, size_t ∗csr_size)

  Creates a CSR specified by the CSR definition from the ATECC508A device. This process involves reading the dynamic CSR data from the device and combining it with the template found in the CSR definition, then signing it. Return the CSR int der format.
- ATCA_STATUS atcacert_get_response (uint8_t device_private_key_slot, const uint8_t challenge[32], uint8_t response[64])

  Calculates the response to a challenge sent from the host.

- ATCA_STATUS atcacert_read_subj_key_id (const atcacert_def_t *cert_def, uint8_t subj_key_id[20])

  Reads the subject key ID based on a certificate definition.
- ATCA_STATUS atcacert_read_subj_key_id_ext (ATCADevice device, const atcacert_def_t *cert_def, uint8_t subj_key_id[20])

  Reads the subject key ID based on a certificate definition.
- ATCA_STATUS atcacert_read_cert_size (const atcacert_def_t *cert_def, size_t *cert_size)

  Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.
- ATCA_STATUS atcacert_read_cert_size_ext (ATCADevice device, const atcacert_def_t *cert_def, size_t *cert_size)

  Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.
- ATCA_STATUS atcacert_date_enc (atcacert_date_format_t format, const atcacert_tm_utc_t *timestamp, uint8_t *formatted_date, size_t *formatted_date_size)

  Format a timestamp according to the format type.
- ATCA_STATUS atcacert_date_dec (atcacert_date_format_t format, const uint8_t *formatted_date, size_t formatted_date_size, atcacert_tm_utc_t *timestamp)

  Parse a formatted timestamp according to the specified format.
- ATCA_STATUS atcacert_date_enc_compcert (const atcacert_tm_utc_t *issue_date, uint8_t expire_years, uint8_t enc_dates[3])

  Encode the issue and expire dates in the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_enc_compcert_ext (const atcacert_tm_utc_t *issue_date, uint8_t expire_years, uint8_t comp_cert[72u])

  Encode the issue and expire dates in the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_dec_compcert (const uint8_t enc_dates[3], atcacert_date_format_t expire_date_format, atcacert_tm_utc_t *issue_date, atcacert_tm_utc_t *expire_date)

  Decode the issue and expire dates from the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_dec_compcert_ext (const uint8_t comp_cert[72u], atcacert_date_format_t expire_date_format, atcacert_tm_utc_t *issue_date, atcacert_tm_utc_t *expire_date)

  Decode the issue and expire dates from the format used by the compressed certificate.
- atcacert_date_format_t atcacert_date_from_asn1_tag (const uint8_t tag)

  Convert the asn1 tag for the supported time formats into the local time format.
- ATCA_STATUS atcacert_date_get_max_date (atcacert_date_format_t format, atcacert_tm_utc_t *timestamp)

  Return the maximum date available for the given format.
- ATCA_STATUS **atcacert_date_enc_iso8601_sep** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(20)])
- ATCA_STATUS **atcacert_date_dec_iso8601_sep** (const uint8_t formatted_date[(20)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_rfc5280_utc** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(13)])
- ATCA_STATUS **atcacert_date_dec_rfc5280_utc** (const uint8_t formatted_date[(13)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_rfc5280_gen** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(15)])
- ATCA_STATUS **atcacert_date_dec_rfc5280_gen** (const uint8_t formatted_date[(15)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_posix_be** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(4)])
- ATCA_STATUS **atcacert_date_dec_posix_be** (const uint8_t formatted_date[(4)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_posix_le** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(4)])
- ATCA_STATUS **atcacert_date_dec_posix_le** (const uint8_t formatted_date[(4)], atcacert_tm_utc_t *timestamp)

- int atcacert_date_cmp (const atcacert_tm_utc_t *timestamp1, const atcacert_tm_utc_t *timestamp2)

    Compare two dates.
- ATCA_STATUS atcacert_get_subject (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, cal_buffer *cert_subj_buf)

    Gets the subject name from a certificate.
- ATCA_STATUS atcacert_get_subj_public_key (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, cal_buffer *subj_public_key)

    Gets the subject public key from a certificate.
- ATCA_STATUS atcacert_get_subj_key_id (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t subj_key_id[20])

    Gets the subject key ID from a certificate.
- ATCA_STATUS atcacert_get_issuer (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t cert_issuer[128])

    Gets the issuer name of a certificate.
- ATCA_STATUS atcacert_get_issue_date (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, atcacert_tm_utc_t *timestamp)

    Gets the issue date from a certificate. Will be parsed according to the date format specified in the certificate definition.
- ATCA_STATUS atcacert_get_expire_date (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, atcacert_tm_utc_t *timestamp)

    Gets the expire date from a certificate. Will be parsed according to the date format specified in the certificate definition.
- ATCA_STATUS atcacert_get_cert_sn (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t *cert_sn, size_t *cert_sn_size)

    Gets the certificate serial number from a certificate.
- ATCA_STATUS atcacert_get_auth_key_id (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t auth_key_id[20])

    Gets the authority key ID from a certificate.
- int atcacert_calc_expire_years (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, int issue_tm_year, uint8_t *expire_years)
- ATCA_STATUS atcacert_der_enc_length (size_t length, uint8_t *der_length, size_t *der_length_size)

    Encode a length in DER format.
- ATCA_STATUS atcacert_der_dec_length (const uint8_t *der_length, size_t *der_length_size, size_t *length)

    Decode a DER format length.
- ATCA_STATUS **atcacert_der_adjust_length** (uint8_t *der_length, size_t *der_length_size, int delta_length, size_t *new_length)
- ATCA_STATUS atcacert_der_enc_integer (const uint8_t *int_data, size_t int_data_size, uint8_t is_unsigned, uint8_t *der_int, size_t *der_int_size)

    Encode an ASN.1 integer in DER format, including tag and length fields.
- ATCA_STATUS atcacert_der_dec_integer (const uint8_t *der_int, size_t *der_int_size, uint8_t *int_data, size_t *int_data_size)

    Decode an ASN.1 DER encoded integer.
- ATCA_STATUS atcacert_der_enc_ecdsa_sig_value (const uint8_t raw_sig[64], uint8_t *der_sig, size_t *der_sig_size)

    Formats a raw ECDSA P256 signature in the DER encoding found in X.509 certificates.
- ATCA_STATUS atcacert_der_dec_ecdsa_sig_value (const uint8_t *der_sig, size_t *der_sig_size, uint8_t raw_sig[64])

    Parses an ECDSA P256 signature in the DER encoding as found in X.509 certificates.
- ATCA_STATUS atcacert_verify_cert_hw (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, const uint8_t ca_public_key[64])

    Verify a certificate against its certificate authority's public key using the host's ATECC device for crypto functions.
- ATCA_STATUS atcacert_gen_challenge_hw (uint8_t challenge[32])

    Generate a random challenge to be sent to the client using the RNG on the host's ATECC device.
- ATCA_STATUS atcacert_verify_response_hw (const uint8_t device_public_key[64], const uint8_t challenge[32], const uint8_t response[64])

Verify a client's response to a challenge using the host's ATECC device for crypto functions.
- ATCA_STATUS atcacert_verify_cert_sw (const atcacert_def_t ∗cert_def, const uint8_t ∗cert, size_t cert_size, const uint8_t ca_public_key[64])

  Verify a certificate against its certificate authority's public key using software crypto functions.The function is currently not implemented.
- ATCA_STATUS atcacert_gen_challenge_sw (uint8_t challenge[32])

  Generate a random challenge to be sent to the client using a software PRNG.The function is currently not implemented.
- ATCA_STATUS atcacert_verify_response_sw (const uint8_t device_public_key[64], const uint8_↩ t challenge[32], const uint8_t response[64])

  Verify a client's response to a challenge using software crypto functions.The function is currently not implemented.

Variables

- const size_t **ATCACERT_DATE_FORMAT_SIZES** [5]

20.6.1 Detailed Description

These methods provide convenient ways to perform certification I/O with CryptoAuth chips and perform certificate manipulation in memory.

20.6.2 Macro Definition Documentation

20.6.2.1 ATCACERT_E_BAD_CERT

```
#define ATCACERT_E_BAD_CERT 10
```

Certificate structure is bad in some way.

20.6.2.2 ATCACERT_E_BAD_PARAMS

```
#define ATCACERT_E_BAD_PARAMS ATCA_BAD_PARAM
```

Invalid/bad parameter passed to function.

20.6.2.3 ATCACERT_E_BUFFER_TOO_SMALL

```
#define ATCACERT_E_BUFFER_TOO_SMALL ATCA_SMALL_BUFFER
```

Supplied buffer for output is too small to hold the result.

20.6.2.4 ATCACERT_E_DECODING_ERROR

```
#define ATCACERT_E_DECODING_ERROR 4
```

Data being decoded/parsed has an invalid format.

20.6.2.5 ATCACERT_E_ELEM_MISSING

```
#define ATCACERT_E_ELEM_MISSING 8
```

The certificate element isn't defined for the certificate definition.

20.6.2.6 ATCACERT_E_ELEM_OUT_OF_BOUNDS

```
#define ATCACERT_E_ELEM_OUT_OF_BOUNDS 9
```

Certificate element is out of bounds for the given certificate.

20.6.2.7 ATCACERT_E_ERROR

```
#define ATCACERT_E_ERROR ATCA_GEN_FAIL
```

General error.

20.6.2.8 ATCACERT_E_INVALID_DATE

```
#define ATCACERT_E_INVALID_DATE 5
```

Date is invalid.

20.6.2.9 ATCACERT_E_INVALID_TRANSFORM

```
#define ATCACERT_E_INVALID_TRANSFORM 13
```

Invalid transform passed to function.

20.6.2.10 ATCACERT_E_SUCCESS

```
#define ATCACERT_E_SUCCESS ATCA_SUCCESS
```

Operation completed successfully.

20.6.2.11 ATCACERT_E_UNEXPECTED_ELEM_SIZE

```
#define ATCACERT_E_UNEXPECTED_ELEM_SIZE 7
```

A certificate element size was not what was expected.

20.6.2.12 ATCACERT_E_UNIMPLEMENTED

```
#define ATCACERT_E_UNIMPLEMENTED ATCA_UNIMPLEMENTED
```

Function is unimplemented for the current configuration.

20.6.2.13 ATCACERT_E_VERIFY_FAILED

```
#define ATCACERT_E_VERIFY_FAILED 12
```

Certificate or challenge/response verification failed.

20.6.2.14 DATEFMT_ISO8601_SEP

```
#define DATEFMT_ISO8601_SEP (0U)
```

ISO8601 full date YYYY-MM-DDThh:mm:ssZ.

Date formats.

20.6.3 Typedef Documentation

20.6.3.1 atcacert_build_state_t

```
typedef struct atcacert_build_state_s atcacert_build_state_t
```

Tracks the state of a certificate as it's being rebuilt from device information.

20.6.3.2 atcacert_cert_element_t

```
typedef struct ATCA_PACKED atcacert_cert_element_s atcacert_cert_element_t
```

Defines a generic dynamic element for a certificate including the device and template locations.

20.6.3.3 atcacert_cert_loc_t

```
typedef struct ATCA_PACKED atcacert_cert_loc_s atcacert_cert_loc_t
```

Defines a chunk of data in a certificate template.

20.6.3.4 atcacert_cert_sn_src_t

```
typedef enum atcacert_cert_sn_src_e atcacert_cert_sn_src_t
```

Sources for the certificate serial number.

20.6.3.5 atcacert_cert_type_t

```
typedef enum atcacert_cert_type_e atcacert_cert_type_t
```

Types of certificates.

20.6.3.6 atcacert_def_t

```
typedef struct atcacert_def_s atcacert_def_t
```

Defines a certificate and all the pieces to work with it.

If any of the standard certificate elements (std_cert_elements) are not a part of the certificate definition, set their count to 0 to indicate their absence.

20.6.3.7 atcacert_device_loc_t

```
typedef struct ATCA_PACKED atcacert_device_loc_s atcacert_device_loc_t
```

Defines a chunk of data in an ATECC device.

20.6.3.8 atcacert_device_zone_t

```
typedef enum atcacert_device_zone_e atcacert_device_zone_t
```

ATECC device zones. The values match the Zone Encodings as specified in the datasheet.

20.6.3.9 atcacert_std_cert_element_t

```
typedef enum atcacert_std_cert_element_e atcacert_std_cert_element_t
```

Standard dynamic certificate elements.

20.6.3.10 atcacert_tm_utc_t

```
typedef struct atcacert_tm_utc_s atcacert_tm_utc_t
```

Holds a broken-down date in UTC. Mimics atcacert_tm_utc_t from time.h.

20.6.4 Enumeration Type Documentation

20.6.4.1 atcacert_cert_sn_src_e

```
enum atcacert_cert_sn_src_e
```

Sources for the certificate serial number.

Enumerator

SNSRC_STORED	Cert serial is stored on the device.
SNSRC_STORED_DYNAMIC	Cert serial is stored on the device with the first byte being the DER size (X509 certs only).
SNSRC_DEVICE_SN	Cert serial number is 0x40(MSB) + 9-byte device serial number. Only applies to device certificates.
SNSRC_SIGNER_ID	Cert serial number is 0x40(MSB) + 2-byte signer ID. Only applies to signer certificates.
SNSRC_PUB_KEY_HASH	Cert serial number is the SHA256(Subject public key + Encoded dates), with uppermost 2 bits set to 01.
SNSRC_DEVICE_SN_HASH	Cert serial number is the SHA256(Device SN + Encoded dates), with uppermost 2 bits set to 01. Only applies to device certificates.
SNSRC_PUB_KEY_HASH_POS	Depreciated, don't use. Cert serial number is the SHA256(Subject public key + Encoded dates), with MSBit set to 0 to ensure it's positive.
SNSRC_DEVICE_SN_HASH_POS	Depreciated, don't use. Cert serial number is the SHA256(Device SN + Encoded dates), with MSBit set to 0 to ensure it's positive. Only applies to device certificates.
SNSRC_PUB_KEY_HASH_RAW	Depreciated, don't use. Cert serial number is the SHA256(Subject public key + Encoded dates).
SNSRC_DEVICE_SN_HASH_RAW	Depreciated, don't use. Cert serial number is the SHA256(Device SN + Encoded dates). Only applies to device certificates.

20.6.4.2 atcacert_cert_type_e

```
enum atcacert_cert_type_e
```

Types of certificates.

Enumerator

CERTTYPE_X509	Standard X509 certificate.
CERTTYPE_CUSTOM	Custom format.
CERTTYPE_X509_FULL_STORED	Full Stored X509 Certificate.

20.6.4.3 atcacert_device_zone_e

```
enum atcacert_device_zone_e
```

ATECC device zones. The values match the Zone Encodings as specified in the datasheet.

Enumerator

DEVZONE_CONFIG	Configuration zone.
DEVZONE_OTP	One Time Programmable zone.
DEVZONE_DATA	Data zone (slots).
DEVZONE_GENKEY	Data zone - Generate Pubkey (slots).
DEVZONE_NONE	Special value used to indicate there is no device location.

20.6.4.4 atcacert_std_cert_element_e

```
enum atcacert_std_cert_element_e
```

Standard dynamic certificate elements.

Enumerator

STDCERT_NUM_ELEMENTS	Special item to give the number of elements in this enum.

20.6.4.5 atcacert_transform_e

```
enum atcacert_transform_e
```

How to transform the data from the device to the certificate.

Enumerator

TF_NONE	No transform, data is used byte for byte.
TF_REVERSE	Reverse the bytes (e.g. change endianness)
TF_BIN2HEX_UC	Convert raw binary into ASCII hex, uppercase.
TF_BIN2HEX_LC	Convert raw binary into ASCII hex, lowercase.
TF_HEX2BIN_UC	Convert ASCII hex, uppercase to binary.
TF_HEX2BIN_LC	Convert ASCII hex, lowercase to binary.
TF_BIN2HEX_SPACE_UC	Convert raw binary into ASCII hex, uppercase space between bytes.
TF_BIN2HEX_SPACE_LC	Convert raw binary into ASCII hex, lowercase space between bytes.
TF_HEX2BIN_SPACE_UC	Convert ASCII hex, uppercase with spaces between bytes to binary.
TF_HEX2BIN_SPACE_LC	Convert ASCII hex, lowercase with spaces between bytes to binary.

20.6.5 Function Documentation

20.6.5.1 atcacert_calc_expire_years()

```
int atcacert_calc_expire_years (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            int issue_tm_year,
            uint8_t * expire_years )
```

Parameters

in	*cert_def*	Certificate definition to find a max size for.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
in	*issue_tm_year*	issue year.
out	*expire_years*	expire years.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.2 atcacert_create_csr()

```
ATCA_STATUS atcacert_create_csr (
            const atcacert_def_t * csr_def,
            uint8_t * csr,
            size_t * csr_size )
```

Creates a CSR specified by the CSR definition from the ATECC508A device. This process involves reading the dynamic CSR data from the device and combining it with the template found in the CSR definition, then signing it. Return the CSR int der format.

Parameters

in	*csr_def*	CSR definition describing where to find the dynamic CSR information on the device and how to incorporate it into the template.
out	*csr*	Buffer to receive the CSR.
in,out	*csr_size*	As input, the size of the CSR buffer in bytes. As output, the size of the CSR returned in cert in bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.6.5.3 atcacert_create_csr_pem()

```
ATCA_STATUS atcacert_create_csr_pem (
            const atcacert_def_t * csr_def,
            char * csr,
            size_t * csr_size )
```

Creates a CSR specified by the CSR definition from the ATECC508A device. This process involves reading the dynamic CSR data from the device and combining it with the template found in the CSR definition, then signing it. Return the CSR int der format.

Parameters

in	*csr_def*	CSR definition describing where to find the dynamic CSR information on the device and how to incorporate it into the template.
out	*csr*	Buffer to received the CSR formatted as PEM.
in,out	*csr_size*	As input, the size of the CSR buffer in bytes. As output, the size of the CSR as PEM returned in cert in bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.6.5.4 atcacert_date_cmp()

```
int atcacert_date_cmp (
            const atcacert_tm_utc_t * timestamp1,
            const atcacert_tm_utc_t * timestamp2 )
```

Compare two dates.

Dates are not checked for validity before comparing.

Parameters

in	*timestamp1*	First date to compare.
in	*timestamp2*	Second date to compare.

Returns

-1 if timestamp1 is before timestamp2, 0 if they are equal, 1 if they are timestamp1 is after timestamp2. ATCACERT_E_BAD_PARAMS if either input is NULL.

20.6.5.5 atcacert_date_dec()

```
ATCA_STATUS atcacert_date_dec (
            atcacert_date_format_t format,
            const uint8_t * formatted_date,
            size_t formatted_date_size,
            atcacert_tm_utc_t * timestamp )
```

Parse a formatted timestamp according to the specified format.

Parameters

in	*format*	Format to parse the formatted date as.
in	*formatted_date*	Formatted date to be parsed.
in	*formatted_date_size*	Size of the formatted date in bytes.
out	*timestamp*	Parsed timestamp is returned here.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.6 atcacert_date_dec_compcert()

```
ATCA_STATUS atcacert_date_dec_compcert (
            const uint8_t enc_dates[3],
            atcacert_date_format_t expire_date_format,
            atcacert_tm_utc_t * issue_date,
            atcacert_tm_utc_t * expire_date )
```

Decode the issue and expire dates from the format used by the compressed certificate.

Parameters

in	*enc_dates*	Encoded date from the compressed certificate. 3 bytes.
in	*expire_date_format*	Expire date format. Only used to determine max date when no expiration date is specified by the encoded date.
out	*issue_date*	Decoded issue date is returned here.
out	*expire_date*	Decoded expire date is returned here. If there is no expiration date, the expire date will be set to a maximum value for the given expire_date_format.

Returns

0 on success

20.6.5.7 atcacert_date_dec_compcert_ext()

```
ATCA_STATUS atcacert_date_dec_compcert_ext (
            const uint8_t comp_cert[72u],
            atcacert_date_format_t expire_date_format,
            atcacert_tm_utc_t * issue_date,
            atcacert_tm_utc_t * expire_date )
```

Decode the issue and expire dates from the format used by the compressed certificate.

Supports extended dates if the format version field is 1

Parameters

in,out	*comp_cert*	Compressed certificate (72 bytes) where the encoded dates will be set. Format version (In comp_cert byte 70([3:0]) must be set to 1 to use extended dates.
in	*expire_date_format*	Expire date format. Only used to determine max date when no expiration date is specified by the encoded date.
out	*issue_date*	Decoded issue date is returned here.
out	*expire_date*	Decoded expire date is returned here. If there is no expiration date, the expire date will be set to a maximum value for the given expire_date_format.

Returns

0 on success

20.6.5.8 atcacert_date_enc()

```
ATCA_STATUS atcacert_date_enc (
            atcacert_date_format_t format,
            const atcacert_tm_utc_t * timestamp,
            uint8_t * formatted_date,
            size_t * formatted_date_size )
```

Format a timestamp according to the format type.

Parameters

in	*format*	Format to use.
in	*timestamp*	Timestamp to format.
out	*formatted_date*	Formatted date will be returned in this buffer.
in,out	*formatted_date_size*	As input, the size of the formatted_date buffer. As output, the size of the returned formatted_date.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.9 atcacert_date_enc_compcert()

```
ATCA_STATUS atcacert_date_enc_compcert (
            const atcacert_tm_utc_t * issue_date,
            uint8_t expire_years,
            uint8_t enc_dates[3] )
```

Encode the issue and expire dates in the format used by the compressed certificate.

Parameters

in	*issue_date*	Issue date to encode. Note that minutes and seconds will be ignored.
in	*expire_years*	Expire date is expressed as a number of years past the issue date. 0 should be used if there is no expire date.
out	*enc_dates*	Encoded dates for use in the compressed certificate is returned here. 3 bytes.

Returns

0 on success

20.6.5.10 atcacert_date_enc_compcert_ext()

```
ATCA_STATUS atcacert_date_enc_compcert_ext (
            const atcacert_tm_utc_t * issue_date,
            uint8_t expire_years,
            uint8_t comp_cert[72u] )
```

Encode the issue and expire dates in the format used by the compressed certificate.

Supports extended dates if the format version field is set appropriately (currently 1).

Parameters

in	*issue_date*	Issue date to encode. Note that minutes and seconds will be ignored.
in	*expire_years*	Expire date is expressed as a number of years past the issue date. 0 should be used if there is no expire date.
in,out	*comp_cert*	Compressed certificate (72 bytes) where the encoded dates will be set. Format version must be set appropriately.

Returns

0 on success

20.6.5.11 atcacert_date_from_asn1_tag()

```
atcacert_date_format_t atcacert_date_from_asn1_tag (
            const uint8_t tag )
```

Convert the asn1 tag for the supported time formats into the local time format.

Returns

DATEFMT_RFC5280_UTC, DATEFMT_RFC5280_GEN, or DATEFMT_INVALID

20.6.5.12 atcacert_date_get_max_date()

```
ATCA_STATUS atcacert_date_get_max_date (
            atcacert_date_format_t format,
            atcacert_tm_utc_t * timestamp )
```

Return the maximum date available for the given format.

Parameters

in	*format*	Format to get the max date for.
out	*timestamp*	Max date is returned here.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.13 atcacert_der_dec_ecdsa_sig_value()

```
ATCA_STATUS atcacert_der_dec_ecdsa_sig_value (
            const uint8_t * der_sig,
            size_t * der_sig_size,
            uint8_t raw_sig[64] )
```

Parses an ECDSA P256 signature in the DER encoding as found in X.509 certificates.

This will parse the DER encoding of the signatureValue field as found in an X.509 certificate (RFC 5280). x509_sig should include the tag, length, and value. The value of the signatureValue is the DER encoding of the ECDSA-Sig-Value as specified by RFC 5480 and SECG SEC1.

Parameters

in	*der_sig*	X.509 format signature (TLV of signatureValue) to be parsed.
in,out	*der_sig_size*	As input, size of the der_sig buffer in bytes. As output, size of the DER x.509 signature parsed from the buffer.
out	*raw_sig*	Parsed P256 ECDSA signature will be returned in this buffer. Formatted as R and S integers concatenated together. 64 bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.14 atcacert_der_dec_integer()

```
ATCA_STATUS atcacert_der_dec_integer (
            const uint8_t * der_int,
            size_t * der_int_size,
            uint8_t * int_data,
            size_t * int_data_size )
```

Decode an ASN.1 DER encoded integer.

X.680 (http://www.itu.int/rec/T-REC-X.680/en) section 19.8, for tag value X.690 (http://www.itu.int/rec/T-REC-X.690/en) section 8.3, for encoding

Parameters

in	*der_int*	DER encoded ASN.1 integer, including the tag and length fields.
in,out	*der_int_size*	As input, the size of the der_int buffer in bytes. As output, the size of the DER integer decoded in bytes.
out	*int_data*	Decode integer is returned in this buffer in a signed big-endian format.
in,out	*int_data_size*	As input, the size of int_data in bytes. As output, the size of the decoded integer in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.15 atcacert_der_dec_length()

```
ATCA_STATUS atcacert_der_dec_length (
            const uint8_t * der_length,
            size_t * der_length_size,
            size_t * length )
```

Decode a DER format length.

X.690 (http://www.itu.int/rec/T-REC-X.690/en) section 8.1.3, for encoding

Parameters

in	*der_length*	DER encoded length.
in,out	*der_length_size*	As input, the size of the der_length buffer in bytes. As output, the size of the DER encoded length that was decoded.
out	*length*	Decoded length is returned here.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.16 atcacert_der_enc_ecdsa_sig_value()

```
ATCA_STATUS atcacert_der_enc_ecdsa_sig_value (
            const uint8_t raw_sig[64],
            uint8_t * der_sig,
            size_t * der_sig_size )
```

Formats a raw ECDSA P256 signature in the DER encoding found in X.509 certificates.

This will return the DER encoding of the signatureValue field as found in an X.509 certificate (RFC 5280). This include the tag, length, and value. The value of the signatureValue is the DER encoding of the ECDSA-Sig-Value as specified by RFC 5480 and SECG SEC1.

Parameters

in	*raw_sig*	P256 ECDSA signature to be formatted. Input format is R and S integers concatenated together. 64 bytes.
out	*der_sig*	X.509 format signature (TLV of signatureValue) will be returned in this buffer.
in,out	*der_sig_size*	As input, the size of the x509_sig buffer in bytes. As output, the size of the returned X.509 signature in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.17 atcacert_der_enc_integer()

```
ATCA_STATUS atcacert_der_enc_integer (
            const uint8_t * int_data,
            size_t int_data_size,
            uint8_t is_unsigned,
            uint8_t * der_int,
            size_t * der_int_size )
```

Encode an ASN.1 integer in DER format, including tag and length fields.

X.680 (http://www.itu.int/rec/T-REC-X.680/en) section 19.8, for tag value X.690 (http://www.itu.int/rec/T-REC-X.690/en) section 8.3, for encoding

Parameters

in	*int_data*	Raw integer in big-endian format.
in	*int_data_size*	Size of the raw integer in bytes.
in	*is_unsigned*	Indicate whether the input integer should be treated as unsigned.
out	*der_int*	DER encoded integer is returned in this buffer.
in,out	*der_int_size*	As input, the size of the der_int buffer in bytes. As output, the size of the DER integer returned in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.18 atcacert_der_enc_length()

```
ATCA_STATUS atcacert_der_enc_length (
            size_t length,
            uint8_t * der_length,
            size_t * der_length_size )
```

Encode a length in DER format.

X.690 (http://www.itu.int/rec/T-REC-X.690/en) section 8.1.3, for encoding

Parameters

in	*length*	Length to be encoded.
out	*der_length*	DER encoded length will returned in this buffer.
in,out	*der_length_size*	As input, size of der_length buffer in bytes. As output, the size of the DER length encoding in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.19 atcacert_gen_challenge_hw()

```
ATCA_STATUS atcacert_gen_challenge_hw (
            uint8_t challenge[32] )
```

Generate a random challenge to be sent to the client using the RNG on the host's ATECC device.

Parameters

out	*challenge*	Random challenge is return here. 32 bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.20 atcacert_gen_challenge_sw()

```
ATCA_STATUS atcacert_gen_challenge_sw (
            uint8_t challenge[32] )
```

Generate a random challenge to be sent to the client using a software PRNG.The function is currently not implemented.

Parameters

out	*challenge*	Random challenge is return here. 32 bytes.

Returns

ATCA_UNIMPLEMENTED , as the function is currently not implemented.

20.6.5.21 atcacert_get_auth_key_id()

```
ATCA_STATUS atcacert_get_auth_key_id (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            uint8_t auth_key_id[20] )
```

Gets the authority key ID from a certificate.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*auth_key↔_id*	Authority key ID is returned in this buffer. 20 bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.22 atcacert_get_cert_sn()

```
ATCA_STATUS atcacert_get_cert_sn (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            uint8_t * cert_sn,
            size_t * cert_sn_size )
```

Gets the certificate serial number from a certificate.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*cert_sn*	Certificate SN will be returned in this buffer.
in,out	*cert_sn_size*	As input, the size of the cert_sn buffer. As output, the size of the certificate SN (cert_sn) in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.23 atcacert_get_expire_date()

```
ATCA_STATUS atcacert_get_expire_date (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            atcacert_tm_utc_t * timestamp )
```

Gets the expire date from a certificate. Will be parsed according to the date format specified in the certificate definition.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*timestamp*	Expire date is returned in this structure.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.24 atcacert_get_issue_date()

```
ATCA_STATUS atcacert_get_issue_date (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            atcacert_tm_utc_t * timestamp )
```

Gets the issue date from a certificate. Will be parsed according to the date format specified in the certificate definition.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*timestamp*	Issue date is returned in this structure.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.25 atcacert_get_issuer()

```
ATCA_STATUS atcacert_get_issuer (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            uint8_t cert_issuer[128] )
```

Gets the issuer name of a certificate.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*cert_issuer*	Certificate's issuer is returned in this buffer.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.26 atcacert_get_response()

```
ATCA_STATUS atcacert_get_response (
            uint8_t device_private_key_slot,
            const uint8_t challenge[32],
            uint8_t response[64] )
```

Calculates the response to a challenge sent from the host.

The challenge-response protocol is an ECDSA Sign and Verify. This performs the ECDSA Sign on the challenge and returns the signature as the response.

Parameters

in	*device_private_key_slot*	Slot number for the device's private key. This must be the same slot used to generate the public key included in the device's certificate.
in	*challenge*	Challenge to generate the response for. Must be 32 bytes.
out	*response*	Response will be returned in this buffer. 64 bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.6.5.27 atcacert_get_subj_key_id()

```
ATCA_STATUS atcacert_get_subj_key_id (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            uint8_t subj_key_id[20] )
```

Gets the subject key ID from a certificate.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*subj_key_id*	Subject key ID is returned in this buffer. 20 bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.28 atcacert_get_subj_public_key()

```
ATCA_STATUS atcacert_get_subj_public_key (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            cal_buffer * subj_public_key )
```

Gets the subject public key from a certificate.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*subj_public_key*	Subject public key is returned in the buffer pointed by subj_public_key

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.29 atcacert_get_subject()

```
ATCA_STATUS atcacert_get_subject (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            cal_buffer * cert_subj_buf )
```

Gets the subject name from a certificate.

Parameters

in	*cert_def*	Certificate definition for the certificate.
in	*cert*	Certificate to get element from.
in	*cert_size*	Size of the certificate (cert) in bytes.
out	*subject*	Subject name is returned in this buffer.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.30 atcacert_read_cert()

```
ATCA_STATUS atcacert_read_cert (
            const atcacert_def_t * cert_def,
            const uint8_t ca_public_key[64],
            uint8_t * cert,
            size_t * cert_size )
```

Reads the certificate specified by the certificate definition from the ATECC508A device.

This process involves reading the dynamic cert data from the device and combining it with the template found in the certificate definition.

Parameters

in	*cert_def*	Certificate definition describing where to find the dynamic certificate information on the device and how to incorporate it into the template.
in	*ca_public_key*	The ECC P256 public key of the certificate authority that signed this certificate. Formatted as the 32 byte X and Y integers concatenated together (64 bytes total). Set to NULL if the authority key id is not needed, set properly in the cert_def template, or stored on the device as specifed in the cert_def cert_elements.
out	*cert*	Buffer to received the certificate.
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.31 atcacert_read_cert_ext()

```
ATCA_STATUS atcacert_read_cert_ext (
            ATCADevice device,
```

```
            const atcacert_def_t * cert_def,
            const uint8_t ca_public_key[64],
            uint8_t * cert,
            size_t * cert_size )
```

Reads the certificate specified by the certificate definition from the ATECC508A device.

This process involves reading the dynamic cert data from the device and combining it with the template found in the certificate definition.

Parameters

in	*device*	Device context
in	*cert_def*	Certificate definition describing where to find the dynamic certificate information on the device and how to incorporate it into the template.
in	*ca_public_key*	The ECC P256 public key of the certificate authority that signed this certificate. Formatted as the 32 byte X and Y integers concatenated together (64 bytes total). Set to NULL if the authority key id is not needed, set properly in the cert_def template, or stored on the device as specifed in the cert_def cert_elements.
out	*cert*	Buffer to received the certificate.
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.32 atcacert_read_cert_size()

```
ATCA_STATUS atcacert_read_cert_size (
            const atcacert_def_t * cert_def,
            size_t * cert_size )
```

Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.

Parameters

in	*cert_def*	Certificate definition to find a max size for.
out	*cert_size*	Certificate size will be returned here in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.33 atcacert_read_cert_size_ext()

```
ATCA_STATUS atcacert_read_cert_size_ext (
            ATCADevice device,
            const atcacert_def_t * cert_def,
            size_t * cert_size )
```

Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.

Parameters

in	*device*	Device context
in	*cert_def*	Certificate definition to find a max size for.
out	*cert_size*	Certificate size will be returned here in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.34 atcacert_read_device_loc()

```
ATCA_STATUS atcacert_read_device_loc (
            const atcacert_device_loc_t * device_loc,
            uint8_t * data )
```

Read the data from a device location.

Parameters

in	*device_loc*	Device location to read data from.
out	*data*	Data read is returned here.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.35 atcacert_read_device_loc_ext()

```
ATCA_STATUS atcacert_read_device_loc_ext (
            ATCADevice device,
            const atcacert_device_loc_t * device_loc,
            uint8_t * data )
```

Read the data from a device location.

Parameters

in	*device*	Device context
in	*device_loc*	Device location to read data from.
out	*data*	Data read is returned here.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.36 atcacert_read_subj_key_id()

```
ATCA_STATUS atcacert_read_subj_key_id (
            const atcacert_def_t * cert_def,
            uint8_t subj_key_id[20] )
```

Reads the subject key ID based on a certificate definition.

Parameters

in	*cert_def*	Certificate definition
out	*subj_key_id*	Subject key ID is returned in this buffer. 20 bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.37 atcacert_read_subj_key_id_ext()

```
ATCA_STATUS atcacert_read_subj_key_id_ext (
            ATCADevice device,
            const atcacert_def_t * cert_def,
            uint8_t subj_key_id[20] )
```

Reads the subject key ID based on a certificate definition.

Parameters

in	*device*	Device context
in	*cert_def*	Certificate definition
out	*subj_key_id*	Subject key ID is returned in this buffer. 20 bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.38 atcacert_verify_cert_hw()

```
ATCA_STATUS atcacert_verify_cert_hw (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            const uint8_t ca_public_key[64] )
```

Verify a certificate against its certificate authority's public key using the host's ATECC device for crypto functions.

Parameters

in	*cert_def*	Certificate definition describing how to extract the TBS and signature components from the certificate specified.
in	*cert*	Certificate to verify.
in	*cert_size*	Size of the certificate (cert) in bytes.
in	*ca_public_key*	The ECC P256 public key of the certificate authority that signed this certificate. Formatted as the 32 byte X and Y integers concatenated together (64 bytes total).

Returns

ATCACERT_E_SUCCESS if the verify succeeds, ATCACERT_VERIFY_FAILED or ATCA_EXECUTION_↩ ERROR if it fails to verify. ATCA_EXECUTION_ERROR may occur when the public key is invalid and doesn't fall on the P256 curve.

20.6.5.39 atcacert_verify_cert_sw()

```
ATCA_STATUS atcacert_verify_cert_sw (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size,
            const uint8_t ca_public_key[64] )
```

Verify a certificate against its certificate authority's public key using software crypto functions.The function is currently not implemented.

Parameters

in	*cert_def*	Certificate definition describing how to extract the TBS and signature components from the certificate specified.
in	*cert*	Certificate to verify.
in	*cert_size*	Size of the certificate (cert) in bytes.
in	*ca_public_key*	The ECC P256 public key of the certificate authority that signed this certificate. Formatted as the 32 byte X and Y integers concatenated together (64 bytes total).

Returns

ATCA_UNIMPLEMENTED , as the function is currently not implemented.

20.6.5.40 atcacert_verify_response_hw()

```
ATCA_STATUS atcacert_verify_response_hw (
            const uint8_t device_public_key[64],
            const uint8_t challenge[32],
            const uint8_t response[64] )
```

Verify a client's response to a challenge using the host's ATECC device for crypto functions.

The challenge-response protocol is an ECDSA Sign and Verify. This performs an ECDSA verify on the response returned by the client, verifying the client has the private key counter-part to the public key returned in its certificate.

Parameters

in	*device_public_key*	Device public key as read from its certificate. Formatted as the X and Y integers concatenated together. 64 bytes.
in	*challenge*	Challenge that was sent to the client. 32 bytes.
in	*response*	Response returned from the client to be verified. 64 bytes.

Returns

ATCACERT_E_SUCCESS if the verify succeeds, ATCACERT_VERIFY_FAILED or ATCA_EXECUTION_↩ ERROR if it fails to verify. ATCA_EXECUTION_ERROR may occur when the public key is invalid and doesn't fall on the P256 curve.

20.6.5.41 atcacert_verify_response_sw()

```
ATCA_STATUS atcacert_verify_response_sw (
            const uint8_t device_public_key[64],
            const uint8_t challenge[32],
            const uint8_t response[64] )
```

Verify a client's response to a challenge using software crypto functions.The function is currently not implemented.

The challenge-response protocol is an ECDSA Sign and Verify. This performs an ECDSA verify on the response returned by the client, verifying the client has the private key counter-part to the public key returned in its certificate.

Parameters

in	*device_public_key*	Device public key as read from its certificate. Formatted as the X and Y integers concatenated together. 64 bytes.
in	*challenge*	Challenge that was sent to the client. 32 bytes.
in	*response*	Response returned from the client to be verified. 64 bytes.

Returns

ATCA_UNIMPLEMENTED , as the function is currently not implemented.

20.6.5.42 atcacert_write_cert()

```
ATCA_STATUS atcacert_write_cert (
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size )
```

Take a full certificate and write it to the ATECC508A device according to the certificate definition.

Parameters

in	*cert_def*	Certificate definition describing where the dynamic certificate information is and how to store it on the device.
in	*cert*	Full certificate to be stored.
in	*cert_size*	Size of the full certificate in bytes.
in	*device*	Device context

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.6.5.43 atcacert_write_cert_ext()

```
ATCA_STATUS atcacert_write_cert_ext (
            ATCADevice device,
            const atcacert_def_t * cert_def,
            const uint8_t * cert,
            size_t cert_size )
```

Take a full certificate and write it to the ATECC508A device according to the certificate definition.

Parameters

in	*device*	Device context
in	*cert_def*	Certificate definition describing where the dynamic certificate information is and how to store it on the device.
in	*cert*	Full certificate to be stored.
in	*cert_size*	Size of the full certificate in bytes.
in	*device*	Device context

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

20.7 Basic Crypto API methods for CryptoAuth Devices (calib_)

These methods provide a simple API to CryptoAuth chips.

20.7.0.1 calib directory - Purpose

The purpose of this directory is to contain the files implementing the APIs for a basic interface to the core CryptoAuthLib library.

High-level functions like these make it very convenient to use the library when standard configurations and defaults are in play. They are the easiest to use when developing examples or trying to understand the "flow" of an authentication operation without getting overwhelmed by the details.

This makes simple jobs easy and if you need more sophistication and power, you can employ the full power of the CryptoAuthLib object model.

See the Doxygen documentation in cryptoauthlib/docs for details on the API of the calib commands.

Data Structures

- struct atca_sha256_ctx
- struct atsha204a_config_s
- struct atecc508a_config_s
- struct atecc608_config_s

Macros

- #define **ATCA_AES_ENABLE_EN_SHIFT** (0)
- #define **ATCA_AES_ENABLE_EN_MASK** (0x01u << ATCA_AES_ENABLE_EN_SHIFT)
- #define **ATCA_I2C_ENABLE_EN_SHIFT** (0)
- #define **ATCA_I2C_ENABLE_EN_MASK** (0x01u << ATCA_I2C_ENABLE_EN_SHIFT)
- #define **ATCA_COUNTER_MATCH_EN_SHIFT** (0)
- #define **ATCA_COUNTER_MATCH_EN_MASK** (0x01u << ATCA_COUNTER_MATCH_EN_SHIFT)
- #define **ATCA_COUNTER_MATCH_KEY_SHIFT** (4)
- #define **ATCA_COUNTER_MATCH_KEY_MASK** (0x0Fu << ATCA_COUNTER_MATCH_KEY_SHIFT)
- #define **ATCA_COUNTER_MATCH_KEY**(v) (ATCA_COUNTER_MATCH_KEY_MASK & (v << ATCA_COUNTER_MATCH_KEY_SHIFT))
- #define **ATCA_CHIP_MODE_I2C_EXTRA_SHIFT** (0)
- #define **ATCA_CHIP_MODE_I2C_EXTRA_MASK** (0x01u << ATCA_CHIP_MODE_I2C_EXTRA_SHIFT)
- #define **ATCA_CHIP_MODE_TTL_EN_SHIFT** (1)
- #define **ATCA_CHIP_MODE_TTL_EN_MASK** (0x01u << ATCA_CHIP_MODE_TTL_EN_SHIFT)
- #define **ATCA_CHIP_MODE_WDG_LONG_SHIFT** (2)
- #define **ATCA_CHIP_MODE_WDG_LONG_MASK** (0x01u << ATCA_CHIP_MODE_WDG_LONG_SHIFT)
- #define **ATCA_CHIP_MODE_CLK_DIV_SHIFT** (3)
- #define **ATCA_CHIP_MODE_CLK_DIV_MASK** (0x1Fu << ATCA_CHIP_MODE_CLK_DIV_SHIFT)
- #define **ATCA_CHIP_MODE_CLK_DIV**(v) (ATCA_CHIP_MODE_CLK_DIV_MASK & (v << ATCA_CHIP_MODE_CLK_DIV_SHIFT))

- #define **ATCA_SLOT_CONFIG_READKEY_SHIFT** (0)
- #define **ATCA_SLOT_CONFIG_READKEY_MASK** (0x0Fu << ATCA_SLOT_CONFIG_READKEY_SHIFT)
- #define **ATCA_SLOT_CONFIG_READKEY**(v) (ATCA_SLOT_CONFIG_READKEY_MASK & (v << ATCA_SLOT_CONFIG_READKEY_SHIFT))
- #define **ATCA_SLOT_CONFIG_NOMAC_SHIFT** (4)
- #define **ATCA_SLOT_CONFIG_NOMAC_MASK** (0x01u << ATCA_SLOT_CONFIG_NOMAC_SHIFT)
- #define **ATCA_SLOT_CONFIG_LIMITED_USE_SHIFT** (5)
- #define **ATCA_SLOT_CONFIG_LIMITED_USE_MASK** (0x01u << ATCA_SLOT_CONFIG_LIMITED_USE_SHIFT)
- #define **ATCA_SLOT_CONFIG_ENC_READ_SHIFT** (6)
- #define **ATCA_SLOT_CONFIG_ENC_READ_MASK** (0x01u << ATCA_SLOT_CONFIG_ENC_READ_SHIFT)
- #define **ATCA_SLOT_CONFIG_IS_SECRET_SHIFT** (7)
- #define **ATCA_SLOT_CONFIG_IS_SECRET_MASK** (0x01u << ATCA_SLOT_CONFIG_IS_SECRET_SHIFT)
- #define **ATCA_SLOT_CONFIG_WRITE_KEY_SHIFT** (8)
- #define **ATCA_SLOT_CONFIG_WRITE_KEY_MASK** ((uint32_t)0x0Fu << ATCA_SLOT_CONFIG_WRITE_KEY_SHIFT)
- #define **ATCA_SLOT_CONFIG_WRITE_KEY**(v) (ATCA_SLOT_CONFIG_WRITE_KEY_MASK & (v << ATCA_SLOT_CONFIG_WRITE_KEY_SHIFT))
- #define **ATCA_SLOT_CONFIG_WRITE_CONFIG_SHIFT** (12)
- #define **ATCA_SLOT_CONFIG_WRITE_CONFIG_MASK** (((uint32_t)0x0Fu << ATCA_SLOT_CONFIG_WRITE_CONFIG_SHIFT))
- #define **ATCA_SLOT_CONFIG_WRITE_CONFIG**(v) ((ATCA_SLOT_CONFIG_WRITE_CONFIG_MASK & ((uint32_t)(v) << ATCA_SLOT_CONFIG_WRITE_CONFIG_SHIFT)))
- #define **ATCA_SLOT_CONFIG_EXT_SIG_SHIFT** (0)
- #define **ATCA_SLOT_CONFIG_EXT_SIG_MASK** (0x01u << ATCA_SLOT_CONFIG_EXT_SIG_SHIFT)
- #define **ATCA_SLOT_CONFIG_INT_SIG_SHIFT** (1)
- #define **ATCA_SLOT_CONFIG_INT_SIG_MASK** (0x01u << ATCA_SLOT_CONFIG_INT_SIG_SHIFT)
- #define **ATCA_SLOT_CONFIG_ECDH_SHIFT** (2)
- #define **ATCA_SLOT_CONFIG_ECDH_MASK** (0x01u << ATCA_SLOT_CONFIG_ECDH_SHIFT)
- #define **ATCA_SLOT_CONFIG_WRITE_ECDH_SHIFT** (3)
- #define **ATCA_SLOT_CONFIG_WRITE_ECDH_MASK** (0x01u << ATCA_SLOT_CONFIG_WRITE_ECDH_SHIFT)
- #define **ATCA_SLOT_CONFIG_GEN_KEY_SHIFT** (8)
- #define **ATCA_SLOT_CONFIG_GEN_KEY_MASK** (0x01u << ATCA_SLOT_CONFIG_GEN_KEY_SHIFT)
- #define **ATCA_SLOT_CONFIG_PRIV_WRITE_SHIFT** (9)
- #define **ATCA_SLOT_CONFIG_PRIV_WRITE_MASK** (0x01u << ATCA_SLOT_CONFIG_PRIV_WRITE_SHIFT)
- #define **ATCA_USE_LOCK_ENABLE_SHIFT** (0)
- #define **ATCA_USE_LOCK_ENABLE_MASK** (0x0Fu << ATCA_USE_LOCK_ENABLE_SHIFT)
- #define **ATCA_USE_LOCK_KEY_SHIFT** (4)
- #define **ATCA_USE_LOCK_KEY_MASK** (0x0Fu << ATCA_USE_LOCK_KEY_SHIFT)
- #define **ATCA_VOL_KEY_PERM_SLOT_SHIFT** (0)
- #define **ATCA_VOL_KEY_PERM_SLOT_MASK** (0x0Fu << ATCA_VOL_KEY_PERM_SLOT_SHIFT)
- #define **ATCA_VOL_KEY_PERM_SLOT**(v) (ATCA_VOL_KEY_PERM_SLOT_MASK & (v << ATCA_VOL_KEY_PERM_SLOT_SHIFT))
- #define **ATCA_VOL_KEY_PERM_EN_SHIFT** (7)
- #define **ATCA_VOL_KEY_PERM_EN_MASK** (0x01u << ATCA_VOL_KEY_PERM_EN_SHIFT)
- #define **ATCA_SECURE_BOOT_MODE_SHIFT** (0)
- #define **ATCA_SECURE_BOOT_MODE_MASK** (0x03u << ATCA_SECURE_BOOT_MODE_SHIFT)
- #define **ATCA_SECURE_BOOT_MODE**(v) (ATCA_SECURE_BOOT_MODE_MASK & (v << ATCA_SECURE_BOOT_MODE_SHIFT))
- #define **ATCA_SECURE_BOOT_PERSIST_EN_SHIFT** (3)
- #define **ATCA_SECURE_BOOT_PERSIST_EN_MASK** (0x01u << ATCA_SECURE_BOOT_PERSIST_EN_SHIFT)

- #define **ATCA_SECURE_BOOT_RAND_NONCE_SHIFT** (4)
- #define **ATCA_SECURE_BOOT_RAND_NONCE_MASK** (0x01u << ATCA_SECURE_BOOT_RAND_↩ NONCE_SHIFT)
- #define **ATCA_SECURE_BOOT_DIGEST_SHIFT** (8)
- #define **ATCA_SECURE_BOOT_DIGEST_MASK** (0x0Fu << ATCA_SECURE_BOOT_DIGEST_SHIFT)
- #define **ATCA_SECURE_BOOT_DIGEST**(v) (ATCA_SECURE_BOOT_DIGEST_MASK & (v << ATCA_↩ SECURE_BOOT_DIGEST_SHIFT))
- #define **ATCA_SECURE_BOOT_PUB_KEY_SHIFT** (12)
- #define **ATCA_SECURE_BOOT_PUB_KEY_MASK** (0x0Fu << ATCA_SECURE_BOOT_PUB_KEY_↩ SHIFT)
- #define **ATCA_SECURE_BOOT_PUB_KEY**(v) (ATCA_SECURE_BOOT_PUB_KEY_MASK & (v << ATCA_SECURE_BOOT_PUB_KEY_SHIFT))
- #define **ATCA_SLOT_LOCKED**(v) ((0x01 << v) & 0xFFFFu)
- #define **ATCA_CHIP_OPT_POST_EN_SHIFT** (0)
- #define **ATCA_CHIP_OPT_POST_EN_MASK** (0x01u << ATCA_CHIP_OPT_POST_EN_SHIFT)
- #define **ATCA_CHIP_OPT_IO_PROT_EN_SHIFT** (1)
- #define **ATCA_CHIP_OPT_IO_PROT_EN_MASK** (0x01u << ATCA_CHIP_OPT_IO_PROT_EN_SHIFT)
- #define **ATCA_CHIP_OPT_KDF_AES_EN_SHIFT** (2)
- #define **ATCA_CHIP_OPT_KDF_AES_EN_MASK** (0x01u << ATCA_CHIP_OPT_KDF_AES_EN_SHIFT)
- #define **ATCA_CHIP_OPT_ECDH_PROT_SHIFT** (8)
- #define **ATCA_CHIP_OPT_ECDH_PROT_MASK** (0x03u << ATCA_CHIP_OPT_ECDH_PROT_SHIFT)
- #define **ATCA_CHIP_OPT_ECDH_PROT**(v) (ATCA_CHIP_OPT_ECDH_PROT_MASK & (v << ATCA_↩ CHIP_OPT_ECDH_PROT_SHIFT))
- #define **ATCA_CHIP_OPT_KDF_PROT_SHIFT** (10)
- #define **ATCA_CHIP_OPT_KDF_PROT_MASK** (0x03u << ATCA_CHIP_OPT_KDF_PROT_SHIFT)
- #define **ATCA_CHIP_OPT_KDF_PROT**(v) (ATCA_CHIP_OPT_KDF_PROT_MASK & (v << ATCA_CHIP↩ _OPT_KDF_PROT_SHIFT))
- #define **ATCA_CHIP_OPT_IO_PROT_KEY_SHIFT** (12)
- #define **ATCA_CHIP_OPT_IO_PROT_KEY_MASK** ((uint16_t)0x0Fu << ATCA_CHIP_OPT_IO_PROT_↩ KEY_SHIFT)
- #define **ATCA_CHIP_OPT_IO_PROT_KEY**(v) (ATCA_CHIP_OPT_IO_PROT_KEY_MASK & (v << ATCA↩ _CHIP_OPT_IO_PROT_KEY_SHIFT))
- #define **ATCA_KEY_CONFIG_OFFSET**(x) (96UL + (x) ∗ 2u)
- #define **ATCA_KEY_CONFIG_PRIVATE_SHIFT** (0)
- #define **ATCA_KEY_CONFIG_PRIVATE_MASK** (0x01u << ATCA_KEY_CONFIG_PRIVATE_SHIFT)
- #define **ATCA_KEY_CONFIG_PUB_INFO_SHIFT** (1)
- #define **ATCA_KEY_CONFIG_PUB_INFO_MASK** (0x01u << ATCA_KEY_CONFIG_PUB_INFO_SHIFT)
- #define **ATCA_KEY_CONFIG_KEY_TYPE_SHIFT** (2)
- #define **ATCA_KEY_CONFIG_KEY_TYPE_MASK** ((0x07u << ATCA_KEY_CONFIG_KEY_TYPE_↩ SHIFT))
- #define **ATCA_KEY_CONFIG_KEY_TYPE**(v) ((ATCA_KEY_CONFIG_KEY_TYPE_MASK & ((v) << ATCA_KEY_CONFIG_KEY_TYPE_SHIFT)))
- #define **ATCA_KEY_CONFIG_LOCKABLE_SHIFT** (5)
- #define **ATCA_KEY_CONFIG_LOCKABLE_MASK** (0x01u << ATCA_KEY_CONFIG_LOCKABLE_SHIFT)
- #define **ATCA_KEY_CONFIG_REQ_RANDOM_SHIFT** (6)
- #define **ATCA_KEY_CONFIG_REQ_RANDOM_MASK** (0x01u << ATCA_KEY_CONFIG_REQ_↩ RANDOM_SHIFT)
- #define **ATCA_KEY_CONFIG_REQ_AUTH_SHIFT** (7)
- #define **ATCA_KEY_CONFIG_REQ_AUTH_MASK** (0x01u << ATCA_KEY_CONFIG_REQ_AUTH_SHIFT)
- #define **ATCA_KEY_CONFIG_AUTH_KEY_SHIFT** (8)
- #define **ATCA_KEY_CONFIG_AUTH_KEY_MASK** (0x0Fu << ATCA_KEY_CONFIG_AUTH_KEY_SHIFT)
- #define **ATCA_KEY_CONFIG_AUTH_KEY**(v) (ATCA_KEY_CONFIG_AUTH_KEY_MASK & (v << ATCA↩ _KEY_CONFIG_AUTH_KEY_SHIFT))
- #define **ATCA_KEY_CONFIG_PERSIST_DIS_SHIFT** (12)
- #define **ATCA_KEY_CONFIG_PERSIST_DIS_MASK** (0x01u << ATCA_KEY_CONFIG_PERSIST_DIS_↩ SHIFT)

- #define **ATCA_KEY_CONFIG_RFU_SHIFT** (13)
- #define **ATCA_KEY_CONFIG_RFU_MASK** (0x01u << ATCA_KEY_CONFIG_RFU_SHIFT)
- #define **ATCA_KEY_CONFIG_X509_ID_SHIFT** (14)
- #define **ATCA_KEY_CONFIG_X509_ID_MASK** (0x03u << ATCA_KEY_CONFIG_X509_ID_SHIFT)
- #define **ATCA_KEY_CONFIG_X509_ID**(v) (ATCA_KEY_CONFIG_X509_ID_MASK & (v << ATCA_KEY↩ _CONFIG_X509_ID_SHIFT))

Typedefs

- typedef struct atca_sha256_ctx **atca_sha256_ctx_t**
- typedef atca_sha256_ctx_t **atca_hmac_sha256_ctx_t**
- typedef struct ATCA_PACKED atsha204a_config_s **atsha204a_config_t**
- typedef struct ATCA_PACKED atecc508a_config_s **atecc508a_config_t**
- typedef struct ATCA_PACKED atecc608_config_s **atecc608_config_t**

Functions

- ATCA_STATUS calib_wakeup_i2c (ATCADevice device)

  basic API methods are all prefixed with atcab_ (CryptoAuthLib Basic) the fundamental premise of the basic API is it is based on a single interface instance and that instance is global, so all basic API commands assume that one global device is the one to operate on.
- ATCA_STATUS calib_wakeup (ATCADevice device)

  wakeup the CryptoAuth device
- ATCA_STATUS calib_idle (ATCADevice device)

  idle the CryptoAuth device
- ATCA_STATUS calib_sleep (ATCADevice device)

  invoke sleep on the CryptoAuth device
- ATCA_STATUS calib_exit (ATCADevice device)

  common cleanup code which idles the device after any operation
- ATCA_STATUS calib_get_addr (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint16_t ∗addr)

  Compute the address given the zone, slot, block, and offset.
- ATCA_STATUS calib_get_zone_size (ATCADevice device, uint8_t zone, uint16_t slot, size_t ∗size)

  Gets the size of the specified zone in bytes.
- ATCA_STATUS calib_ca2_get_addr (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint16_t ∗addr)

  Compute the address given the zone, slot, block, and offset for the device.
- ATCA_STATUS **calib_is_locked** (ATCADevice device, uint8_t zone, bool ∗is_locked)
- ATCA_STATUS **calib_is_slot_locked** (ATCADevice device, uint16_t slot, bool ∗is_locked)
- ATCA_STATUS calib_ca2_is_locked (ATCADevice device, uint8_t zone, bool ∗is_locked)

  Use Info command to check config/data is locked or not.
- ATCA_STATUS calib_ca2_is_data_locked (ATCADevice device, bool ∗is_locked)

  Use Info command to check ECC204 Data zone lock status.
- ATCA_STATUS calib_ca2_is_config_locked (ATCADevice device, bool ∗is_locked)

  Executes Read command, which reads the configuration zone to see if the specified slot is locked.
- ATCADeviceType **calib_get_devicetype** (uint8_t revision[4])

  Parse the revision field to get the device type.
- ATCADeviceType **calib_get_devicetype_with_device_id** (uint8_t device_id, uint8_t device_revision)
- ATCA_STATUS calib_info_base (ATCADevice device, uint8_t mode, uint16_t param2, uint8_t ∗out_data)

  Issues an Info command, which return internal device information and can control GPIO and the persistent latch.
- ATCA_STATUS calib_info (ATCADevice device, uint8_t ∗revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS calib_info_privkey_valid (ATCADevice device, uint16_t key_id, uint8_t ∗is_valid)

Use Info command to check ECC Private key stored in key slot is valid or not.

- ATCA_STATUS calib_info_lock_status (ATCADevice device, uint16_t param2, uint8_t *is_locked)

    Use Info command to ECC204,TA010 config/data zone lock status.

- ATCA_STATUS calib_info_chip_status (ATCADevice device, uint8_t *chip_status)

    Use Info command to get ECC204,TA010,SHA10x chip status.

20.7.1 Detailed Description

These methods provide a simple API to CryptoAuth chips.

20.7.2 Function Documentation

20.7.2.1 calib_ca2_get_addr()

```
ATCA_STATUS calib_ca2_get_addr (
            uint8_t zone,
            uint16_t slot,
            uint8_t block,
            uint8_t offset,
            uint16_t * addr )
```

Compute the address given the zone, slot, block, and offset for the device.

Parameters

in	*zone*	Zone to get address from. Config(1) or Data(0) which requires a slot.
in	*slot*	Slot Id number for data zone and zero for other zones.
in	*block*	Block number within the data zone .
in	*offset*	Aalways zero.
out	*addr*	Pointer to the address of data or configuration zone.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.2 calib_ca2_is_config_locked()

```
ATCA_STATUS calib_ca2_is_config_locked (
            ATCADevice device,
            bool * is_locked )
```

Executes Read command, which reads the configuration zone to see if the specified slot is locked.

Parameters

in	*device*	Device context pointer
in	*slot*	Slot to query for locked (slot 0-15)
out	*is_locked*	Lock state returned here. True if locked.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Use Info command to check ECC204 Config zone lock status

Parameters

in	*device*	Device context pointer
out	*is_locked*	return lock status

Returns

ATCA_SUCCESS on success, otherwise an error code

20.7.2.3 calib_ca2_is_data_locked()

```
ATCA_STATUS calib_ca2_is_data_locked (
            ATCADevice device,
            bool * is_locked )
```

Use Info command to check ECC204 Data zone lock status.

Parameters

in	*device*	Device context pointer
out	*is_locked*	return lock status

Returns

ATCA_SUCCESS on success, otherwise an error code

20.7.2.4 calib_ca2_is_locked()

```
ATCA_STATUS calib_ca2_is_locked (
            ATCADevice device,
            uint8_t zone,
            bool * is_locked )
```

Use Info command to check config/data is locked or not.

Parameters

in	*device*	Device contect pointer
in	*zone*	Config/Data zone
out	*is_locked*	return lock status here

Returns

ATCA_SUCCESS on success, otherwise an error code

20.7.2.5 calib_exit()

```
ATCA_STATUS calib_exit (
            ATCADevice device )
```

common cleanup code which idles the device after any operation

Parameters

in	*device*	Device context pointer

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.6 calib_get_addr()

```
ATCA_STATUS calib_get_addr (
            uint8_t zone,
            uint16_t slot,
            uint8_t block,
            uint8_t offset,
            uint16_t * addr )
```

Compute the address given the zone, slot, block, and offset.

Parameters

in	*zone*	Zone to get address from. Config(0), OTP(1), or Data(2) which requires a slot.
in	*slot*	Slot Id number for data zone and zero for other zones.
in	*block*	Block number within the data or configuration or OTP zone .
in	*offset*	Offset Number within the block of data or configuration or OTP zone.
out	*addr*	Pointer to the address of data or configuration or OTP zone.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.7 calib_get_zone_size()

```
ATCA_STATUS calib_get_zone_size (
            ATCADevice device,
            uint8_t zone,
            uint16_t slot,
            size_t * size )
```

Gets the size of the specified zone in bytes.

Parameters

in	*device*	Device context pointer
in	*zone*	Zone to get size information from. Config(0), OTP(1), or Data(2) which requires a slot.
in	*slot*	If zone is Data(2), the slot to query for size.
out	*size*	Zone size is returned here.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.8 calib_idle()

```
ATCA_STATUS calib_idle (
            ATCADevice device )
```

idle the CryptoAuth device

Parameters

in	*device*	Device context pointer

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.9 calib_info()

```
ATCA_STATUS calib_info (
            ATCADevice device,
            uint8_t * revision )
```

Use the Info command to get the device revision (DevRev).

Parameters

in	*device*	Device context pointer
out	*revision*	Device revision is returned here (4 bytes).

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.10 calib_info_base()

```
ATCA_STATUS calib_info_base (
            ATCADevice device,
            uint8_t mode,
            uint16_t param2,
            uint8_t * out_data )
```

Issues an Info command, which return internal device information and can control GPIO and the persistent latch.

Parameters

in	*device*	Device context pointer
in	*mode*	Selects which mode to be used for info command.
in	*param2*	Selects the particular fields for the mode.
out	*out_data*	Response from info command (4 bytes). Can be set to NULL if not required.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.11 calib_info_chip_status()

```
ATCA_STATUS calib_info_chip_status (
            ATCADevice device,
            uint8_t * chip_status )
```

Use Info command to get ECC204,TA010,SHA10x chip status.

Parameters

in	*device*	Device context pointer
out	*chip_status*	return chip status here

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.12 calib_info_lock_status()

```
ATCA_STATUS calib_info_lock_status (
            ATCADevice device,
            uint16_t param2,
            uint8_t * is_locked )
```

Use Info command to ECC204,TA010 config/data zone lock status.

Parameters

in	*device*	Device context pointer
in	*param2*	selects the zone and slot
out	*is_locked*	return lock status here

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.13 calib_info_privkey_valid()

```
ATCA_STATUS calib_info_privkey_valid (
            ATCADevice device,
            uint16_t key_id,
            uint8_t * is_valid )
```

Use Info command to check ECC Private key stored in key slot is valid or not.

Parameters

in	*device*	Device context pointer
in	*key_id*	ECC private key slot id For ECC204,TA010 key_id is 0x00
out	*is_valid*	return private key is valid or invalid

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.14 calib_sleep()

```
ATCA_STATUS calib_sleep (
            ATCADevice device )
```

invoke sleep on the CryptoAuth device

Parameters

in	*device*	Device context pointer

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.15 calib_wakeup()

```
ATCA_STATUS calib_wakeup (
            ATCADevice device )
```

wakeup the CryptoAuth device

Parameters

in	*device*	Device context pointer

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.7.2.16 calib_wakeup_i2c()

```
ATCA_STATUS calib_wakeup_i2c (
            ATCADevice device )
```

basic API methods are all prefixed with atcab_ (CryptoAuthLib Basic) the fundamental premise of the basic API is it is based on a single interface instance and that instance is global, so all basic API commands assume that one global device is the one to operate on.

Drive the SDA pin low for wake up Set i2c device addr as 0U to drive SDA low

I2C general call should not interpreted as an addr write

Set the i2c device address

20.8 Software crypto methods (atcac_)

These methods provide a software implementation of various crypto algorithms.

20.8.0.1 crypto directory - Purpose

This directory contains software implementations of cryptographic functions. The functions at the base level are wrappers that will point to the final implementations of the software crypto functions.

Functions

- ATCA_STATUS **atcac_sw_sha1** (const uint8_t ∗data, size_t data_size, uint8_t digest[(20U)])
- ATCA_STATUS **atcac_sha256_hmac_ctr_iteration** (struct atcac_hmac_ctx ∗ctx, uint8_t iteration, uint16_t length, const uint8_t ∗label, size_t label_len, const uint8_t ∗data, size_t data_len, uint8_t digest[(32U)])
- ATCA_STATUS **atcac_sha256_hmac_counter** (uint8_t ∗key, size_t key_len, const uint8_t ∗label, size_t label_len, const uint8_t ∗data, size_t data_len, uint8_t ∗digest, size_t diglen)

20.8.1 Detailed Description

These methods provide a software implementation of various crypto algorithms.

20.9 Hardware abstraction layer (hal_)

These methods define the hardware abstraction layer for communicating with a CryptoAuth device.

20.9.0.1 HAL Directory - Purpose

This directory contains all the Hardware Abstraction Layer (HAL) files used to adapt the upper levels of atca-ng and abstractions to physical hardware.

HAL contains physical implementations for I2C, SWI, SPI, UART and timers for specific hardware platforms.

Include just those HAL files you require based on platform type.

20.9.1 Cryptoauthlib HAL Architecture

Cryptoauthlib has several intermediate conceptual layers

1. The highest layer of cryptoauthlib (outside of integration APIS) that may be used with an application is the atcab_ api functions. These are general purpose functions that present a simple and consistent crypto interface to the application regardless of the device being used.
2. calib_, talib_ APIs are the library functions behind atcab_ ones that generate the correct command packets and process the received responses. Device specific logic is handled by the library here
3. hal_ these functions perform the transmit/recieve of data for a given interface. These are split into sublayers
    - The HAL layer is the first hal layer that presents the interface expected by the higher level library. When using a native driver and no further interpretation is required this layer is all that is required.
    - The PHY layer if for hals that perform an interpretation or additional protocol logic. In this situation the HAL performs protocol interpretation while the phy performs the physical communication

20.9.1.0.1 HAL and PHY Requirements

The hal and phy layers have the same construction. A hal or phy must have the following functions and their signatures

- ATCA_STATUS hal_<name>*init(ATCAIface iface, ATCAIfaceCfg ∗cfg);*
- *ATCA_STATUS hal*<name>*post_init(ATCAIface iface);*
- *ATCA_STATUS hal*<name>*send(ATCAIface iface, uint8_t address, uint8_t ∗txdata, int txlength);*
- *ATCA_STATUS hal*<name>*receive(ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength);*
- *ATCA_STATUS hal*<name>*control(ATCAIface iface, uint8_t option, void∗ param, size_t paramlen);*
- *ATCA_STATUS hal*<name>_release(void ∗hal_data);

If the hal is a native driver no phy is required. See the tables below for which hal is required to be ported based on a configured interface

20.9.2 CryptoAuthLib Supported HAL Layers

Device Interface	Physical Interface	HAL	PHY
i2c	i2c	hal_i2c	
	gpio	hal_i2c_gpio	hal_gpio
spi	spi	hal_spi	
swi	uart	hal_swi	hal_uart
	gpio	hal_swi_gpio	hal_gpio
any	uart	kit	hal_uart
	hid	kit	hal_hid
	any (user provided)	kit_bridge	

20.9.2.1 Microchip Harmony 3 for all PIC32 & ARM products - Use the Harmony 3 Configurator to generate and configure prjects

Obtain library and configure using `Harmony 3`

Interface	Files	API	Notes
I2C	hal_i2c_harmony.c	plib.h	For all Harmony 3 based projects
SPI	hal_spi_harmony.c	plib.h	
UART	hal_uart_harmony.c	plib.h	

20.9.2.2 Microchip 8 & 16 bit products - AVR, PIC16/18, PIC24/DSPIC

Obtain library and integration through `Microchip Code Configurator`

20.9.2.3 OS & RTOS integrations

Use `CMake` to configure the library in Linux, Windows, and MacOS environments

OS	Interface	Files	API	Notes
Linux	I2C	hal_linux_i2c_userspace.c/h	i2c-dev	
Linux	SPI	hal_linux_spi_userspace.c/h	spidev	
Linux/Mac		hal_linux.c		For all Linux/Mac projects
Windows		hal_windows.c		For all Windows projects
All	kit-hid	hal_all_platforms_kit_hidapi.c/h	hidapi	Works for Windows, Linux, and Mac
freeRTOS		hal_freertos.c		freeRTOS common routines

20.9.2.4 Legacy Support - Atmel START for AVR, ARM based processesors (SAM)

Interface	Files	API	Notes
	hal_timer_start.c	START	Timer implementation
I2C	hal_i2c_start.c/h	START	
SWI	swi_uart_start.c/h	START	SWI using UART

20.9.2.5 Legacy Support - ASF3 for ARM Cortex-m0 & Cortex-m based processors (SAM)

SAM Micros	Interface	Files	API	Notes
cortex-m0	I2C	hal_sam0_i2c_asf.c/h	ASF3	SAMD21, SAMB11, etc
cortex-m3/4/7	I2C	hal_sam_i2c_asf.c/h	ASF3	SAM4S, SAMG55, SAMV71, etc
all		hal_sam_timer_asf.c	ASF3	Common timer hal for all platforms

Data Structures

- struct atca_hal_kit_phy_t
- struct atca_hal_shm_t
- struct i2c_start_instance
- struct atca_i2c_host_s
- struct i2c_sam_instance
- struct atcaI2Cmaster

  this is the hal_data for ATCA HAL for ASF SERCOM
- struct atcaSWImaster

  this is the hal_data for ATCA HAL for ASF SERCOM

Macros

- #define **ATCA_POLLING_INIT_TIME_MSEC** 1
- #define **ATCA_POLLING_FREQUENCY_TIME_MSEC** 2
- #define **ATCA_POLLING_MAX_TIME_MSEC** 2500
- #define **ATCA_HAL_CONTROL_WAKE** (0U)

  Execute the hardware specific wake - generally only for kits.
- #define **ATCA_HAL_CONTROL_IDLE** (1U)

  Execute the hardware specific idle - generally only for kits.
- #define **ATCA_HAL_CONTROL_SLEEP** (2U)

  Execute the hardware specific sleep - generally only for kits.
- #define **ATCA_HAL_CONTROL_RESET** (3U)

Execute the hardware specific reset - generally only for kits.
- #define **ATCA_HAL_CONTROL_SELECT** (4U)

  Select the device - assert CS, open device, etc.
- #define **ATCA_HAL_CONTROL_DESELECT** (5U)

  Select the device - de-assert CS, release device, etc.
- #define **ATCA_HAL_CHANGE_BAUD** (6U)

  Change the datarate of the phy.
- #define **ATCA_HAL_FLUSH_BUFFER** (7U)

  If the phy has a buffer make sure all bytes are transmitted.
- #define **ATCA_HAL_CONTROL_DIRECTION** (8U)

  Set the PIN mode (in vs out)
- #define **MAX_I2C_BUSES** 3
- #define **KIT_MAX_SCAN_COUNT** 8
- #define **KIT_MAX_TX_BUF** 32
- #define **KIT_TX_WRAP_SIZE** (10)
- #define **KIT_MSG_SIZE** (32u)
- #define **KIT_RX_WRAP_SIZE** (KIT_MSG_SIZE + 6u)
- #define MAX_SWI_BUSES 6
- #define **RECEIVE_MODE** 0
- #define **TRANSMIT_MODE** 1
- #define **RX_DELAY** 10
- #define **TX_DELAY** 90
- #define **DEBUG_PIN_1** EXT2_PIN_5
- #define **DEBUG_PIN_2** EXT2_PIN_6
- #define MAX_SWI_BUSES 6
- #define **RECEIVE_MODE** 0
- #define **TRANSMIT_MODE** 1
- #define **RX_DELAY** 10
- #define **TX_DELAY** 93

Typedefs

- typedef void ∗ **hal_mutex_t**

  Generic mutex type definition for most systems.
- typedef void(∗ **start_change_baudrate**) (ATCAIface iface, uint32_t speed)
- typedef struct i2c_start_instance **i2c_start_instance_t**
- typedef struct atca_i2c_host_s **atca_i2c_host_t**
- typedef void(∗ **sam_change_baudrate**) (ATCAIface iface, uint32_t speed)
- typedef struct i2c_sam_instance **i2c_sam_instance_t**
- typedef struct atcaI2Cmaster **ATCAI2CMaster_t**

  this is the hal_data for ATCA HAL for ASF SERCOM
- typedef struct atcaSWImaster **ATCASWIMaster_t**

  this is the hal_data for ATCA HAL for ASF SERCOM
- typedef struct atcaSWImaster **ATCASWIMaster_t**

  this is the hal_data for ATCA HAL for ASF SERCOM

Functions

- ATCA_STATUS hal_iface_init (ATCAIfaceCfg *cfg, ATCAHAL_t **hal, ATCAHAL_t **phy)

    Standard HAL API for ATCA to initialize a physical interface.
- ATCA_STATUS hal_iface_release (ATCAIfaceType iface_type, void *hal_data)

    releases a physical interface, HAL knows how to interpret hal_data
- ATCA_STATUS hal_check_wake (const uint8_t *response, int response_size)

    Utility function for hal_wake to check the reply.
- void atca_delay_ms (uint32_t ms)

    Timer API for legacy implementations.
- void atca_delay_us (uint32_t delay)

    This function delays for a number of microseconds.
- void hal_delay_ms (uint32_t delay)

    Timer API implemented at the HAL level.
- void hal_delay_us (uint32_t delay)

    This function delays for a number of microseconds.
- ATCA_STATUS hal_create_mutex (void **ppMutex, const char *pName)

    Optional hal interfaces.
- ATCA_STATUS **hal_init_mutex** (void *pMutex, bool shared)
- ATCA_STATUS **hal_destroy_mutex** (void *pMutex)
- ATCA_STATUS **hal_lock_mutex** (void *pMutex)
- ATCA_STATUS **hal_unlock_mutex** (void *pMutex)
- ATCA_STATUS **hal_alloc_shared** (void **pShared, size_t size, const char *pName, bool *initialized)
- ATCA_STATUS **hal_free_shared** (void *pShared, size_t size)
- ATCA_STATUS hal_iface_register_hal (ATCAIfaceType iface_type, ATCAHAL_t *hal, ATCAHAL_t **old_hal, ATCAHAL_t *phy, ATCAHAL_t **old_phy)

    Register/Replace a HAL with a.
- uint8_t hal_is_command_word (uint8_t word_address)

    Utility function for hal_wake to check the reply.
- ATCA_STATUS hal_kit_hid_init (ATCAIface iface, ATCAIfaceCfg *cfg)

    HAL implementation of Kit USB HID init.
- ATCA_STATUS hal_kit_hid_post_init (ATCAIface iface)

    HAL implementation of Kit HID post init.
- ATCA_STATUS hal_kit_hid_send (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)

    HAL implementation of kit protocol send over USB HID.
- ATCA_STATUS hal_kit_hid_receive (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_↩
t *rxlength)

    HAL implementation of send over USB HID.
- ATCA_STATUS hal_kit_hid_control (ATCAIface iface, uint8_t option, void *param, size_t paramlen)

    Perform control operations for the kit protocol.
- ATCA_STATUS hal_kit_hid_release (void *hal_data)

    Close the physical port for HID.
- void * **hal_malloc** (size_t size)
- void **hal_free** (void *ptr)
- void hal_rtos_delay_ms (uint32_t delay)

    This function delays for a number of milliseconds.
- ATCA_STATUS hal_i2c_discover_buses (int i2c_buses[ ], int max_buses)

    discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-prior knowledge
- ATCA_STATUS hal_i2c_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int *found)

    discover any CryptoAuth devices on a given logical bus number
- ATCA_STATUS hal_i2c_init (ATCAIface iface, ATCAIfaceCfg *cfg)

hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.

- ATCA_STATUS hal_i2c_post_init (ATCAIface iface)

  HAL implementation of I2C post init.
- ATCA_STATUS hal_i2c_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of I2C send over START.
- ATCA_STATUS hal_i2c_receive (ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of I2C receive function for START I2C.
- ATCA_STATUS change_i2c_speed (ATCAIface iface, uint32_t speed)

  method to change the bus speec of I2C
- ATCA_STATUS hal_i2c_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Perform control operations for the kit protocol.
- ATCA_STATUS hal_i2c_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist
- ATCA_STATUS hal_i2c_init (void ∗hal, ATCAIfaceCfg ∗cfg)

  hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.
- ATCA_STATUS hal_i2c_wake (ATCAIface iface)

  wake up CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_idle (ATCAIface iface)

  idle CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_sleep (ATCAIface iface)

  sleep CryptoAuth device using I2C bus
- ATCA_STATUS hal_kit_attach_phy (ATCAIfaceCfg ∗cfg, atca_hal_kit_phy_t ∗phy)

  Helper function that connects a physical layer context structure that will be used by the kit protocol bridge.
- ATCA_STATUS hal_kit_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  HAL implementation of Kit USB HID init.
- ATCA_STATUS hal_kit_post_init (ATCAIface iface)

  HAL implementation of Kit HID post init.
- ATCA_STATUS hal_kit_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of kit protocol send over USB HID.
- ATCA_STATUS hal_kit_receive (ATCAIface iface, uint8_t word_address, uint8_t ∗rxdata, uint16_t ∗rxsize)

  HAL implementation of send over USB HID.
- ATCA_STATUS hal_kit_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Kit Protocol Control.
- ATCA_STATUS hal_kit_release (void ∗hal_data)

  Close the physical port for HID.
- ATCA_STATUS **hal_check_pid** (hal_pid_t pid)

  Check if the pid exists in the system.
- void atca_delay_10us (uint32_t delay)

  This function delays for a number of tens of microseconds.
- ATCA_STATUS hal_spi_discover_buses (int spi_buses[ ], int max_buses)

  discover spi buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge
- ATCA_STATUS hal_spi_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int ∗found)

  discover any TA10x devices on a given logical bus number
- ATCA_STATUS hal_spi_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  initialize an SPI interface using given config

- ATCA_STATUS hal_spi_post_init (ATCAIface iface)

  HAL implementation of SPI post init.
- ATCA_STATUS hal_spi_select (ATCAIface iface)

  HAL implementation to assert the device chip select.
- ATCA_STATUS hal_spi_deselect (ATCAIface iface)

  HAL implementation to deassert the device chip select.
- ATCA_STATUS hal_spi_send (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)

  HAL implementation of SPI send over Harmony.
- ATCA_STATUS hal_spi_receive (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)

  HAL implementation of SPI receive function for HARMONY SPI.
- ATCA_STATUS hal_spi_control (ATCAIface iface, uint8_t option, void *param, size_t paramlen)

  Perform control operations for the kit protocol.
- ATCA_STATUS hal_spi_release (void *hal_data)

  manages reference count on given bus and releases resource if no more refences exist
- ATCA_STATUS hal_swi_init (ATCAIface iface, ATCAIfaceCfg *cfg)

  initialize an SWI interface using given config
- ATCA_STATUS hal_swi_post_init (ATCAIface iface)

  HAL implementation of SWI post init.
- ATCA_STATUS hal_swi_send (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)

  HAL implementation of SWI send command over UART.
- ATCA_STATUS hal_swi_receive (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)

  HAL implementation of SWI receive function over UART.
- ATCA_STATUS hal_swi_wake (ATCAIface iface)

  Send Wake flag via SWI.
- ATCA_STATUS hal_swi_sleep (ATCAIface iface)

  Send Sleep flag via SWI.
- ATCA_STATUS hal_swi_idle (ATCAIface iface)

  Send Idle flag via SWI.
- ATCA_STATUS hal_swi_control (ATCAIface iface, uint8_t option, void *param, size_t paramlen)

  Perform control operations for the kit protocol.
- ATCA_STATUS hal_swi_release (void *hal_data)

  manages reference count on given bus and releases resource if no more refences exist
- const char * kit_id_from_devtype (ATCADeviceType devtype)
- const char * kit_interface_from_kittype (ATCAKitType kittype)
- const char * kit_interface (ATCAKitType kittype)
- ATCA_STATUS **kit_init** (ATCAIface iface, ATCAIfaceCfg *cfg)
- ATCA_STATUS **kit_post_init** (ATCAIface iface)
- ATCA_STATUS **kit_send** (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)
- ATCA_STATUS **kit_receive** (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxsize)
- ATCA_STATUS **kit_control** (ATCAIface iface, uint8_t option, void *param, size_t paramlen)
- ATCA_STATUS **kit_release** (void *hal_data)
- ATCA_STATUS **kit_wrap_cmd** (ATCAIface iface, uint8_t word_address, const uint8_t *txdata, int txlen, char *pkitcmd, int *nkitcmd)
- ATCA_STATUS **kit_parse_rsp** (const char *pkitbuf, int nkitbuf, uint8_t *kitstatus, uint8_t *rxdata, int *datasize)
- ATCA_STATUS **kit_wake** (ATCAIface iface)
- ATCA_STATUS **kit_idle** (ATCAIface iface)
- ATCA_STATUS **kit_sleep** (ATCAIface iface)
- ATCA_STATUS **kit_phy_send** (ATCAIface iface, uint8_t *txdata, int txlength)
- ATCA_STATUS **kit_phy_receive** (ATCAIface iface, uint8_t *rxdata, int *rxsize)
- ATCA_STATUS swi_uart_init (ATCASWIMaster_t *instance)

  Implementation of SWI UART init.

- ATCA_STATUS swi_uart_deinit (ATCASWIMaster_t ∗instance)

    Implementation of SWI UART deinit.
- void swi_uart_setbaud (ATCASWIMaster_t ∗instance, uint32_t baudrate)

    implementation of SWI UART change baudrate.
- void swi_uart_mode (ATCASWIMaster_t ∗instance, uint8_t mode)

    implementation of SWI UART change mode.
- void swi_uart_discover_buses (int swi_uart_buses[ ], int max_buses)

    discover UART buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge
- ATCA_STATUS swi_uart_send_byte (ATCASWIMaster_t ∗instance, uint8_t data)

    HAL implementation of SWI UART send byte over ASF. This function send one byte over UART.
- ATCA_STATUS swi_uart_receive_byte (ATCASWIMaster_t ∗instance, uint8_t ∗data)

    HAL implementation of SWI UART receive bytes over ASF. This function receive one byte over UART.

Variables

- struct port_config **pin_conf**

20.9.3 Detailed Description

These methods define the hardware abstraction layer for communicating with a CryptoAuth device.

These methods define the hardware abstraction layer for communicating with a CryptoAuth device using SWI Interface.

These methods define the hardware abstraction layer for communicating with a TA10x device.

< Uncomment when debugging

These methods define the hardware abstraction layer for communicating with a CryptoAuth device using I2C driver of ASF.

20.9.4 Macro Definition Documentation

20.9.4.1 MAX_SWI_BUSES [1/2]

```
#define MAX_SWI_BUSES 6
```

- this HAL implementation assumes you've included the ASF SERCOM UART libraries in your project, otherwise, the HAL layer will not compile because the ASF UART drivers are a dependency ∗

20.9.4.2 MAX_SWI_BUSES [2/2]

```
#define MAX_SWI_BUSES 6
```

- this HAL implementation assumes you've included the ASF SERCOM UART libraries in your project, otherwise, the HAL layer will not compile because the ASF UART drivers are a dependency *

20.9.5 Function Documentation

20.9.5.1 atca_delay_10us()

```
void atca_delay_10us (
            uint32_t delay )
```

This function delays for a number of tens of microseconds.

Parameters

in	*delay*	number of 0.01 milliseconds to delay

Parameters

in	*delay*	number of 0.01 milliseconds to delay

20.9.5.2 atca_delay_ms()

```
void atca_delay_ms (
            uint32_t delay )
```

Timer API for legacy implementations.

This function delays for a number of milliseconds.

```
You can override this function if you like to do
something else in your system while delaying.
```

Parameters

in	*delay*	number of milliseconds to delay

```
You can override this function if you like to do
something else in your system while delaying.
```

Parameters

in	*delay*	number of milliseconds to delay

20.9.5.3 atca_delay_us()

```
void atca_delay_us (
            uint32_t delay )
```

This function delays for a number of microseconds.

Parameters

in	*delay*	number of 0.001 milliseconds to delay

Parameters

in	*delay*	number of microseconds to delay

Parameters

in	*delay*	number of 0.001 milliseconds to delay

20.9.5.4 change_i2c_speed()

```
ATCA_STATUS change_i2c_speed (
            ATCAIface iface,
            uint32_t speed )
```

method to change the bus speec of I2C

method to change the bus speed of I2C

Parameters

in	*iface*	interface on which to change bus speed
in	*speed*	baud rate (typically 100000 or 400000)
in	*iface*	interface on which to change bus speed
in	*speed*	baud rate (typically 100000 or 400000)

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.5 hal_check_wake()

```
ATCA_STATUS hal_check_wake (
            const uint8_t * response,
            int response_size )
```

Utility function for hal_wake to check the reply.

Parameters

in	*response*	Wake response to be checked.
in	*response_size*	Size of the response to check.

Returns

ATCA_SUCCESS for expected wake, ATCA_STATUS_SELFTEST_ERROR if the power on self test failed, ATCA_WAKE_FAILED for other failures.

20.9.5.6 hal_create_mutex()

```
ATCA_STATUS hal_create_mutex (
            void ** ppMutex,
            const char * pName )
```

Optional hal interfaces.

Application callback for creating a mutex object.

Parameters

in,out	*ppMutex*	location to receive ptr to mutex
in,out	*pName*	String used to identify the mutex
	[IN/OUT]	ppMutex location to receive ptr to mutex
	[IN]	pName Name of the mutex for systems using named objects

20.9.5.7 hal_delay_ms()

```
void hal_delay_ms (
            uint32_t delay )
```

Timer API implemented at the HAL level.

This function delays for a number of milliseconds.

Parameters

in	*delay*	number of milliseconds to delay

```
You can override this function if you like to do
something else in your system while delaying.
```

Parameters

in	*delay*	number of milliseconds to delay

20.9.5.8 hal_delay_us()

```
void hal_delay_us (
            uint32_t delay )
```

This function delays for a number of microseconds.

Parameters

in	*delay*	number of microseconds to delay

Parameters

in	*delay*	number of microseconds to delay

20.9.5.9 hal_i2c_control()

```
ATCA_STATUS hal_i2c_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations for the kit protocol.

Parameters

in	*iface*	Interface to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.10 hal_i2c_discover_buses()

```
ATCA_STATUS hal_i2c_discover_buses (
            int i2c_buses[],
            int max_buses )
```

discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-prior knowledge

This HAL implementation assumes you've included the ASF TWI libraries in your project, otherwise, the HAL layer will not compile because the ASF TWI drivers are a dependency.

logical to physical bus mapping structure

discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge

Parameters

in	*i2c_buses*	- an array of logical bus numbers
in	*max_buses*	- maximum number of buses the app wants to attempt to discover

Returns

ATCA_SUCCESS

discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge

Parameters

in	*i2c_buses*	- an array of logical bus numbers
in	*max_buses*	- maximum number of buses the app wants to attempt to discover

Returns

ATCA_SUCCESS

discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge

Parameters

in	*i2c_buses*	- an array of logical bus numbers
in	*max_buses*	- maximum number of buses the app wants to attempt to discover return ATCA_SUCCESS

20.9.5.11 hal_i2c_discover_devices()

```
ATCA_STATUS hal_i2c_discover_devices (
            int bus_num,
            ATCAIfaceCfg cfg[ ],
            int * found )
```

discover any CryptoAuth devices on a given logical bus number

Parameters

in	*bus_num*	logical bus number on which to look for CryptoAuth devices
out	*cfg*	pointer to head of an array of interface config structures which get filled in by this method
out	*found*	number of devices found on this bus

Returns

ATCA_SUCCESS

Parameters

in	*bus_num*	- logical bus number on which to look for CryptoAuth devices
out	*cfg[ ]*	- pointer to head of an array of interface config structures which get filled in by this method
out	**found*	- number of devices found on this bus

Returns

ATCA_SUCCESS

Parameters

in	*bus_num*	Logical bus number on which to look for CryptoAuth devices
out	*cfg*	Pointer to head of an array of interface config structures which get filled in by this method
out	*found*	Number of devices found on this bus

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.12 hal_i2c_idle()

```
ATCA_STATUS hal_i2c_idle (
            ATCAIface iface )
```

idle CryptoAuth device using I2C bus

Parameters

in	*iface*	interface to logical device to idle

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	interface to logical device to idle

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.13 hal_i2c_init() [1/2]

```
ATCA_STATUS hal_i2c_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c↩ _init manages these things and ATCAIFace is abstracted from the physical details.

HAL implementation of I2C init.

- this HAL implementation assumes you've included the START Twi libraries in your project, otherwise, the HAL layer will not compile because the START TWI drivers are a dependency *

initialize an I2C interface using given config

Parameters

in	*hal*	- opaque ptr to HAL data
in	*cfg*	- interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

this implementation assumes I2C peripheral has been enabled by user. It only initialize an I2C interface using given config.

Parameters

in	*hal*	pointer to HAL specific data that is maintained by this HAL
in	*cfg*	pointer to HAL specific configuration data that is used to initialize this HAL

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.14 hal_i2c_init() [2/2]

```
ATCA_STATUS hal_i2c_init (
            void * hal,
            ATCAIfaceCfg * cfg )
```

hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.

hal_i2c_init manages requests to initialize a physical interface. It manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.

initialize an I2C interface using given config

- this HAL implementation assumes you've included the START Twi libraries in your project, otherwise, the HAL layer will not compile because the START TWI drivers are a dependency *

initialize an I2C interface using given config

Parameters

in	*hal*	- opaque ptr to HAL data
in	*cfg*	- interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

- this HAL implementation assumes you've included the ASF SERCOM I2C libraries in your project, otherwise, the HAL layer will not compile because the ASF I2C drivers are a dependency *

Parameters

in	*hal*	- opaque ptr to HAL data
in	*cfg*	- interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

initialize an I2C interface using given config

Parameters

in	*hal*	- opaque ptr to HAL data
in	*cfg*	- interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

- this HAL implementation assumes you've included the ASF Twi libraries in your project, otherwise, the HAL layer will not compile because the ASF TWI drivers are a dependency *

initialize an I2C interface using given config

Parameters

in	*hal*	- opaque ptr to HAL data
in	*cfg*	- interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.15 hal_i2c_post_init()

```
ATCA_STATUS hal_i2c_post_init (
            ATCAIface iface )
```

HAL implementation of I2C post init.

Parameters

in	*iface*	instance

Returns

ATCA_SUCCESS

Parameters

in	*iface*	instance

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	instance

Returns

ATCA_SUCCESS

20.9.5.16 hal_i2c_receive()

```
ATCA_STATUS hal_i2c_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

HAL implementation of I2C receive function for START I2C.

HAL implementation of I2C receive function for ASF I2C.

HAL implementation of I2C receive function.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	Device to interact with.
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	Device to interact with.
in	*address*	device address
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device word address
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.17 hal_i2c_release()

```
ATCA_STATUS hal_i2c_release (
            void * hal_data )
```

manages reference count on given bus and releases resource if no more refences exist

manages reference count on given bus and releases resource if no more refernces exist

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation return ATCA_SUCCESS

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS

20.9.5.18 hal_i2c_send()

```
ATCA_STATUS hal_i2c_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of I2C send over START.

HAL implementation of I2C send over ASF.

HAL implementation of I2C send.

Parameters

in	*iface*	instance
in	*word_address*	device transaction type
in	*txdata*	pointer to space to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	instance
in	*txdata*	pointer to space to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	instance
in	*word_address*	device word address
in	*txdata*	pointer to space to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	instance
in	*word_address*	device word address
in	*txdata*	pointer to space to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

Add 1 byte for word address

Add 1 byte for word address

20.9.5.19 hal_i2c_sleep()

```
ATCA_STATUS hal_i2c_sleep (
            ATCAIface iface )
```

sleep CryptoAuth device using I2C bus

Parameters

in	*iface*	interface to logical device to sleep

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	interface to logical device to sleep

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.20 hal_i2c_wake()

```
ATCA_STATUS hal_i2c_wake (
            ATCAIface iface )
```

wake up CryptoAuth device using I2C bus

Parameters

in	*iface*	interface to logical device to wakeup

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*iface*	interface to logical device to wakeup

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.21 hal_iface_init()

```
ATCA_STATUS hal_iface_init (
            ATCAIfaceCfg * cfg,
            ATCAHAL_t ** hal,
            ATCAHAL_t ** phy )
```

Standard HAL API for ATCA to initialize a physical interface.

Parameters

in	*cfg*	pointer to ATCAIfaceCfg object
in	*hal*	pointer to ATCAHAL_t intermediate data structure

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.22 hal_iface_register_hal()

```
ATCA_STATUS hal_iface_register_hal (
            ATCAIfaceType iface_type,
            ATCAHAL_t * hal,
            ATCAHAL_t ** old_hal,
            ATCAHAL_t * phy,
            ATCAHAL_t ** old_phy )
```

Register/Replace a HAL with a.

Parameters

in	*iface_type*	- the type of physical interface to register
in	*hal*	pointer to the new ATCAHAL_t structure to register
out	*old*	pointer to the existing ATCAHAL_t structure

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.23 hal_iface_release()

```
ATCA_STATUS hal_iface_release (
            ATCAIfaceType iface_type,
            void * hal_data )
```

releases a physical interface, HAL knows how to interpret hal_data

Parameters

in	*iface_type*	- the type of physical interface to release
in	*hal_data*	- pointer to opaque hal data maintained by HAL implementation for this interface type

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.24 hal_is_command_word()

```
uint8_t hal_is_command_word (
            uint8_t word_address )
```

Utility function for hal_wake to check the reply.

Parameters

in	*word_address*	Command to check

Returns

true if the word_address is considered a command

20.9.5.25 hal_kit_attach_phy()

```
ATCA_STATUS hal_kit_attach_phy (
            ATCAIfaceCfg * cfg,
            atca_hal_kit_phy_t * phy )
```

Helper function that connects a physical layer context structure that will be used by the kit protocol bridge.

Returns

ATCA_STATUS

Parameters

cfg	[IN] Interface configuration structure
phy	[IN] Structure with physical layer interface functions and context

20.9.5.26 hal_kit_control()

```
ATCA_STATUS hal_kit_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Kit Protocol Control.

Parameters

in	*iface*	ATCAIface instance that is the interface object to send the bytes over
in	*option*	Control option to use

Returns

ATCA_STATUS

20.9.5.27 hal_kit_hid_control()

```
ATCA_STATUS hal_kit_hid_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations for the kit protocol.

Parameters

in	*iface*	Interface to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.28 hal_kit_hid_init()

```
ATCA_STATUS hal_kit_hid_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

HAL implementation of Kit USB HID init.

Parameters

in	*hal*	pointer to HAL specific data that is maintained by this HAL
in	*cfg*	pointer to HAL specific configuration data that is used to initialize this HAL

Returns

ATCA_STATUS

20.9.5.29 hal_kit_hid_post_init()

```
ATCA_STATUS hal_kit_hid_post_init (
            ATCAIface iface )
```

HAL implementation of Kit HID post init.

Parameters

in	*iface*	instance

Returns

ATCA_STATUS

20.9.5.30 hal_kit_hid_receive()

```
ATCA_STATUS hal_kit_hid_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

HAL implementation of send over USB HID.

Parameters

in	*iface*	instance
in	*word_address*	determine device transaction type
in	*rxdata*	pointer to space to receive the data
in,out	*rxsize*	ptr to expected number of receive bytes to request

Returns

ATCA_STATUS

20.9.5.31 hal_kit_hid_release()

```
ATCA_STATUS hal_kit_hid_release (
            void * hal_data )
```

Close the physical port for HID.

Parameters

in	*hal_data*	The hardware abstraction data specific to this HAL

Returns

ATCA_STATUS

20.9.5.32 hal_kit_hid_send()

```
ATCA_STATUS hal_kit_hid_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of kit protocol send over USB HID.

Parameters

in	*iface*	instance
in	*word_address*	determine device transaction type
in	*txdata*	pointer to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_STATUS

20.9.5.33 hal_kit_init()

```
ATCA_STATUS hal_kit_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

HAL implementation of Kit USB HID init.

Parameters

in	*iface*	instance
in	*cfg*	pointer to HAL specific configuration data that is used to initialize this HAL

Returns

ATCA_STATUS

20.9.5.34 hal_kit_post_init()

```
ATCA_STATUS hal_kit_post_init (
            ATCAIface iface )
```

HAL implementation of Kit HID post init.

Parameters

in	*iface*	instance

Returns

ATCA_STATUS

20.9.5.35 hal_kit_receive()

```
ATCA_STATUS hal_kit_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxsize )
```

HAL implementation of send over USB HID.

Parameters

in	*iface*	instance
in	*word_address*	determine device transaction type
in	*rxdata*	pointer to space to receive the data
in,out	*rxsize*	ptr to expected number of receive bytes to request

Returns

ATCA_STATUS

20.9.5.36 hal_kit_release()

```
ATCA_STATUS hal_kit_release (
            void * hal_data )
```

Close the physical port for HID.

Parameters

in	*hal_data*	The hardware abstraction data specific to this HAL

Returns

ATCA_STATUS

20.9.5.37 hal_kit_send()

```
ATCA_STATUS hal_kit_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of kit protocol send over USB HID.

Parameters

in	*iface*	instance
in	*word_address*	determine device transaction type
in	*txdata*	pointer to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_STATUS

Add 1 byte to txlength for word address

20.9.5.38 hal_rtos_delay_ms()

```
void hal_rtos_delay_ms (
            uint32_t delay )
```

This function delays for a number of milliseconds.

```
You can override this function if you like to do
something else in your system while delaying.
```

Parameters

in	*delay*	Number of milliseconds to delay

20.9.5.39 hal_spi_control()

```
ATCA_STATUS hal_spi_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations for the kit protocol.

Parameters

in	*iface*	Interface to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.40 hal_spi_deselect()

```
ATCA_STATUS hal_spi_deselect (
            ATCAIface iface )
```

HAL implementation to deassert the device chip select.

Parameters

in	*iface*	Device to interact with.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.41 hal_spi_discover_buses()

```
ATCA_STATUS hal_spi_discover_buses (
            int spi_buses[],
            int max_buses )
```

discover spi buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge

Parameters

in	*spi_buses*	- an array of logical bus numbers
in	*max_buses*	- maximum number of buses the app wants to attempt to discover

Returns

ATCA_SUCCESS

20.9.5.42 hal_spi_discover_devices()

```
ATCA_STATUS hal_spi_discover_devices (
            int bus_num,
            ATCAIfaceCfg cfg[ ],
            int * found )
```

discover any TA10x devices on a given logical bus number

Parameters

in	*bus_num*	logical bus number on which to look for TA10x devices
out	*cfg*	pointer to head of an array of interface config structures which get filled in by this method
out	*found*	number of devices found on this bus

Returns

ATCA_SUCCESS

20.9.5.43 hal_spi_init()

```
ATCA_STATUS hal_spi_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

initialize an SPI interface using given config

Parameters

in	*hal*	- opaque ptr to HAL data
in	*cfg*	- interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.44 hal_spi_post_init()

```
ATCA_STATUS hal_spi_post_init (
            ATCAIface iface )
```

HAL implementation of SPI post init.

Parameters

in	*iface*	instance

Returns

ATCA_SUCCESS

20.9.5.45 hal_spi_receive()

```
ATCA_STATUS hal_spi_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

HAL implementation of SPI receive function for HARMONY SPI.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.46 hal_spi_release()

```
ATCA_STATUS hal_spi_release (
            void * hal_data )
```

manages reference count on given bus and releases resource if no more refences exist

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.47 hal_spi_select()

```
ATCA_STATUS hal_spi_select (
            ATCAIface iface )
```

HAL implementation to assert the device chip select.

Parameters

in	*iface*	Device to interact with.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.48 hal_spi_send()

```
ATCA_STATUS hal_spi_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of SPI send over Harmony.

Parameters

in	*iface*	instance
in	*word_address*	device transaction type
in	*txdata*	pointer to space to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.49 hal_swi_control()

```
ATCA_STATUS hal_swi_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations for the kit protocol.

Parameters

in	*iface*	Interface to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.50 hal_swi_idle()

```
ATCA_STATUS hal_swi_idle (
            ATCAIface iface )
```

Send Idle flag via SWI.

Parameters

in	*iface*	interface of the logical device to idle

Returns

ATCA_SUCCES

20.9.5.51 hal_swi_init()

```
ATCA_STATUS hal_swi_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

initialize an SWI interface using given config

Parameters

in	*hal*	- opaque ptr to HAL data
in	*cfg*	- interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.52 hal_swi_post_init()

```
ATCA_STATUS hal_swi_post_init (
            ATCAIface iface )
```

HAL implementation of SWI post init.

Parameters

in	*iface*	instance

Returns

ATCA_SUCCESS

20.9.5.53 hal_swi_receive()

```
ATCA_STATUS hal_swi_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

HAL implementation of SWI receive function over UART.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.54 hal_swi_release()

```
ATCA_STATUS hal_swi_release (
            void * hal_data )
```

manages reference count on given bus and releases resource if no more refences exist

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.55 hal_swi_send()

```
ATCA_STATUS hal_swi_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of SWI send command over UART.

Parameters

in	*iface*	instance
in	*word_address*	device transaction type
in	*txdata*	pointer to space to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

Send word address

Send data

20.9.5.56 hal_swi_sleep()

```
ATCA_STATUS hal_swi_sleep (
            ATCAIface iface )
```

Send Sleep flag via SWI.

Parameters

in	*iface*	interface of the logical device to sleep

Returns

ATCA_SUCCESS

20.9.5.57 hal_swi_wake()

```
ATCA_STATUS hal_swi_wake (
            ATCAIface iface )
```

Send Wake flag via SWI.

Parameters

in	*iface*	interface of the logical device to wake up

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.58 kit_id_from_devtype()

```
const char * kit_id_from_devtype (
            ATCADeviceType devtype )
```

Kit Protocol is key

20.9.5.59 kit_interface()

```
const char * kit_interface (
            ATCAKitType kittype )
```

Kit parser physical interface string

20.9.5.60 kit_interface_from_kittype()

```
const char * kit_interface_from_kittype (
            ATCAKitType kittype )
```

Kit interface from device

20.9.5.61 swi_uart_deinit()

```
ATCA_STATUS swi_uart_deinit (
            ATCASWIMaster_t * instance )
```

Implementation of SWI UART deinit.

HAL implementation of SWI UART deinit.

Parameters

in	*instance*	instance

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*instance*	instance

Returns

ATCA_SUCCESS

20.9.5.62 swi_uart_discover_buses()

```
void swi_uart_discover_buses (
            int swi_uart_buses[],
            int max_buses )
```

discover UART buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge

Parameters

in	*swi_uart_buses*	- an array of logical bus numbers
in	*max_buses*	- maximum number of buses the app wants to attempt to discover

20.9.5.63 swi_uart_init()

```
ATCA_STATUS swi_uart_init (
            ATCASWIMaster_t * instance )
```

Implementation of SWI UART init.

HAL implementation of SWI UART init.

- this HAL implementation assumes you've included the ASF SERCOM UART libraries in your project, otherwise, the HAL layer will not compile because the ASF UART drivers are a dependency *

Parameters

in	*instance*	instance

Returns

ATCA_SUCCESS on success, otherwise an error code.

- this HAL implementation assumes you've included the START SERCOM UART libraries in your project, otherwise, the HAL layer will not compile because the START UART drivers are a dependency *

Parameters

in	*instance*	instance

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.64 swi_uart_mode()

```
void swi_uart_mode (
            ATCASWIMaster_t * instance,
            uint8_t mode )
```

implementation of SWI UART change mode.

HAL implementation of SWI UART change mode.

Parameters

in	*instance*	instance
in	*mode*	(TRANSMIT_MODE or RECEIVE_MODE)

20.9.5.65 swi_uart_receive_byte()

```
ATCA_STATUS swi_uart_receive_byte (
            ATCASWIMaster_t * instance,
            uint8_t * data )
```

HAL implementation of SWI UART receive bytes over ASF. This function receive one byte over UART.

Parameters

in	*instance*	instance
out	*data*	pointer to space to receive the data

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.66 swi_uart_send_byte()

```
ATCA_STATUS swi_uart_send_byte (
            ATCASWIMaster_t * instance,
            uint8_t data )
```

HAL implementation of SWI UART send byte over ASF. This function send one byte over UART.

Parameters

in	*instance*	instance
in	*data*	number of byte to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.9.5.67 swi_uart_setbaud()

```
void swi_uart_setbaud (
            ATCASWIMaster_t * instance,
            uint32_t baudrate )
```

implementation of SWI UART change baudrate.

HAL implementation of SWI UART change baudrate.

Parameters

in	*instance*	instance
in	*baudrate*	(typically 230400 , 160000 or 115200)
in	*instance*	instance
in	*baudrate*	(typically 230400 or 115200)

20.10 Host side crypto methods (atcah_)

Use these functions if your system does not use an ATCADevice as a host but implements the host in firmware. The functions provide host-side cryptographic functionality for an ATECC client device. They are intended to accompany the CryptoAuthLib functions. They can be called directly from an application, or integrated into an API.

Data Structures

- struct atca_temp_key

  Structure to hold TempKey fields.
- struct atca_include_data_in_out

  Input / output parameters for function atca_include_data().
- struct atca_nonce_in_out

  Input/output parameters for function atca_nonce().
- struct atca_io_decrypt_in_out
- struct atca_verify_mac
- struct atca_secureboot_enc_in_out
- struct atca_secureboot_mac_in_out
- struct atca_mac_in_out

  Input/output parameters for function atca_mac().
- struct atca_hmac_in_out

  Input/output parameters for function atca_hmac().
- struct atca_gen_dig_in_out

  Input/output parameters for function atcah_gen_dig().
- struct atca_diversified_key_in_out

  Input/output parameters for function atcah_gendivkey().
- struct atca_write_mac_in_out

  Input/output parameters for function atcah_write_auth_mac() and atcah_privwrite_auth_mac().
- struct atca_derive_key_in_out

  Input/output parameters for function atcah_derive_key().
- struct atca_derive_key_mac_in_out

  Input/output parameters for function atcah_derive_key_mac().
- struct atca_decrypt_in_out

  Input/output parameters for function atca_decrypt().
- struct atca_check_mac_in_out

  Input/output parameters for function atcah_check_mac().
- struct atca_resp_mac_in_out

  Input/Output parameters for calculating the output response mac in SHA105 device. Used with the atcah_gen_output_resp_mac() function.
- struct atca_verify_in_out

  Input/output parameters for function atcah_verify().
- struct atca_gen_key_in_out

  Input/output parameters for calculating the PubKey digest put into TempKey by the GenKey command with the atcah_gen_key_msg() function.
- struct atca_sign_internal_in_out

  Input/output parameters for calculating the message and digest used by the Sign(internal) command. Used with the atcah_sign_internal_msg() function.
- struct atca_session_key_in_out

  Input/Output paramters for calculating the session key by the nonce command. Used with the atcah_gen_session_key() function.
- struct atca_delete_in_out

  Input/Output paramters for calculating the mac.Used with Delete command.

Typedefs

- typedef struct atca_temp_key **atca_temp_key_t**

  Structure to hold TempKey fields.
- typedef struct atca_nonce_in_out **atca_nonce_in_out_t**
- typedef struct atca_io_decrypt_in_out **atca_io_decrypt_in_out_t**
- typedef struct atca_verify_mac **atca_verify_mac_in_out_t**
- typedef struct atca_secureboot_enc_in_out **atca_secureboot_enc_in_out_t**
- typedef struct atca_secureboot_mac_in_out **atca_secureboot_mac_in_out_t**
- typedef struct atca_mac_in_out **atca_mac_in_out_t**
- typedef struct atca_gen_dig_in_out **atca_gen_dig_in_out_t**

  Input/output parameters for function atcah_gen_dig().
- typedef struct atca_diversified_key_in_out **atca_diversified_key_in_out_t**

  Input/output parameters for function atcah_gendivkey().
- typedef struct atca_write_mac_in_out **atca_write_mac_in_out_t**

  Input/output parameters for function atcah_write_auth_mac() and atcah_privwrite_auth_mac().
- typedef struct atca_check_mac_in_out **atca_check_mac_in_out_t**

  Input/output parameters for function atcah_check_mac().
- typedef struct atca_resp_mac_in_out **atca_resp_mac_in_out_t**

  Input/Output parameters for calculating the output response mac in SHA105 device. Used with the atcah_gen_output_resp_mac() function.
- typedef struct atca_verify_in_out **atca_verify_in_out_t**
- typedef struct atca_gen_key_in_out **atca_gen_key_in_out_t**

  Input/output parameters for calculating the PubKey digest put into TempKey by the GenKey command with the atcah_gen_key_msg() function.
- typedef struct atca_sign_internal_in_out **atca_sign_internal_in_out_t**

  Input/output parameters for calculating the message and digest used by the Sign(internal) command. Used with the atcah_sign_internal_msg() function.
- typedef struct atca_session_key_in_out **atca_session_key_in_out_t**

  Input/Output paramters for calculating the session key by the nonce command. Used with the atcah_gen_session_key() function.
- typedef struct atca_delete_in_out **atca_delete_in_out_t**

  Input/Output paramters for calculating the mac.Used with Delete command.

Functions

- ATCA_STATUS **atcah_nonce** (struct atca_nonce_in_out ∗param)
- ATCA_STATUS **atcah_mac** (struct atca_mac_in_out ∗param)
- ATCA_STATUS **atcah_check_mac** (struct atca_check_mac_in_out ∗param)
- ATCA_STATUS **atcah_hmac** (struct atca_hmac_in_out ∗param)
- ATCA_STATUS **atcah_gen_dig** (struct atca_gen_dig_in_out ∗param)
- ATCA_STATUS **atcah_gendivkey** (struct atca_diversified_key_in_out ∗param)
- ATCA_STATUS **atcah_gen_mac** (struct atca_gen_dig_in_out ∗param)
- ATCA_STATUS **atcah_write_auth_mac** (struct atca_write_mac_in_out ∗param)
- ATCA_STATUS **atcah_privwrite_auth_mac** (struct atca_write_mac_in_out ∗param)
- ATCA_STATUS **atcah_derive_key** (struct atca_derive_key_in_out ∗param)
- ATCA_STATUS **atcah_derive_key_mac** (struct atca_derive_key_mac_in_out ∗param)
- ATCA_STATUS **atcah_decrypt** (struct atca_decrypt_in_out ∗param)
- ATCA_STATUS **atcah_sha256** (uint32_t len, const uint8_t ∗message, uint8_t ∗digest)
- uint8_t ∗ **atcah_include_data** (struct atca_include_data_in_out ∗param)
- ATCA_STATUS **atcah_gen_key_msg** (struct atca_gen_key_in_out ∗param)
- ATCA_STATUS **atcah_config_to_sign_internal** (ATCADeviceType device_type, struct atca_sign_internal_in_out ∗param, const uint8_t ∗config)

- ATCA_STATUS **atcah_sign_internal_msg** (ATCADeviceType device_type, struct atca_sign_internal_in_out ∗param)
- ATCA_STATUS **atcah_verify_mac** (atca_verify_mac_in_out_t ∗param)
- ATCA_STATUS **atcah_secureboot_enc** (atca_secureboot_enc_in_out_t ∗param)
- ATCA_STATUS **atcah_secureboot_mac** (atca_secureboot_mac_in_out_t ∗param)
- ATCA_STATUS **atcah_encode_counter_match** (uint32_t counter_value, uint8_t ∗counter_match_value)
- ATCA_STATUS **atcah_io_decrypt** (struct atca_io_decrypt_in_out ∗param)
- ATCA_STATUS **atcah_ecc204_write_auth_mac** (struct atca_write_mac_in_out ∗param)
- ATCA_STATUS **atcah_gen_session_key** (atca_session_key_in_out_t ∗param)
- ATCA_STATUS **atcah_gen_output_resp_mac** (struct atca_resp_mac_in_out ∗param)

Variables

- uint8_t ∗ **atca_include_data_in_out::p_temp**

  [out] pointer to output buffer
- const uint8_t ∗ **atca_include_data_in_out::otp**

  [in] pointer to one-time-programming data
- const uint8_t ∗ **atca_include_data_in_out::sn**

  [in] pointer to serial number data
- uint8_t **atca_nonce_in_out::mode**

  [in] Mode parameter used in Nonce command (Param1).
- uint16_t **atca_nonce_in_out::zero**

  [in] Zero parameter used in Nonce command (Param2).
- const uint8_t ∗ **atca_nonce_in_out::num_in**

  [in] Pointer to 20-byte NumIn data used in Nonce command.
- const uint8_t ∗ **atca_nonce_in_out::rand_out**

  [in] Pointer to 32-byte RandOut data from Nonce command.
- struct atca_temp_key ∗ **atca_nonce_in_out::temp_key**

  [in,out] Pointer to TempKey structure.
- uint8_t **atca_mac_in_out::mode**

  [in] Mode parameter used in MAC command (Param1).
- uint16_t **atca_mac_in_out::key_id**

  [in] KeyID parameter used in MAC command (Param2).
- const uint8_t ∗ **atca_mac_in_out::challenge**

  [in] Pointer to 32-byte Challenge data used in MAC command, depending on mode.
- const uint8_t ∗ **atca_mac_in_out::key**

  [in] Pointer to 32-byte key used to generate MAC digest.
- const uint8_t ∗ **atca_mac_in_out::otp**

  [in] Pointer to 11-byte OTP, optionally included in MAC digest, depending on mode.
- const uint8_t ∗ **atca_mac_in_out::sn**

  [in] Pointer to 9-byte SN, optionally included in MAC digest, depending on mode.
- uint8_t ∗ **atca_mac_in_out::response**

  [out] Pointer to 32-byte SHA-256 digest (MAC).
- struct atca_temp_key ∗ **atca_mac_in_out::temp_key**

  [in,out] Pointer to TempKey structure.
- uint8_t **atca_hmac_in_out::mode**

  [in] Mode parameter used in HMAC command (Param1).
- uint16_t **atca_hmac_in_out::key_id**

  [in] KeyID parameter used in HMAC command (Param2).
- const uint8_t ∗ **atca_hmac_in_out::key**

  [in] Pointer to 32-byte key used to generate HMAC digest.

- const uint8_t ∗ **atca_hmac_in_out::otp**

  [in] Pointer to 11-byte OTP, optionally included in HMAC digest, depending on mode.
- const uint8_t ∗ **atca_hmac_in_out::sn**

  [in] Pointer to 9-byte SN, optionally included in HMAC digest, depending on mode.
- uint8_t ∗ **atca_hmac_in_out::response**

  [out] Pointer to 32-byte SHA-256 HMAC digest.
- struct atca_temp_key ∗ **atca_hmac_in_out::temp_key**

  [in,out] Pointer to TempKey structure.
- uint8_t ∗ **atca_decrypt_in_out::crypto_data**

  [in,out] Pointer to 32-byte data. Input encrypted data from Read command (Contents field), output decrypted.
- struct atca_temp_key ∗ **atca_decrypt_in_out::temp_key**

  [in,out] Pointer to TempKey structure.
- uint16_t **atca_verify_in_out::curve_type**

  [in] Curve type used in Verify command (Param2).
- const uint8_t ∗ **atca_verify_in_out::signature**

  [in] Pointer to ECDSA signature to be verified
- const uint8_t ∗ **atca_verify_in_out::public_key**

  [in] Pointer to the public key to be used for verification
- struct atca_temp_key ∗ **atca_verify_in_out::temp_key**

  [in,out] Pointer to TempKey structure.

Definitions for ATECC Message Sizes to Calculate a SHA256 Hash

"||" is the concatenation operator. The number in braces is the length of the hash input value in bytes.

- #define **ATCA_MSG_SIZE_NONCE** (55)

  RandOut{32} || NumIn{20} || OpCode{1} || Mode{1} || LSB of Param2{1}.
- #define **ATCA_MSG_SIZE_MAC** (88)

  (Key or TempKey){32} || (Challenge or TempKey){32} || OpCode{1} || Mode{1} || Param2{2} || (OTP0_7 or 0){8} || (OTP8_10 or 0){3} || SN8{1} || (SN4_7 or 0){4} || SN0_1{2} || (SN2_3 or 0){2}
- #define **ATCA_MSG_SIZE_HMAC** (88u)
- #define **ATCA_MSG_SIZE_GEN_DIG** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2} || 0{25} || TempKey{32}.
- #define **ATCA_MSG_SIZE_DIVERSIFIED_KEY** (96)

  ParentKey{32} || OtherData{4} || SN8{1} || SN0_1{2} || 0{25} || InputData{32}.
- #define **ATCA_MSG_SIZE_DERIVE_KEY** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2} || 0{25} || TempKey{32}.
- #define **ATCA_MSG_SIZE_DERIVE_KEY_MAC** (39)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2}.
- #define **ATCA_MSG_SIZE_ENCRYPT_MAC** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2}|| SN8{1} || SN0_1{2} || 0{25} || TempKey{32}.
- #define **ATCA_MSG_SIZE_SESSION_KEY** (96)

  TransportKey{32} || 0x15{1} || 0x00{1} || KeyId{2} || SN8{1} || SN0_1{2} || 0{25} || Nonce{32}.
- #define **ATCA_MSG_SIZE_DELETE_MAC** (96)

  Hmac/SecretKey{32} || 0x13{1} || 0x00{1} || 0x0000{2} || SN8{1} || SN0_1{2} || 0{25} || Nonce{32}.
- #define **ATCA_MSG_SIZE_RESPONSE_MAC** (97)

  SlotKey{32} || Opcode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2} || 0{25} || client_Resp{32} || checkmac←↩ _result{1}.
- #define **ATCA_MSG_SIZE_PRIVWRITE_MAC** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2}|| SN8{1} || SN0_1{2} || 0{21} || PlainText{36}.

- #define **ATCA_COMMAND_HEADER_SIZE** (4)
- #define **ATCA_GENDIG_ZEROS_SIZE** (25)
- #define **ATCA_GENDIVKEY_ZEROS_SIZE** (25)
- #define **ATCA_WRITE_MAC_ZEROS_SIZE** (25)
- #define **ATCA_DELETE_MAC_ZEROS_SIZE** (25)
- #define **ATCA_RESP_MAC_ZEROS_SIZE** (25)
- #define **ATCA_PRIVWRITE_MAC_ZEROS_SIZE** (21)
- #define **ATCA_PRIVWRITE_PLAIN_TEXT_SIZE** (36)
- #define **ATCA_DERIVE_KEY_ZEROS_SIZE** (25)
- #define **ATCA_HMAC_BLOCK_SIZE** (64u)
- #define **ATCA_ENCRYPTION_KEY_SIZE** (64)

Definition for TempKey Mode

- #define **MAC_MODE_USE_TEMPKEY_MASK** ((uint8_t)0x03)

  mode mask for MAC command when using TempKey

20.10.1 Detailed Description

Use these functions if your system does not use an ATCADevice as a host but implements the host in firmware. The functions provide host-side cryptographic functionality for an ATECC client device. They are intended to accompany the CryptoAuthLib functions. They can be called directly from an application, or integrated into an API.

Modern compilers can garbage-collect unused functions. If your compiler does not support this feature, you can just discard this module from your project if you do use an ATECC as a host. Or, if you don't, delete the functions you do not use.

20.11 JSON Web Token (JWT) methods (atca_jwt_)

Methods for signing and verifying JSON Web Token (JWT) tokens.

Methods for signing and verifying JSON Web Token (JWT) tokens.

20.12 mbedTLS Wrapper methods (atca_mbedtls_)

These methods are for interfacing cryptoauthlib to mbedtls.

20.12.0.1 mbedtls directory - Purpose

This directory contains the interfacing and wrapper functions to integrate mbedtls as the software crypto library as well as provide eliptic curve cryptography (ECC) hardware acceleration.

Data Structures

- struct atca_mbedtls_eckey_s

Typedefs

- typedef struct atca_mbedtls_eckey_s atca_mbedtls_eckey_t

Functions

- int **atca_mbedtls_ecdsa_sign** (const mbedtls_mpi ∗d, mbedtls_mpi ∗r, mbedtls_mpi ∗s, const unsigned char ∗buf, size_t buf_len)
- int atca_mbedtls_pk_init_ext (ATCADevice device, mbedtls_pk_context ∗pkey, const uint16_t slotid)

    Initializes an mbedtls pk context for use with EC operations.
- int atca_mbedtls_pk_init (mbedtls_pk_context ∗pkey, const uint16_t slotid)

    Initializes an mbedtls pk context for use with EC operations.
- int **atca_mbedtls_cert_add** (struct mbedtls_x509_crt ∗cert, const struct atcacert_def_s ∗cert_def)
- int atca_mbedtls_ecdh_slot_cb (void)

    ECDH Callback to obtain the "slot" used in ECDH operations from the application.
- int atca_mbedtls_ecdh_ioprot_cb (uint8_t secret[32])

    ECDH Callback to obtain the IO Protection secret from the application.
- struct mbedtls_x509_crt ∗ **atcac_mbedtls_new** (void)
- struct atcac_x509_ctx ∗ **atcac_x509_ctx_new** (void)
- void **atcac_x509_ctx_free** (struct atcac_x509_ctx ∗ctx)

20.12.1 Detailed Description

These methods are for interfacing cryptoauthlib to mbedtls.

20.12.2 Typedef Documentation

20.12.2.1 atca_mbedtls_eckey_t

```
typedef struct atca_mbedtls_eckey_s atca_mbedtls_eckey_t
```

Structure to hold metadata - is written into the mbedtls pk structure as the private key bignum value 'd' which otherwise would be unused. Bignums can be any arbitrary length of bytes

20.12.3 Function Documentation

20.12.3.1 atca_mbedtls_ecdh_ioprot_cb()

```
int atca_mbedtls_ecdh_ioprot_cb (
            uint8_t secret[32] )
```

ECDH Callback to obtain the IO Protection secret from the application.

Parameters

out	*secret*	32 byte array used to store the secret

Returns

ATCA_SUCCESS on success, otherwise an error code.

20.12.3.2 atca_mbedtls_ecdh_slot_cb()

```
int atca_mbedtls_ecdh_slot_cb (
            void )
```

ECDH Callback to obtain the "slot" used in ECDH operations from the application.

Returns

Slot Number

20.12.3.3 atca_mbedtls_pk_init()

```
int atca_mbedtls_pk_init (
            mbedtls_pk_context * pkey,
            const uint16_t slotid )
```

Initializes an mbedtls pk context for use with EC operations.

Parameters

in,out	*pkey*	ptr to space to receive version string
in	*slotid*	Associated with this key

Returns

0 on success, otherwise an error code.

20.12.3.4 atca_mbedtls_pk_init_ext()

```
int atca_mbedtls_pk_init_ext (
            ATCADevice device,
            mbedtls_pk_context * pkey,
            const uint16_t slotid )
```

Initializes an mbedtls pk context for use with EC operations.

Parameters

in,out	*pkey*	ptr to space to receive version string
in	*slotid*	Associated with this key

Returns

0 on success, otherwise an error code.

20.13 Attributes (pkcs11_attrib_)

Data Structures

- struct pkcs11_conf_filedata_s
- struct pcks11_mech_table_e

Macros

- #define **PKCS11_CONFIG_U8_MAX** 0xFFL
- #define **PKCS11_CONFIG_U16_MAX** 0xFFFFL
- #define **PKCS11_CONFIG_U32_MAX** 0xFFFFFFFFL
- #define **PCKS11_MECH_ECC508_EC_CAPABILITY** (CKF_EC_F_P | CKF_EC_NAMEDCURVE | CKF_↩ EC_UNCOMPRESS)
- #define **TABLE_SIZE**(x) sizeof(x) / sizeof(x[0])

Typedefs

- typedef struct pkcs11_conf_filedata_s **pkcs11_conf_filedata**
- typedef struct pkcs11_conf_filedata_s * **pkcs11_conf_filedata_ptr**
- typedef struct pcks11_mech_table_e **pcks11_mech_table_e**
- typedef struct pcks11_mech_table_e * **pcks11_mech_table_ptr**

Functions

- CK_RV pkcs11_attrib_fill (CK_ATTRIBUTE_PTR pAttribute, const void *pData, const CK_ULONG ulSize)

  Perform the nessasary checks and copy data into an attribute structure.
- CK_RV **pkcs11_attrib_value** (CK_ATTRIBUTE_PTR pAttribute, const CK_ULONG ulValue, const CK_↩ ULONG ulSize)

  Helper function to write a numerical value to an attribute buffer.
- CK_RV **pkcs11_attrib_false** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_attrib_true** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_attrib_empty** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_cert_load** (pkcs11_object_ptr pObject, CK_ATTRIBUTE_PTR pAttribute, ATCADevice device)
- CK_RV **pkcs11_cert_x509_write** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)

- CK_RV **pkcs11_cert_clear_session_cache** (pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_cert_clear_object_cache** (pkcs11_object_ptr pObject)
- void **pkcs11_config_set_key_size** (pkcs11_object_ptr pObject)
- void **pkcs11_config_init_private** (pkcs11_object_ptr pObject, const char *label, size_t len)
- void **pkcs11_config_init_public** (pkcs11_object_ptr pObject, const char *label, size_t len)
- void **pkcs11_config_init_secret** (pkcs11_object_ptr pObject, const char *label, size_t len, size_t keylen)
- void **pkcs11_config_init_cert** (pkcs11_object_ptr pObject, const char *label, size_t len)
- void **pkcs11_config_split_string** (char *s, char splitter, int *argc, char *argv[ ])
- CK_RV **pkcs11_config_cert** (pkcs11_lib_ctx_ptr pLibCtx, pkcs11_slot_ctx_ptr pSlot, pkcs11_object_ptr p↩ Object, CK_ATTRIBUTE_PTR pLabel)
- CK_RV **pkcs11_config_key** (pkcs11_lib_ctx_ptr pLibCtx, pkcs11_slot_ctx_ptr pSlot, pkcs11_object_ptr p↩ Object, CK_ATTRIBUTE_PTR pLabel)
- CK_RV **pkcs11_config_remove_object** (pkcs11_lib_ctx_ptr pLibCtx, pkcs11_slot_ctx_ptr pSlot, pkcs11↩ _object_ptr pObject)
- CK_RV **pkcs11_config_load_objects** (pkcs11_slot_ctx_ptr slot_ctx)
- CK_RV **pkcs11_config_load** (pkcs11_slot_ctx_ptr slot_ctx)
- CK_RV **pkcs11_encrypt_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_encrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulData↩ Len, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)
- CK_RV **pkcs11_encrypt_update** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)
- CK_RV **pkcs11_encrypt_final** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK↩ _ULONG_PTR pulEncryptedDataLen)

  Finishes a multiple-part encryption operation.
- CK_RV **pkcs11_decrypt_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_decrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_↩ ULONG ulEncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)
- CK_RV **pkcs11_decrypt_update** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG ulEncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)
- CK_RV **pkcs11_decrypt_final** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG↩ _PTR pulDataLen)

  Finishes a multiple-part decryption operation.
- CK_RV **pkcs11_find_init** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_↩ ULONG ulCount)
- CK_RV **pkcs11_find_continue** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE_PTR ph↩ Object, CK_ULONG ulMaxObjectCount, CK_ULONG_PTR pulObjectCount)
- CK_RV **pkcs11_find_finish** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_find_get_attribute** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)
- CK_RV **pkcs11_get_lib_info** (CK_INFO_PTR pInfo)

  Obtains general information about Cryptoki.
- pkcs11_lib_ctx_ptr **pkcs11_get_context** (void)

  Retrieve the current library context.
- CK_RV **pkcs11_lock_context** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_context** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_lock_device** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_device** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_lock_both** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_both** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_init_check** (pkcs11_lib_ctx_ptr *ppContext, CK_BBOOL lock)

  Check if the library is initialized properly.
- CK_RV pkcs11_init (CK_C_INITIALIZE_ARGS const *pInitArgs)

Initializes the PKCS11 API Library for Cryptoauthlib.

- CK_RV pkcs11_deinit (CK_VOID_PTR pReserved)
- const pkcs11_key_info_t * **pkcs11_get_object_key_type** (ATCADevice device_ctx, pkcs11_object_ptr obj_ptr)
- CK_RV **pkcs11_ta_get_pubkey** (CK_VOID_PTR pObject, cal_buffer *key_buffer, pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_key_write** (CK_VOID_PTR pSession, CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR p←Attribute)
- CK_RV **pkcs11_key_generate** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phKey)
- CK_RV **pkcs11_key_generate_pair** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p←Mechanism, CK_ATTRIBUTE_PTR pPublicKeyTemplate, CK_ULONG ulPublicKeyAttributeCount, CK_←ATTRIBUTE_PTR pPrivateKeyTemplate, CK_ULONG ulPrivateKeyAttributeCount, CK_OBJECT_HANDLE←_PTR phPublicKey, CK_OBJECT_HANDLE_PTR phPrivateKey)
- CK_RV **pkcs11_key_derive** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hBaseKey, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT←_HANDLE_PTR phKey)
- CK_RV **pkcs11_key_clear_session_cache** (pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_key_clear_object_cache** (pkcs11_object_ptr pObject)
- CK_RV **C_Initialize** (CK_VOID_PTR pInitArgs)

  Initializes Cryptoki library NOTES: If pInitArgs is a non-NULL_PTR is must dereference to a CK_C_INITIALIZE_ARGS structure.
- CK_RV **C_Finalize** (CK_VOID_PTR pReserved)

  Clean up miscellaneous Cryptoki-associated resources.
- CK_RV **C_GetInfo** (CK_INFO_PTR pInfo)

  Obtains general information about Cryptoki.
- CK_RV **C_GetFunctionList** (CK_FUNCTION_LIST_PTR_PTR ppFunctionList)

  Obtains entry points of Cryptoki library functions.
- CK_RV **C_GetSlotList** (CK_BBOOL tokenPresent, CK_SLOT_ID_PTR pSlotList, CK_ULONG_PTR pul←Count)

  Obtains a list of slots in the system.
- CK_RV **C_GetSlotInfo** (CK_SLOT_ID slotID, CK_SLOT_INFO_PTR pInfo)

  Obtains information about a particular slot.
- CK_RV **C_GetTokenInfo** (CK_SLOT_ID slotID, CK_TOKEN_INFO_PTR pInfo)

  Obtains information about a particular token.
- CK_RV **C_GetMechanismList** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE_PTR pMechanismList, CK←_ULONG_PTR pulCount)

  Obtains a list of mechanisms supported by a token (in a slot)
- CK_RV **C_GetMechanismInfo** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE type, CK_MECHANISM_←INFO_PTR pInfo)

  Obtains information about a particular mechanism of a token (in a slot)
- CK_RV **C_InitToken** (CK_SLOT_ID slotID, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen, CK_UTF8←CHAR_PTR pLabel)

  Initializes a token (in a slot)
- CK_RV **C_InitPIN** (CK_SESSION_HANDLE hSession, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen)

  Initializes the normal user's PIN.
- CK_RV **C_SetPIN** (CK_SESSION_HANDLE hSession, CK_UTF8CHAR_PTR pOldPin, CK_ULONG ul←OldLen, CK_UTF8CHAR_PTR pNewPin, CK_ULONG ulNewLen)

  Modifies the PIN of the current user.
- CK_RV **C_OpenSession** (CK_SLOT_ID slotID, CK_FLAGS flags, CK_VOID_PTR pApplication, CK_←NOTIFY Notify, CK_SESSION_HANDLE_PTR phSession)

  Opens a connection between an application and a particular token or sets up an application callback for token insertion.
- CK_RV **C_CloseSession** (CK_SESSION_HANDLE hSession)

Close the given session.

- CK_RV **C_CloseAllSessions** (CK_SLOT_ID slotID)

  Close all open sessions.
- CK_RV **C_GetSessionInfo** (CK_SESSION_HANDLE hSession, CK_SESSION_INFO_PTR pInfo)

  Retrieve information about the specified session.
- CK_RV **C_GetOperationState** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pOperationState, CK_ULONG_PTR pulOperationStateLen)

  Obtains the cryptographic operations state of a session.
- CK_RV **C_SetOperationState** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pOperationState, CK_ULONG ulOperationStateLen, CK_OBJECT_HANDLE hEncryptionKey, CK_OBJECT_HANDLE hAuthenticationKey)

  Sets the cryptographic operations state of a session.
- CK_RV **C_Login** (CK_SESSION_HANDLE hSession, CK_USER_TYPE userType, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen)

  Login on the token in the specified session.
- CK_RV **C_Logout** (CK_SESSION_HANDLE hSession)

  Log out of the token in the specified session.
- CK_RV **C_CreateObject** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phObject)

  Create a new object on the token in the specified session using the given attribute template.
- CK_RV **C_CopyObject** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phNewObject)

  Create a copy of the object with the specified handle.
- CK_RV **C_DestroyObject** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject)

  Destroy the specified object.
- CK_RV **C_GetObjectSize** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ULONG_PTR pulSize)

  Obtains the size of an object in bytes.
- CK_RV **C_GetAttributeValue** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)

  Obtains an attribute value of an object.
- CK_RV **C_SetAttributeValue** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)

  Change or set the value of the specified attributes on the specified object.
- CK_RV **C_FindObjectsInit** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)

  Initializes an object search in the specified session using the specified attribute template as search parameters.
- CK_RV **C_FindObjects** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE_PTR phObject, CK_ULONG ulMaxObjectCount, CK_ULONG_PTR pulObjectCount)

  Continue the search for objects in the specified session.
- CK_RV **C_FindObjectsFinal** (CK_SESSION_HANDLE hSession)

  Finishes an object search operation (and cleans up)
- CK_RV **C_EncryptInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hKey)

  Initializes an encryption operation using the specified mechanism and session.
- CK_RV **C_Encrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)

  Perform a single operation encryption operation in the specified session.
- CK_RV **C_EncryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen, CK_BYTE_PTR pEncryptedPart, CK_ULONG_PTR pulEncryptedPartLen)

  Continues a multiple-part encryption operation.
- CK_RV **C_EncryptFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pLastEncryptedPart, CK_ULONG_PTR pulLastEncryptedPartLen)

Finishes a multiple-part encryption operation.

- CK_RV **C_DecryptInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ OBJECT_HANDLE hKey)

  Initialize decryption using the specified object.
- CK_RV **C_Decrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG ul↩ EncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)

  Perform a single operation decryption in the given session.
- CK_RV **C_DecryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedPart, CK_↩ ULONG ulEncryptedPartLen, CK_BYTE_PTR pPart, CK_ULONG_PTR pulPartLen)

  Continues a multiple-part decryption operation.
- CK_RV **C_DecryptFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pLastPart, CK_ULONG_PTR pulLastPartLen)

  Finishes a multiple-part decryption operation.
- CK_RV **C_DigestInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism)

  Initializes a message-digesting operation using the specified mechanism in the specified session.
- CK_RV **C_Digest** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pDigest, CK_ULONG_PTR pulDigestLen)

  Digest the specified data in a one-pass operation and return the resulting digest.
- CK_RV **C_DigestUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPart↩ Len)

  Continues a multiple-part digesting operation.
- CK_RV **C_DigestKey** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hKey)

  Update a running digest operation by digesting a secret key with the specified handle.
- CK_RV **C_DigestFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pDigest, CK_ULONG_PTR pulDigestLen)

  Finishes a multiple-part digesting operation.
- CK_RV **C_SignInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ OBJECT_HANDLE hKey)

  Initialize a signing operation using the specified key and mechanism.
- CK_RV **C_Sign** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK↩ _BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Sign the data in a single pass operation.
- CK_RV **C_SignUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part signature operation.
- CK_RV **C_SignFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Finishes a multiple-part signature operation.
- CK_RV **C_SignRecoverInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hKey)

  Initializes a signature operation, where the data can be recovered from the signature.
- CK_RV **C_SignRecover** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulData↩ Len, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Signs single-part data, where the data can be recovered from the signature.
- CK_RV **C_VerifyInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ OBJECT_HANDLE hKey)

  Initializes a verification operation using the specified key and mechanism.
- CK_RV **C_Verify** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK↩ _BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Verifies a signature on single-part data.
- CK_RV **C_VerifyUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPart↩ Len)

  Continues a multiple-part verification operation.

- CK_RV **C_VerifyFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG ul←
SignatureLen)

    Finishes a multiple-part verification operation.
- CK_RV **C_VerifyRecoverInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hKey)

    Initializes a verification operation where the data is recovered from the signature.
- CK_RV **C_VerifyRecover** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)

    Verifies a signature on single-part data, where the data is recovered from the signature.
- CK_RV **C_DigestEncryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen, CK_BYTE_PTR pEncryptedPart, CK_ULONG_PTR pulEncryptedPartLen)

    Continues simultaneous multiple-part digesting and encryption operations.
- CK_RV **C_DecryptDigestUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedPart, CK_ULONG ulEncryptedPartLen, CK_BYTE_PTR pPart, CK_ULONG_PTR pulPartLen)

    Continues simultaneous multiple-part decryption and digesting operations.
- CK_RV **C_SignEncryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen, CK_BYTE_PTR pEncryptedPart, CK_ULONG_PTR pulEncryptedPartLen)

    Continues simultaneous multiple-part signature and encryption operations.
- CK_RV **C_DecryptVerifyUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedPart, CK_ULONG ulEncryptedPartLen, CK_BYTE_PTR pPart, CK_ULONG_PTR pulPartLen)

    Continues simultaneous multiple-part decryption and verification operations.
- CK_RV **C_GenerateKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_←
ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phKey)

    Generates a secret key using the specified mechanism.
- CK_RV **C_GenerateKeyPair** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_ATTRIBUTE_PTR pPublicKeyTemplate, CK_ULONG ulPublicKeyAttributeCount, CK_ATTRIBUTE_PTR pPrivateKeyTemplate, CK_ULONG ulPrivateKeyAttributeCount, CK_OBJECT_HANDLE_PTR phPublicKey, CK_OBJECT_HANDLE_PTR phPrivateKey)

    Generates a public-key/private-key pair using the specified mechanism.
- CK_RV **C_WrapKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_←
OBJECT_HANDLE hWrappingKey, CK_OBJECT_HANDLE hKey, CK_BYTE_PTR pWrappedKey, CK_←
ULONG_PTR pulWrappedKeyLen)

    Wraps (encrypts) the specified key using the specified wrapping key and mechanism.
- CK_RV **C_UnwrapKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_←
OBJECT_HANDLE hUnwrappingKey, CK_BYTE_PTR pWrappedKey, CK_ULONG ulWrappedKeyLen, CK←
_ATTRIBUTE_PTR pTemplate, CK_ULONG ulAttributeCount, CK_OBJECT_HANDLE_PTR phKey)

    Unwraps (decrypts) the specified key using the specified unwrapping key.
- CK_RV **C_DeriveKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK←
_OBJECT_HANDLE hBaseKey, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulAttributeCount, CK_←
OBJECT_HANDLE_PTR phKey)

    Derive a key from the specified base key.
- CK_RV **C_SeedRandom** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSeed, CK_ULONG ul←
SeedLen)

    Mixes in additional seed material to the random number generator.
- CK_RV **C_GenerateRandom** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR RandomData, CK_←
ULONG ulRandomLen)

    Generate the specified amount of random data.
- CK_RV **C_GetFunctionStatus** (CK_SESSION_HANDLE hSession)

    Legacy function - see PKCS#11 v2.40.
- CK_RV **C_CancelFunction** (CK_SESSION_HANDLE hSession)

    Legacy function.
- CK_RV **C_WaitForSlotEvent** (CK_FLAGS flags, CK_SLOT_ID_PTR pSlot, CK_VOID_PTR pRserved)

    Wait for a slot event (token insertion, removal, etc) on the specified slot to occur.

- CK_RV **pkcs11_mech_get_list** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE_PTR pMechanismList, CK_ULONG_PTR pulCount)
- CK_RV **pkcs_mech_get_info** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE type, CK_MECHANISM_↩ INFO_PTR pInfo)
- CK_RV **pkcs11_object_alloc** (CK_SLOT_ID slotId, pkcs11_object_ptr ∗ppObject)
- CK_RV **pkcs11_object_free** (pkcs11_object_ptr pObject)
- CK_RV **pkcs11_object_check** (pkcs11_object_ptr ∗ppObject, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_object_get_handle** (pkcs11_object_ptr pObject, CK_OBJECT_HANDLE_PTR phObject)
- CK_RV **pkcs11_object_get_owner** (pkcs11_object_ptr pObject, CK_SLOT_ID_PTR pSlotId)
- CK_RV **pkcs11_object_get_name** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_class** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_type** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_destroyable** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_size** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ULONG_PTR pulSize)
- CK_RV **pkcs11_object_find** (CK_SLOT_ID slotId, pkcs11_object_ptr ∗ppObject, CK_ATTRIBUTE_PTR p↩ Template, CK_ULONG ulCount)
- CK_RV **pkcs11_object_create** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phObject)

  Create a new object on the token in the specified session using the given attribute template.
- CK_RV **pkcs11_object_destroy** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject)

  Destroy the specified object.
- CK_RV **pkcs11_object_deinit** (pkcs11_lib_ctx_ptr pContext)
- ATCA_STATUS **pkcs11_object_load_handle_info** (ATCADevice device, pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_object_is_private** (pkcs11_object_ptr pObject, CK_BBOOL ∗is_private, pkcs11_session_ctx_ptr pSession)

  Checks the attributes of the underlying cryptographic asset to determine if it is a private key - this changes the way the associated public key is referenced.
- CK_RV pkcs11_os_create_mutex (CK_VOID_PTR_PTR ppMutex)

  Application callback for creating a mutex object.
- CK_RV **pkcs11_os_destroy_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_lock_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_unlock_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_alloc_shared_ctx** (void ∗∗ppShared, size_t size)
- CK_RV **pkcs11_os_free_shared_ctx** (void ∗pShared, size_t size)
- pkcs11_session_ctx_ptr **pkcs11_get_session_context** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_session_check** (pkcs11_session_ctx_ptr ∗pSession, CK_SESSION_HANDLE hSession)

  Check if the session is initialized properly.
- CK_RV **pkcs11_reserve_resource** (pkcs11_lib_ctx_ptr pContext, pkcs11_session_ctx_ptr pSession, uint8_t resource)
- CK_RV **pkcs11_release_resource** (pkcs11_lib_ctx_ptr pContext, pkcs11_session_ctx_ptr pSession, uint8_t resource)
- CK_RV **pkcs11_session_open** (CK_SLOT_ID slotID, CK_FLAGS flags, CK_VOID_PTR pApplication, CK↩ _NOTIFY notify, CK_SESSION_HANDLE_PTR phSession)
- CK_RV **pkcs11_session_close** (CK_SESSION_HANDLE hSession)
- CK_RV pkcs11_session_closeall (CK_SLOT_ID slotID)

  Close all sessions for a given slot - not actually all open sessions.
- CK_RV **pkcs11_session_get_info** (CK_SESSION_HANDLE hSession, CK_SESSION_INFO_PTR pInfo)

  Obtains information about a particular session.
- CK_RV pkcs11_session_login (CK_SESSION_HANDLE hSession, CK_USER_TYPE userType, CK_UTF8↩ CHAR_PTR pPin, CK_ULONG ulPinLen)

- CK_RV **pkcs11_session_logout** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_signature_sign_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↩ Mechanism, CK_OBJECT_HANDLE hKey)

  Initialize a signing operation using the specified key and mechanism.
- CK_RV **pkcs11_signature_sign** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Sign the data in a single pass operation.
- CK_RV **pkcs11_signature_sign_continue** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part signature operation.
- CK_RV **pkcs11_signature_sign_finish** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Finishes a multiple-part signature operation.
- CK_RV **pkcs11_signature_verify_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↩ Mechanism, CK_OBJECT_HANDLE hKey)

  Initializes a verification operation using the specified key and mechanism.
- CK_RV **pkcs11_signature_verify** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Verifies a signature on single-part data.
- CK_RV **pkcs11_signature_verify_continue** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part verification operation.
- CK_RV **pkcs11_signature_verify_finish** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Finishes a multiple-part verification operation.
- pkcs11_slot_ctx_ptr **pkcs11_slot_get_context** (pkcs11_lib_ctx_ptr lib_ctx, CK_SLOT_ID slotID)

  Retrieve the current slot context.
- pkcs11_slot_ctx_ptr **pkcs11_slot_get_new_context** (pkcs11_lib_ctx_ptr lib_ctx)
- CK_VOID_PTR **pkcs11_slot_initslots** (CK_ULONG pulCount)
- CK_RV **pkcs11_slot_deinitslots** (pkcs11_lib_ctx_ptr lib_ctx)
- CK_RV **pkcs11_slot_config** (CK_SLOT_ID slotID)
- CK_RV **pkcs11_slot_init** (CK_SLOT_ID slotID)

  This is an internal function that initializes a pkcs11 slot - it must already have the locks in place before being called.
- CK_RV **pkcs11_slot_get_list** (CK_BBOOL tokenPresent, CK_SLOT_ID_PTR pSlotList, CK_ULONG_PTR pulCount)
- CK_RV **pkcs11_slot_get_info** (CK_SLOT_ID slotID, CK_SLOT_INFO_PTR pInfo)

  Obtains information about a particular slot.
- CK_RV pkcs11_token_init (CK_SLOT_ID slotID, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen, CK_↩ UTF8CHAR_PTR pLabel)
- CK_RV **pkcs11_token_get_access_type** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_writable** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_storage** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_info** (CK_SLOT_ID slotID, CK_TOKEN_INFO_PTR pInfo)

  Obtains information about a particular token.
- CK_RV **pkcs11_token_random** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pRandomData, CK↩ _ULONG ulRandomLen)

  Generate the specified amount of random data.
- CK_RV **pkcs11_token_convert_pin_to_key** (const CK_UTF8CHAR_PTR pPin, const CK_ULONG ulPin↩ Len, const CK_UTF8CHAR_PTR pSalt, const CK_ULONG ulSaltLen, CK_BYTE_PTR pKey, CK_ULONG ulKeyLen, pkcs11_slot_ctx_ptr slot_ctx)

- CK_RV **pkcs11_token_set_pin** (CK_SESSION_HANDLE hSession, CK_UTF8CHAR_PTR pOldPin, CK_ULONG ulOldLen, CK_UTF8CHAR_PTR pNewPin, CK_ULONG ulNewLen)
- void **pkcs11_util_escape_string** (CK_UTF8CHAR_PTR buf, CK_ULONG buf_len)
- CK_RV **pkcs11_util_convert_rv** (ATCA_STATUS status)
- int **pkcs11_util_memset** (void *dest, size_t destsz, int ch, size_t count)

Variables

- const pkcs11_attrib_model pkcs11_cert_x509public_attributes [ ]
- const CK_ULONG **pkcs11_cert_x509public_attributes_count** = (CK_ULONG)(sizeof(pkcs11_cert_x509public_attributes) / sizeof(pkcs11_cert_x509public_attributes [0]))
- const pkcs11_attrib_model pkcs11_cert_wtlspublic_attributes [ ]
- const CK_ULONG **pkcs11_cert_wtlspublic_attributes_count** = (CK_ULONG)(sizeof(pkcs11_cert_wtlspublic_attributes) / sizeof(pkcs11_cert_wtlspublic_attributes [0]))
- const pkcs11_attrib_model pkcs11_cert_x509_attributes [ ]
- const CK_ULONG **pkcs11_cert_x509_attributes_count** = (CK_ULONG)(sizeof(pkcs11_cert_x509_attributes) / sizeof(pkcs11_cert_x509_attributes [0]))
- const char **pkcs11_lib_manufacturer_id** [ ] = "Microchip Technology Inc"
- const char **pkcs11_lib_description** [ ] = "Cryptoauthlib PKCS11 Interface"
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p256 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec256 [ ]
- CK_BYTE **pkcs11_key_ec_params_p256** [ ] = { 0x06, 0x08, 0x2a, 0x86, 0x48, 0xce, 0x3d, 0x03, 0x01, 0x07 }
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p224 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec224 [ ]
- CK_BYTE **pkcs11_key_ec_params_p224** [ ] = { 0x06, 0x05, 0x2B, 0x81, 0x04, 0x00, 0x21 }
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p384 [ ]
- CK_BYTE **pkcs11_key_ec_params_p384** [ ] = { 0x06, 0x05, 0x2B, 0x81, 0x04, 0x00, 0x22 }
- CK_BYTE pkcs11_x962_asn1_hdr_ec384 [ ]
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p521 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec521 [ ]
- CK_BYTE **pkcs11_key_ec_params_p521** [ ] = { 0x06, 0x05, 0x2B, 0x81, 0x04, 0x00, 0x23 }
- const pkcs11_ecc_key_info_t ec_key_data_table [4]
- const pkcs11_rsa_key_info_t rsa_key_data_table [4]
- const pkcs11_key_info_t key_data_table [ ]
- const pkcs11_attrib_model pkcs11_key_public_attributes [ ]
- const CK_ULONG **pkcs11_key_public_attributes_count** = (CK_ULONG)(sizeof(pkcs11_key_public_attributes) / sizeof(pkcs11_key_public_attributes [0]))
- const pkcs11_attrib_model pkcs11_key_private_attributes [ ]
- const CK_ULONG **pkcs11_key_private_attributes_count** = (CK_ULONG)(sizeof(pkcs11_key_private_attributes) / sizeof(pkcs11_key_private_attributes [0]))
- const pkcs11_attrib_model pkcs11_key_secret_attributes [ ]
- const CK_ULONG **pkcs11_key_secret_attributes_count** = (CK_ULONG)(sizeof(pkcs11_key_secret_attributes) / sizeof(pkcs11_key_secret_attributes [0]))
- pkcs11_object_cache_t **pkcs11_object_cache** [PKCS11_MAX_OBJECTS_ALLOWED]
- const pkcs11_attrib_model pkcs11_object_monotonic_attributes [ ]
- const CK_ULONG **pkcs11_object_monotonic_attributes_count** = (CK_ULONG)(sizeof(pkcs11_object_monotonic_attribute) / sizeof(pkcs11_object_monotonic_attributes [0]))

20.13.1 Detailed Description

20.13.2 Function Documentation

20.13.2.1 pkcs11_attrib_fill()

```
CK_RV pkcs11_attrib_fill (
            CK_ATTRIBUTE_PTR pAttribute,
            const void * pData,
            const CK_ULONG ulSize )
```

Perform the nessasary checks and copy data into an attribute structure.

The ulValueLen field is modified to hold the exact length of the specified attribute for the object. In the special case of an attribute whose value is an array of attributes, for example CKA_WRAP_TEMPLATE, where it is passed in with pValue not NULL, then if the pValue of elements within the array is NULL_PTR then the ulValueLen of elements within the array will be set to the required length. If the pValue of elements within the array is not NULL_PTR, then the ulValueLen element of attributes within the array MUST reflect the space that the corresponding pValue points to, and pValue is filled in if there is sufficient room.Therefore it is important to initialize the contents of a buffer before calling C_GetAttributeValue to get such an array value. If any ulValueLen within the array isn't large enough, it will be set to CK_UNAVAILABLE_INFORMATION and the function will return CKR_BUFFER_TOO_SMALL, as it does if an attribute in the pTemplate argument has ulValueLen too small Note that any attribute whose value is an array of attributes is identifiable by virtue of the attribute type having the CKF_ARRAY_ATTRIBUTE bit set.

20.13.2.2 pkcs11_deinit()

```
CK_RV pkcs11_deinit (
            CK_VOID_PTR pReserved )
```

20.13.2.3 pkcs11_init()

```
CK_RV pkcs11_init (
            CK_C_INITIALIZE_ARGS const * pInitArgs )
```

Initializes the PKCS11 API Library for Cryptoauthlib.

20.13.2.4 pkcs11_os_create_mutex()

```
CK_RV pkcs11_os_create_mutex (
            CK_VOID_PTR_PTR ppMutex )
```

Application callback for creating a mutex object.

Parameters

in,out	*ppMutex*	location to receive ptr to mutex

20.13.2.5 pkcs11_session_closeall()

```
CK_RV pkcs11_session_closeall (
            CK_SLOT_ID slotID )
```

Close all sessions for a given slot - not actually all open sessions.

for specified slotid close all sessions related with it.

20.13.2.6 pkcs11_session_login()

```
CK_RV pkcs11_session_login (
            CK_SESSION_HANDLE hSession,
            CK_USER_TYPE userType,
            CK_UTF8CHAR_PTR pPin,
            CK_ULONG ulPinLen )
```

Reserve the PKCS11_AUTH_OP_0 / PKCS11_AUTH_OP_1 based on availability

Auth operation unavailable return error

20.13.2.7 pkcs11_token_init()

```
CK_RV pkcs11_token_init (
            CK_SLOT_ID slotID,
            CK_UTF8CHAR_PTR pPin,
            CK_ULONG ulPinLen,
            CK_UTF8CHAR_PTR pLabel )
```

Write the configuration into the device and generate new keys

20.13.3 Variable Documentation

20.13.3.1 ec_key_data_table

```
const pkcs11_ecc_key_info_t ec_key_data_table[4]
```

Initial value:

```
= {
    { ATCA_KEY_TYPE_ECCP256, (CK_BYTE)ATCA_ECCP256_OID_SIZE, pkcs11_key_ec_params_p256,
      pkcs11_ec_pbkey_asn1_hdr_p256,
      pkcs11_x962_asn1_hdr_ec256, (uint16_t)ATCA_ECCP256_ASN1_HDR_SIZE, ATCA_ECCP256_PUBKEY_SIZE,
      ATCA_ECCP256_MSG_SIZE, ATCA_ECCP256_SIG_SIZE }
    ,{ TA_KEY_TYPE_ECCP224, (CK_BYTE)TA_ECC224_OID_SIZE, pkcs11_key_ec_params_p224,
      pkcs11_ec_pbkey_asn1_hdr_p224,
      pkcs11_x962_asn1_hdr_ec224, (uint16_t)TA_ECC224_ASN1_HDR_SIZE, TA_ECC224_PUB_KEY_SIZE,
      TA_SIGN_P224_MSG_SIZE, TA_SIGN_P224_SIG_SIZE },
    { TA_KEY_TYPE_ECCP384, (CK_BYTE)TA_ECC384_OID_SIZE, pkcs11_key_ec_params_p384,
      pkcs11_ec_pbkey_asn1_hdr_p384,
      pkcs11_x962_asn1_hdr_ec384, (uint16_t)TA_ECC384_ASN1_HDR_SIZE, TA_ECC384_PUB_KEY_SIZE,
      TA_SIGN_P384_MSG_SIZE, TA_SIGN_P384_SIG_SIZE },
    { TA_KEY_TYPE_ECCP521, (CK_BYTE)TA_ECC521_OID_SIZE, pkcs11_key_ec_params_p521,
      pkcs11_ec_pbkey_asn1_hdr_p521,
      pkcs11_x962_asn1_hdr_ec521, (uint16_t)TA_ECC521_ASN1_HDR_SIZE, TA_ECC521_PUB_KEY_SIZE,
      TA_SIGN_P521_MSG_SIZE, TA_SIGN_P521_SIG_SIZE },
}
```

20.13.3.2 key_data_table

```
const pkcs11_key_info_t key_data_table[]
```

Initial value:

```
= {
    { &ec_key_data_table[0], NULL },
    { &ec_key_data_table[1], NULL },
    { &ec_key_data_table[2], NULL },
    { &ec_key_data_table[3], NULL },
}
```

20.13.3.3 pkcs11_cert_wtlspublic_attributes

```
const pkcs11_attrib_model pkcs11_cert_wtlspublic_attributes[]
```

CKO_CERTIFICATE (Type: CKC_WTLS) - WTLS Public Key Certificate Model

20.13.3.4 pkcs11_cert_x509_attributes

```
const pkcs11_attrib_model pkcs11_cert_x509_attributes[]
```

CKO_CERTIFICATE (Type: CKC_X_509_ATTR_CERT) - X509 Attribute Certificate Model

20.13.3.5 pkcs11_cert_x509public_attributes

```
const pkcs11_attrib_model pkcs11_cert_x509public_attributes[]
```

CKO_CERTIFICATE (Type: CKC_X_509) - X509 Public Key Certificate Model

20.13.3.6 pkcs11_ec_pbkey_asn1_hdr_p224

```
CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p224[]
```

Initial value:

```
= {
    0x30, 0x4e,
    0x30, 0x10,
    0x06, 0x07,
    0x2a, 0x86, 0x48, 0xce, 0x3d, 0x02, 0x01,
    0x06, 0x05, 0x2b, 0x81, 0x04, 0x00, 0x21,
    0x03, 0x3a, 0x00,
    0x04
}
```

ASN.1 Header for SECP224R1 public keys

20.13.3.7 pkcs11_ec_pbkey_asn1_hdr_p256

```
CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p256[]
```

Initial value:

```
= {
    0x30, 0x59,
    0x30, 0x13,
    0x06, 0x07,
    0x2A, 0x86, 0x48, 0xce, 0x3d, 0x02, 0x01,
    0x06, 0x08, 0x2a, 0x86, 0x48, 0xce, 0x3d, 0x03, 0x01, 0x07,
    0x03, 0x42, 0x00,
    0x04
}
```

ASN.1 Header for SECP256R1 public keys

20.13.3.8 pkcs11_ec_pbkey_asn1_hdr_p384

```
CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p384[]
```

Initial value:

```
= {
    0x30, 0x76,
    0x30, 0x10,
    0x06, 0x07,
    0x2a, 0x86, 0x48, 0xce, 0x3d, 0x02, 0x01,
    0x06, 0x05,
    0x2b, 0x81, 0x04, 0x00, 0x22,
    0x03, 0x62, 0x00,
    0x04
}
```

ASN.1 Header for SECP384R1 public keys

20.13.3.9 pkcs11_ec_pbkey_asn1_hdr_p521

```
CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p521[]
```

Initial value:

```
= {
    0x30, 0x81, 0x9b,
    0x30, 0x10,
    0x06, 0x07,
    0x2a, 0x86, 0x48, 0xce, 0x3d, 0x02, 0x01,
    0x06, 0x05,
    0x2b, 0x81, 0x04, 0x00, 0x23,
    0x03, 0x81, 0x86, 0x00,
    0x04
}
```

ASN.1 Header for SECP521R1 public keys

20.13.3.10 pkcs11_key_private_attributes

```
const pkcs11_attrib_model pkcs11_key_private_attributes[]
```

CKO_PRIVATE_KEY - Private Key Object Base Model

20.13.3.11 pkcs11_key_public_attributes

```
const pkcs11_attrib_model pkcs11_key_public_attributes[ ]
```

CKO_PUBLIC_KEY - Public Key Object Model

20.13.3.12 pkcs11_key_secret_attributes

```
const pkcs11_attrib_model pkcs11_key_secret_attributes[ ]
```

CKO_SECRET_KEY - Secret Key Object Base Model

20.13.3.13 pkcs11_object_monotonic_attributes

```
const pkcs11_attrib_model pkcs11_object_monotonic_attributes[ ]
```

Initial value:

```
= {
    { 0x00000000UL ,          pkcs11_object_get_class },
    { 0x00000300UL , pkcs11_object_get_type  },
    { 0x00000301UL ,  pkcs11_attrib_false    },
    { 0x00000302UL ,      pkcs11_attrib_false    },
    { 0x00000011UL ,           0                 },
}
```

CKA_CLASS == CKO_HW_FEATURE_TYPE CKA_HW_FEATURE_TYPE == CKH_MONOTONIC_COUNTER

20.13.3.14 pkcs11_x962_asn1_hdr_ec224

```
CK_BYTE pkcs11_x962_asn1_hdr_ec224[ ]
```

Initial value:

```
= {
    0x04, 0x39, 0x04
}
```

X.962 ASN.1 Header for EC224 public keys

20.13.3.15 pkcs11_x962_asn1_hdr_ec256

```
CK_BYTE pkcs11_x962_asn1_hdr_ec256[ ]
```

Initial value:

```
= {
    0x04, 0x41, 0x04
}
```

X.962 ASN.1 Header for EC256 public keys

20.13.3.16 pkcs11_x962_asn1_hdr_ec384

```
CK_BYTE pkcs11_x962_asn1_hdr_ec384[ ]
```

Initial value:

```
= {
    0x04, 0x61, 0x04
}
```

X.962 ASN.1 Header for EC384 public keys

20.13.3.17 pkcs11_x962_asn1_hdr_ec521

```
CK_BYTE pkcs11_x962_asn1_hdr_ec521[ ]
```

Initial value:

```
= {
    0x04, 0x85, 0x04
}
```

X.962 ASN.1 Header for EC521 public keys

20.13.3.18 rsa_key_data_table

```
const pkcs11_rsa_key_info_t rsa_key_data_table[4]
```

Initial value:

```
= {
}
```

Chapter 21

Namespace Documentation

21.1 cryptoauthlib Namespace Reference

Namespaces

- namespace atcab
- namespace atcacert
- namespace atcaenum
- namespace atjwt
- namespace device
- namespace exceptions
- namespace iface
- namespace library
- namespace sha206_api
- namespace status
- namespace tng

Variables

- **try** :
- os **_lib_definition_file** = os.path.join(os.path.dirname(__file__), 'cryptoauth.json')

21.1.1 Detailed Description

```
Package Definition
```

21.2 cryptoauthlib.atcab Namespace Reference

Data Structures

- class atca_aes_cbc_ctx
- class atca_aes_cbcmac_ctx
- class atca_aes_ccm_ctx
- class atca_aes_cmac_ctx
- class atca_aes_ctr_ctx
- class atca_aes_gcm_ctx
- class atca_hmac_sha256_ctx
- class atca_sha256_ctx

Functions

- def atcab_init (iface_cfg)
- def atcab_release ()
- def atcab_get_device ()
- def atcab_get_device_type ()
- def atcab_aes (mode, key_id, aes_in, aes_out)
- def atcab_aes_encrypt (key_id, key_block, plaintext, ciphertext)
- def atcab_aes_decrypt (key_id, key_block, ciphertext, plaintext)
- def atcab_aes_gfm (hash_key, inp, output)
- def atcab_aes_cbc_init (ctx, key_id, key_block, iv)
- def atcab_aes_cbc_encrypt_block (ctx, plaintext, ciphertext)
- def atcab_aes_cbc_decrypt_block (ctx, ciphertext, plaintext)
- def atcab_aes_cmac_init (ctx, key_id, key_block)
- def atcab_aes_cmac_update (ctx, data, data_size)
- def atcab_aes_cmac_finish (ctx, cmac, size)
- def atcab_aes_ctr_init (ctx, key_id, key_block, counter_size, iv)
- def atcab_aes_ctr_init_rand (ctx, key_id, key_block, counter_size, iv)
- def atcab_aes_ctr_encrypt_block (ctx, plaintext, ciphertext)
- def atcab_aes_ctr_decrypt_block (ctx, ciphertext, plaintext)
- def atcab_aes_gcm_init (ctx, key_id, key_block, iv, iv_size)
- def atcab_aes_gcm_init_rand (ctx, key_id, key_block, rand_size, free_field, free_field_size, iv)
- def atcab_aes_gcm_aad_update (ctx, aad, aad_size)
- def atcab_aes_gcm_encrypt_update (ctx, plaintext, plaintext_size, ciphertext)
- def atcab_aes_gcm_encrypt_finish (ctx, tag, tag_size)
- def atcab_aes_gcm_decrypt_update (ctx, ciphertext, ciphertext_size, plaintext)
- def atcab_aes_gcm_decrypt_finish (ctx, tag, tag_size, is_verified)
- def atcab_aes_cbcmac_init (ctx, key_id, key_block)
- def atcab_aes_cbcmac_update (ctx, data, data_size)
- def atcab_aes_cbcmac_finish (ctx, mac, mac_size)
- def atcab_aes_ccm_init (ctx, key_id, key_block, iv, iv_size, aad_size, text_size, tag_size)
- def atcab_aes_ccm_init_rand (ctx, key_id, key_block, iv, iv_size, aad_size, text_size, tag_size)
- def atcab_aes_ccm_aad_update (ctx, aad, aad_size)
- def atcab_aes_ccm_aad_finish (ctx)
- def atcab_aes_ccm_encrypt_update (ctx, plaintext, plaintext_size, ciphertext)
- def atcab_aes_ccm_decrypt_update (ctx, ciphertext, ciphertext_size, plaintext)
- def atcab_aes_ccm_encrypt_finish (ctx, tag, tag_size)
- def atcab_aes_ccm_decrypt_finish (ctx, tag, is_verified)
- def atcab_checkmac (mode, key_id, challenge, response, other_data)
- def atcab_counter (mode, counter_id, counter_value)
- def atcab_counter_increment (counter_id, counter_value)
- def atcab_counter_read (counter_id, counter_value)
- def atcab_derivekey (mode, target_key, mac)
- def atcab_ecdh_base (mode, key_id, public_key, pms, out_nonce)
- def atcab_ecdh (key_id, public_key, pms)
- def atcab_ecdh_enc (key_id, public_key, pms, read_key, read_key_id, num_in=None)
- def atcab_ecdh_ioenc (key_id, public_key, pms, io_key)
- def atcab_ecdh_tempkey (public_key, pms)
- def atcab_ecdh_tempkey_ioenc (public_key, pms, io_key)
- def atcab_gendig (zone, key_id, other_data, other_data_size)
- def atcab_genkey_base (mode, key_id, other_data, public_key=None)
- def atcab_genkey (key_id, public_key)
- def atcab_get_pubkey (key_id, public_key)
- def atcab_hmac (mode, key_id, digest)
- def atcab_info_base (mode, param2, out_data)

- def atcab_info (revision)
- def atcab_info_get_latch (state)
- def atcab_info_set_latch (state)
- def atcab_kdf (mode, key_id, details, message, out_data, out_nonce)
- def atcab_lock (mode, summary_crc)
- def atcab_lock_config_zone ()
- def atcab_lock_config_zone_crc (summary_crc)
- def atcab_lock_data_zone ()
- def atcab_lock_data_zone_crc (summary_crc)
- def atcab_lock_data_slot (slot)
- def atcab_mac (mode, key_id, challenge, digest)
- def atcab_nonce_base (mode, zero, num_in, rand_out)
- def atcab_nonce (num_in)
- def atcab_nonce_load (target, num_in, num_in_size)
- def atcab_nonce_rand (num_in, rand_out)
- def atcab_challenge (num_in)
- def atcab_challenge_seed_update (num_in, rand_out)
- def atcab_priv_write (key_id, priv_key, write_key_id, write_key, num_in=None)
- def atcab_random (random_number)
- def atcab_read_zone (zone, slot, block, offset, data, length)
- def atcab_read_serial_number (serial_number)
- def atcab_is_slot_locked (slot, is_locked)
- def atcab_is_locked (zone, is_locked)
- def atcab_read_enc (key_id, block, data, enc_key, enc_key_id, num_in=None)
- def atcab_read_config_zone (config_data)
- def atcab_cmp_config_zone (config_data, same_config)
- def atcab_read_sig (slot, sig)
- def atcab_read_pubkey (slot, public_key)
- def atcab_read_bytes_zone (zone, slot, offset, data, length)
- def atcab_secureboot (mode, param2, digest, signature, mac)
- def atcab_secureboot_mac (mode, digest, signature, num_in, io_keys, is_verified)
- def atcab_selftest (mode, param2, result)
- def atcab_sha_base (mode, length, message, data_out, data_out_size)
- def atcab_sha_start ()
- def atcab_sha_update (message)
- def atcab_sha_end (digest, length, message)
- def atcab_sha_read_context (context, context_size)
- def atcab_sha_write_context (context, context_size)
- def atcab_sha (length, message, digest)
- def atcab_hw_sha2_256_init (ctx)
- def atcab_hw_sha2_256_update (ctx, data, data_size)
- def atcab_hw_sha2_256_finish (ctx, digest)
- def atcab_hw_sha2_256 (data, data_size, digest)
- def atcab_sha_hmac_init (ctx, key_slot)
- def atcab_sha_hmac_update (ctx, data, data_size)
- def atcab_sha_hmac_finish (ctx, digest, target)
- def atcab_sha_hmac (data, data_size, key_slot, digest, target)
- def atcab_sign_base (mode, key_id, signature)
- def atcab_sign (key_id, msg, signature)
- def atcab_sign_internal (key_id, is_invalidate, is_full_sn, signature)
- def atcab_updateextra (mode, new_value)
- def atcab_verify (mode, key_id, signature, public_key, other_data, mac)
- def atcab_verify_extern_stored_mac (mode, key_id, message, signature, public_key, num_in, io_key, is_↩ verified)
- def atcab_verify_extern (message, signature, public_key, is_verified)

- def atcab_verify_extern_mac (message, signature, public_key, num_in, io_key, is_verified)
- def atcab_verify_stored (message, signature, key_id, is_verified)
- def atcab_verify_stored_mac (message, signature, key_id, num_in, io_key, is_verified)
- def atcab_verify_validate (key_id, signature, other_data, is_verified)
- def atcab_verify_invalidate (key_id, signature, other_data, is_verified)
- def atcab_write (zone, address, value, mac)
- def atcab_write_zone (zone, slot, block, offset, data, length)
- def atcab_write_enc (key_id, block, data, enc_key, enc_key_id, num_in=None)
- def atcab_write_config_zone (conf)
- def atcab_write_pubkey (slot, public_key)
- def atcab_write_bytes_zone (zone, slot, offset_bytes, data, length)
- def atcab_write_config_counter (counter_id, counter_value)

21.2.1 Detailed Description

```
Dynamic link library loading under ctypes and HAL initilization/release functions
```

21.2.2 Function Documentation

21.2.2.1 atcab_aes()

```
def cryptoauthlib.atcab.atcab_aes (
              mode,
              key_id,
              aes_in,
              aes_out )
```

```
Compute the AES-128 encrypt, decrypt, or GFM calculation.

Args:
    mode                The mode for the AES command. (int)
    key_id              Key location. Can either be a slot number or
                        ATCA_TEMPKEY_KEYID for TempKey. (int)
    aes_in              Input data to the AES command (16 bytes). (Can be of type bytearray or bytes)
    aes_out             Output data from the AES command is returned here
                        (16 bytes). (Expects bytearray of size 16)

Returns:
    Status Code
```

21.2.2.2 atcab_aes_cbc_decrypt_block()

```
def cryptoauthlib.atcab.atcab_aes_cbc_decrypt_block (
              ctx,
              ciphertext,
              plaintext )
```

```
Decrypt a block of data using CBC mode and a key within the
ATECC608. atcab_aes_cbc_init() should be called before the
first use of this function.

Args:
    ctx                 AES CBC context.
    ciphertext          Ciphertext to be decrypted (16 bytes).
                        (Bytearray or bytes)
    plaintext           Decrypted data is returned here (16 bytes).
                        (Bytearray or bytes)

Returns:
    Status code
```

21.2.2.3 atcab_aes_cbc_encrypt_block()

```
def cryptoauthlib.atcab.atcab_aes_cbc_encrypt_block (
              ctx,
              plaintext,
              ciphertext )
```

```
Encrypt a block of data using CBC mode and a key within the
ATECC608. atcab_aes_cbc_init() should be called before the
first use of this function.

Args:
    ctx                 AES CBC context.
    plaintext           Plaintext to be encrypted (16 bytes).
                        (Bytearray or bytes)
    ciphertext          Encrypted data is returned here (16 bytes).
                        (Bytearray or bytes)

Returns:
    Status code
```

21.2.2.4 atcab_aes_cbc_init()

```
def cryptoauthlib.atcab.atcab_aes_cbc_init (
              ctx,
              key_id,
              key_block,
              iv )
```

```
Initialize context for AES CBC operation.
Args:
    ctx                 AES CBC context to be initialized
    key_id              Key location. Can either be a slot number
                        or ATCA_TEMPKEY_KEYID for TempKey.
    key_block           Index of the 16-byte block to use within the
                        key location for the actual key.
    iv                  Initialization vector (16 bytes). Bytearray format

Returns:
    Status Code
```

21.2.2.5 atcab_aes_cbcmac_finish()

def cryptoauthlib.atcab.atcab_aes_cbcmac_finish (
ctx,
mac,
mac_size)

```
Finish a CBC-MAC operation returning the CBC-MAC value. If the data
provided to the atcab_aes_cbcmac_update() function has incomplete
block this function will return an error code.

Args:
    ctx        AES-128 CBC-MAC context.
    mac        CBC-MAC is returned here.
    mac_size   Size of CBC-MAC requested in bytes (max 16 bytes).

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.6 atcab_aes_cbcmac_init()

def cryptoauthlib.atcab.atcab_aes_cbcmac_init (
ctx,
key_id,
key_block)

```
Initialize context for AES CBC-MAC operation.

Args:
    ctx             AES CBC-MAC context to be initialized
    key_id          Key location. Can either be a slot number or
                    ATCA_TEMPKEY_KEYID for TempKey.
    key_block       Index of the 16-byte block to use within the key
                    location for the actual key.

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.7 atcab_aes_cbcmac_update()

```
def cryptoauthlib.atcab.atcab_aes_cbcmac_update (
              ctx,
              data,
              data_size )
```

```
Calculate AES CBC-MAC with key stored within ECC608A device.
atcab_aes_cbcmac_init() should be called before the first use of
this function.

Args:
    ctx             AES CBC-MAC context structure.
    data            Data to be added for AES CBC-MAC calculation. Can be
                    bytearray or bytes.
    data_size       Data length in bytes.

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.8 atcab_aes_ccm_aad_finish()

```
def cryptoauthlib.atcab.atcab_aes_ccm_aad_finish (
              ctx )
```

```
Finish processing Additional Authenticated Data (AAD) using CCM mode.

Args:
ctx          AES CCM context
```

21.2.2.9 atcab_aes_ccm_aad_update()

```
def cryptoauthlib.atcab.atcab_aes_ccm_aad_update (
              ctx,
              aad,
              aad_size )
```

```
Process Additional Authenticated Data (AAD) using CCM mode and a
key within the ATECC608A device

Args:
ctx          AES CCM context
aad          Additional authenticated data to be added
aad_size     Size of aad in bytes.
```

21.2.2.10 atcab_aes_ccm_decrypt_finish()

```
def cryptoauthlib.atcab.atcab_aes_ccm_decrypt_finish (
              ctx,
              tag,
              is_verified )
```

```
Complete a CCM decrypt operation authenticating provided tag.
Args:
ctx              AES CCM context structure.
tag              Authentication tag is returned here.
is_verified      Value is set to true if the tag is authenticated else
                 the value is set to false.
```

21.2.2.11 atcab_aes_ccm_decrypt_update()

```
def cryptoauthlib.atcab.atcab_aes_ccm_decrypt_update (
              ctx,
              ciphertext,
              ciphertext_size,
              plaintext )
```

```
Process data using CCM mode and a key within the ATECC608A device.
atcab_aes_ccm_init() or atcab_aes_ccm_init_rand() should be called
before the first use of this function.

Args:
ctx              AES CCM context structure.
ciphertext       Data to be processed.
ciphertext_size  Size of the data to be processed.
plaintext        Output data is returned here.
```

21.2.2.12 atcab_aes_ccm_encrypt_finish()

```
def cryptoauthlib.atcab.atcab_aes_ccm_encrypt_finish (
              ctx,
              tag,
              tag_size )
```

```
Complete a CCM encrypt operation returning the authentication tag.

Args:
ctx              AES CCM context structure.
tag              Authentication tag is returned here.
tag_size         Tag size in bytes.
```

21.2.2.13 atcab_aes_ccm_encrypt_update()

```
def cryptoauthlib.atcab.atcab_aes_ccm_encrypt_update (
              ctx,
              plaintext,
              plaintext_size,
              ciphertext )
```

```
Process data using CCM mode and a key within the ATECC608A device.
atcab_aes_ccm_init() or atcab_aes_ccm_init_rand() should be called
before the first use of this function.

Args:
ctx             AES CCM context structure.
plaintext       Data to be processed.
plaintext_size  Size of the data to be processed.
ciphertext      Output data is returned here.
```

21.2.2.14 atcab_aes_ccm_init()

```
def cryptoauthlib.atcab.atcab_aes_ccm_init (
              ctx,
              key_id,
              key_block,
              iv,
              iv_size,
              aad_size,
              text_size,
              tag_size )
```

```
Initialize context for AES CCM operation with an existing IV, which
is common when starting a decrypt operation.

Args:
ctx          AES CCM context to be initialized
key_id       Key location. Can either be a slot number or
             ATCA_TEMPKEY_KEYID for TempKey.
key_block    Index of the 16-byte block to use within the key
             location for the actual key.
iv           Nonce to be fed into the AES CCM calculation.
iv_size      Size of iv.
aad_size     Size of Additional authtication data.
text_size    Size of plaintext/ciphertext to be processed.
tag_size     Prefered size of tag.
```

21.2.2.15 atcab_aes_ccm_init_rand()

```
def cryptoauthlib.atcab.atcab_aes_ccm_init_rand (
              ctx,
              key_id,
              key_block,
              iv,
              iv_size,
              aad_size,
              text_size,
              tag_size )
```

```
Initialize context for AES CCM operation with a random nonce

Args:
ctx           AES CCM context to be initialized
key_id        Key location. Can either be a slot number or
              ATCA_TEMPKEY_KEYID for TempKey.
key_block     Index of the 16-byte block to use within the key
              location for the actual key.
iv            Nonce to be fed into the AES CCM calculation.
iv_size       Size of iv.
aad_size      Size of Additional authtication data.
text_size     Size of plaintext/ciphertext to be processed.
tag_size      Prefered size of tag.
```

21.2.2.16 atcab_aes_cmac_finish()

def cryptoauthlib.atcab.atcab_aes_cmac_finish (
ctx,
cmac,
size)

```
Finish a CMAC operation returning the CMAC value.

Args:
    ctx                 AES-128 CMAC context.
    cmac                CMAC is returned here.
    cmac_size           Size of CMAC requested in bytes (max 16 bytes).

Returns:
    Status code
```

21.2.2.17 atcab_aes_cmac_init()

def cryptoauthlib.atcab.atcab_aes_cmac_init (
ctx,
key_id,
key_block)

```
Initialize a CMAC calculation using an AES-128 key in the ATECC608.

Args:
    ctx                 AES-128 CMAC context.
    key_id              Key location. Can either be a slot number
                        or ATCA_TEMPKEY_KEYID for TempKey.
    key_block           Index of the 16-byte block to use within
                        the key location for the actual key.

Returns:
    Status code
```

21.2.2.18 atcab_aes_cmac_update()

```
def cryptoauthlib.atcab.atcab_aes_cmac_update (
              ctx,
              data,
              data_size )
```

```
Add data to an initialized CMAC calculation.

Args:
    ctx                  AES-128 CMAC context.
    data                 Data to be added.
    data_size            Size of the data to be added in bytes.

Returns:
    Status code
```

21.2.2.19 atcab_aes_ctr_decrypt_block()

```
def cryptoauthlib.atcab.atcab_aes_ctr_decrypt_block (
              ctx,
              ciphertext,
              plaintext )
```

```
Decrypt a block of data using CTR mode and a key within the
ATECC608 device. atcab_aes_ctr_init() or atcab_aes_ctr_init_rand()
should be called before the first use of this function.

Args:
    ctx                  AES CTR context structure.
    ciphertext           Ciphertext to be decrypted (16 bytes).
    plaintext            Decrypted data is returned here (16 bytes).

Returns:
    Status code
```

21.2.2.20 atcab_aes_ctr_encrypt_block()

```
def cryptoauthlib.atcab.atcab_aes_ctr_encrypt_block (
              ctx,
              plaintext,
              ciphertext )
```

```
Encrypt a block of data using CTR mode and a key within the
ATECC608 device. atcab_aes_ctr_init() or atcab_aes_ctr_init_rand()
should be called before the first use of this function.

Args:
    ctx                  AES CTR context structure.
    plaintext            Plaintext to be encrypted (16 bytes).
    ciphertext           Encrypted data is returned here (16 bytes).

Returns:
    Status code
```

21.2.2.21 atcab_aes_ctr_init()

```
def cryptoauthlib.atcab.atcab_aes_ctr_init (
              ctx,
              key_id,
              key_block,
              counter_size,
              iv )
```

```
Initialize context for AES CTR operation with an existing IV, which
is common when start a decrypt operation.

The IV is a combination of nonce (left-field) and big-endian counter
(right-field). The counter_size field sets the size of the counter and the
remaining bytes are assumed to be the nonce.

Args:
    ctx                 AES CTR context to be initialized.
    key_id              Key location. Can either be a slot number or
                        ATCA_TEMPKEY_KEYID for TempKey.
    key_block           Index of the 16-byte block to use within the key
                        location for the actual key.
    counter_size        Size of counter in IV in bytes. 4 bytes is a
                        common size.
    iv                  Initialization vector (concatenation of nonce and
                        counter) 16 bytes.

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.22 atcab_aes_ctr_init_rand()

```
def cryptoauthlib.atcab.atcab_aes_ctr_init_rand (
              ctx,
              key_id,
              key_block,
              counter_size,
              iv )
```

```
Initialize context for AES CTR operation with a random nonce and
counter set to 0 as the IV, which is common when starting an
encrypt operation.

The IV is a combination of nonce (left-field) and big-endian counter
(right-field). The counter_size field sets the size of the counter and the
remaining bytes are assumed to be the nonce.

Args:
    ctx                 AES CTR context to be initialized.
    key_id              Key location. Can either be a slot number or
                        ATCA_TEMPKEY_KEYID for TempKey.
    key_block           Index of the 16-byte block to use within the key
                        location for the actual key.
    counter_size        Size of counter in IV in bytes. 4 bytes is a
                        common size.
    iv                  Initialization vector (concatenation of nonce and
                        counter) is returned here (16 bytes).

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.23 atcab_aes_decrypt()

```
def cryptoauthlib.atcab.atcab_aes_decrypt (
            key_id,
            key_block,
            ciphertext,
            plaintext )
```

```
Perform an AES-128 decrypt operation with a key in the device.

Args:
    key_id              Key location. Can either be a slot number or
                        ATCA_TEMPKEY_KEYID for TempKey.(int)
    key_block           Index of the 16-byte block to use within the key
                        location for the actual key. (int)
    ciphertext          Input ciphertext to be decrypted (16 bytes).
                        (bytearray or bytes)
    plaintext           Output plaintext is returned here (16 bytes).
                        (Expects bytearray of size 16)s

Returns:
    Status Code
```

21.2.2.24 atcab_aes_encrypt()

```
def cryptoauthlib.atcab.atcab_aes_encrypt (
            key_id,
            key_block,
            plaintext,
            ciphertext )
```

```
Perform an AES-128 encrypt operation with a key in the device.

Args:
    key_id              Key location. Can either be a slot number or
                        ATCA_TEMPKEY_KEYID for TempKey. (int)
    key_block           Index of the 16-byte block to use within the key
                        location for the actual key.(int)
    plaintext           Input plaintext to be encrypted (16 bytes).
                        (Can be of type bytearray or bytes)
    ciphertext          Output ciphertext is returned here (16 bytes).
                        (Expects bytearray of size 16)

Returns:
    Status Code
```

21.2.2.25 atcab_aes_gcm_aad_update()

```
def cryptoauthlib.atcab.atcab_aes_gcm_aad_update (
            ctx,
            aad,
            aad_size )
```

```
Process Additional Authenticated Data (AAD) using GCM mode and a
key within the ATECC608 device.

This can be called multiple times. atcab_aes_gcm_init() or
atcab_aes_gcm_init_rand() should be called before the first use of this
function. When there is AAD to include, this should be called before
atcab_aes_gcm_encrypt_update() or atcab_aes_gcm_decrypt_update().

Args:
    ctx                AES GCM context
    aad                Additional authenticated data to be added
    aad_size           Size of aad in bytes

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.26 atcab_aes_gcm_decrypt_finish()

def cryptoauthlib.atcab.atcab_aes_gcm_decrypt_finish (
ctx,
tag,
tag_size,
is_verified)

```
Complete a GCM decrypt operation verifying the authentication tag.

Args:
    ctx                AES GCM context structure.
    tag                Expected authentication tag.
    tag_size           Size of tag in bytes (12 to 16 bytes).
    is_verified        Returns whether or not the tag verified.

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.27 atcab_aes_gcm_decrypt_update()

def cryptoauthlib.atcab.atcab_aes_gcm_decrypt_update (
ctx,
ciphertext,
ciphertext_size,
plaintext)

```
Decrypt data using GCM mode and a key within the ATECC608 device.
atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called
before the first use of this function.

Args:
    ctx                AES GCM context structure.
    ciphertext         Ciphertext to be decrypted.
    ciphertext_size    Size of ciphertext in bytes.
    plaintext          Decrypted data is returned here.

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.28 atcab_aes_gcm_encrypt_finish()

```
def cryptoauthlib.atcab.atcab_aes_gcm_encrypt_finish (
              ctx,
              tag,
              tag_size )
```

```
Complete a GCM encrypt operation returning the authentication tag.

Args:
    ctx                 AES GCM context structure.
    tag                 Authentication tag is returned here.
    tag_size            Tag size in bytes (12 to 16 bytes).

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.29 atcab_aes_gcm_encrypt_update()

```
def cryptoauthlib.atcab.atcab_aes_gcm_encrypt_update (
              ctx,
              plaintext,
              plaintext_size,
              ciphertext )
```

```
Encrypt data using GCM mode and a key within the ATECC608 device.
atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called
before the first use of this function.

Args:
    ctx                 AES GCM context structure.
    plaintext           Plaintext to be encrypted (16 bytes).
    plaintext_size      Size of plaintext in bytes.
    ciphertext          Encrypted data is returned here.

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.30 atcab_aes_gcm_init()

```
def cryptoauthlib.atcab.atcab_aes_gcm_init (
              ctx,
              key_id,
              key_block,
              iv,
              iv_size )
```

```
Initialize context for AES GCM operation with an existing IV, which
is common when starting a decrypt operation.

Args:
    ctx                 AES GCM context to be initialized.
    key_id              Key location. Can either be a slot number or
                        ATCA_TEMPKEY_KEYID for TempKey.
    key_block           Index of the 16-byte block to use within the key
                        location for the actual key.
    iv                  Initialization vector.
    iv_size       Size of IV in bytes. Standard is 12 bytes.
Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.31 atcab_aes_gcm_init_rand()

```
def cryptoauthlib.atcab.atcab_aes_gcm_init_rand (
              ctx,
              key_id,
              key_block,
              rand_size,
              free_field,
              free_field_size,
              iv )
```

```
Initialize context for AES GCM operation with a IV composed of a
random and optional fixed(free) field, which is common when
starting an encrypt operation.

Args:
    ctx                 AES CTR context to be initialized.
    key_id              Key location. Can either be a slot number or
                        ATCA_TEMPKEY_KEYID for TempKey.
    key_block           Index of the 16-byte block to use within the
                        key location for the actual key.
    rand_size           Size of the random field in bytes. Minimum and
                        recommended size is 12 bytes. Max is 32 bytes.
    free_field          Fixed data to include in the IV after the
                        random field. Can be NULL if not used.
    free_field_size     Size of the free field in bytes.
    iv                  Initialization vector is returned here. Its
                        size will be rand_size and free_field_size
                        combined.
Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.2.2.32 atcab_aes_gfm()

```
def cryptoauthlib.atcab.atcab_aes_gfm (
              hash_key,
              inp,
              output )
```

```
Perform a Galois Field Multiply (GFM) operation.

Args:
    hash_key            First input value (16 bytes).
                        (bytearray or bytes)
    inp                 Second input value (16 bytes).
                        (bytearray or bytes)
    output              GFM result is returned here (16 bytes).
                        (Expects bytearray of size 16)

Returns:
    Status Code
```

21.2.2.33 atcab_challenge()

def cryptoauthlib.atcab.atcab_challenge (
    num_in)

```
Execute a Nonce command in pass-through mode to initialize TempKey
to a specified value.

Args:
    num_in              Data to be loaded into TempKey (32 bytes).
                        (bytearray or bytes)

Returns:
    Status Code
```

21.2.2.34 atcab_challenge_seed_update()

def cryptoauthlib.atcab.atcab_challenge_seed_update (
    num_in,
    rand_out)

```
Execute a Nonce command to generate a random challenge combining
a host nonce (num_in) and a device random number.

Args:
    num_in              Host nonce to be combined with the device random
                        number (20 bytes). (bytearray or bytes)
    rand_out            Internally generated 32-byte random number that was
                        used in the nonce/challenge calculation is returned
                        here. Can be NULL if not needed. (Expects bytearray)

Returns:
    Status code
```

21.2.2.35 atcab_checkmac()

def cryptoauthlib.atcab.atcab_checkmac (
    mode,
    key_id,
    challenge,
    response,
    other_data)

```
Compares a MAC response with input values

Args:
    mode                Controls which fields within the device are used in
                        the message (int)
    key_id              Key location in the CryptoAuth device to use for the
                        MAC (int)
    challenge           Challenge data (32 bytes) (bytearray or bytes)
    response            MAC response data (32 bytes) (bytearray or bytes)
    other_data          OtherData parameter (13 bytes) (bytearray or bytes)

Returns:
    Status code
```

21.2.2.36 atcab_cmp_config_zone()

```
def cryptoauthlib.atcab.atcab_cmp_config_zone (
              config_data,
              same_config )
```

```
Compares a specified configuration zone with the configuration zone
currently on the device.

This only compares the static portions of the configuration zone and skips
those that are unique per device (first 16 bytes) and areas that can change
after the configuration zone has been locked (e.g. LastKeyUse).

Args:
    config_data         Full configuration data to compare the device
                        against. (bytearray or bytes)
    same_config         Result is returned here. True if the static portions
                        on the configuration zones are the same.
                        (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.37 atcab_counter()

```
def cryptoauthlib.atcab.atcab_counter (
              mode,
              counter_id,
              counter_value )
```

```
Compute the Counter functions

Args:
    mode                The mode used for the counter (int)
    counter_id          The counter to be used (int)
    counter_value       Counter value returned from device
                        (AtcaReference expected)

Returns:
    Status code
```

21.2.2.38 atcab_counter_increment()

```
def cryptoauthlib.atcab.atcab_counter_increment (
              counter_id,
              counter_value )
```

```
Increments one of the device's monotonic counters

Args:
    counter_id          Counter to be incremented (int)
    counter_value       New value of the counter is returned here
                        (AtcaReference expected)

Returns:
    Status code
```

21.2.2.39 atcab_counter_read()

```
def cryptoauthlib.atcab.atcab_counter_read (
              counter_id,
              counter_value )
```

```
Reads one of the device's monotonic counters

Args:
    counter_id          Counter to be read (int)
    counter_value       Counter value is returned here
                        (AtcaReference expected)

Returns:
    Status code
```

21.2.2.40 atcab_derivekey()

```
def cryptoauthlib.atcab.atcab_derivekey (
              mode,
              target_key,
              mac )
```

```
Executes the DeviveKey command for deriving a new key from a
nonce (TempKey) and an existing key.

Args:
    mode                Bit 2 must match the value in TempKey.SourceFlag (int)
    target_key          Key slot to be written (int)
    mac                 Optional 32 byte MAC used to validate operation.
                        (bytearray or bytes)

Returns:
    Status code
```

21.2.2.41 atcab_ecdh()

```
def cryptoauthlib.atcab.atcab_ecdh (
              key_id,
              public_key,
              pms )
```

```
ECDH command with a private key in a slot and the premaster secret
is returned in the clear.

Args:
    key_id              Slot of key for ECDH computation (int)
    public_key          Public key input to ECDH calculation. X and Y
                        integers in big-endian format. 64 bytes for P256
                        key.(bytearray or bytes)
    pms                 ByteArray - Computed ECDH premaster secret is returned
                        here (32 bytes).(Expects bytearray of size 32)

Returns:
    Status code
```

21.2.2.42 atcab_ecdh_base()

```
def cryptoauthlib.atcab.atcab_ecdh_base (
            mode,
            key_id,
            public_key,
            pms,
            out_nonce )
```

```
Base function for generating premaster secret key using ECDH.

Args:
    mode                Mode to be used for ECDH computation (int)
    key_id              Slot of key for ECDH computation (int)
    public_key          Public key input to ECDH calculation. X and Y
                        integers in big-endian format. 64 bytes for P256
                        key. (bytearray or bytes)
    pms                 ByteArray - Computed ECDH pre-master secret is returned here (32
                        bytes) if returned directly. Otherwise NULL.
    out_nonce           ByteArray - Nonce used to encrypt pre-master secret. NULL if
                        output encryption not used.

Returns:
    Status code
```

21.2.2.43 atcab_ecdh_enc()

```
def cryptoauthlib.atcab.atcab_ecdh_enc (
            key_id,
            public_key,
            pms,
            read_key,
            read_key_id,
            num_in = None )
```

```
ECDH command with a private key in a slot and the premaster secret
is read from the next slot. This function only works for even
numbered slots with the proper configuration.

Args:
    key_id              Slot of key for ECDH computation (int)
    public_key          Public key input to ECDH calculation. X and Y
                        integers in big-endian format. 64 bytes for P256
                        key. (bytearray or bytes)
    read_key            Read key for the premaster secret slot (key_id|1)
                        (32 bytes). (bytearray or bytes)
    read_key_id         Read key slot for read_key. (int)
    pms                 ByteArray - Computed ECDH premaster secret is returned
                        here (32 bytes).(Expects bytearray of size 32)
    num_in              Bytearray - Host nonce used to calculate nonce (20 bytes)
Returns:
    Status code
```

21.2.2.44 atcab_ecdh_ioenc()

def cryptoauthlib.atcab.atcab_ecdh_ioenc (
key_id,
public_key,
pms,
io_key)

```
ECDH command with a private key in a slot and the premaster secret
is returned encrypted using the IO protection key.

Args:
    key_id              Slot of key for ECDH computation (int)
    public_key          Public key input to ECDH calculation. X and Y
                        integers in big-endian format. 64 bytes for P256
                        key. (bytearray or bytes)
    io_key              IO protection key (32 bytes). (bytearray or bytes)
    pms                 Computed ECDH premaster secret is returned here
                        (32 bytes). (Expects bytearray of size 32)

Returns:
    Status code
```

21.2.2.45 atcab_ecdh_tempkey()

def cryptoauthlib.atcab.atcab_ecdh_tempkey (
public_key,
pms)

```
ECDH command with a private key in TempKey and the premaster secret
is returned in the clear.

Args:
    public_key          Public key input to ECDH calculation. X and Y
                        integers in big-endian format. 64 bytes for P256
                        key. (bytearray or bytes)
    pms                 Computed ECDH premaster secret is returned here
                        (32 bytes). (Expects bytearray of size 32)

Retuns:
    Status code
```

21.2.2.46 atcab_ecdh_tempkey_ioenc()

def cryptoauthlib.atcab.atcab_ecdh_tempkey_ioenc (
public_key,
pms,
io_key)

```
ECDH command with a private key in TempKey and the premaster secret
is returned encrypted using the IO protection key.

Args:
    public_key          Public key input to ECDH calculation. X and Y
                        integers in big-endian format. 64 bytes for P256
                        key. (bytearray or bytes)
    io_key              IO protection key (32 bytes).(bytearray or bytes)
    pms                 Computed ECDH premaster secret is returned here
                        (32 bytes). (Expects bytearray of size 32)

Returns:
    Status code
```

21.2.2.47 atcab_gendig()

def cryptoauthlib.atcab.atcab_gendig (
zone,
key_id,
other_data,
other_data_size)

```
Issues a GenDig command, which performs a SHA256 hash on the source
data indicated by zone with the contents of TempKey.  See the
CryptoAuth datasheet for your chip to see what the values of zone
correspond to.

Args:
    zone                Designates the source of the data to hash
                        with TempKey.(int)
    key_id              Indicates the key, OTP block, or message
                        order for shared nonce mode. (int)
    other_data          Four bytes of data for SHA calculation when
                        using a NoMac key, 32 bytes for "Shared Nonce"
                        mode, otherwise ignored (can be NULL).
                        (bytearray or bytes)
    other_data_size     Size of other_data in bytes. (int)

Returns:
    Status code
```

21.2.2.48 atcab_genkey()

def cryptoauthlib.atcab.atcab_genkey (
key_id,
public_key)

```
Issues GenKey command, which generates a new random private key in
slot and returns the public key.

Args:
    key_id              Slot number where an ECC private key is configured.
                        Can also be ATCA_TEMPKEY_KEYID to generate a private
                        key in TempKey. (int)
    public_key          Public key will be returned here. Format will be
                        the X and Y integers in big-endian format.
                        64 bytes for P256 curve. Set to NULL if public key
                        isn't required. (Expects bytearray)

Returns:
    Status code
```

21.2.2.49 atcab_genkey_base()

```
def cryptoauthlib.atcab.atcab_genkey_base (
              mode,
              key_id,
              other_data,
              public_key = None )
```

```
Issues GenKey command, which can generate a private key, compute a
public key, nd/or compute a digest of a public key.

Args:
    mode                Mode determines what operations the GenKey
                        command performs. (int)
    key_id              Slot to perform the GenKey command on. (int)
    other_data          OtherData for PubKey digest calculation. Can be set
                        to NULL otherwise. (bytearray or bytes)
    public_key          If the mode indicates a public key will be
                        calculated, it will be returned here. Format will
                        be the X and Y integers in big-endian format.
                        64 bytes for P256 curve. Set to NULL if public key
                        isn't required. (Expects bytearray of size 64 bytes)
Returns:
    Status code
```

21.2.2.50 atcab_get_device()

```
def cryptoauthlib.atcab.atcab_get_device (
             void )
```

```
Return the global device instance
```

21.2.2.51 atcab_get_device_type()

```
def cryptoauthlib.atcab.atcab_get_device_type (
             void )
```

```
Return the device type of the currently initialized device.
```

21.2.2.52 atcab_get_pubkey()

def cryptoauthlib.atcab.atcab_get_pubkey (
key_id,
public_key)

```
Uses GenKey command to calculate the public key from an existing
private key in a slot.

Args:
    key_id              Slot number of the private key. (int)
    public_key          Public key will be returned here. Format will be
                        the X and Y integers in big-endian format.
                        64 bytes for P256 curve. Set to NULL if public key
                        isn't required.(Expects bytearray)
Returns:
    Status code
```

21.2.2.53 atcab_hmac()

def cryptoauthlib.atcab.atcab_hmac (
mode,
key_id,
digest)

```
Issues a HMAC command, which computes an HMAC/SHA-256 digest of a
key stored in the device, a challenge, and other information on the
device.

Args:
    mode                Controls which fields within the device are used in the
                        message. (int)
    key_id              Which key is to be used to generate the response.
                        Bits 0:3 only are used to select a slot but all 16 bits
                        are used in the HMAC message. (int)
    digest              HMAC digest is returned in this buffer (32 bytes).
                        (Expects bytearray)
Returns:
    Status code
```

21.2.2.54 atcab_hw_sha2_256()

def cryptoauthlib.atcab.atcab_hw_sha2_256 (
data,
data_size,
digest)

```
Use the SHA command to compute a SHA-256 digest.

Args:
    data                Message data to be hashed. (bytearray or bytes)
    data_size           Size of data in bytes. (int)
    digest              Digest is returned here (32 bytes).
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.55 atcab_hw_sha2_256_finish()

```
def cryptoauthlib.atcab.atcab_hw_sha2_256_finish (
              ctx,
              digest )
```

```
Finish SHA-256 digest for a SHA context for performing a hardware
SHA-256 operation on a device.

Args:
ctx                     SHA256 context (atca_sha256_ctx)
digest                  SHA256 digest is returned here (32 bytes)
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.56 atcab_hw_sha2_256_init()

```
def cryptoauthlib.atcab.atcab_hw_sha2_256_init (
              ctx )
```

```
Initialize a SHA context for performing a hardware SHA-256 operation
on a device. Note that only one SHA operation can be run at a time.

Args:
    ctx                     SHA256 context (atca_sha256_ctx)

Returns:
    Status code
```

21.2.2.57 atcab_hw_sha2_256_update()

```
def cryptoauthlib.atcab.atcab_hw_sha2_256_update (
              ctx,
              data,
              data_size )
```

```
--> Add message data to a SHA context for performing a hardware SHA-256
    operation on a device.

Args:
    ctx                 SHA256 context (atca_sha256_ctx)
    data                Message data to be added to hash. (bytearray or bytes)
    data_size           Size of data in bytes. (int)

Returns:
    Status code
```

21.2.2.58 atcab_info()

```
def cryptoauthlib.atcab.atcab_info (
            revision )
```

```
Used to get the device revision number. (DevRev)

Args:
    revision            4-byte bytearray receiving the revision number
                        from the device. (Expects bytearray)

Returns:
    Status code
```

21.2.2.59 atcab_info_base()

```
def cryptoauthlib.atcab.atcab_info_base (
            mode,
            param2,
            out_data )
```

```
Issues an Info command, which return internal device information and
can control GPIO and the persistent latch.

Args:
    mode                Selects which mode to be used for info command.(int)
    param2              Selects the particular fields for the mode.(int)
    out_data            Response from info command (4 bytes). Can be set to
                        NULL if not required.(Expects bytearray)

Returns:
    Status
```

21.2.2.60 atcab_info_get_latch()

```
def cryptoauthlib.atcab.atcab_info_get_latch (
            state )
```

```
Using the Info command to get the persistent latch current state for
an ATECC608 device.

Args:
    state               The state is returned here. Set (True) or
                        clear (False). Expects AtcaReference.

Returns:
    Status code
```

21.2.2.61 atcab_info_set_latch()

```
def cryptoauthlib.atcab.atcab_info_set_latch (
              state )
```

```
Use the Info command to set the persistent latch state for an
ATECC608 device.

Args:
    state               Persistent latch state. Set (True) or
                        clear (False).

Returns:
    Status code
```

21.2.2.62 atcab_init()

```
def cryptoauthlib.atcab.atcab_init (
              iface_cfg )
```

```
Initialize the communication stack and initializes the ATCK590 kit
Communication over USB HID and Kit Protocol by default
raise CryptoException
```

21.2.2.63 atcab_is_locked()

```
def cryptoauthlib.atcab.atcab_is_locked (
              zone,
              is_locked )
```

```
Executes Read command, which reads the configuration zone to see if
the specified slot is locked.

Args:
    zone                The zone to query for locked (use LOCK_ZONE_CONFIG(0x00) or
                        LOCK_ZONE_DATA(0x01) ). (int)
    is_locked           Lock state returned here. True if locked.
                        (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.64 atcab_is_slot_locked()

```
def cryptoauthlib.atcab.atcab_is_slot_locked (
            slot,
            is_locked )
```

```
Executes Read command, which reads the configuration zone to see if
the specified slot is locked.

Args:
    slot                Slot to query for locked (slot 0-15) (int)
    is_locked           Lock state returned here. True if locked.
                        (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.65 atcab_kdf()

```
def cryptoauthlib.atcab.atcab_kdf (
            mode,
            key_id,
            details,
            message,
            out_data,
            out_nonce )
```

```
Executes the KDF command, which derives a new key in PRF, AES, or
HKDF modes. Generally this function combines a source key with an input
string and creates a result key/digest/array.

Args:
    mode            Mode determines KDF algorithm (PRF,AES,HKDF), source
                    key location, and target key locations. (int)
    key_id          Source and target key slots if locations are in the
                    EEPROM. Source key slot is the LSB and target key
                    slot is the MSB. (int)
    details         Further information about the computation, depending
                    on the algorithm. (int)
    message         Input value from system (up to 128 bytes). Actual size
                    of message is 16 bytes for AES algorithm or is encoded
                    in the MSB of the details parameter for other
                    algorithms.(bytearray or bytes)
    out_data        Output of the KDF function is returned here. If the
                    result remains in the device, this can be NULL.
                    (Expects bytearray)
    out_nonce       If the output is encrypted, a 32 byte random nonce
                    generated by the device is returned here. If output
                    encryption is not used, this can be NULL.
                    (Expects bytearray)

Retuns:
    Status code
```

21.2.2.66 atcab_lock()

```
def cryptoauthlib.atcab.atcab_lock (
              mode,
              summary_crc )
```

```
The Lock command prevents future modifications of the Configuration
and/or Data and OTP zones. If the device is so configured, then
this command can be used to lock individual data slots. This
command fails if the designated area is already locked.

Args:
    mode                Zone, and/or slot, and summary check (bit 7).(int)
    summary_crc         CRC of the config or data zones. Ignored for
                        slot locks or when mode bit 7 is set. (int)

Returns:
    Status code
```

21.2.2.67 atcab_lock_config_zone()

```
def cryptoauthlib.atcab.atcab_lock_config_zone (
             void  )
```

```
Unconditionally (no CRC required) lock the config zone.

Args:
    None

Returns:
    Status code
```

21.2.2.68 atcab_lock_config_zone_crc()

```
def cryptoauthlib.atcab.atcab_lock_config_zone_crc (
              summary_crc )
```

```
Lock the config zone with summary CRC.

The CRC is calculated over the entire config zone contents. 88 bytes for
ATSHA devices, 128 bytes for ATECC devices. Lock will fail if the provided
CRC doesn't match the internally calculated one.

Args:
    summary_crc         Expected CRC over the config zone. (int)

Returns:
    Status code
```

21.2.2.69 atcab_lock_data_slot()

```
def cryptoauthlib.atcab.atcab_lock_data_slot (
             slot )
```

```
Lock an individual slot in the data zone on an ATECC device. Not
available for ATSHA devices. Slot must be configured to be slot
lockable (KeyConfig.Lockable=1).

Args:
    slot                Slot to be locked in data zone. (int)

Returns:
    Status code
```

21.2.2.70 atcab_lock_data_zone()

```
def cryptoauthlib.atcab.atcab_lock_data_zone (
             void  )
```

```
Unconditionally (no CRC required) lock the data zone (slots and OTP).

ConfigZone must be locked and DataZone must be unlocked for the
zone to be successfully locked.

Args:
    None

Returns:
    Status code
```

21.2.2.71 atcab_lock_data_zone_crc()

```
def cryptoauthlib.atcab.atcab_lock_data_zone_crc (
             summary_crc )
```

```
Lock the data zone (slots and OTP) with summary CRC.

The CRC is calculated over the concatenated contents of all the slots and
OTP at the end. Private keys (KeyConfig.Private=1) are skipped. Lock will
fail if the provided CRC doesn't match the internally calculated one.

Args:
    summary_crc         Expected CRC over the config zone. (int)

Returns:
    Status code
```

21.2.2.72 atcab_mac()

```
def cryptoauthlib.atcab.atcab_mac (
              mode,
              key_id,
              challenge,
              digest )
```

```
Executes MAC command, which computes a SHA-256 digest of a key
stored in the device, a challenge, and other information on the
device.

Args:
    mode                Controls which fields within the device are used in
                        the message (int)
    key_id              Key in the CryptoAuth device to use for the MAC (int)
    challenge           Challenge message (32 bytes). May be NULL if mode
                        indicates a challenge isn't required. (bytearray or bytes)
    digest              MAC response is returned here (32 bytes). (Expects bytearray)

Returns:
    Status code
```

21.2.2.73 atcab_nonce()

```
def cryptoauthlib.atcab.atcab_nonce (
              num_in )
```

```
Execute a Nonce command in pass-through mode to initialize TempKey
to a specified value.

Args:
    num_in              Data to be loaded into TempKey (32 bytes).
                        (bytearray or bytes)

Returns:
    None
```

21.2.2.74 atcab_nonce_base()

```
def cryptoauthlib.atcab.atcab_nonce_base (
              mode,
              zero,
              num_in,
              rand_out )
```

```
Executes Nonce command, which loads a random or fixed nonce/data
into the device for use by subsequent commands.

Args:
    mode                Controls the mechanism of the internal RNG or fixed
                        write. (int)
    zero                Param2, normally 0, but can be used to indicate a
                        nonce calculation mode (bit 15). (int)
    num_in              Input value to either be included in the nonce
                        calculation in random modes (20 bytes) or to be
                        written directly (32 bytes or 64 bytes(ATECC608))
                        in pass-through mode. (bytearray or bytes)
    rand_out            If using a random mode, the internally generated
                        32-byte random number that was used in the nonce
                        calculation is returned here. Can be NULL if not
                        needed. (Expects bytearray)

Returns:
    Status code
```

21.2.2.75 atcab_nonce_load()

def cryptoauthlib.atcab.atcab_nonce_load (
target,
num_in,
num_in_size)

```
Execute a Nonce command in pass-through mode to load one of the
device's internal buffers with a fixed value.

For the ATECC608, available targets are TempKey (32 or 64 bytes), Message
Digest Buffer (32 or 64 bytes), or the Alternate Key Buffer (32 bytes). For
all other devices, only TempKey (32 bytes) is available.

Args:
    target              Target device buffer to load. Can be
                        NONCE_MODE_TARGET_TEMPKEY,
                        NONCE_MODE_TARGET_MSGDIGBUF, or
                        NONCE_MODE_TARGET_ALTKEYBUF.(int)
    num_in              Data to load into the buffer.(bytearray or bytes)
    num_in_size         Size of num_in in bytes. Can be 32 or 64 bytes
                        depending on device and target. (int)

Returns:
    Status code
```

21.2.2.76 atcab_nonce_rand()

def cryptoauthlib.atcab.atcab_nonce_rand (
num_in,
rand_out)

```
Execute a Nonce command to generate a random nonce combining a host
nonce (num_in) and a device random number.

Args:
    num_in              Host nonce to be combined with the device random
                        number (20 bytes). (bytearray or bytes)
    rand_out            Internally generated 32-byte random number that was
                        used in the nonce/challenge calculation is returned
                        here. Can be NULL if not needed.(Expects bytearray)

Returns:
    Status code
```

21.2.2.77 atcab_priv_write()

def cryptoauthlib.atcab.atcab_priv_write (
key_id,
priv_key,
write_key_id,
write_key,
num_in = None)

```
Executes PrivWrite command, to write externally generated ECC
private keys into the device.

Args:
    key_id              Slot to write the external private key into. (int)
    priv_key            External private key (36 bytes) to be written.
                        The first 4 bytes should be zero for P256 curve.
                        (bytearray or bytes)
    write_key_id        Write key slot. Ignored if write_key is NULL.(int)
    write_key           Write key (32 bytes). If NULL, perform an
                        unencrypted PrivWrite, which is only available when
                        the data zone is unlocked. (bytearray or bytes)
    num_in              Bytearray - Host nonce used to calculate nonce (20 bytes)
Returns:
    Status code
```

21.2.2.78 atcab_random()

def cryptoauthlib.atcab.atcab_random (
random_number)

```
Generates a 32 byte random number. Note that if the configuration zone
isn't locked yet (LockConfig) then it will return a 0xFFFF0000 repeating
pattern instead.

Args:
    random_number       Random number is returned here (expects bytearray)

Returns:
    Status code
```

21.2.2.79 atcab_read_bytes_zone()

```
def cryptoauthlib.atcab.atcab_read_bytes_zone (
            zone,
            slot,
            offset,
            data,
            length )
```

```
Used to read an arbitrary number of bytes from any zone configured
for clear reads.

This function will issue the Read command as many times as is required to
read the requested data.

Args:
    zone                Zone to read data from. Option are ATCA_ZONE_CONFIG(0),
                        ATCA_ZONE_OTP(1), or ATCA_ZONE_DATA(2). (int)
    slot                Slot number to read from if zone is ATCA_ZONE_DATA(2).
                        Ignored for all other zones. (int)
    offset              Byte offset within the zone to read from. (int)
    length              Number of bytes to read starting from the offset.(int)
    data                Read data is returned here. (Expects bytearray)

Returns:
    Status code
```

21.2.2.80 atcab_read_config_zone()

```
def cryptoauthlib.atcab.atcab_read_config_zone (
            config_data )
```

```
Executes Read command to read the complete device configuration
zone.

Args:
    config_data         Configuration zone data is returned here. 88 bytes
                        for ATSHA devices, 128 bytes for ATECC devices.
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.81 atcab_read_enc()

```
def cryptoauthlib.atcab.atcab_read_enc (
            key_id,
            block,
            data,
            enc_key,
            enc_key_id,
            num_in = None )
```

```
Executes Read command on a slot configured for encrypted reads and
decrypts the data to return it as plaintext.

Data zone must be locked for this command to succeed. Can only read 32 byte
blocks.

Args:
    key_id              The slot ID to read from. (int)
    block               Index of the 32 byte block within the slot to read. (int)
    enc_key             32 byte ReadKey for the slot being read.(bytearray or bytes)
    enc_key_id          KeyID of the ReadKey being used.(int)
    data                Decrypted (plaintext) data from the read is returned
                        here (32 bytes). (Expects bytearray)
    num_in              Bytearray - Host nonce used to calculate nonce (20 byte)
Returns:
    Status code
```

21.2.2.82 atcab_read_pubkey()

def cryptoauthlib.atcab.atcab_read_pubkey (
slot,
public_key)

```
Executes Read command to read an ECC P256 public key from a slot
configured for clear reads.

This function assumes the public key is stored using the ECC public key
format specified in the datasheet.

Args:
    slot                Slot number to read from. Only slots 8 to 15 are
                        large enough for a public key. (int)
    public_key          Public key is returned here (64 bytes). Format will
                        be the 32 byte X and Y big-endian integers
                        concatenated. (Expects bytearray)
Returns:
    Status code
```

21.2.2.83 atcab_read_serial_number()

def cryptoauthlib.atcab.atcab_read_serial_number (
serial_number)

```
Executes Read command, which reads the 9 byte serial number of the
device from the config zone.

Args:
    serial_number       9 byte serial number is returned here.
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.84 atcab_read_sig()

```
def cryptoauthlib.atcab.atcab_read_sig (
             slot,
             sig )
```

```
Executes Read command to read a 64 byte ECDSA P256 signature from a
slot configured for clear reads.

Args:
    slot                Slot number to read from. Only slots 8 to 15 are large
                        enough for a signature. (int)
    sig                 Signature will be returned here (64 bytes). Format will be
                        the 32 byte R and S big-endian integers concatenated.
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.85 atcab_read_zone()

```
def cryptoauthlib.atcab.atcab_read_zone (
             zone,
             slot,
             block,
             offset,
             data,
             length )
```

```
Executes Read command, which reads either 4 or 32 bytes of data from
a given slot, configuration zone, or the OTP zone.

When reading a slot or OTP, data zone must be locked and the slot
configuration must not be secret for a slot to be successfully read.

Args:
    zone                Zone to be read from device. Options are
                        ATCA_ZONE_CONFIG, ATCA_ZONE_OTP, or ATCA_ZONE_DATA.(int)
    slot                Slot number for data zone and ignored for other zones. (int)
    block               32 byte block index within the zone. (int)
    offset              4 byte work index within the block. Ignored for 32 byte
                        reads. (Expects bytearray)
    length              Length of the data to be read. Must be either 4 or 32.
    data                Read data is returned here. (Expects bytearray)

Returns:
    Status code
```

21.2.2.86 atcab_release()

```
def cryptoauthlib.atcab.atcab_release (
            void )
```

```
Release the kit and the communication stack
raise CryptoException
```

21.2.2.87 atcab_secureboot()

```
def cryptoauthlib.atcab.atcab_secureboot (
            mode,
            param2,
            digest,
            signature,
            mac )
```

```
Executes Secure Boot command, which provides support for secure
boot of an external MCU or MPU.

Args:
    mode                Mode determines what operations the SecureBoot
                        command performs. (int)
    param2              Not used, must be 0. (int)
    digest              Digest of the code to be verified (32 bytes).
                        (bytearray or bytes)
    signature           Signature of the code to be verified (64 bytes). Can
                        be NULL when using the FullStore mode. (bytearray or bytes)
    mac                 Validating MAC will be returned here (32 bytes). Can
                        be NULL if not required. (Expects bytearray)

Return:
    Status code
```

21.2.2.88 atcab_secureboot_mac()

```
def cryptoauthlib.atcab.atcab_secureboot_mac (
            mode,
            digest,
            signature,
            num_in,
            io_keys,
            is_verified )
```

```
Executes Secure Boot command with encrypted digest and validated
MAC response using the IO protection key.

Args:
    mode                Mode determines what operations the SecureBoot
                        command performs. (int)
    digest              Digest of the code to be verified (32 bytes).
                        This is the plaintext digest (not encrypted).
                        (bytearray or bytes)
    signature           Signature of the code to be verified (64 bytes). Can
                        be NULL when using the FullStore mode.
                        (bytearray or bytes)
    num_in              Host nonce (20 bytes).(bytearray or bytes)
    io_key              IO protection key (32 bytes). (bytearray or bytes)
    is_verified         Verify result is returned here. (Expects
                        AtcaReference)

Returns:
    Status code
```

21.2.2.89 atcab_selftest()

```
def cryptoauthlib.atcab.atcab_selftest (
              mode,
              param2,
              result )
```

```
Executes the SelfTest command, which performs a test of one or more
of the cryptographic engines within the ATECC608 chip.

Args:
    mode                Functions to test. Can be a bit field combining any
                        of the following: SELFTEST_MODE_RNG,
                        SELFTEST_MODE_ECDSA_VERIFY, SELFTEST_MODE_ECDSA_SIGN,
                        SELFTEST_MODE_ECDH, SELFTEST_MODE_AES,
                        SELFTEST_MODE_SHA, SELFTEST_MODE_ALL. (int)
    param2              Currently unused, should be 0. (int)
    result              Results are returned here as a bit field. (Expects
                        AtcaReference)

Returns:
    Status code
```

21.2.2.90 atcab_sha()

```
def cryptoauthlib.atcab.atcab_sha (
              length,
              message,
              digest )
```

```
Use the SHA command to compute a SHA-256 digest.

Args:
    length              Size of message parameter in bytes. (int)
    message             Message data to be hashed. (bytearray or bytes)
    digest              Digest is returned here (32 bytes). (Expects bytearray)

Returns:
    Status code
```

21.2.2.91 atcab_sha_base()

```
def cryptoauthlib.atcab.atcab_sha_base (
              mode,
              length,
              message,
              data_out,
              data_out_size )
```

```
Executes SHA command, which computes a SHA-256 or HMAC/SHA-256
digest for general purpose use by the host system.

Only the Start(0) and Compute(1) modes are available for ATSHA devices.

Args:
    mode                SHA command mode Start(0), Update/Compute(1),
                        End(2), Public(3), HMACstart(4), HMACend(5),
                        Read_Context(6), or Write_Context(7). Also
                        message digest target location for the
                        ATECC608. (int)
    length              Number of bytes in the message parameter or
                        KeySlot for the HMAC key if Mode is
                        HMACstart(4) or Public(3). (int)
    message             Message bytes to be hashed or Write_Context if
                        restoring a context on the ATECC608. Can be
                        NULL if not required by the mode.
                        (bytearray or bytes)
    data_out            Data returned by the command (digest or
                        context).(Expects bytearray)
    data_out_size       As input, the size of the data_out buffer. As
                        output, the number of bytes returned in
                        data_out. (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.92 atcab_sha_end()

def cryptoauthlib.atcab.atcab_sha_end (
digest,
length,
message)

```
Executes SHA command to complete SHA-256 or HMAC/SHA-256 operation.

Args:
    length              Length of any remaining data to include in hash. Max 64
                        bytes.(int)
    message             Remaining data to include in hash. NULL if length is 0. (bytearray or bytes)
    digest              Digest from SHA-256 or HMAC/SHA-256 will be returned
                        here (32 bytes). (Expects bytearray)

Returns:
    Status code
```

21.2.2.93 atcab_sha_hmac()

def cryptoauthlib.atcab.atcab_sha_hmac (
data,
data_size,
key_slot,
digest,
target)

```
Use the SHA command to compute an HMAC/SHA-256 operation.

Args:
    data                Message data to be hashed. (bytearray or bytes)
    data_size           Size of data in bytes. (int)
    key_slot            Slot key id to use for the HMAC calculation (int)
    target              Where to save the digest internal to the device.
                        For ATECC608, can be SHA_MODE_TARGET_TEMPKEY,
                        SHA_MODE_TARGET_MSGDIGBUF, or
                        SHA_MODE_TARGET_OUT_ONLY. For all other devices,
                        SHA_MODE_TARGET_TEMPKEY is the only option. (int)
    digest              Digest is returned here (32 bytes).
                        (Expects bytearray)

Return:
    Status code
```

21.2.2.94 atcab_sha_hmac_finish()

def cryptoauthlib.atcab.atcab_sha_hmac_finish (
ctx,
digest,
target)

```
Executes SHA command to complete a HMAC/SHA-256 operation.

Args:
    ctx                 HMAC/SHA-256 context (atca_hmac_sha256_ctx_t)
    target              Where to save the digest internal to the device.
                        For ATECC608, can be SHA_MODE_TARGET_TEMPKEY,
                        SHA_MODE_TARGET_MSGDIGBUF, or SHA_MODE_TARGET_OUT_ONLY.
                        For all other devices, SHA_MODE_TARGET_TEMPKEY is the
                        only option. (int)
    digest              HMAC/SHA-256 result is returned here (32 bytes).
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.95 atcab_sha_hmac_init()

def cryptoauthlib.atcab.atcab_sha_hmac_init (
ctx,
key_slot)

```
Executes SHA command to start an HMAC/SHA-256 operation

Args:
    ctx                 HMAC/SHA-256 context (atca_hmac_sha256_ctx_t)
    key_slot            Slot key id to use for the HMAC calculation (int)

Returns:
    Status code
```

21.2.2.96 atcab_sha_hmac_update()

```
def cryptoauthlib.atcab.atcab_sha_hmac_update (
              ctx,
              data,
              data_size )
```

```
Executes SHA command to add an arbitrary amount of message data to
a HMAC/SHA-256 operation.

Args:
    ctx                 HMAC/SHA-256 context (atca_hmac_sha256_ctx_t)
    data                Message data to add (bytearray or bytes)
    data_size           Size of message data in bytes (int)

Returns:
    Status code
```

21.2.2.97 atcab_sha_read_context()

```
def cryptoauthlib.atcab.atcab_sha_read_context (
              context,
              context_size )
```

```
Executes SHA command to read the SHA-256 context back. Only for
ATECC608 with SHA-256 contexts. HMAC not supported.

Args:
    context             Context data is returned here. (Expects bytearray)
    context_size        As input, the size of the context buffer in
                        bytes. As output, the size of the returned
                        context data. (Expects AtcaReference)

Retuns:
    Status code
```

21.2.2.98 atcab_sha_start()

```
def cryptoauthlib.atcab.atcab_sha_start (
             void  )
```

```
Executes SHA command to initialize SHA-256 calculation engine

Args:
    None

Returns;
    Status code
```

21.2.2.99 atcab_sha_update()

```
def cryptoauthlib.atcab.atcab_sha_update (
              message )
```

```
Executes SHA command to add 64 bytes of message data to the current
context.

Args:
    message             64 bytes of message data to add to add to operation.
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.100 atcab_sha_write_context()

```
def cryptoauthlib.atcab.atcab_sha_write_context (
              context,
              context_size )
```

```
Executes SHA command to write (restore) a SHA-256 context into the
the device. Only supported for ATECC608 with SHA-256 contexts.

Args:
    context             Context data to be restored. (bytearray or bytes)
    context_size        Size of the context data in bytes. (int)

Returns:
    Status code
```

21.2.2.101 atcab_sign()

```
def cryptoauthlib.atcab.atcab_sign (
              key_id,
              msg,
              signature )
```

```
Executes Sign command, to sign a 32-byte external message using the private key
in the specified slot. The message to be signed will be loaded into the Message
Digest Buffer to the ATECC608 device or TempKey for other devices.

Args:
    key_id          Slot of the private key to be used to sign the message (int)
    msg             32-byte message to be signed. Typically the SHA256 hash
                    of the full message. (bytearray or bytes)
    signature       Signature will be returned here. Format is R and S integers in
                    big-endian format. 64 bytes for P256 curve. (Expects bytearray)

Returns:
    Status code
```

21.2.2.102 atcab_sign_base()

```
def cryptoauthlib.atcab.atcab_sign_base (
            mode,
            key_id,
            signature )
```

```
Executes the Sign command, which generates a signature using the ECDSA algorithm.

Args:
    mode            Mode determines what the source of the message to be signed (int)
    key_id          Private key slot used to sign the message. (int)
    signature       Signature is returned here. Format is R and S integers in
                    big-endian format. 64 bytes for P256 curve (Expects bytearray)

Returns:
    Stauts code
```

21.2.2.103 atcab_sign_internal()

```
def cryptoauthlib.atcab.atcab_sign_internal (
            key_id,
            is_invalidate,
            is_full_sn,
            signature )
```

```
Executes Sign command to sign an internally generated message.

Args:
    key_id              Slot of the private key to be used to sign the message (int)
    is_invalidate       Set to true if the signature will be used with the Verify(Invalidate)
                        command. false for all other cases.
    is_full_sn          Set to true if the message should incorporate the device's
                        full serial number.
    signature           Signature is returned here. Format is R and S integers in
                        big-endian format. 64 bytes for P256 curve (Expects bytearray)

Returns:
    Status code
```

21.2.2.104 atcab_updateextra()

```
def cryptoauthlib.atcab.atcab_updateextra (
            mode,
            new_value )
```

```
Executes UpdateExtra command to update the values of the two extra bytes within
the Configuration zone (bytes 84 and 85). an also be used to decrement the limited
use counter associated with the key in slot NewValue.

Args:
    mode        Mode determines what operations the UpdateExtra command performs. (int)
    new_value   Value to be written. (int)

Returns:
    Status code
```

21.2.2.105 atcab_verify()

```
def cryptoauthlib.atcab.atcab_verify (
              mode,
              key_id,
              signature,
              public_key,
              other_data,
              mac )
```

```
Executes the Verify command, which takes an ECDSA [R,S] signature and verifies that
it is correctly generated from a given message and public key. In all cases, the
signature is an input to the command. For the Stored, External, and ValidateExternal
Modes, the contents of TempKey (or Message Digest Buffer in some cases for the
ATECC608) should contain the 32 byte message.

Args:
    mode                Verify command mode and options (int)
    key_id              Stored mode, the slot containing the public key to be
                        used for the verification. ValidateExternal mode, the
                        slot containing the public key to be validated. External
                        mode, KeyID contains the curve type to be used to Verify
                        the signature. Validate or Invalidate mode, the slot
                        containing the public key to be (in)validated.(int)
    signature           Signature to be verified. R and S integers in
                        big-endian format. 64 bytes for P256 curve.
                        (bytearray or bytes)
    public_key          If mode is External, the public key to be used for
                        verification. X and Y integers in big-endian format.
                        64 bytes for P256 curve. NULL for all other modes.
                        (bytearray or bytes)
    other_data          If mode is Validate, the bytes used to generate the
                        message for the validation (19 bytes). NULL for all other modes.
                        (bytearray or bytes)
    mac                 If mode indicates a validating MAC, then the MAC will
                        be returned here. Can be NULL otherwise.
                        (Expects bytearray)

Returns:
    Status code
```

21.2.2.106 atcab_verify_extern()

```
def cryptoauthlib.atcab.atcab_verify_extern (
              message,
              signature,
              public_key,
              is_verified )
```

```
Executes the Verify command, which verifies a signature (ECDSA verify operation) with
all components (message, signature, and public key) supplied. The message to be signed
will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for
other devices.

Args:
    message             32 byte message to be verified. Typically the SHA256 hash of
                        the full message. (Expects bytes)
    signature           Signature to be verified. R and S integers in big-endian format.
                        64 bytes for P256 curve. (Expects bytes)
    public_key          The public key to be used for verification. X and Y integers
                        in big-endian format. 64 bytes for P256 curve. (Expects bytes)
```

```
    is_verified         Boolean whether or not the message, signature, public key verified.
                        (Expects AtcaReference)


Returns:
    Status code
```

21.2.2.107 atcab_verify_extern_mac()

def cryptoauthlib.atcab.atcab_verify_extern_mac (
message,
signature,
public_key,
num_in,
io_key,
is_verified)

```
Executes the Verify command with verification MAC, which verifies a signature
(ECDSA verify operation) with all components (message,  signature, and public key)
supplied. This function is only available on the ATECC608.

Args:
    message             32 byte message to be verified. Typically the SHA256 hash of
                        the full message. (bytearray or bytes)
    signature           Signature to be verified. R and S integers in big-endian format.
                        64 bytes for P256 curve. (bytearray or bytes)
    public_key          The public key to be used for verification. X and Y integers in
                        big-endian format. 64 bytes for P256 curve. (bytearray or bytes)
    num_in              System nonce (32 byte) used for the verification MAC. (bytearray or bytes)
    io_key              IO protection key for verifying the validation MAC. (bytearray or bytes)
    is_verified         Boolean whether or not the message, signature, public key verified.
                        (Expects AtcaReference)

Returns:
    Stats code
```

21.2.2.108 atcab_verify_extern_stored_mac()

def cryptoauthlib.atcab.atcab_verify_extern_stored_mac (
mode,
key_id,
message,
signature,
public_key,
num_in,
io_key,
is_verified)

```
Executes the Verify command with verification MAC for the External or Stored Verify modes..

Args:
    mode                Verify command mode. Can be VERIFY_MODE_EXTERNAL or
                        VERIFY_MODE_STORED. (int)
    key_id              For VERIFY_MODE_STORED mode, the slot containing the public key
```

```
                        to be used for the verification. For VERIFY_MODE_EXTERNAL mode,
                        KeyID contains the curve type to be used to Verify the signature.
                        Only VERIFY_KEY_P256 supported. (int)
    message             32 byte message to be verified. Typically the SHA256 hash of the
                        full message. (bytearray or bytes)
    signature           Signature to be verified. R and S integers in big-endian format.
                        64 bytes for P256 curve. (bytearray or bytes)
    public_key          For VERIFY_MODE_EXTERNAL mode, the public key to be used for
                        verification. X and Y integers in big-endian format. 64 bytes
                        for P256 curve. Null for VERIFY_MODE_STORED mode. (bytearray or bytes)
    num_in              System nonce (32 byte) used for the verification MAC. (bytearray or bytes)
    io_key              IO protection key for verifying the validation MAC. (bytearray or bytes)
    is_verified         Boolean whether or not the message, signature, public key verified.
                        (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.109 atcab_verify_invalidate()

def cryptoauthlib.atcab.atcab_verify_invalidate (
key_id,
signature,
other_data,
is_verified)

```
Executes the Verify command in Invalidate mode which invalidates a previously
validated public key stored in a slot. This command can only be run after
GenKey has been used to create a PubKey digest of the public key to be
invalidated in TempKey (mode=0x10).

Args:
    key_id              Slot containing the public key to be invalidated. (int)
    signature           Signature to be verified. R and S integers in big-endian format.
                        64 bytes for P256 curve. (bytearray or bytes)
    other_data          19 bytes of data used to build the verification message (bytearray or bytes)
    is_verified         Boolean whether or not the message, signature, public key verified.
                        (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.110 atcab_verify_stored()

def cryptoauthlib.atcab.atcab_verify_stored (
message,
signature,
key_id,
is_verified)

```
Executes the Verify command, which verifies a signature (ECDSA verify operation)
with a public key stored in the device. The message to be signed will be loaded
into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

Args:
    message             32 byte message to be verified. Typically the SHA256 hash of
```

```
                        the full message. (bytearray or bytes)
    signature           Signature to be verified. R and S integers in big-endian format.
                        64 bytes for P256 curve. (bytearray or bytes)
    key_id              Slot containing the public key to be used in the verification.(int)
    is_verified         Boolean whether or not the message, signature, public key verified.
                        (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.111 atcab_verify_stored_mac()

def cryptoauthlib.atcab.atcab_verify_stored_mac (
message,
signature,
key_id,
num_in,
io_key,
is_verified)

```
Executes the Verify command with verification MAC, which verifies a  signature
(ECDSA verify operation) with a public key stored in the device. This function
is only available on the ATECC608.

Args:
    message             32 byte message to be verified. Typically the SHA256 hash of
                        the full message. (bytearray or bytes)
    signature           Signature to be verified. R and S integers in big-endian format.
                        64 bytes for P256 curve. (bytearray or bytes)
    key_id              Slot containing the public key to be used in the verification.
                        (int)
    num_in              System nonce (32 byte) used for the verification MAC.
                        (bytearray or bytes)
    io_key              IO protection key for verifying the validation MAC.
                        (bytearray or bytes)
    is_verified         Boolean whether or not the message, signature, public key verified.
                        (Expects AtcaReference)

Retuns:
    Status code
```

21.2.2.112 atcab_verify_validate()

def cryptoauthlib.atcab.atcab_verify_validate (
key_id,
signature,
other_data,
is_verified)

```
Executes the Verify command in Validate mode to validate a public key stored
in a slot. This command can only be run after GenKey has been used to create
a PubKey digest of the public key to be validated in TempKey (mode=0x10).

Args:
    key_id              Slot containing the public key to be validated.(int)
```

```
    signature           Signature to be verified. R and S integers in big-endian format.
                        64 bytes for P256 curve. (bytearray or bytes)
    other_data          19 bytes of data used to build the verification message (bytearray or bytes)
    is_verified         Boolean whether or not the message, signature, public key verified.
                        (Expects AtcaReference)

Returns:
    Status code
```

21.2.2.113 atcab_write()

def cryptoauthlib.atcab.atcab_write (
zone,
address,
value,
mac)

```
Executes the Write command, which writes either one four byte word or a 32-byte
block to one of the EEPROM zones on the device. Depending upon the value of the
WriteConfig byte for this slot, the data may be required to be encrypted by the
system prior to being sent to the device. This command cannot be used to write
slots configured as ECC private keys.

Args:
    zone                Zone/Param1 for the write command. (int)
    address             Address/Param2 for the write command. (int)
    value               Plain-text data to be written or cipher-text for encrypted writes.
                        32 or 4 bytes depending on bit 7 in the zone. (bytearray or bytes)
    data                Data to be written. (bytearray or bytes)
    mac                 MAC required for encrypted writes (32 bytes).
                        (bytearray or bytes)

Returns:
    Status code
```

21.2.2.114 atcab_write_bytes_zone()

def cryptoauthlib.atcab.atcab_write_bytes_zone (
zone,
slot,
offset_bytes,
data,
length)

```
Executes the Write command, which writes data into config, otp, or data zone with a given
byte offset and length. Offset and length must be multiples of a word (4 bytes).

Config zone must be unlocked for writes to that zone. If data zone is
unlocked, only 32-byte writes are allowed to slots and OTP and the offset
and length must be multiples of 32 or the write will fail.

Args:
    zone                Zone to write data to: Zones.ATCA_ZONE_CONFIG, Zones.ATCA_ZONE_OTP,
                        or Zones.ATCA_ZONE_DATA. (int)
    slot                If zone is Zones.ATCA_ZONE_DATA, the slot number to write to.
```

```
                        Ignored for all other zones. (int)
    offset_bytes        Byte offset within the zone to write to. Must be a multiple of
                        a word (4 bytes). (int)
    data                bytearray containing Data to be written. (bytearray or bytes)
    length              Number of bytes to be written. Must be a multiple of a word (4 bytes).
                        (int)

Returns:
    None
```

21.2.2.115 atcab_write_config_counter()

def cryptoauthlib.atcab.atcab_write_config_counter (
counter_id,
counter_value)

```
Initialize one of the monotonic counters in device with a specific value. The monotonic
counters are stored in the configuration zone using a special format. This encodes a
binary count value into the 8 byte encoded value required. This can only be set while
the configuration zone is unlocked.

Args:
    counter_id          Counter to be written (int)
    counter_value       Counter value to set (int)
```

21.2.2.116 atcab_write_config_zone()

def cryptoauthlib.atcab.atcab_write_config_zone (
conf)

```
Executes the Write command, which writes the configuration zone. First 16 bytes are
skipped as they are not writable. LockValue and LockConfig are also skipped and can
only be changed via the Lock command.

This command may fail if UserExtra and/or Selector bytes have
already been set to non-zero values.

Args:
    conf                Data to the config zone data. This should be a 88
                        byte bytearray for SHA devices and 128 byte bytearray for ECC
                        devices. (bytearray or bytes)

Returns:
    Status code
```

21.2.2.117 atcab_write_enc()

```
def cryptoauthlib.atcab.atcab_write_enc (
        key_id,
        block,
        data,
        enc_key,
        enc_key_id,
        num_in = None )
```

```
Executes the Write command, which performs an encrypted write of a 32 byte block into
given slot. The function takes clear text bytes and encrypts them for writing over the
wire. Data zone must be locked and the slot configuration must be set to encrypted
write for the block to be successfully written.

Args:
    key_id              Slot ID to write to. (int)
    block               Index of the 32 byte block to write in the slot. (int)
    data                32 bytes of clear text data to be written to the slot.
                        (bytearray or bytes)
    enc_key             WriteKey to encrypt with for writing
                        (bytearray or bytes)
    enc_key_id          The KeyID of the WriteKey (int)
    num_in              Bytearray - Host nonce used to calculate nonce (20 bytes)
Returns:
    Status code
```

21.2.2.118 atcab_write_pubkey()

```
def cryptoauthlib.atcab.atcab_write_pubkey (
        slot,
        public_key )
```

```
Executes the Write command, which writes a public key to a data slot in the device format.

Args:
    slot                Slot number to write. Only slots 8 to 15 are large enough to
                        store a public key. (int)
    public_key          Public key to write into the slot specified. X and Y integers
                        in big-endian format. 64 bytes for P256 curve. (bytearray or bytes)

Returns:
    Status code
```

21.2.2.119 atcab_write_zone()

```
def cryptoauthlib.atcab.atcab_write_zone (
        zone,
        slot,
        block,
        offset,
        data,
        length )
```

```
Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.

Args:
    zone                Device zone to write to (0=config, 1=OTP, 2=data). (int)
    slot                If writing to the data zone, it is the slot to write to, otherwise
                        it should be 0. (int)
    block               32-byte block to write to. (int)
    offset              4-byte word within the specified block to write to. If performing a
                        32-byte write, this should be 0. (int)
    data                Data to be written. (bytearray or bytes)
    len                 Number of bytes to be written. Must be either 4 or 32. (int)

Returns:
    Status code
```

21.3 cryptoauthlib.atcacert Namespace Reference

Data Structures

- class atcacert_cert_element_t
- class atcacert_cert_loc_t
- class atcacert_cert_sn_src_t
- class atcacert_cert_type_t
- class atcacert_comp_data_t
- class atcacert_date_format_t
- class atcacert_def_t
- class atcacert_device_loc_t
- class atcacert_device_zone_t
- class atcacert_std_cert_element_t
- class atcacert_tm_utc_t
- class atcacert_transform_t
- class CertStatus

Functions

- def _atcacert_convert_bytes (kwargs, name, pointer)
- def _atcacert_convert_enum (kwargs, name, enum)
- def atcacert_max_cert_size (cert_def, max_cert_size)
- def atcacert_get_response (device_private_key_slot, challenge, response)
- def atcacert_read_cert (cert_def, ca_public_key, cert, cert_size)
- def atcacert_write_cert (cert_def, cert, cert_size)
- def atcacert_create_csr (csr_def, csr, csr_size)
- def atcacert_create_csr_pem (csr_def, csr, csr_size)
- def atcacert_date_enc (date_format, timestamp, formatted_date, formatted_date_size)
- def atcacert_date_dec (date_format, formatted_date, formatted_date_size, timestamp)
- def atcacert_date_enc_compcert (issue_date, expire_years, enc_dates)
- def atcacert_date_dec_compcert (enc_dates, expire_date_format, issue_date, expire_date)
- def atcacert_date_get_max_date (date_format, timestamp)

21.3.1 Detailed Description

```
ATCACERT: classes and functions for interacting with compressed certificates
```

21.3.2 Function Documentation

21.3.2.1 _atcacert_convert_bytes()

```
def cryptoauthlib.atcacert._atcacert_convert_bytes (
              kwargs,
              name,
              pointer )  [protected]
```

```
Internal Helper Function: Convert python 'bytes' into memory pointer for ctypes structure
:param kwargs: kwargs dictionary
:param name: _field_ name that will be converted
:param pointer: Conversion Class (resulting type - pointer of type x)
:return:
```

21.3.2.2 _atcacert_convert_enum()

```
def cryptoauthlib.atcacert._atcacert_convert_enum (
              kwargs,
              name,
              enum )  [protected]
```

```
Internal Helper Function: Convert python enum into ctypes integer
:param kwargs: kwargs dictionary
:param name: _field_ name that will be converted
:param enum: Conversion Class (resulting type)
:return:
```

21.3.2.3 atcacert_create_csr()

```
def cryptoauthlib.atcacert.atcacert_create_csr (
              csr_def,
              csr,
              csr_size )
```

```
Creates a CSR specified by the CSR definition from the ATECC508A device.
This process involves reading the dynamic CSR data from the device and combining it
with the template found in the CSR definition, then signing it. Return the CSR int der format

Args:
    csr_def                CSR definition describing where to find the dynamic CSR information
                           on the device and how to incorporate it into the template.
                           Expects atcacert_def_t.
    csr                    Buffer to receive the CSR. Expects bytearray.
    csr_size               As input, the size of the CSR buffer in bytes.
                           As output, the size of the CSR as PEM returned in cert in bytes.
                           Expects AtcaReference.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.4 atcacert_create_csr_pem()

def cryptoauthlib.atcacert.atcacert_create_csr_pem (
csr_def,
csr,
csr_size)

```
Creates a CSR specified by the CSR definition from the ATECC508A device.
This process involves reading the dynamic CSR data from the device and combining it
with the template found in the CSR definition, then signing it. Return the CSR int der format

Args:
    csr_def                 CSR definition describing where to find the dynamic CSR information
                            on the device and how to incorporate it into the template.
                            Expects atcacert_def_t.
    csr                     Buffer to receive the CSR. Expects bytearray.
    csr_size                As input, the size of the CSR buffer in bytes.
                            As output, the size of the CSR as PEM returned in cert in bytes.
                            Expects AtcaReference.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.5 atcacert_date_dec()

def cryptoauthlib.atcacert.atcacert_date_dec (
date_format,
formatted_date,
formatted_date_size,
timestamp)

```
Parse a formatted timestamp according to the specified format.

Args:
    date_format             Format to parse the formatted date as.
    formatted_date          Formatted date to be parsed.
    formatted_date_size     Size of the formatted date in bytes.
    timestamp               Parsed timestamp is returned here. Expects atcacert_tm_utc_t.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.6 atcacert_date_dec_compcert()

def cryptoauthlib.atcacert.atcacert_date_dec_compcert (
enc_dates,
expire_date_format,
issue_date,
expire_date)

```
Decode the issue and expire dates from the format used by the compressed certificate.

Args:
    enc_dates               Encoded date from the compressed certificate. 3 bytes.
    expire_date_format      Expire date format. Only used to determine max date when no
                            expiration date is specified by the encoded date.
    issue_date              Decoded issue date is returned here. Expects atcacert_tm_utc_t.
    expire_date             Decoded expire date is returned here. If there is no
                            expiration date, the expire date will be set to a maximum
                            value for the given expire_date_format. Expects atcacert_tm_utc_t.
Returns:
    ATCACERT_E_SUCCESS on success
```

21.3.2.7 atcacert_date_enc()

def cryptoauthlib.atcacert.atcacert_date_enc (
date_format,
timestamp,
formatted_date,
formatted_date_size)

```
Format a timestamp according to the format type.

Args:
    date_format             Format to use.
    timestamp               Timestamp to format. Expects atcacert_tm_utc_t.
    formatted_date          Formatted date will be returned in this buffer.
                            Expects bytearray.
    formatted_date_size     As input, the size of the formatted_date buffer.
                            As output, the size of the returned formatted_date.
                            Expects AtcaReference.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.8 atcacert_date_enc_compcert()

def cryptoauthlib.atcacert.atcacert_date_enc_compcert (
issue_date,
expire_years,
enc_dates)

```
Encode the issue and expire dates in the format used by the compressed certificate.

Args:
    issue_date              Issue date to encode. Note that minutes and seconds will be ignored.
                            Expects atcacert_tm_utc_t.
    expire_years            Expire date is expressed as a number of years past the issue date.
                            0 should be used if there is no expire date.
    enc_dates               Encoded dates for use in the compressed certificate is returned here.
                            3 bytes. Expects bytearray.

Returns:
    ATCACERT_E_SUCCESS on success
```

21.3.2.9 atcacert_date_get_max_date()

```
def cryptoauthlib.atcacert.atcacert_date_get_max_date (
              date_format,
              timestamp )
```

```
Return the maximum date available for the given format.

Args:
    format                  Format to get the max date for.
    timestamp               Max date is returned here. Expects atcacert_tm_utc_t.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.10 atcacert_get_response()

```
def cryptoauthlib.atcacert.atcacert_get_response (
              device_private_key_slot,
              challenge,
              response )
```

```
Calculates the response to a challenge sent from the host.
The challenge-response protocol is an ECDSA Sign and Verify. This performs the ECDSA Sign on the
challenge and returns the signature as the response.

Args:
    device_private_key_slot         Slot number for the device's private key. This must be the
                                    same slot used to generate the public key included in the
                                    device's certificate.
    challenge                       Challenge to generate the response for. Must be 32 bytes.
    response                        Response will be returned in this buffer. 64 bytes.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.11 atcacert_max_cert_size()

```
def cryptoauthlib.atcacert.atcacert_max_cert_size (
              cert_def,
              max_cert_size )
```

```
Return the maximum possible certificate size in bytes for a given
cert def. Certificate can be variable size, so this gives an
appropriate buffer size when reading the certificates.

Args:
    cert_def       Certificate definition to find a max size for.
                   Expects atcacert_def_t.
    max_cert_size  Maximum certificate size will be returned here in bytes.
                   Expects AtcaReference.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.12 atcacert_read_cert()

```
def cryptoauthlib.atcacert.atcacert_read_cert (
              cert_def,
              ca_public_key,
              cert,
              cert_size )
```

```
Reads the certificate specified by the certificate definition from the
ATECC508A device.
This process involves reading the dynamic cert data from the device and combining it
with the template found in the certificate definition.

Args:
    cert_def                Certificate definition describing where to find the dynamic
                            certificate information on the device and how to incorporate it
                            into the template. Expects atcacert_def_t.
    ca_public_key           The ECC P256 public key of the certificate authority that signed
                            this certificate. Formatted as the 32 byte X and Y integers
                            concatenated together (64 bytes total). Set to NULL if the
                            authority key id is not needed, set properly in the cert_def
                            template, or stored on the device as specifed in the
                            cert_def cert_elements.
    cert                    Buffer to received the certificate. Expects bytearray.
    cert_size               As input, the size of the cert buffer in bytes.
                            As output, the size of the certificate returned in cert in bytes.
                            Expects AtcaReference.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.3.2.13 atcacert_write_cert()

```
def cryptoauthlib.atcacert.atcacert_write_cert (
              cert_def,
              cert,
              cert_size )
```

```
Take a full certificate and write it to the ATECC508A device according to the
certificate definition.

Args:
    cert_def                Certificate definition describing where the dynamic certificate
                            information is and how to store it on the device.
                            Expects atcacert_def_t.
    cert                    Full certificate to be stored.
    cert_size               Size of the full certificate in bytes.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.4 cryptoauthlib.atcaenum Namespace Reference

Data Structures

- class AtcaEnum

21.4.1 Detailed Description

```
Enum Extension for improved comparisons
```

21.5 cryptoauthlib.atjwt Namespace Reference

Data Structures

- class HwEcAlgorithm
- class HwHmacAlgorithm
- class PyJWT

Variables

- **try** :

21.5.1 Detailed Description

```
JWT: Extension to the jwt module with hardware based security
```

21.6 cryptoauthlib.device Namespace Reference

Data Structures

- class AesEnable
- class Atecc508aConfig
- class Atecc608Config
- class Atsha204aConfig
- class ChipMode508
- class ChipMode608
- class ChipOptions
- class Counter204
- class CountMatch
- class I2cEnable
- class KeyConfig
- class SecureBoot
- class SlotConfig
- class UseLock
- class VolatileKeyPermission
- class X509Format

21.6.1 Detailed Description

```
Cryptoauthlib Device Configuration
```

21.7 cryptoauthlib.exceptions Namespace Reference

Data Structures

- class AssertionFailure
- class BadArgumentError
- class BadCrcError
- class BadOpcodeError
- class CheckmacVerifyFailedError
- class CommunicationError
- class ConfigZoneLockedError
- class CrcError
- class CryptoError
- class DataZoneLockedError
- class EccFaultError
- class ExecutionError
- class FunctionError
- class GenericError
- class HealthTestError
- class InvalidIdentifierError
- class InvalidSizeError
- class LibraryLoadError
- class LibraryMemoryError
- class LibraryNotInitialized
- class NoDevicesFoundError
- class NoResponseError
- class NoUseFlagError
- class ParityError
- class ParseError
- class ReceiveError
- class ReceiveTimeoutError
- class ResyncWithWakeupError
- class StatusUnknownError
- class TimeOutError
- class TransmissionError
- class TransmissionTimeoutError
- class UnimplementedError
- class UnsupportedInterface
- class WakeFailedError
- class ZoneNotLockedError

21.7.1 Detailed Description

```
Cryptoauthlib Exceptions
```

21.8 cryptoauthlib.iface Namespace Reference

Data Structures

- class _ATCACUSTOM
- class _ATCAHID
- class _ATCAI2C
- class _ATCAIfaceParams
- class _ATCAKIT
- class _ATCASPI
- class _ATCASWI
- class _ATCAUART
- class _U_Address
- class ATCADeviceType
- class ATCAIfaceCfg
- class ATCAIfaceType
- class ATCAKitType

Functions

- def _iface_load_default_config (name)
- def cfg_ateccx08a_i2c_default ()
- def cfg_ateccx08a_swi_default ()
- def cfg_ateccx08a_kithid_default ()
- def cfg_atsha20xa_i2c_default ()
- def cfg_atsha20xa_swi_default ()
- def cfg_atsha20xa_kithid_default ()

21.8.1 Detailed Description

```
Interface Configuration
```

21.8.2 Function Documentation

21.8.2.1 _iface_load_default_config()

```
def cryptoauthlib.iface._iface_load_default_config (
              name )  [protected]
```

```
"Attempt to load the default configuration structure from the library by name
```

21.8.2.2 cfg_ateccx08a_i2c_default()

```
def cryptoauthlib.iface.cfg_ateccx08a_i2c_default ( )
```

Default configuration for an ECCx08A device on the first logical I2C bus

21.8.2.3 cfg_ateccx08a_kithid_default()

```
def cryptoauthlib.iface.cfg_ateccx08a_kithid_default ( )
```

Default configuration for Kit protocol over a HID interface

21.8.2.4 cfg_ateccx08a_swi_default()

```
def cryptoauthlib.iface.cfg_ateccx08a_swi_default ( )
```

Default configuration for an ECCx08A device on the logical SWI bus over UART

21.8.2.5 cfg_atsha20xa_i2c_default()

```
def cryptoauthlib.iface.cfg_atsha20xa_i2c_default ( )
```

Default configuration for a SHA204A device on the first logical I2C bus

21.8.2.6 cfg_atsha20xa_kithid_default()

```
def cryptoauthlib.iface.cfg_atsha20xa_kithid_default ( )
```

Default configuration for Kit protocol over a HID interface for SHA204

21.8.2.7 cfg_atsha20xa_swi_default()

```
def cryptoauthlib.iface.cfg_atsha20xa_swi_default ( )
```

```
Default configuration for an SHA204A device on the logical SWI bus over UART
```

21.9 cryptoauthlib.library Namespace Reference

Data Structures

- class _CtypeIterator
- class AtcaReference
- class AtcaStructure
- class AtcaUnion

Functions

- def **indent** (lines, insert)
- def _force_local_library ()
- def load_cryptoauthlib (lib=None)
- def get_cryptoauthlib ()
- def get_device_name (revision)
- def get_device_name_with_device_id (revision)
- def get_device_type_id (name)
- def get_size_by_name (name)
- def get_ctype_by_name (name)
- def get_ctype_structure_instance (structure, value)
- def get_ctype_array_instance (array, value)
- def _get_field_definition (obj, name)
- def _def_to_field (f_type, f_size=None)
- def _convert_pointer_to_list (p, length)
- def _get_attribute_from_ctypes (obj, obj_type, length=None, ∗args)
- def _check_type_rationality (cls)
- def _array_to_code (obj, name=None, parent=None, ∗∗kwargs)
- def _object_definition_code (obj, name=None, parent=None, parent_name=None, anon=None, type_↩ info=None, check_names={}, ∗∗kwargs)
- def **_union_to_code** (obj, name=None, parent=None, anon=None, entry=None, parent_name=None, type↩ _info=None, ∗∗kwargs)
- def _structure_to_code (obj, name=None, parent=None, type_info=None, parent_name=None, ∗∗kwargs)
- def _obj_to_code (obj, name, parent=None, anon=None, parent_name=None, ∗∗kwargs)
- def _pointer_to_code (obj, name=None, parent=None, parent_name=None, check_names={}, skip_↩ references=[ ], ∗∗kwargs)
- def _is_pointer (obj, type_info=None, ∗∗kwargs)
- def _to_code (obj, name=None, ∗∗kwargs)
- def _structure_to_string (item, int level=0)
- def _ctype_from_definition (cls)
- def ctypes_to_bytes (obj)
- def **create_byte_buffer** (init_or_size)

Variables

- **try** :
- dict **ATCA_NAMES** = {'i2c': 'i2c', 'hid': 'kithid', 'sha': 'sha204', 'ecc': 'eccx08'}
- None **_CRYPTO_LIB** = None
- dict **_CTYPES_BY_SIZE** = {1: c_uint8, 2: c_uint16, 4:c_uint32}
- **_fields_**

21.9.1 Detailed Description

```
Cryptoauthlib Library Management
```

21.9.2 Function Documentation

21.9.2.1 _array_to_code()

```
def cryptoauthlib.library._array_to_code (
              obj,
              name = None,
              parent = None,
             ** kwargs )  [protected]
```

```
Convert an array like item from a ctypes structure into a C language formatted
string
```

21.9.2.2 _check_type_rationality()

```
def cryptoauthlib.library._check_type_rationality (
              cls )  [protected]
```

```
This checks the structure or union size against the constants that are stored in the library
during compilation. This is not an absolute guarentee that alignment is completely correct
but it will catch most cases of incompability between the compiled library that is installed
and the python module
```

21.9.2.3 _convert_pointer_to_list()

```
def cryptoauthlib.library._convert_pointer_to_list (
              p,
              length )  [protected]
```

```
Pointer types can be frustrating to interact with generally when processing data in python
so this converts them into types that are iterable and bounded
```

21.9.2.4 _ctype_from_definition()

```
def cryptoauthlib.library._ctype_from_definition (
              cls )  [protected]
```

```
Extends the ctypes structure and union types to add a new attribute _def_ which is a dictionary
of field attributes. This extends functionality by quite a bit by supporting additional types
and field linkages
```

21.9.2.5 _def_to_field()

```
def cryptoauthlib.library._def_to_field (
              f_type,
              f_size = None )  [protected]
```

```
Helper function to convert an entry in the _def_ dictionary to the
tuple required for a _field_ entry
```

21.9.2.6 _force_local_library()

```
def cryptoauthlib.library._force_local_library ( )  [protected]
```

```
In some environments loading seems to fail under all circumstances unless
brute forcing it.
```

21.9.2.7 _get_attribute_from_ctypes()

```
def cryptoauthlib.library._get_attribute_from_ctypes (
              obj,
              obj_type,
              length = None,
             * args )  [protected]
```

```
Helper function that is used by AtcaStructure and AtcaUnion to intercept attribute access
to those objects and convert the resulting values into easier to use python objects based
on the configuration of the structure/union
```

21.9.2.8 _get_field_definition()

```
def cryptoauthlib.library._get_field_definition (
              obj,
              name )  [protected]
```

```
Get meta information about the ctypes structure/union by accessing
the field description attributes of the class that were provided
as part of the ctype structure/union definition
```

21.9.2.9 _is_pointer()

```
def cryptoauthlib.library._is_pointer (
              obj,
              type_info = None,
             ** kwargs )  [protected]
```

```
Checks to see if object looks like a pointer
```

21.9.2.10 _obj_to_code()

```
def cryptoauthlib.library._obj_to_code (
              obj,
              name,
              parent = None,
              anon = None,
              parent_name = None,
             ** kwargs )  [protected]
```

```
Convert python/ctypes object into a C language representation
```

21.9.2.11 _object_definition_code()

```
def cryptoauthlib.library._object_definition_code (
              obj,
              name = None,
              parent = None,
              parent_name = None,
              anon = None,
              type_info = None,
              check_names = {},
             ** kwargs )  [protected]
```

```
Emits the first half of the assignment of this object
```

21.9.2.12 _pointer_to_code()

```
def cryptoauthlib.library._pointer_to_code (
             obj,
             name = None,
             parent = None,
             parent_name = None,
             check_names = {},
             skip_references = [],
            ** kwargs )  [protected]
```

Convert the pointer into a representative object by creating a definition in the prepend area

21.9.2.13 _structure_to_code()

```
def cryptoauthlib.library._structure_to_code (
             obj,
             name = None,
             parent = None,
             type_info = None,
             parent_name = None,
            ** kwargs )  [protected]
```

Emits a string with a C language representation of the structure(s) following pointers the best that is can

21.9.2.14 _structure_to_string()

```
def cryptoauthlib.library._structure_to_string (
             item,
            int  level = 0 )  [protected]
```

Emits a readable string of the structure elements coverting types and following pointers and arrays the best that is can

21.9.2.15 _to_code()

```
def cryptoauthlib.library._to_code (
             obj,
             name = None,
            ** kwargs )  [protected]
```

Map object types to the proper renderer function by catching pointer like objects first

Returns: (append, prepend)

21.9.2.16 ctypes_to_bytes()

```
def cryptoauthlib.library.ctypes_to_bytes (
              obj )
```

```
Convert a ctypes structure/array into bytes. This is for python2 compatibility
```

21.9.2.17 get_cryptoauthlib()

```
def cryptoauthlib.library.get_cryptoauthlib ( )
```

```
This is a helper function for the other python files in this module to use the loaded library
```

21.9.2.18 get_ctype_array_instance()

```
def cryptoauthlib.library.get_ctype_array_instance (
              array,
              value )
```

```
Internal Helper Function: Convert python list into ctype array
:param value: Value to convert
:param array: Conversion Class (resulting type)
:return:
```

21.9.2.19 get_ctype_by_name()

```
def cryptoauthlib.library.get_ctype_by_name (
              name )
```

```
For known (atca_utils_sizes.c) types that are custom to the library retrieve the size
```

21.9.2.20 get_ctype_structure_instance()

```
def cryptoauthlib.library.get_ctype_structure_instance (
              structure,
              value )
```

```
Internal Helper Function:  Convert a value into the correct ctypes structure for a given field
:param value: Value to convert
:param structure: Conversion Class (resulting type)
:return:
```

21.9.2.21 get_device_name()

```
def cryptoauthlib.library.get_device_name (
              revision )
```

```
Returns the device name based on the info byte array values returned by atcab_info
```

21.9.2.22 get_device_name_with_device_id()

```
def cryptoauthlib.library.get_device_name_with_device_id (
              revision )
```

```
Returns the device name based on the info byte array values returned by atcab_info for ECC204 family
```

21.9.2.23 get_device_type_id()

```
def cryptoauthlib.library.get_device_type_id (
              name )
```

```
Returns the ATCADeviceType value based on the device name
```

21.9.2.24 get_size_by_name()

```
def cryptoauthlib.library.get_size_by_name (
              name )
```

```
Get the size of an object in the library using the name_size api from atca_utils_sizes.c
```

21.9.2.25 load_cryptoauthlib()

```
def cryptoauthlib.library.load_cryptoauthlib (
              lib = None )
```

```
Load CryptoAauthLib into Python environment
raise LibraryLoadError if cryptoauthlib library can't be loaded
```

21.10 cryptoauthlib.sha206_api Namespace Reference

Functions

- def sha206a_generate_derive_key (parent_key, derived_key, param1, param2)
- def sha206a_generate_challenge_response_pair (key, challenge, response)
- def sha206a_authenticate (challenge, expected_response, is_verified)
- def sha206a_write_data_store (slot, data, block, offset, length, lock_after_write)
- def sha206a_read_data_store (slot, data, offset, length)
- def sha206a_get_data_store_lock_status (slot, is_locked)
- def sha206a_get_dk_update_count (dk_update_count)
- def sha206a_get_pk_useflag_count (pk_avail_count)
- def sha206a_get_dk_useflag_count (dk_avail_count)
- def sha206a_check_pk_useflag_validity (is_consumed)
- def sha206a_check_dk_useflag_validity (is_consumed)
- def sha206a_verify_device_consumption (is_consumed)
- def sha206a_diversify_parent_key (parent_key, diversified_key)

21.10.1 Detailed Description

```
SHA206 API: classes and functions for interacting with SHA206A device
```

21.10.2 Function Documentation

21.10.2.1 sha206a_authenticate()

```
def cryptoauthlib.sha206_api.sha206a_authenticate (
              challenge,
              expected_response,
              is_verified )
```

```
verifies the challenge and provided response using key in device

Args:
    challenge            Challenge to be used in the response calculations
                         (Expects bytearray of size 32)

    expected_response    Expected response from the device
                         (Expects bytearray of size 32)

    is_authenticated     result of expected of response and calcualted response
                         (AtcaReference expected)

Returns:
    Status Code
```

21.10.2.2 sha206a_check_dk_useflag_validity()

def cryptoauthlib.sha206_api.sha206a_check_dk_useflag_validity (*is_consumed*)

```
verifies Derived Key use flags for consumption

Args:
    is_consumed            indicates if derived key is available for consumption
                           (Expected AtcaReference)

Returns:
    Status Code
```

21.10.2.3 sha206a_check_pk_useflag_validity()

def cryptoauthlib.sha206_api.sha206a_check_pk_useflag_validity (*is_consumed*)

```
verifies Parent Key use flags for consumption

Args:
    is_consumed            indicates if parent key is available for consumption
                           (Expected AtcaReference)

Returns:
    Status Code
```

21.10.2.4 sha206a_diversify_parent_key()

def cryptoauthlib.sha206_api.sha206a_diversify_parent_key (*parent_key*, *diversified_key*)

```
Computes the diversified key based on the parent key provided and device serial number

Args:
    parent_key             parent key to be diversified (Expected bytearray of size 32)

    diversified_key        output diversified key is returned here
                           (Expected bytearray of size 32)
Returns:
    Status Code
```

21.10.2.5 sha206a_generate_challenge_response_pair()

```
def cryptoauthlib.sha206_api.sha206a_generate_challenge_response_pair (
              key,
              challenge,
              response )
```

```
Generates the response based on Key and Challenge provided

Args:
    key             input data contains device’s key
                    (Expects bytearray of size 32)

    challenge       input data to be used in challenge response calculation
                    (Expects bytearray of size 32)

    response        output response is returned here
                    (Expects bytearray of size 32)

Returns:
    Status Code
```

21.10.2.6 sha206a_generate_derive_key()

```
def cryptoauthlib.sha206_api.sha206a_generate_derive_key (
              parent_key,
              derived_key,
              param1,
              param2 )
```

```
Generates the derived key based on the parent key and other parameters provided

Args:
    parent_key      input data contains device’s parent key
                    (Expects bytearray of size 32)

    derived key     output derived key is returned here
                    (Expects bytearray of size 32)

    param1          input data to be used in derive key calculation (int)

    param2          input data to be used in derive key calculation (int)

Returns:
    Status Code
```

21.10.2.7 sha206a_get_data_store_lock_status()

```
def cryptoauthlib.sha206_api.sha206a_get_data_store_lock_status (
              slot,
              is_locked )
```

```
Returns the lock status of the given data store

Args:
    slot               Slot number of the data store (int)

    is_locked          lock status of the data store slot
                       (Expected AtcaReference)

Returns:
    Status Code
```

21.10.2.8 sha206a_get_dk_update_count()

def cryptoauthlib.sha206_api.sha206a_get_dk_update_count (
dk_update_count)

```
Read Derived Key slot update count. It will be wraps around 256

Args:
    dk_update_count       returns number of times the slot has been
                          updated with derived key (Expected AtcaReference)

Returns:
    Status Code
```

21.10.2.9 sha206a_get_dk_useflag_count()

def cryptoauthlib.sha206_api.sha206a_get_dk_useflag_count (
dk_avail_count)

```
calculates available Derived Key use counts

Args:
    dk_avail_count        counts available bit's as 1 (int)

Returns:
    Status Code
```

21.10.2.10 sha206a_get_pk_useflag_count()

def cryptoauthlib.sha206_api.sha206a_get_pk_useflag_count (
pk_avail_count)

```
calculates available Parent Key use counts

Args:
    pk_avail_count        counts available bit's as 1 (int)

Returns:
    Status Code
```

21.10.2.11 sha206a_read_data_store()

```
def cryptoauthlib.sha206_api.sha206a_read_data_store (
              slot,
              data,
              offset,
              length )
```

```
Read the data stored in Data store

Args:
    slot               Slot number to read from (int)

    data               Pointer that holds the data
                       (Expected bytearray of size 32)

    offset             Byte offset within the zone to read from. (int)

    length             data length (int)

Returns:
    Status Code
```

21.10.2.12 sha206a_verify_device_consumption()

```
def cryptoauthlib.sha206_api.sha206a_verify_device_consumption (
              is_consumed )
```

```
verifies the device is fully consumed or not based on Parent and Derived Key use flags.

Args:
    is_consumed            result of device consumption is returned here
                           (Expected AtcaReference)

Returns:
    Status Code
```

21.10.2.13 sha206a_write_data_store()

```
def cryptoauthlib.sha206_api.sha206a_write_data_store (
              slot,
              data,
              block,
              offset,
              length,
              lock_after_write )
```

```
Update the data store slot with user data and lock it if necessary

Args:
    slot                Slot number to be written with data (int)

    data                Pointer that holds the data
                        (Expected bytearray of size 32)

    block               32-byte block to write (int)

    offset              4-byte word within the specified block to write to. If
                        performing a 32-byte write, this should be 0. (int)

    length              data length (int)

    lock_after_write    set 1 to lock slot after write, otherwise 0
                        (Expected bool/int)

Returns:
    Status Code
```

21.11 cryptoauthlib.status Namespace Reference

Data Structures

- class Status

Functions

- def check_status (status, *args, **kwargs)

Variables

- dict **STATUS_EXCEPTION_MAP**

21.11.1 Detailed Description

```
Status codes and status to exception conversions.
```

21.11.2 Function Documentation

21.11.2.1 check_status()

```
def cryptoauthlib.status.check_status (
             status,
            * args,
            ** kwargs )
```

```
Look up the status return code from an API call and raise the exception that matches
```

21.12 cryptoauthlib.tng Namespace Reference

Functions

- def tng_get_device_pubkey (public_key)
- def tng_atcacert_max_device_cert_size (max_cert_size)
- def tng_atcacert_read_device_cert (cert, cert_size, signer_cert=None)
- def tng_atcacert_device_public_key (public_key, cert=None)
- def tng_atcacert_max_signer_cert_size (max_cert_size)
- def tng_atcacert_read_signer_cert (cert, cert_size)
- def tng_atcacert_signer_public_key (public_key, cert=None)
- def tng_atcacert_root_cert_size (cert_size)
- def tng_atcacert_root_cert (cert, cert_size)
- def tng_atcacert_root_public_key (public_key)

21.12.1 Detailed Description

```
TNG: classes and functions for interacting with TNG devices
```

21.12.2 Function Documentation

21.12.2.1 tng_atcacert_device_public_key()

```
def cryptoauthlib.tng.tng_atcacert_device_public_key (
              public_key,
              cert = None )
```

```
Reads the device public key.

Args:
    public_key   Public key will be returned here. Format will be
                 the X and Y integers in big-endian format.
                 64 bytes for P256 curve. Expects bytearray.
    cert         If supplied, the device public key is used from
                 this certificate. If set to None, the device
                 public key is read from the device. Expects bytes or None.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.2 tng_atcacert_max_device_cert_size()

```
def cryptoauthlib.tng.tng_atcacert_max_device_cert_size (
              max_cert_size )
```

```
Return the maximum possible certificate size in bytes for a TNG
device certificate. Certificate can be variable size, so this
gives an appropriate buffer size when reading the certificate.

Args:
    max_cert_size  Maximum certificate size will be returned here
                   in bytes. Expects AtcaReference.
Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.3 tng_atcacert_max_signer_cert_size()

```
def cryptoauthlib.tng.tng_atcacert_max_signer_cert_size (
              max_cert_size )
```

```
Return the maximum possible certificate size in bytes for a TNG
signer certificate. Certificate can be variable size, so this
gives an appropriate buffer size when reading the certificate.

Args:
    max_cert_size  Maximum certificate size will be returned here
                   in bytes. Expects AtcaReference.
Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.4 tng_atcacert_read_device_cert()

```
def cryptoauthlib.tng.tng_atcacert_read_device_cert (
              cert,
              cert_size,
              signer_cert = None )
```

```
Reads the device certificate for a TNG device.

Args:
    cert         Buffer to received the certificate (DER format).
                 Expects bytearray.
    cert_size    As input, the size of the cert buffer in bytes.
                 As output, the size of the certificate returned
                 in cert in bytes. Expects AtcaReference.
    signer_cert  If supplied, the signer public key is used from
                 this certificate. If set to None, the signer
                 public key is read from the device.
                 Expects bytes or None.
Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.5 tng_atcacert_read_signer_cert()

```
def cryptoauthlib.tng.tng_atcacert_read_signer_cert (
              cert,
              cert_size )
```

```
Reads the signer certificate for a TNG device.

Args:
    cert         Buffer to received the certificate (DER format).
                 Expects bytearray.
    cert_size    As input, the size of the cert buffer in bytes.
                 As output, the size of the certificate returned
                 in cert in bytes. Expects AtcaReference.
Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.6 tng_atcacert_root_cert()

```
def cryptoauthlib.tng.tng_atcacert_root_cert (
              cert,
              cert_size )
```

```
Get the TNG root cert.

Args:
    cert       Buffer to received the certificate (DER format).
               Expects bytearray.
    cert_size  As input, the size of the cert buffer in bytes.
               As output, the size of the certificate returned
               in cert in bytes. Expects AtcaReference.
Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.7 tng_atcacert_root_cert_size()

```
def cryptoauthlib.tng.tng_atcacert_root_cert_size (
              cert_size )
```

```
Get the size of the TNG root cert.

Args:
    cert_size  Certificate size will be returned here in bytes.
               Expects AtcaReference.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.8 tng_atcacert_root_public_key()

```
def cryptoauthlib.tng.tng_atcacert_root_public_key (
              public_key )
```

```
Gets the root public key.

Args:
    public_key  Public key will be returned here. Format will be
                the X and Y integers in big-endian format.
                64 bytes for P256 curve. Expects bytearray.
Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.9 tng_atcacert_signer_public_key()

```
def cryptoauthlib.tng.tng_atcacert_signer_public_key (
              public_key,
              cert = None )
```

```
Reads the signer public key.

Args:
    public_key   Public key will be returned here. Format will be
                 the X and Y integers in big-endian format.
                 64 bytes for P256 curve. Expects bytearray.
    cert         If supplied, the signer public key is used from
                 this certificate. If set to None, the signer
                 public key is read from the device. Expects bytes or None.

Returns:
    ATCACERT_E_SUCCESS on success, otherwise an error code.
```

21.12.2.10 tng_get_device_pubkey()

```
def cryptoauthlib.tng.tng_get_device_pubkey (
              public_key )
```

```
Uses GenKey command to calculate the public key from the primary
device public key.

Args:
    public_key  Public key will be returned here. Format will be
                the X and Y integers in big-endian format.
                64 bytes for P256 curve. Expects bytearray.

Returns:
    ATCA_SUCCESS on success, otherwise an error code.
```

21.13 test_device Namespace Reference

Functions

- def **test_device_config_size** (config, size)
- def **test_device_config_from_def** (config, definition, vector)
- def **test_device_config_from_vector** (config, vector)
- def **test_device_serial_number_from_def** (config, definition, vector)

Variables

- bytearray **ATSHA204A_SER_NUM_VECTOR** = bytearray.fromhex('01 23 6E AA CE FE 0B 8D EE')
- bytearray ATSHA204A_DEVICE_CONFIG_VECTOR
- dict ATSHA204A_DEVICE_CONFIG
- bytearray **ATECC508A_SER_NUM_VECTOR** = bytearray.fromhex('01 23 72 E8 B9 63 B2 D3 EE')
- bytearray ATECC508A_DEVICE_CONFIG_VECTOR
- dict ATECC508A_DEVICE_CONFIG
- bytearray **ATECC608_SER_NUM_VECTOR** = bytearray.fromhex('01 23 72 E8 B9 63 B2 D3 EE')
- bytearray ATECC608_DEVICE_CONFIG_VECTOR
- dict ATECC608_DEVICE_CONFIG
- **id**

21.13.1 Detailed Description

```
Device.py tests. Covers the configuration structures
```

21.13.2 Variable Documentation

21.13.2.1 ATECC508A_DEVICE_CONFIG

```
dict test_device.ATECC508A_DEVICE_CONFIG
```

Initial value:

```
=  {
    ’SN03’: [0x01, 0x23, 0x72, 0xE8],
    ’RevNum’: [0x00, 0x00, 0x60, 0x02],
    ’SN48’: [0xB9, 0x63, 0xB2, 0xD3, 0xEE],
    ’I2C_Enable’: 0x2D,
    ’I2C_Address’: 0xB0,
    ’OTPmode’: 0x55,
    ’SlotConfig’: [0x208F, 0x44C4, 0x2087, 0x2087,
                   0x0F8F, 0x36C4, 0x0F9F, 0x2082,
                   0x0F0F, 0x44C4, 0x0F0F, 0x0F0F,
                   0x0F0F, 0x0F0F, 0x0F0F, 0x0F0F],
    ’Counter0’: [0xFF, 0xFF, 0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00],
    ’Counter1’: [0xFF, 0xFF, 0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00],
    ’LastKeyUse’: [0xFF, 0xFF, 0xFF, 0xFF,
                   0xFF, 0xFF, 0xFF, 0xFF,
                   0xFF, 0xFF, 0xFF, 0xFF,
                   0xFF, 0xFF, 0xFF, 0xFF],
    ’LockValue’: 0x55,
    ’LockConfig’: 0x55,
    ’SlotLocked’: 0xFFFF,
    ’KeyConfig’: [0x0033, 0x001C, 0x0013, 0x0013,
                  0x007C, 0x001C, 0x003C, 0x0033,
                  0x003C, 0x003C, 0x003C, 0x0030,
                  0x003C, 0x003C, 0x003C, 0x0030]
}
```

21.13.2.2 ATECC508A_DEVICE_CONFIG_VECTOR

`bytearray test_device.ATECC508A_DEVICE_CONFIG_VECTOR`

Initial value:

```
=  bytearray.fromhex(
    '01 23 72 E8 00 00 60 02 B9 63 B2 D3 EE 00 2D 00'
    'B0 00 55 00 8F 20 C4 44 87 20 87 20 8F 0F C4 36'
    '9F 0F 82 20 0F 0F C4 44 0F 0F 0F 0F 0F 0F 0F 0F'
    '0F 0F 0F 0F FF FF FF FF 00 00 00 00 FF FF FF FF'
    '00 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF'
    'FF FF FF FF 00 00 55 55 FF FF 00 00 00 00 00 00'
    '33 00 1C 00 13 00 13 00 7C 00 1C 00 3C 00 33 00'
    '3C 00 3C 00 3C 00 30 00 3C 00 3C 00 3C 00 30 00')
```

21.13.2.3 ATECC608_DEVICE_CONFIG

`dict test_device.ATECC608_DEVICE_CONFIG`

Initial value:

```
=  {
    'SN03': [0x01, 0x23, 0x72, 0xE8],
    'RevNum': [0x00, 0x00, 0x60, 0x02],
    'SN48': [0xB9, 0x63, 0xB2, 0xD3, 0xEE],
    'AES_Enable': {'Enable': 1},
    'I2C_Enable': 0x2D,
    'I2C_Address': 0xB0,
    'ChipMode': 1,
    'CountMatch': 0x55,
    'SlotConfig': [0x208F, 0x44C4, 0x2087, 0x2087,
                   0x0F8F, 0x36C4, 0x0F9F, 0x2082,
                   0x0F0F, 0x44C4, 0x0F0F, 0x0F0F,
                   0x0F0F, 0x0F0F, 0x0F0F, 0x0F0F],
    'Counter0': [0xFF, 0xFF, 0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00],
    'Counter1': [0xFF, 0xFF, 0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00],
    'SlotLocked': 0xFFFF,
    'ChipOptions': {
        'IoProtectionKeyEnable': 1,
        'KdfAesEnable': 1,
        'IoProtectionKey': 4
    },
    'KeyConfig': [0x0033, 0x001C, 0x0013, 0x0013,
                  0x007C, 0x001C, 0x003C, 0x0033,
                  0x003C, 0x003C, 0x003C, 0x0030,
                  0x003C, 0x003C, 0x003C, 0x0030]
}
```

21.13.2.4 ATECC608_DEVICE_CONFIG_VECTOR

`bytearray test_device.ATECC608_DEVICE_CONFIG_VECTOR`

Initial value:

```
=  bytearray.fromhex(
    '01 23 72 E8 00 00 60 02 B9 63 B2 D3 EE 01 2D 00'
    'B0 00 55 01 8F 20 C4 44 87 20 87 20 8F 0F C4 36'
    '9F 0F 82 20 0F 0F C4 44 0F 0F 0F 0F 0F 0F 0F 0F'
    '0F 0F 0F 0F FF FF FF FF 00 00 00 00 FF FF FF FF'
    '00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00'
    '00 00 00 00 00 00 00 00 FF FF 06 40 00 00 00 00'
    '33 00 1C 00 13 00 13 00 7C 00 1C 00 3C 00 33 00'
    '3C 00 3C 00 3C 00 30 00 3C 00 3C 00 3C 00 30 00')
```

21.13.2.5 ATSHA204A_DEVICE_CONFIG

```
dict test_device.ATSHA204A_DEVICE_CONFIG
```

Initial value:

```
=  {
    ’SN03’: [0x01, 0x23, 0x6E, 0xAA],
    ’RevNum’: [0x00, 0x09, 0x04, 0x00],
    ’SN48’: [0xCE, 0xFE, 0x0B, 0x8D, 0xEE],
    ’I2C_Enable’: 0x01,
    ’I2C_Address’: 0xC8,
    ’OTPmode’: 0x55,
    ’SlotConfig’: [0x808F, 0xA180, 0xE082, 0xF4C4,
                   0x0084, 0x85A0, 0x4086, 0x0787,
                   0x000F, 0x64C4, 0x7A8A, 0x8B0B,
                   0x4C0C, 0x4DDD, 0x42C2, 0x8FAF],
    ’Counter’: [0xFF, 0xFF, 0xFF, 0xFF,
                0xFF, 0xFF, 0xFF, 0xFF],
    ’LastKeyUse’: [0xFF, 0xFF, 0xFF, 0xFF,
                   0xFF, 0xFF, 0xFF, 0xFF,
                   0xFF, 0xFF, 0xFF, 0xFF,
                   0xFF, 0xFF, 0xFF, 0xFF],
    ’LockValue’: 0x55,
    ’LockConfig’: 0x55
}
```

21.13.2.6 ATSHA204A_DEVICE_CONFIG_VECTOR

```
bytearray test_device.ATSHA204A_DEVICE_CONFIG_VECTOR
```

Initial value:

```
=  bytearray.fromhex(
    ’01 23 6E AA 00 09 04 00 CE FE 0B 8D EE 00 01 00’
    ’C8 00 55 00 8F 80 80 A1 82 E0 C4 F4 84 00 A0 85’
    ’86 40 87 07 0F 00 C4 64 8A 7A 0B 8B 0C 4C DD 4D’
    ’C2 42 AF 8F FF 00 FF 00 FF 00 FF 00 FF 00 FF 00’
    ’FF 00 FF 00 FF FF FF FF FF FF FF FF FF FF FF FF’
    ’FF FF FF FF 00 00 55 55’)
```

21.14 test_iface Namespace Reference

Functions

- def **test_iface_init** (test_init_with_lib)
- def **test_iface_cfg_size** (test_iface_init)
- def **test_iface_cfg_ateccx08a_i2c** (test_iface_init)
- def **test_iface_cfg_ateccx08a_swi** (test_iface_init)
- def **test_iface_cfg_ateccx08a_kithid** (test_iface_init)
- def **test_iface_cfg_atsha20xa_i2c** (test_iface_init)
- def **test_iface_cfg_atsha20xa_swi** (test_iface_init)
- def **test_iface_cfg_atsha20xa_kithid** (test_iface_init)

21.14.1 Detailed Description

```
These tests verify the structures match the expectation from what is in atca_cfs.c
If that file has been modified then the tests will fail. If the file has not been
modified then we can reasonably expect that there is a problem with the ctypes
definition or assumptions of the platform build and memory alignment is wrong
```

Chapter 22

Data Structure Documentation

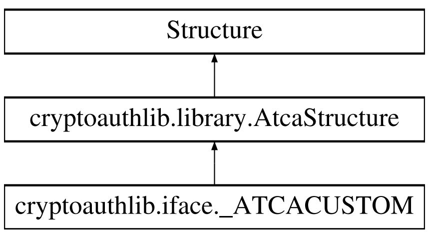
22.1 _ascii_kit_host_context Struct Reference

Data Fields

- const atca_hal_kit_phy_t ∗ **phy**
- uint8_t **buffer** [(2500)]
- ATCADevice **device**
- ATCAIfaceCfg ∗∗ **iface**
- size_t **iface_count**
- uint32_t **flags**

22.2 cryptoauthlib.iface._ATCACUSTOM Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCACUSTOM:



Static Protected Attributes

- list _fields_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.2.1 Detailed Description

```
Custom HAL configuration
```

22.2.2 Field Documentation

22.2.2.1 _fields_

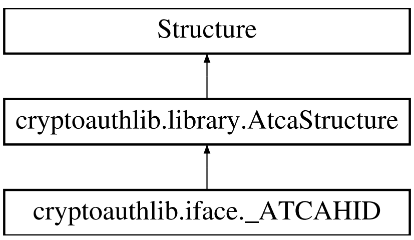
```
list cryptoauthlib.iface._ATCACUSTOM._fields_ [static], [protected]
```

Initial value:

```
=  [('halinit', c_void_p),
                ('halpostinit', c_void_p),
                ('halsend', c_void_p),
                ('halreceive', c_void_p),
                ('halwake', c_void_p),
                ('halidle', c_void_p),
                ('halsleep', c_void_p),
                ('halrelease', c_void_p)]
```

22.3 cryptoauthlib.iface._ATCAHID Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCAHID:



Static Protected Attributes

- dict _def_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.3.1 Detailed Description

```
USB (HID) HAL configuration
```

22.3.2 Field Documentation

22.3.2.1 _def_

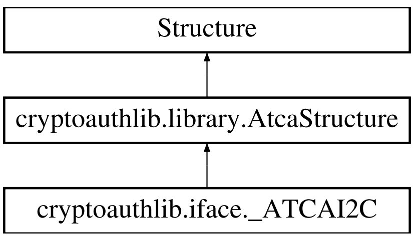
```
dict cryptoauthlib.iface._ATCAHID._def_ [static], [protected]
```

Initial value:

```
= {
        'idx': (c_int,),
        'dev_interface': (ATCAKitType,),
        'dev_identity': (c_uint8,),
        'vid': (c_uint32,),
        'pid': (c_uint32,),
        'packetsize': (c_uint32,)
    }
```

22.4 cryptoauthlib.iface._ATCAI2C Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCAI2C:



Static Protected Attributes

- tuple **_anonymous_** = ('u',)
- dict _map_
- list _fields_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, *args, **kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, **kwargs)
- def **update_from_buffer** (self, buffer)

22.4.1 Detailed Description

```
I2C/TWI HAL configuration
```

22.4.2 Field Documentation

22.4.2.1 _fields_

```
list cryptoauthlib.iface._ATCAI2C._fields_ [static], [protected]
```

Initial value:

```
= [('u', _U_Address),
                ('bus', c_uint8),
                ('baud', c_uint32)]
```

22.4.2.2 _map_

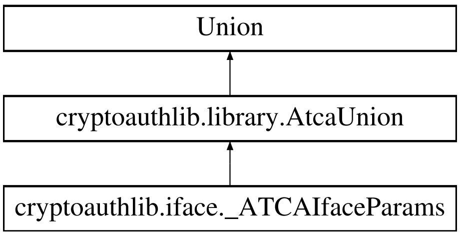
```
dict cryptoauthlib.iface._ATCAI2C._map_ [static], [protected]
```

Initial value:

```
= {
        'u': (1,)
    }
```

22.5 cryptoauthlib.iface._ATCAIfaceParams Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCAIfaceParams:



Static Protected Attributes

- list _fields_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaUnion

- def **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

Protected Attributes inherited from cryptoauthlib.library.AtcaUnion

- **_selected**

22.5.1 Detailed Description

```
HAL Configurations supported by the library (this is a union)
```

22.5.2 Field Documentation

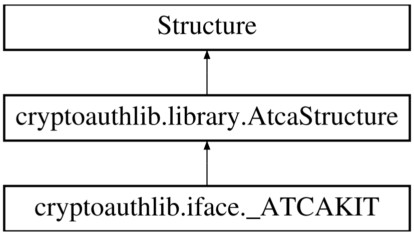
22.5.2.1 _fields_

```
list cryptoauthlib.iface._ATCAIfaceParams._fields_ [static], [protected]
```

Initial value:
```
=  [('atcai2c', _ATCAI2C),
                ('atcaswi', _ATCASWI),
                ('atcaspi', _ATCASPI),
                ('atcauart', _ATCAUART),
                ('atcahid', _ATCAHID),
                ('atcakit', _ATCAKIT),
                ('atcacustom', _ATCACUSTOM)]
```

22.6 cryptoauthlib.iface._ATCAKIT Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCAKIT:



Static Protected Attributes

- dict _def_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, *args, **kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, **kwargs)
- def **update_from_buffer** (self, buffer)

22.6.1 Detailed Description

```
Kit (Bridge) HAL Configuration
```

22.6.2 Field Documentation

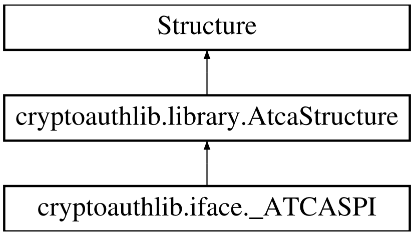
22.6.2.1 _def_

```
dict cryptoauthlib.iface._ATCAKIT._def_ [static], [protected]
```

Initial value:
```
=  {
        'dev_interface': (ATCAKitType,),
        'dev_identity': (c_uint8,),
        'flags': (c_uint32,)
    }
```

22.7 cryptoauthlib.iface._ATCASPI Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCASPI:



Static Protected Attributes

- list _fields_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.7.1 Detailed Description

```
SPI HAL configuration
```

22.7.2 Field Documentation

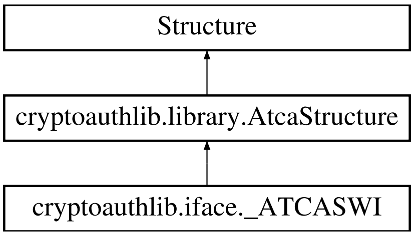
22.7.2.1 _fields_

```
list cryptoauthlib.iface._ATCASPI._fields_ [static], [protected]
```

Initial value:
```
=  [('bus', c_uint8),
                  ('select_pin', c_uint8),
                  ('baud', c_uint32)]
```

22.8 cryptoauthlib.iface._ATCASWI Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCASWI:



Static Protected Attributes

- list _fields_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.8.1 Detailed Description

```
SWI (Atmel Single Wire Interface) HAL configuration
```

22.8.2 Field Documentation

22.8.2.1 _fields_

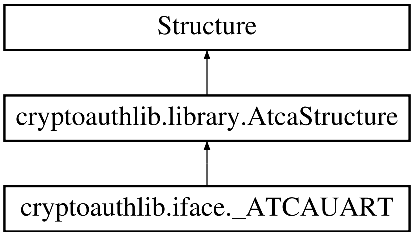
```
list cryptoauthlib.iface._ATCASWI._fields_ [static], [protected]
```

Initial value:

```
= [('address', c_uint8),
              ('bus', c_uint8)]
```

22.9 cryptoauthlib.iface._ATCAUART Class Reference

Inheritance diagram for cryptoauthlib.iface._ATCAUART:



Static Protected Attributes

- dict _def_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.9.1 Detailed Description

```
Generic UART HAL configuration
```

22.9.2 Field Documentation

22.9.2.1 _def_

```
dict cryptoauthlib.iface._ATCAUART._def_ [static], [protected]
```

Initial value:

```
= {
        'dev_interface': (ATCAKitType,),
        'dev_identity': (c_uint8,),
        'port': (c_uint8,),
        'baud': (c_uint32,),
        'wordsize': (c_uint8,),
        'parity': (c_uint8,),
        'stopbits': (c_uint8,)
    }
```

22.10 cryptoauthlib.library._CtypeIterator Class Reference

Public Member Functions

- None **__init__** (self, obj)
- def **__iter__** (self)
- def **__next__** (self)

Protected Attributes

- **_obj**
- **_index**
- **_end**

22.10.1 Detailed Description

```
Used to iterate through a ctypes structure or union. This iterator
returns a tuple of three elements:
        <field_name>, <field_contents>, <field_info>
Of course field_info is a tuple of varying size depending on how the
field was defined (arrays, bitfields, etc)
```

22.11 _kit_host_map_entry Struct Reference

```
#include <app/kit_host/ascii_kit_host.h>
```

Data Fields

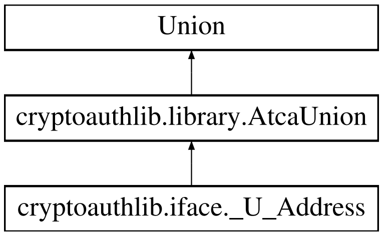
- const char ∗ **id**
- ATCA_STATUS(∗ **fp_command**)(ascii_kit_host_context_t ∗ctx, int argc, char ∗argv[ ], uint8_t ∗response, size_t ∗rlen)

22.11.1 Detailed Description

Used to create command tables for the kit host parser

22.12 cryptoauthlib.iface._U_Address Class Reference

Inheritance diagram for cryptoauthlib.iface._U_Address:



Static Protected Attributes

- list _fields_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaUnion

- def **__init__** (self, *args, **kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, **kwargs)
- def **update_from_buffer** (self, buffer)

Protected Attributes inherited from cryptoauthlib.library.AtcaUnion

- **_selected**

22.12.1 Detailed Description

```
Hidden union to provide backward compatibility with the api change
```

22.12.2 Field Documentation

22.12.2.1 _fields_

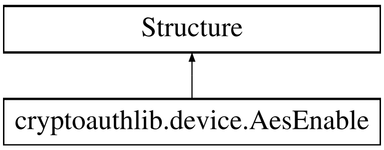
```
list cryptoauthlib.iface._U_Address._fields_  [static], [protected]
```

Initial value:

```
=  [('slave_address', c_uint8),
               ('address', c_uint8)]
```

22.13 cryptoauthlib.device.AesEnable Class Reference

Inheritance diagram for cryptoauthlib.device.AesEnable:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.13.1 Detailed Description

```
AES Enable (608) Field Definition
```

22.13.2 Field Documentation

22.13.2.1 _fields_

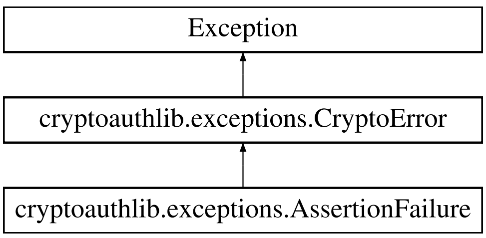
```
list cryptoauthlib.device.AesEnable._fields_ [static], [protected]
```

Initial value:

```
=  [('Enable', c_uint8, 1),
                ('Reserved', c_uint8, 6)]
```

22.14 cryptoauthlib.exceptions.AssertionFailure Class Reference

Inheritance diagram for cryptoauthlib.exceptions.AssertionFailure:

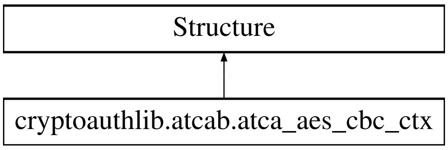


22.14.1 Detailed Description

```
Code failed run-time consistency check
```

22.15 cryptoauthlib.atcab.atca_aes_cbc_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_aes_cbc_ctx:



Static Protected Attributes

- list _fields_

22.15.1 Detailed Description

```
AES CBC Context
```

22.15.2 Field Documentation

22.15.2.1 _fields_

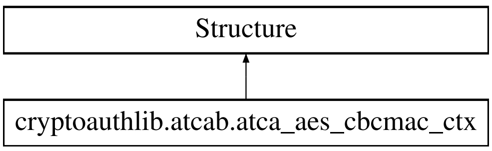
```
list cryptoauthlib.atcab.atca_aes_cbc_ctx._fields_  [static], [protected]
```

Initial value:

```
=  [("device", c_void_p),
                ("key_id", c_uint16),
                ("key_block", c_uint8),
                ("ciphertext", c_char*16)]
```

22.16 cryptoauthlib.atcab.atca_aes_cbcmac_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_aes_cbcmac_ctx:



Static Protected Attributes

- list _fields_

22.16.1 Detailed Description

```
AES CBCMAC Context
```

22.16.2 Field Documentation

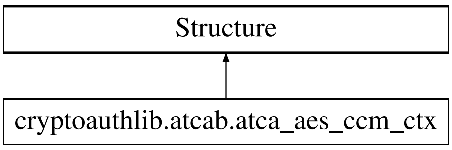
22.16.2.1 _fields_

```
list cryptoauthlib.atcab.atca_aes_cbcmac_ctx._fields_ [static], [protected]
```

Initial value:
```
= [("cbc_ctx", atca_aes_cbc_ctx),
                ("block_size", c_uint8),
                ("block", c_char*16)]
```

22.17 cryptoauthlib.atcab.atca_aes_ccm_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_aes_ccm_ctx:



Static Protected Attributes

- list _fields_

22.17.1 Detailed Description

```
AES CCM Context
```

22.17.2 Field Documentation

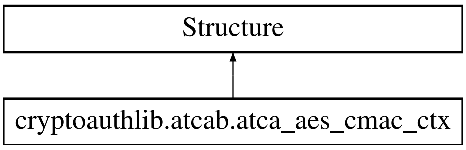
22.17.2.1 _fields_

```
list cryptoauthlib.atcab.atca_aes_ccm_ctx._fields_  [static], [protected]
```

Initial value:
```
=  [("cbc_mac_ctx", atca_aes_cbc_ctx),
                ("ctr_ctx", atca_aes_ctr_ctx),
                ("iv_size", c_uint8),
                ("M", c_uint8),
                ("counter", c_char*16),
                ("partial_aad", c_char*16),
                ("partial_aad_size", c_uint32),
                ("text_size", c_uint32),
                ("enc_cb", c_char*16),
                ("data_size", c_uint32),
                ("ciphertext_block", c_char*16)]
```

22.18 cryptoauthlib.atcab.atca_aes_cmac_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_aes_cmac_ctx:



Static Protected Attributes

- list _fields_

22.18.1 Detailed Description

```
AES CMAC Context
```

22.18.2 Field Documentation

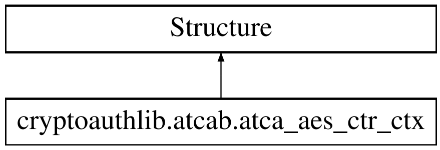
22.18.2.1 _fields_

```
list cryptoauthlib.atcab.atca_aes_cmac_ctx._fields_  [static], [protected]
```

Initial value:
```
=  [("cbc_ctx", atca_aes_cbc_ctx),
                ("block_size", c_uint32),
                ("block", c_char*16)]
```

22.19 cryptoauthlib.atcab.atca_aes_ctr_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_aes_ctr_ctx:



Static Protected Attributes

- list _fields_

22.19.1 Detailed Description

```
AES CTR Context
```

22.19.2 Field Documentation

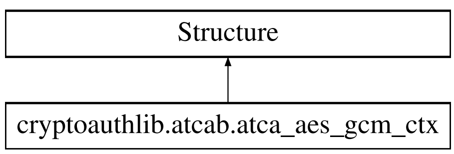
22.19.2.1 _fields_

```
list cryptoauthlib.atcab.atca_aes_ctr_ctx._fields_  [static], [protected]
```

Initial value:
```
=  [("key_id", c_uint16),
                 ("key_block", c_uint8),
                 ("iv", c_char*16),
                 ("counter_size", c_uint8)]
```

22.20 cryptoauthlib.atcab.atca_aes_gcm_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_aes_gcm_ctx:



Static Protected Attributes

- list _fields_

22.20.1 Detailed Description

```
Context structure for AES GCM operations
```

22.20.2 Field Documentation

22.20.2.1 _fields_

```
list cryptoauthlib.atcab.atca_aes_gcm_ctx._fields_  [static], [protected]
```

Initial value:

```
=  [("key_id", c_uint16),
                ("key_block", c_uint8),
                ("cb", c_char*16),
                ("data_size", c_uint32),
                ("aad_size", c_uint32),
                ("h", c_char*16),
                ("j0", c_char*16),
                ("y", c_char*16),
                ("partial_aad", c_char*16),
                ("partial_aad_size", c_uint32),
                ("enc_cb", c_char*16),
                ("ciphertext_block", c_char*16)]
```

22.21 atca_check_mac_in_out Struct Reference

Input/output parameters for function atcah_check_mac().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **mode**

  [in] CheckMac command Mode
- uint16_t **key_id**

  [in] CheckMac command KeyID
- const uint8_t ∗ **sn**

  [in] Device serial number SN[0:8]. Only SN[0:1] and SN[8] are required though.
- const uint8_t ∗ **client_chal**

  [in] ClientChal data, 32 bytes. Can be NULL if mode[0] is 1.
- uint8_t ∗ **client_resp**

  [out] Calculated ClientResp will be returned here.
- const uint8_t ∗ **other_data**

  [in] OtherData, 13 bytes
- const uint8_t ∗ **otp**

  [in] First 8 bytes of the OTP zone data. Can be NULL is mode[5] is 0.
- const uint8_t ∗ slot_key
- const uint8_t ∗ target_key
- struct atca_temp_key ∗ **temp_key**

  [in,out] Current state of TempKey. Required if mode[0] or mode[1] are 1.

22.21.1 Detailed Description

Input/output parameters for function atcah_check_mac().

22.21.2 Field Documentation

22.21.2.1 slot_key

```
const uint8_t* atca_check_mac_in_out::slot_key
```

[in] 32 byte key value in the slot specified by slot_id. Can be NULL if mode[1] is 1.

22.21.2.2 target_key

```
const uint8_t* atca_check_mac_in_out::target_key
```

[in] If this is not NULL, it assumes CheckMac copy is enabled for the specified key_id (ReadKey=0). If key_id is even, this should be the 32-byte key value for the slot key_id+1, otherwise this should be set to slot_key.

22.22 atca_decrypt_in_out Struct Reference

Input/output parameters for function atca_decrypt().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t ∗ **crypto_data**
  [in,out] Pointer to 32-byte data. Input encrypted data from Read command (Contents field), output decrypted.
- struct atca_temp_key ∗ **temp_key**
  [in,out] Pointer to TempKey structure.

22.22.1 Detailed Description

Input/output parameters for function atca_decrypt().

22.23 atca_delete_in_out Struct Reference

Input/Output paramters for calculating the mac.Used with Delete command.

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint16_t **key_id**
- const uint8_t * **sn**
- uint8_t * **nonce**
- const uint8_t * **key**
- uint8_t * **mac**

22.23.1 Detailed Description

Input/Output paramters for calculating the mac.Used with Delete command.

22.24 atca_derive_key_in_out Struct Reference

Input/output parameters for function atcah_derive_key().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **mode**

  Mode (param 1) of the derive key command.
- uint16_t **target_key_id**

  Key ID (param 2) of the target slot to run the command on.
- const uint8_t * **sn**

  Device serial number SN[0:8]. Only SN[0:1] and SN[8] are required though.
- const uint8_t * **parent_key**

  Parent key to be used in the derive key calculation (32 bytes).
- uint8_t * **target_key**

  Derived key will be returned here (32 bytes).
- struct atca_temp_key * **temp_key**

  Current state of TempKey.

22.24.1 Detailed Description

Input/output parameters for function atcah_derive_key().

22.25 atca_derive_key_mac_in_out Struct Reference

Input/output parameters for function atcah_derive_key_mac().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **mode**

  Mode (param 1) of the derive key command.
- uint16_t **target_key_id**

  Key ID (param 2) of the target slot to run the command on.
- const uint8_t * **sn**

  Device serial number SN[0:8]. Only SN[0:1] and SN[8] are required though.
- const uint8_t * **parent_key**

  Parent key to be used in the derive key calculation (32 bytes).
- uint8_t * **mac**

  DeriveKey MAC will be returned here.

22.25.1 Detailed Description

Input/output parameters for function atcah_derive_key_mac().

22.26 atca_device Struct Reference

atca_device is the C object backing ATCADevice. See the atca_device.h file for details on the ATCADevice methods

```
#include <lib/atca_device.h>
```

Data Fields

- atca_iface_t mIface
- uint8_t device_state
- uint8_t **clock_divider**
- uint16_t **execution_time_msec**
- void * **session_ctx**
- ctx_cb **session_cb**

22.26.1 Detailed Description

atca_device is the C object backing ATCADevice. See the atca_device.h file for details on the ATCADevice methods

22.26.2 Field Documentation

22.26.2.1 device_state

```
uint8_t atca_device::device_state
```

Device Power State

22.26.2.2 mIface

`atca_iface_t atca_device::mIface`

Physical interface

22.27 atca_diversified_key_in_out Struct Reference

Input/output parameters for function atcah_gendivkey().

`#include <lib/host/atca_host.h>`

Data Fields

- const uint8_t ∗ **parent_key**
- const uint8_t ∗ **other_data**
- const uint8_t ∗ **sn**

  [in] Device serial number SN[0:8]. Only SN[0:1] and SN[8] are required though.
- const uint8_t ∗ **input_data**
- struct atca_temp_key ∗ **temp_key**

  [inout] Current state of TempKey

22.27.1 Detailed Description

Input/output parameters for function atcah_gendivkey().

22.28 atca_evp_ctx Struct Reference

Data Fields

- void ∗ **ptr**

22.29 atca_gen_dig_in_out Struct Reference

Input/output parameters for function atcah_gen_dig().

`#include <lib/host/atca_host.h>`

Data Fields

- uint8_t **zone**

  [in] Zone/Param1 for the GenDig command
- uint16_t **key_id**

  [in] KeyId/Param2 for the GenDig command
- uint16_t **slot_conf**

  [in] Slot config for the GenDig command
- uint16_t **key_conf**

  [in] Key config for the GenDig command
- uint8_t **slot_locked**

  [in] slot locked for the GenDig command
- uint32_t **counter**

  [in] counter for the GenDig command
- bool **is_key_nomac**

  [in] Set to true if the slot pointed to be key_id has the SotConfig.NoMac bit set
- const uint8_t ∗ **sn**

  [in] Device serial number SN[0:8]. Only SN[0:1] and SN[8] are required though.
- const uint8_t ∗ **stored_value**

  [in] 32-byte slot value, config block, OTP block as specified by the Zone/KeyId parameters
- const uint8_t ∗ **other_data**

  [in] 32-byte value for shared nonce zone, 4-byte value if is_key_nomac is true, ignored and/or NULL otherwise
- struct atca_temp_key ∗ **temp_key**

  [inout] Current state of TempKey

22.29.1 Detailed Description

Input/output parameters for function atcah_gen_dig().

22.30 atca_gen_key_in_out Struct Reference

Input/output parameters for calculating the PubKey digest put into TempKey by the GenKey command with the atcah_gen_key_msg() function.

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **mode**

  [in] GenKey Mode
- uint16_t **key_id**

  [in] GenKey KeyID
- const uint8_t ∗ **public_key**

  [in] Public key to be used in the PubKey digest. X and Y integers in big-endian format. 64 bytes for P256 curve.
- size_t **public_key_size**

  [in] Total number of bytes in the public key. 64 bytes for P256 curve.
- const uint8_t ∗ **other_data**

  [in] 3 bytes required when bit 4 of the mode is set. Can be NULL otherwise.
- const uint8_t ∗ **sn**

  [in] Device serial number SN[0:8] (9 bytes). Only SN[0:1] and SN[8] are required though.
- struct atca_temp_key ∗ **temp_key**

  [in,out] As input the current state of TempKey. As output, the resulting PubKEy digest.

22.30.1 Detailed Description

Input/output parameters for calculating the PubKey digest put into TempKey by the GenKey command with the atcah_gen_key_msg() function.

22.31 atca_hal_kit_phy_t Struct Reference

Data Fields

- ATCA_STATUS(∗ send)(void ∗ctx, uint8_t ∗txdata, uint16_t txlen)
- ATCA_STATUS(∗ recv)(void ∗ctx, uint8_t ∗rxdata, uint16_t ∗rxlen)
- void ∗(∗ packet_alloc)(size_t bytes)
- void(∗ packet_free)(void ∗packet)
- void ∗ hal_data

22.31.1 Field Documentation

22.31.1.1 hal_data

```
void* atca_hal_kit_phy_t::hal_data
```

Physical layer context

22.31.1.2 packet_alloc

```
void *(* atca_hal_kit_phy_t::packet_alloc) (size_t bytes)
```

Allocate a phy packet

22.31.1.3 packet_free

```
void(* atca_hal_kit_phy_t::packet_free) (void *packet)
```

Free a phy packet

22.31.1.4 recv

```
ATCA_STATUS(* atca_hal_kit_phy_t::recv) (void *ctx, uint8_t *rxdata, uint16_t *rxlen)
```

Must be a blocking receive

22.31.1.5 send

```
ATCA_STATUS(* atca_hal_kit_phy_t::send) (void *ctx, uint8_t *txdata, uint16_t txlen)
```

Must be a blocking send

22.32 atca_hal_list_entry_t Struct Reference

Structure that holds the hal/phy maping for different interface types.

Data Fields

- uint8_t **iface_type**
- ATCAHAL_t * **hal**
- ATCAHAL_t * phy

22.32.1 Detailed Description

Structure that holds the hal/phy maping for different interface types.

22.32.2 Field Documentation

22.32.2.1 phy

```
ATCAHAL_t* atca_hal_list_entry_t::phy
```

Physical interface for the specific HAL

22.33 atca_hal_shm_t Struct Reference

Data Fields

- int **recordedPID**
- uint8_t **sessionID**
- uint8_t **index**

22.34 atca_hmac_in_out Struct Reference

Input/output parameters for function atca_hmac().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **mode**

  [in] Mode parameter used in HMAC command (Param1).
- uint16_t **key_id**

  [in] KeyID parameter used in HMAC command (Param2).
- const uint8_t ∗ **key**

  [in] Pointer to 32-byte key used to generate HMAC digest.
- const uint8_t ∗ **otp**

  [in] Pointer to 11-byte OTP, optionally included in HMAC digest, depending on mode.
- const uint8_t ∗ **sn**

  [in] Pointer to 9-byte SN, optionally included in HMAC digest, depending on mode.
- uint8_t ∗ **response**

  [out] Pointer to 32-byte SHA-256 HMAC digest.
- struct atca_temp_key ∗ **temp_key**

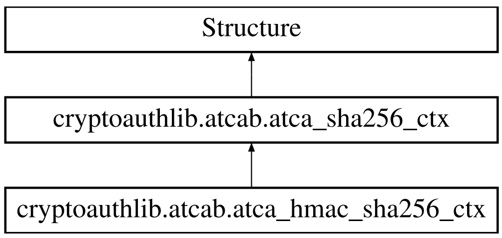
  [in,out] Pointer to TempKey structure.

22.34.1 Detailed Description

Input/output parameters for function atca_hmac().

22.35 cryptoauthlib.atcab.atca_hmac_sha256_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_hmac_sha256_ctx:



Additional Inherited Members

Static Protected Attributes inherited from cryptoauthlib.atcab.atca_sha256_ctx

- list _fields_

22.35.1 Detailed Description

```
HMAC-SHA256 context
```

22.36 atca_i2c_host_s Struct Reference

Data Fields

- char **i2c_file** [16]
- int **ref_ct**

22.37 atca_iface Struct Reference

atca_iface is the context structure for a configured interface

```
#include <lib/atca_iface.h>
```

Data Fields

- ATCAIfaceCfg ∗ mIfaceCFG
- ATCAHAL_t ∗ hal
- ATCAHAL_t ∗ phy
- void ∗ hal_data

22.37.1 Detailed Description

atca_iface is the context structure for a configured interface

22.37.2 Field Documentation

22.37.2.1 hal

```
ATCAHAL_t* atca_iface::hal
```

The configured HAL for the interface

22.37.2.2 hal_data

```
void* atca_iface::hal_data
```

Pointer to HAL specific context/data

22.37.2.3 mIfaceCFG

```
ATCAIfaceCfg* atca_iface::mIfaceCFG
```

Points to previous defined/given Cfg object, the caller manages this

22.37.2.4 phy

`ATCAHAL_t* atca_iface::phy`

When a HAL is not a "native" hal it needs a physical layer to be associated with it

22.38 atca_include_data_in_out Struct Reference

Input / output parameters for function atca_include_data().

`#include <lib/host/atca_host.h>`

Data Fields

- uint8_t * **p_temp**

  [out] pointer to output buffer
- const uint8_t * **otp**

  [in] pointer to one-time-programming data
- const uint8_t * **sn**

  [in] pointer to serial number data
- uint8_t **mode**

22.38.1 Detailed Description

Input / output parameters for function atca_include_data().

22.39 atca_io_decrypt_in_out Struct Reference

Data Fields

- const uint8_t * **io_key**

  IO protection key (32 bytes).
- const uint8_t * **out_nonce**

  OutNonce returned from command (32 bytes).
- uint8_t * **data**

  As input, encrypted data. As output, decrypted data.
- size_t **data_size**

  Size of data in bytes (32 or 64).

22.40 atca_mac_in_out Struct Reference

Input/output parameters for function atca_mac().

`#include <lib/host/atca_host.h>`

Data Fields

- uint8_t **mode**

    [in] Mode parameter used in MAC command (Param1).
- uint16_t **key_id**

    [in] KeyID parameter used in MAC command (Param2).
- const uint8_t ∗ **challenge**

    [in] Pointer to 32-byte Challenge data used in MAC command, depending on mode.
- const uint8_t ∗ **key**

    [in] Pointer to 32-byte key used to generate MAC digest.
- const uint8_t ∗ **otp**

    [in] Pointer to 11-byte OTP, optionally included in MAC digest, depending on mode.
- const uint8_t ∗ **sn**

    [in] Pointer to 9-byte SN, optionally included in MAC digest, depending on mode.
- uint8_t ∗ **response**

    [out] Pointer to 32-byte SHA-256 digest (MAC).
- struct atca_temp_key ∗ **temp_key**

    [in,out] Pointer to TempKey structure.

22.40.1 Detailed Description

Input/output parameters for function atca_mac().

22.41 atca_mbedtls_eckey_s Struct Reference

```
#include <lib/mbedtls/atca_mbedtls_wrap.h>
```

Data Fields

- ATCADevice **device**
- uint16_t **handle**

22.41.1 Detailed Description

Structure to hold metadata - is written into the mbedtls pk structure as the private key bignum value 'd' which otherwise would be unused. Bignums can be any arbitrary length of bytes

22.42 atca_nonce_in_out Struct Reference

Input/output parameters for function atca_nonce().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **mode**

  [in] Mode parameter used in Nonce command (Param1).
- uint16_t **zero**

  [in] Zero parameter used in Nonce command (Param2).
- const uint8_t * **num_in**

  [in] Pointer to 20-byte NumIn data used in Nonce command.
- const uint8_t * **rand_out**

  [in] Pointer to 32-byte RandOut data from Nonce command.
- struct atca_temp_key * **temp_key**

  [in,out] Pointer to TempKey structure.

22.42.1 Detailed Description

Input/output parameters for function atca_nonce().

22.43 atca_resp_mac_in_out Struct Reference

Input/Output parameters for calculating the output response mac in SHA105 device. Used with the atcah_gen_output_resp_mac() function.

```
#include <lib/host/atca_host.h>
```

Data Fields

- const uint8_t * **slot_key**
- uint8_t **mode**
- uint16_t **key_id**
- const uint8_t * **sn**
- uint8_t * **client_resp**
- uint8_t **checkmac_result**
- uint8_t * **mac_output**

22.43.1 Detailed Description

Input/Output parameters for calculating the output response mac in SHA105 device. Used with the atcah_gen_output_resp_mac() function.

22.44 atca_secureboot_enc_in_out Struct Reference

Data Fields

- const uint8_t ∗ **io_key**
  IO protection key value (32 bytes)
- const struct atca_temp_key ∗ **temp_key**
  Current value of TempKey.
- const uint8_t ∗ **digest**
  Plaintext digest as input.
- uint8_t ∗ **hashed_key**
  Calculated key is returned here (32 bytes)
- uint8_t ∗ **digest_enc**
  Encrypted (ciphertext) digest is return here (32 bytes)

22.45 atca_secureboot_mac_in_out Struct Reference

Data Fields

- uint8_t **mode**
  SecureBoot mode (param1)
- uint16_t **param2**
  SecureBoot param2.
- uint16_t **secure_boot_config**
  SecureBootConfig value from configuration zone.
- const uint8_t ∗ **hashed_key**
  Hashed key. SHA256(IO Protection Key | TempKey)
- const uint8_t ∗ **digest**
  Digest (unencrypted)
- const uint8_t ∗ **signature**
  Signature (can be NULL if not required)
- uint8_t ∗ **mac**
  MAC is returned here.

22.46 atca_session_key_in_out Struct Reference

Input/Output paramters for calculating the session key by the nonce command. Used with the atcah_gen_session←_key() function.

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t ∗ **transport_key**
- uint16_t **transport_key_id**
- const uint8_t ∗ **sn**
- uint8_t ∗ **nonce**
- uint8_t ∗ **session_key**

22.46.1 Detailed Description

Input/Output paramters for calculating the session key by the nonce command. Used with the atcah_gen_session↩_key() function.

22.47 atca_sha256_ctx Struct Reference

Data Fields

- uint32_t **total_msg_size**

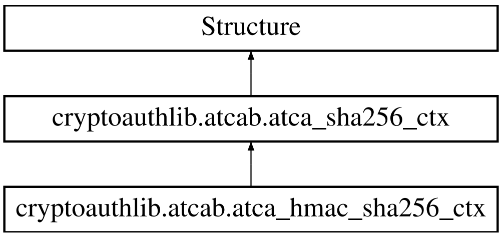
  Total number of message bytes processed.
- uint32_t **block_size**

  Number of bytes in current block.
- uint8_t **block** [ATCA_SHA256_BLOCK_SIZE ∗2]

  Unprocessed message storage.

22.48 cryptoauthlib.atcab.atca_sha256_ctx Class Reference

Inheritance diagram for cryptoauthlib.atcab.atca_sha256_ctx:



Static Protected Attributes

- list _fields_

22.48.1 Detailed Description

```
SHA256 context
```

22.48.2 Field Documentation

22.48.2.1 _fields_

```
list cryptoauthlib.atcab.atca_sha256_ctx._fields_ [static], [protected]
```

Initial value:
```
=  [("total_msg_size", c_uint32),
                ("block_size", c_uint32),
                ("block", c_char*64*2)]
```

22.49 atca_sign_internal_in_out Struct Reference

Input/output parameters for calculating the message and digest used by the Sign(internal) command. Used with the atcah_sign_internal_msg() function.

`#include <lib/host/atca_host.h>`

Data Fields

- uint8_t **mode**

  [in] Sign Mode
- uint16_t **key_id**

  [in] Sign KeyID
- uint16_t **slot_config**

  [in] SlotConfig[TempKeyFlags.keyId]
- uint16_t **key_config**

  [in] KeyConfig[TempKeyFlags.keyId]
- uint8_t **use_flag**

  [in] UseFlag[TempKeyFlags.keyId], 0x00 for slots 8 and above and for ATECC508A
- uint8_t **update_count**

  [in] UpdateCount[TempKeyFlags.keyId], 0x00 for slots 8 and above and for ATECC508A
- bool **is_slot_locked**

  [in] Is TempKeyFlags.keyId slot locked.
- bool **for_invalidate**

  [in] Set to true if this will be used for the Verify(Invalidate) command.
- const uint8_t * **sn**

  [in] Device serial number SN[0:8] (9 bytes)
- const struct atca_temp_key * **temp_key**

  [in] The current state of TempKey.
- uint8_t * **message**

  [out] Full 55 byte message the Sign(internal) command will build. Can be NULL if not required.
- uint8_t * **verify_other_data**

  [out] The 19 byte OtherData bytes to be used with the Verify(In/Validate) command. Can be NULL if not required.
- uint8_t * **digest**

  [out] SHA256 digest of the full 55 byte message. Can be NULL if not required.

22.49.1 Detailed Description

Input/output parameters for calculating the message and digest used by the Sign(internal) command. Used with the atcah_sign_internal_msg() function.

22.50 atca_spi_host_s Struct Reference

Data Fields

- char **spi_file** [20]
- int **f_spi**

22.51 atca_temp_key Struct Reference

Structure to hold TempKey fields.

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **value** [ATCA_KEY_SIZE ∗2]

  Value of TempKey (64 bytes for ATECC608 only)
- unsigned **key_id**: 4

  If TempKey was derived from a slot or transport key (GenDig or GenKey), that key ID is saved here.
- unsigned **source_flag**: 1

  Indicates id TempKey started from a random nonce (0) or not (1).
- unsigned **gen_dig_data**: 1

  TempKey was derived from the GenDig command.
- unsigned **gen_key_data**: 1

  TempKey was derived from the GenKey command (ATECC devices only).
- unsigned **no_mac_flag**: 1

  TempKey was derived from a key that has the NoMac bit set preventing the use of the MAC command. Known as CheckFlag in ATSHA devices).
- unsigned **valid**: 1

  TempKey is valid.
- uint8_t **is_64**

  TempKey has 64 bytes of valid data.

22.51.1 Detailed Description

Structure to hold TempKey fields.

22.52 atca_uart_host_s Struct Reference

Data Fields

- char **uart_file** [20]
- int **fd_uart**
- int **ref_ct**
- HANDLE **hSerial**

22.53 atca_verify_in_out Struct Reference

Input/output parameters for function atcah_verify().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint16_t **curve_type**

  [in] Curve type used in Verify command (Param2).
- const uint8_t ∗ **signature**

  [in] Pointer to ECDSA signature to be verified
- const uint8_t ∗ **public_key**

  [in] Pointer to the public key to be used for verification
- struct atca_temp_key ∗ **temp_key**

  [in,out] Pointer to TempKey structure.

22.53.1 Detailed Description

Input/output parameters for function atcah_verify().

22.54 atca_verify_mac Struct Reference

Data Fields

- uint8_t **mode**

  Mode (Param1) parameter used in Verify command.
- uint16_t **key_id**

  KeyID (Param2) used in Verify command.
- const uint8_t ∗ **signature**

  Signature used in Verify command (64 bytes).
- const uint8_t ∗ **other_data**

  OtherData used in Verify command (19 bytes).
- const uint8_t ∗ **msg_dig_buf**

  Message digest buffer (64 bytes).
- const uint8_t ∗ **io_key**

  IO protection key value (32 bytes).
- const uint8_t ∗ **sn**

  Serial number (9 bytes).
- const atca_temp_key_t ∗ **temp_key**

  TempKey.
- uint8_t ∗ **mac**

  Calculated verification MAC is returned here (32 bytes).

22.55 atca_write_mac_in_out Struct Reference

Input/output parameters for function atcah_write_auth_mac() and atcah_privwrite_auth_mac().

```
#include <lib/host/atca_host.h>
```

Data Fields

- uint8_t **zone**

  Zone/Param1 for the Write or PrivWrite command.
- uint16_t **key_id**

  KeyID/Param2 for the Write or PrivWrite command.
- const uint8_t * **sn**

  Device serial number SN[0:8]. Only SN[0:1] and SN[8] are required though.
- const uint8_t * **input_data**

  Data to be encrypted. 32 bytes for Write command, 36 bytes for PrivWrite command.
- uint8_t * **encrypted_data**

  Encrypted version of input_data will be returned here. 32 bytes for Write command, 36 bytes for PrivWrite command.
- uint8_t * **auth_mac**

  Write MAC will be returned here. 32 bytes.
- struct atca_temp_key * **temp_key**

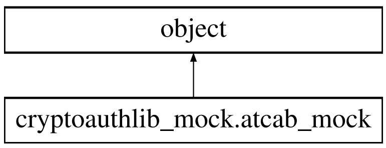
  Current state of TempKey.

22.55.1 Detailed Description

Input/output parameters for function atcah_write_auth_mac() and atcah_privwrite_auth_mac().

22.56 cryptoauthlib_mock.atcab_mock Class Reference

Inheritance diagram for cryptoauthlib_mock.atcab_mock:



Public Member Functions

- def **atcab_init** (self)
- def **atcab_release** (self)
- def **atcab_get_device_type** (self)
- def **atcab_aes** (self, mode, key_id, aes_in, aes_out)
- def **atcab_aes_encrypt** (self, key_id, key_block, plaintext, ciphertext)
- def **atcab_aes_decrypt** (self, key_id, key_block, ciphertext, plaintext)
- def **atcab_aes_gfm** (self, hash_key, inp, output)
- def **atcab_aes_cbc_init** (self, ctx, key_id, key_block, iv)
- def **atcab_aes_cbc_encrypt_block** (self, ctx, plaintext, ciphertext)
- def **atcab_aes_cbc_decrypt_block** (self, ctx, ciphertext, plaintext)
- def **atcab_aes_cmac_init** (self, ctx, key_id, key_block)
- def **atcab_aes_cmac_update** (self, ctx, data, data_size)
- def **atcab_aes_cmac_finish** (self, ctx, cmac, size)
- def **atcab_aes_ctr_init** (self, ctx, key_id, key_block, counter_size, iv)
- def **atcab_aes_ctr_init_rand** (self, ctx, key_id, key_block, counter_size, iv)

- def **atcab_aes_ctr_encrypt_block** (self, ctx, plaintext, ciphertext)
- def **atcab_aes_ctr_decrypt_block** (self, ctx, ciphertext, plaintext)
- def **atcab_aes_gcm_init** (self, ctx, key_id, key_block, iv, iv_size)
- def **atcab_aes_gcm_init_rand** (self, ctx, key_id, key_block, rand_size, free_field, free_field_size, iv)
- def **atcab_aes_gcm_aad_update** (self, ctx, aad, aad_size)
- def **atcab_aes_gcm_encrypt_update** (self, ctx, plaintext, plaintext_size, ciphertext)
- def **atcab_aes_gcm_encrypt_finish** (self, ctx, tag, tag_size)
- def **atcab_aes_gcm_decrypt_update** (self, ctx, ciphertext, ciphertext_size, plaintext)
- def **atcab_aes_gcm_decrypt_finish** (self, ctx, tag, tag_size, is_verified)
- def **atcab_aes_cbcmac_init** (self, ctx, key_id, key_block)
- def **atcab_aes_cbcmac_update** (self, ctx, data, data_size)
- def **atcab_aes_cbcmac_finish** (self, ctx, mac, mac_size)
- def **atcab_aes_ccm_init** (self, ctx, key_id, key_block, iv, iv_size, aad_size, text_size, tag_size)
- def **atcab_aes_ccm_init_rand** (self, ctx, key_id, key_block, iv, iv_size, aad_size, text_size, tag_size)
- def **atcab_aes_ccm_aad_update** (self, ctx, aad, aad_size)
- def **atcab_aes_ccm_aad_finish** (self, ctx)
- def **atcab_aes_ccm_encrypt_update** (self, ctx, plaintext, plaintext_size, ciphertext)
- def **atcab_aes_ccm_decrypt_update** (self, ctx, ciphertext, ciphertext_size, plaintext)
- def **atcab_aes_ccm_encrypt_finish** (self, ctx, tag, tag_size)
- def **atcab_aes_ccm_decrypt_finish** (self, ctx, tag, is_verified)
- def **atcab_checkmac** (self, mode, key_id, challenge, response, other_data)
- def **atcab_counter** (self, mode, counter_id, counter_value)
- def **atcab_counter_increment** (self, counter_id, counter_value)
- def **atcab_counter_read** (self, counter_id, counter_value)
- def **atcab_derivekey** (self, mode, target_key, mac)
- def **atcab_ecdh_base** (self, mode, key_id, public_key, pms, out_nonce)
- def **atcab_ecdh** (self, key_id, public_key, pms)
- def **atcab_ecdh_enc** (self, key_id, public_key, pms, read_key, read_key_id, num_in)
- def **atcab_ecdh_ioenc** (self, key_id, public_key, pms, io_key)
- def **atcab_ecdh_tempkey** (self, public_key, pms)
- def **atcab_ecdh_tempkey_ioenc** (self, public_key, pms, io_key)
- def **atcab_gendig** (self, zone, key_id, other_data, other_data_size)
- def **atcab_genkey_base** (self, mode, key_id, other_data, public_key)
- def **atcab_genkey** (self, key_id, public_key)
- def **atcab_get_pubkey** (self, key_id, public_key)
- def **atcab_hmac** (self, mode, key_id, digest)
- def **atcab_info_base** (self, mode, param2, out_data)
- def **atcab_info** (self, revision)
- def **atcab_info_get_latch** (self, state)
- def **atcab_info_set_latch** (self, state)
- def **atcab_kdf** (self, mode, key_id, details, message, out_data, out_nonce)
- def **atcab_lock** (self, mode, summary_crc)
- def **atcab_lock_config_zone** (self)
- def **atcab_lock_config_zone_crc** (self, summary_crc)
- def **atcab_lock_data_zone** (self)
- def **atcab_lock_data_zone_crc** (self, summary_crc)
- def **atcab_lock_data_slot** (self, slot)
- def **atcab_mac** (self, mode, key_id, challenge, digest)
- def **atcab_nonce_base** (self, mode, zero, num_in, rand_out)
- def **atcab_nonce** (self, num_in)
- def **atcab_nonce_load** (self, target, num_in, num_in_size)
- def **atcab_nonce_rand** (self, num_in, rand_out)
- def **atcab_challenge** (self, num_in)
- def **atcab_challenge_seed_update** (self, num_in, rand_out)
- def **atcab_priv_write** (self, key_id, priv_key, write_key_id, write_key, num_in)

- def **atcab_random** (self, random_number)
- def **atcab_read_zone** (self, zone, slot, block, offset, data, length)
- def **atcab_read_serial_number** (self, serial_number)
- def **atcab_is_slot_locked** (self, slot, is_locked)
- def **atcab_is_locked** (self, zone, is_locked)
- def **atcab_read_enc** (self, key_id, block, data, enc_key, enc_key_id, num_in)
- def **atcab_read_config_zone** (self, config_data)
- def **atcab_cmp_config_zone** (self, config_data, same_config)
- def **atcab_read_sig** (self, slot, sig)
- def **atcab_read_pubkey** (self, slot, public_key)
- def **atcab_read_bytes_zone** (self, zone, slot, offset, data, length)
- def **atcab_secureboot** (self, mode, param2, digest, signature, mac)
- def **atcab_secureboot_mac** (self, mode, digest, signature, num_in, io_keys, is_verified)
- def **atcab_selftest** (self, mode, param2, result)
- def **atcab_sha_base** (self, mode, length, message, data_out, data_out_size)
- def **atcab_sha_start** (self)
- def **atcab_sha_update** (self, message)
- def **atcab_sha_end** (self, digest, length, message)
- def **atcab_sha_read_context** (self, context, context_size)
- def **atcab_sha_write_context** (self, context, context_size)
- def **atcab_sha** (self, length, message, digest)
- def **atcab_hw_sha2_256_init** (self, ctx)
- def **atcab_hw_sha2_256_update** (self, ctx, data, data_size)
- def **atcab_hw_sha2_256_finish** (self, ctx, digest)
- def **atcab_hw_sha2_256** (self, data, data_size, digest)
- def **atcab_sha_hmac_init** (self, ctx, key_slot)
- def **atcab_sha_hmac_update** (self, ctx, data, data_size)
- def **atcab_sha_hmac_finish** (self, ctx, digest, target)
- def **atcab_sha_hmac** (self, data, data_size, key_slot, digest, target)
- def **atcab_sign_base** (self, mode, key_id, signature)
- def **atcab_sign** (self, key_id, msg, signature)
- def **atcab_sign_internal** (self, key_id, is_invalidate, is_full_sn, signature)
- def **atcab_updateextra** (self, mode, new_value)
- def **atcab_verify** (self, mode, key_id, signature, public_key, other_data, mac)
- def **atcab_verify_extern_stored_mac** (self, mode, key_id, message, signature, public_key, num_in, io_key, is_verified)
- def **atcab_verify_extern** (self, message, signature, public_key, is_verified)
- def **atcab_verify_extern_mac** (self, message, signature, public_key, num_in, io_key, is_verified)
- def **atcab_verify_stored** (self, message, signature, key_id, is_verified)
- def **atcab_verify_stored_mac** (self, message, signature, key_id, num_in, io_key, is_verified)
- def **atcab_verify_validate** (self, key_id, signature, other_data, is_verified)
- def **atcab_verify_invalidate** (self, key_id, signature, other_data, is_verified)
- def **atcab_write** (self, zone, address, value, mac)
- def **atcab_write_zone** (self, zone, slot, block, offset, data, length)
- def **atcab_write_enc** (self, key_id, block, data, enc_key, enc_key_id, num_in)
- def **atcab_write_config_zone** (self, conf)
- def **atcab_write_pubkey** (self, slot, public_key)
- def **atcab_write_bytes_zone** (self, zone, slot, offset_bytes, data, length)
- def **atcab_write_config_counter** (self, counter_id, counter_value)
- def **atcacert_get_response** (self, device_private_key_slot, challenge, response)
- def **atcacert_read_cert** (self, cert_def, ca_public_key, cert, cert_size)
- def **atcacert_write_cert** (self, cert_def, cert, cert_size)
- def **atcacert_create_csr** (self, csr_def, csr, csr_size)
- def **atcacert_create_csr_pem** (self, csr_def, csr, csr_size)
- def **atcacert_date_enc** (self, format, timestamp, formatted_date, formatted_date_size)

- def **atcacert_date_dec** (self, format, formatted_date, formatted_date_size, timestamp)
- def **atcacert_date_enc_compcert** (self, issue_date, expire_years, enc_dates)
- def **atcacert_date_dec_compcert** (self, enc_dates, expire_date_format, issue_date, expire_date)
- def **atcacert_date_get_max_date** (self, date_format, timestamp)
- def **atcacert_max_cert_size** (self, cert_def, max_cert_size)
- def **tng_get_device_pubkey** (self, public_key)
- def **tng_atcacert_max_device_cert_size** (self, max_cert_size)
- def **tng_atcacert_read_device_cert** (self, cert, cert_size, signer_cert)
- def **tng_atcacert_device_public_key** (self, public_key, cert)
- def **tng_atcacert_max_signer_cert_size** (self, max_cert_size)
- def **tng_atcacert_read_signer_cert** (self, cert, cert_size)
- def **tng_atcacert_signer_public_key** (self, public_key, cert)
- def **tng_atcacert_root_cert_size** (self, cert_size)
- def **tng_atcacert_root_cert** (self, cert, cert_size)
- def **tng_atcacert_root_public_key** (self, public_key)
- def **sha206a_generate_derive_key** (self, parent_key, derived_key, param1, param2)
- def **sha206a_diversify_parent_key** (self, parent_key, diversified_key)
- def **sha206a_generate_challenge_response_pair** (self, key, challenge, response)
- def **sha206a_authenticate** (self, challenge, expected_response, is_verified)
- def **sha206a_write_data_store** (self, slot, data, block, offset, length, lock_after_write)
- def **sha206a_read_data_store** (self, slot, data, offset, length)
- def **sha206a_get_data_store_lock_status** (self, slot, is_locked)
- def **sha206a_get_dk_update_count** (self, dk_update_count)
- def **sha206a_get_pk_useflag_count** (self, pk_avail_count)
- def **sha206a_get_dk_useflag_count** (self, dk_avail_count)
- def **sha206a_check_pk_useflag_validity** (self, is_consumed)
- def **sha206a_check_dk_useflag_validity** (self, is_consumed)
- def **sha206a_verify_device_consumption** (self, is_consumed)

Static Public Attributes

- int **r_devtype** = 3
- create_string_buffer **r_aes_out** = create_string_buffer(16)
- **value**
- create_string_buffer **r_ciphertext** = create_string_buffer(16)
- create_string_buffer **r_plaintext** = create_string_buffer(16)
- create_string_buffer **r_aes_gfm_output** = create_string_buffer(16)
- create_string_buffer **r_aes_cmac_output** = create_string_buffer(16)
- create_string_buffer **r_aes_ctr_output** = create_string_buffer(16)
- create_string_buffer **r_iv** = create_string_buffer(16)
- create_string_buffer **r_tag** = create_string_buffer(16)
- c_uint8 **r_is_verified** = c_uint8()
- create_string_buffer **r_aes_cbcmac_output** = create_string_buffer(16)
- c_uint8 **r_tag_size** = c_uint8()
- c_uint32 **r_counter_value** = c_uint32()
- create_string_buffer **r_ecdh_pms** = create_string_buffer(32)
- create_string_buffer **r_ecdh_out_nonce** = create_string_buffer(32)
- create_string_buffer **r_genkey_pubkey** = create_string_buffer(64)
- create_string_buffer **r_hmac_digest** = create_string_buffer(32)
- create_string_buffer **r_revision** = create_string_buffer(4)
- c_uint8 **r_latch_state** = c_uint8()
- create_string_buffer **r_kdf_out_data** = create_string_buffer(64)
- create_string_buffer **r_kdf_out_nonce** = create_string_buffer(32)
- create_string_buffer **r_mac_digest** = create_string_buffer(32)

- create_string_buffer **r_nonce_rand_out** = create_string_buffer(32)
- create_string_buffer **r_rand_out** = create_string_buffer(32)
- create_string_buffer **r_read_zone_data** = create_string_buffer(32)
- create_string_buffer **r_ser_num** = create_string_buffer(9)
- c_uint8 **r_is_locked** = c_uint8()
- create_string_buffer **r_read_enc_data** = create_string_buffer(32)
- create_string_buffer **r_read_config_data** = create_string_buffer(128)
- c_uint8 **r_same_config** = c_uint8()
- create_string_buffer **r_read_sig** = create_string_buffer(64)
- create_string_buffer **r_read_pubkey** = create_string_buffer(64)
- create_string_buffer **r_read_bytes_zone_data** = create_string_buffer(64)
- create_string_buffer **r_sboot_mac** = create_string_buffer(32)
- c_uint8 **r_sboot_is_verified** = c_uint8()
- c_uint8 **r_stest_res** = c_uint8()
- create_string_buffer **r_sha_base_data** = create_string_buffer(130)
- c_uint8 **r_sha_base_data_size** = c_uint8()
- create_string_buffer **r_sha_digest** = create_string_buffer(32)
- create_string_buffer **r_sha_context_data** = create_string_buffer(130)
- c_uint8 **r_sha_context_size** = c_uint8()
- create_string_buffer **r_signature** = create_string_buffer(64)
- create_string_buffer **r_mac** = create_string_buffer(64)
- c_uint8 **r_verify_is_verified** = c_uint8()
- create_string_buffer **r_response** = create_string_buffer(64)
- c_size_t **r_cert_size** = c_size_t(64)
- create_string_buffer **r_cert** = create_string_buffer(r_cert_size.value)
- c_uint8 **r_csr_size** = c_uint8()
- create_string_buffer **r_csr** = create_string_buffer(64)
- create_string_buffer **r_formatted_date** = create_string_buffer(3)
- c_uint8 **r_formatted_date_size** = c_uint8()
- create_string_buffer **r_enc_dates** = create_string_buffer(3)
- c_size_t **r_max_cert_size** = c_size_t(123)
- c_int **r_tng_type** = c_int(1)
- create_string_buffer **r_derived_key** = create_string_buffer(32)
- create_string_buffer **r_diversified_key** = create_string_buffer(32)
- create_string_buffer **r_challenge_response** = create_string_buffer(32)
- c_uint8 **r_verify_is_locked** = c_uint8()
- c_uint8 **r_dk_update_count** = c_uint8()
- c_uint8 **r_pk_avail_count** = c_uint8()
- c_uint8 **r_dk_avail_count** = c_uint8()
- c_uint8 **r_verify_is_consumed** = c_uint8()

22.57 atcac_aes_cmac_ctx Struct Reference

Data Fields

- mbedtls_cipher_context_t **mctx**
- void ∗ **ptr**

22.58 atcac_aes_gcm_ctx Struct Reference

Data Fields

- mbedtls_cipher_context_t **mctx**

22.59 atcac_hmac_ctx Struct Reference

Data Fields

- mbedtls_md_context_t * **mctx**
- void * **ptr**

22.60 atcac_pk_ctx Struct Reference

Data Fields

- mbedtls_pk_context **mctx**
- void * **ptr**

22.61 atcac_sha1_ctx Struct Reference

Data Fields

- mbedtls_md_context_t **mctx**
- void * **ptr**

22.62 atcac_sha2_256_ctx Struct Reference

Data Fields

- void * **ptr**

22.63 atcac_sha2_384_ctx Struct Reference

Data Fields

- void * **ptr**

22.64 atcac_sha2_512_ctx Struct Reference

Data Fields

- void * **ptr**

22.65 atcac_x509_ctx Struct Reference

Data Fields

- void * **ptr**

22.66 atcacert_build_state_s Struct Reference

```
#include <lib/atcacert/atcacert_def.h>
```

Data Fields

- const atcacert_def_t * **cert_def**

  Certificate definition for the certificate being rebuilt.
- uint8_t * **cert**

  Buffer to contain the rebuilt certificate.
- size_t * **cert_size**

  Current size of the certificate in bytes.
- size_t **max_cert_size**

  Max size of the cert buffer in bytes.
- uint8_t **is_device_sn**

  Indicates the structure contains the device SN.
- ATCADeviceType **devtype**

  Device type info for the certificate being rebuilt.
- uint8_t **device_sn** [9]

  Storage for the device SN, when it's found.
- uint8_t **is_comp_cert**

  Indicates the structure contains the compressed certificate.
- uint8_t **comp_cert** [72]

  Storage for the compressed certificate when it's found.

22.66.1 Detailed Description

Tracks the state of a certificate as it's being rebuilt from device information.

22.67 atcacert_cert_element_s Struct Reference

```
#include <lib/atcacert/atcacert_def.h>
```

Data Fields

- char **id** [25]

    ID identifying this element.
- atcacert_device_loc_t **device_loc**

    Location in the device for the element.
- atcacert_cert_loc_t **cert_loc**

    Location in the certificate template for the element.
- atcacert_transform_t **transforms** [2]

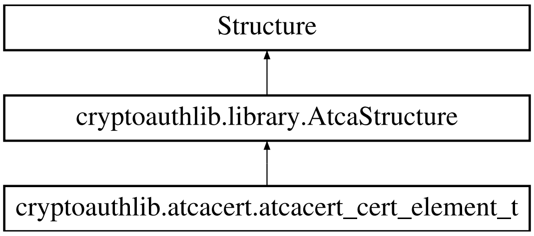
    List of transforms from device to cert for this element.

22.67.1 Detailed Description

Defines a generic dynamic element for a certificate including the device and template locations.

22.68 cryptoauthlib.atcacert.atcacert_cert_element_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_cert_element_t:



Static Protected Attributes

- int **_pack_** = 1
- dict _def_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.68.1 Detailed Description

```
CTypes mirror of atcacert_cert_element_t from atcacert_def.h
```

22.68.2 Field Documentation

22.68.2.1 _def_

```
dict cryptoauthlib.atcacert.atcacert_cert_element_t._def_  [static], [protected]
```

Initial value:

```
=  {
        'id': (c_char, 25),  # ID identifying this element.
        'device_loc': (atcacert_device_loc_t,),  # Location in the device for the element.
        'cert_loc': (atcacert_cert_loc_t,),  # Location in the certificate template for the element.
        'transforms': (atcacert_transform_t, 2)  # Transforms for converting the device data.
    }
```

22.69 atcacert_cert_loc_s Struct Reference

#include <lib/atcacert/atcacert_def.h>

Data Fields

- uint16_t **offset**

  Byte offset in the certificate template.
- uint16_t **count**

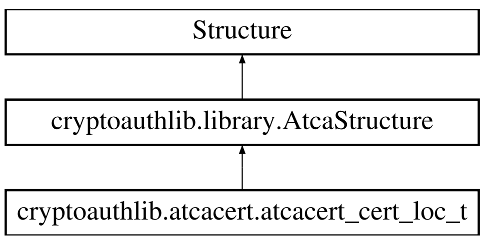
  Byte count. Set to 0 if it doesn't exist.

22.69.1 Detailed Description

Defines a chunk of data in a certificate template.

22.70 cryptoauthlib.atcacert.atcacert_cert_loc_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_cert_loc_t:



Static Protected Attributes

- int **_pack_** = 1
- list **_fields_** = [('offset', c_uint16), ('count', c_uint16)]

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

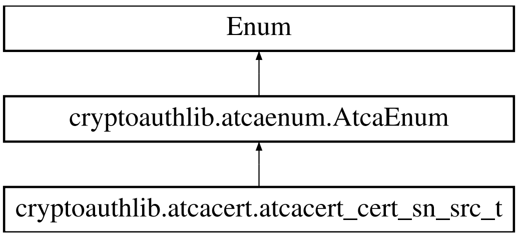
- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.70.1 Detailed Description

```
CTypes mirror of atcacert_cert_loc_t from atcacert_def.h
```

22.71 cryptoauthlib.atcacert.atcacert_cert_sn_src_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_cert_sn_src_t:



Static Public Attributes

- int **SNSRC_STORED** = 0x0
- int **SNSRC_STORED_DYNAMIC** = 0x7
- int **SNSRC_DEVICE_SN** = 0x8
- int **SNSRC_SIGNER_ID** = 0x9
- int **SNSRC_PUB_KEY_HASH** = 0xA
- int **SNSRC_DEVICE_SN_HASH** = 0xB
- int **SNSRC_PUB_KEY_HASH_POS** = 0xC
- int **SNSRC_DEVICE_SN_HASH_POS** = 0xD
- int **SNSRC_PUB_KEY_HASH_RAW** = 0xE
- int **SNSRC_DEVICE_SN_HASH_RAW** = 0xF

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

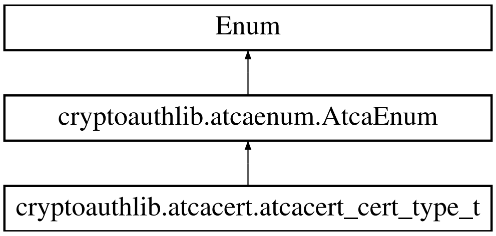
- **name**
- **value**

22.71.1 Detailed Description

```
Sources for the certificate serial number
```

22.72 cryptoauthlib.atcacert.atcacert_cert_type_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_cert_type_t:



Static Public Attributes

- int **CERTTYPE_X509** = 0
- int **CERTTYPE_CUSTOM** = 1

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

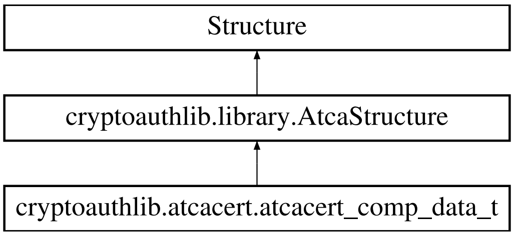
- **name**
- **value**

22.72.1 Detailed Description

```
Types of certificates
```

22.73 cryptoauthlib.atcacert.atcacert_comp_data_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_comp_data_t:



Static Protected Attributes

- int **_pack_** = 1
- int **_size_** = 72
- list _fields_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, *args, **kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, **kwargs)
- def **update_from_buffer** (self, buffer)

22.73.1 Detailed Description

```
CTypes definition of certificate signature storage which includes other certificate metadata
which is why it's often identified as "compresessed cert" for the slot in configurators
```

22.73.2 Field Documentation

22.73.2.1 _fields_

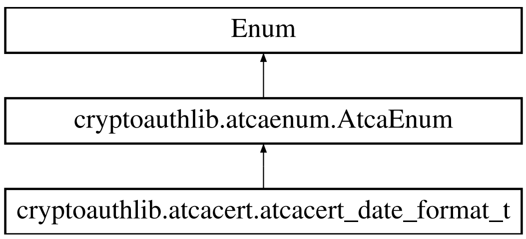
```
list cryptoauthlib.atcacert.atcacert_comp_data_t._fields_  [static], [protected]
```

Initial value:

```
=  [
        (’r’, c_uint8*32),              # P256 signature ’r’ value - big endian
        (’s’, c_uint8*32),              # P256 signature ’s’ value - big endian
        (’year’, c_uint64, 5),          # Years after 2000
        (’month’, c_uint64, 4),         # Month (0 - 11), see atcacert_tm_utc_t
        (’day’, c_uint64, 5),           # Day (1 - 31), see atcacert_tm_utc_t
        (’hour’, c_uint64, 5),          # Hour (0 - 23), see atcacert_tm_utc_t
        (’expire’, c_uint64, 5),        # Expire years (<=31)
        (’signer_id’, c_uint64, 16),    # Value used in the siging cert subject name
        (’chain_id’, c_uint64, 4),      # Revision identifier
        (’template_id’, c_uint64, 4),   # Location in a chain
        (’reserved_70_4’, c_uint64, 4), # Reserved - lower four bits of byte 70
        (’sn_source’, c_uint64, 4),     # Serial number format, see atcacert_cert_sn_src_t
        (’reserved_71_8’, c_uint64, 8)  # Reserved - byte 71
    ]
```

22.74 cryptoauthlib.atcacert.atcacert_date_format_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_date_format_t:



Static Public Attributes

- int **DATEFMT_ISO8601_SEP** = 0
- int **DATEFMT_RFC5280_UTC** = 1
- int **DATEFMT_POSIX_UINT32_BE** = 2
- int **DATEFMT_POSIX_UINT32_LE** = 3
- int **DATEFMT_RFC5280_GEN** = 4

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

- **name**
- **value**

22.74.1 Detailed Description

```
Support Date formats by the atcacert
```

22.75 atcacert_def_s Struct Reference

```
#include <lib/atcacert/atcacert_def.h>
```

Data Fields

- atcacert_cert_type_t **type**

  Certificate type.
- atcacert_device_loc_t **comp_cert_dev_loc**

  Where on the device the compressed cert can be found.
- const struct atcacert_def_s ∗ **ca_cert_def**

  Certificate definition of the CA certificate.

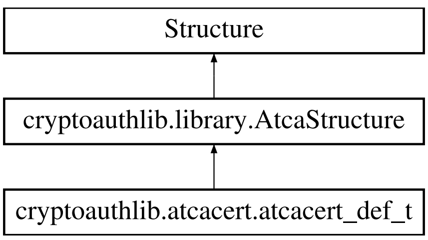
22.75.1 Detailed Description

Defines a certificate and all the pieces to work with it.

If any of the standard certificate elements (std_cert_elements) are not a part of the certificate definition, set their count to 0 to indicate their absence.

22.76 cryptoauthlib.atcacert.atcacert_def_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_def_t:



Static Protected Attributes

- **_def_**

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.76.1 Detailed Description

```
CTypes mirror of atcacert_def_t from atcacert_def.h
```

22.77 atcacert_device_loc_s Struct Reference

```
#include <lib/atcacert/atcacert_def.h>
```

Data Fields

- atcacert_device_zone_t **zone**

  Zone in the device.
- uint16_t **slot**

  Slot within the data zone. Only applies if zone is DEVZONE_DATA.
- uint8_t **is_genkey**

  If true, use GenKey command to get the contents instead of Read.
- uint16_t **offset**

  Byte offset in the zone.
- uint16_t **count**

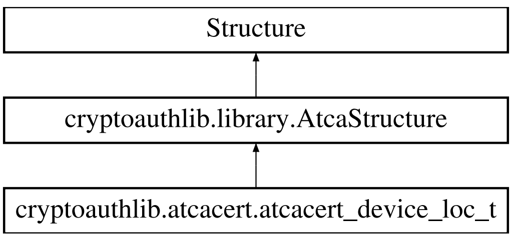
  Byte count.

22.77.1 Detailed Description

Defines a chunk of data in an ATECC device.

22.78 cryptoauthlib.atcacert.atcacert_device_loc_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_device_loc_t:



Static Protected Attributes

- int **_pack_** = 1
- dict _def_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, *args, **kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, **kwargs)
- def **update_from_buffer** (self, buffer)

22.78.1 Detailed Description

```
CTypes mirror of atcacert_device_loc_t from atcacert_def.h
```

22.78.2 Field Documentation

22.78.2.1 _def_

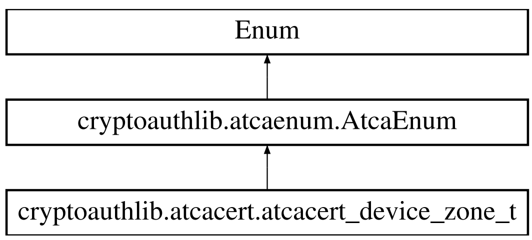
```
dict cryptoauthlib.atcacert.atcacert_device_loc_t._def_ [static], [protected]
```

Initial value:

```
= {
        'zone': (atcacert_device_zone_t,),  # Zone in the device.
        'slot': (c_uint16,),  # Slot within the data zone. Only applies if zone is DEVZONE_DATA.
        'is_genkey': (c_uint8,),  # If true, use GenKey command to get the contents instead of Read.
        'offset': (c_uint16,),  # Byte offset in the zone.
        'count': (c_uint16,)  # Byte count.
    }
```

22.79 cryptoauthlib.atcacert.atcacert_device_zone_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_device_zone_t:



Static Public Attributes

- int **DEVZONE_CONFIG** = 0x00
- int **DEVZONE_OTP** = 0x01
- int **DEVZONE_DATA** = 0x02
- int **DEVZONE_GENKEY** = 0x03,
- int **DEVZONE_NONE** = 0x07

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def __str__ (self)
- def __eq__ (self, other)
- def __ne__ (self, other)
- def __int__ (self)
- def __hash__ (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

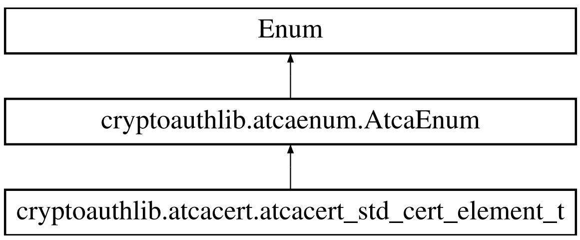
- **name**
- **value**

22.79.1 Detailed Description

```
ATECC device zones. The values match the Zone Encodings as specified in the datasheet
```

22.80 cryptoauthlib.atcacert.atcacert_std_cert_element_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_std_cert_element_t:



Static Public Attributes

- int **STDCERT_PUBLIC_KEY** = 0
- int **STDCERT_SIGNATURE** = 1
- int **STDCERT_ISSUE_DATE** = 2
- int **STDCERT_EXPIRE_DATE** = 3
- int **STDCERT_SIGNER_ID** = 4
- int **STDCERT_CERT_SN** = 5
- int **STDCERT_AUTH_KEY_ID** = 6
- int **STDCERT_SUBJ_KEY_ID** = 7

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def __str__ (self)
- def __eq__ (self, other)
- def __ne__ (self, other)
- def __int__ (self)
- def __hash__ (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

- **name**
- **value**

22.80.1 Detailed Description

```
Standard dynamic certificate elements
```

22.81 atcacert_tm_utc_s Struct Reference

```
#include <lib/atcacert/atcacert_date.h>
```

Data Fields

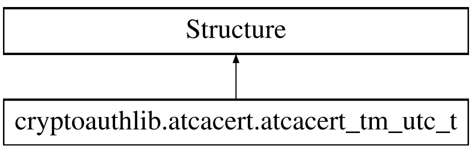
- int **tm_sec**
- int **tm_min**
- int **tm_hour**
- int **tm_mday**
- int **tm_mon**
- int **tm_year**

22.81.1 Detailed Description

Holds a broken-down date in UTC. Mimics atcacert_tm_utc_t from time.h.

22.82 cryptoauthlib.atcacert.atcacert_tm_utc_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_tm_utc_t:



Public Member Functions

- def **__init__** (self, ∗args, ∗∗kwargs)

Static Protected Attributes

- list _fields_

22.82.1 Detailed Description

```
CTypes mirror of atcacert_tm_utc_t from atcacert_date.h which mimics the posix time structure
```

22.82.2 Field Documentation

22.82.2.1 _fields_

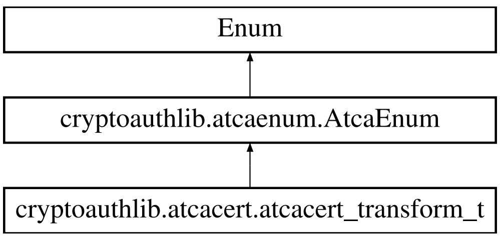
```
list cryptoauthlib.atcacert.atcacert_tm_utc_t._fields_ [static], [protected]
```

Initial value:

```
=  [
        ('tm_sec', c_int),    # 0 to 59
        ('tm_min', c_int),    # 0 to 59
        ('tm_hour', c_int),   # 0 to 23
        ('tm_mday', c_int),   # 1 to 31
        ('tm_mon', c_int),    # 0 to 11
        ('tm_year', c_int),   # years since 1900
    ]
```

22.83 cryptoauthlib.atcacert.atcacert_transform_t Class Reference

Inheritance diagram for cryptoauthlib.atcacert.atcacert_transform_t:



Static Public Attributes

- int **TF_NONE** = 0x00
- int **TF_REVERSE** = 0x01
- int **TF_BIN2HEX_UC** = 0x02
- int **TF_BIN2HEX_LC** = 0x03
- int **TF_HEX2BIN_UC** = 0x04
- int **TF_HEX2BIN_LC** = 0x05
- int **TF_BIN2HEX_SPACE_UC** = 0x06
- int **TF_BIN2HEX_SPACE_LC** = 0x07
- int **TF_HEX2BIN_SPACE_UC** = 0x08
- int **TF_HEX2BIN_SPACE_LC** = 0x09

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

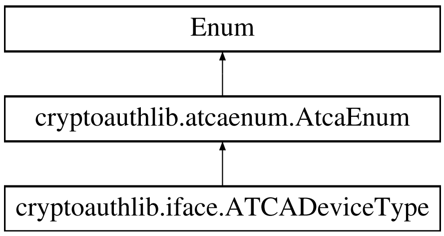
- **name**
- **value**

22.83.1 Detailed Description

```
Transforms for converting the device data.
```

22.84 cryptoauthlib.iface.ATCADeviceType Class Reference

Inheritance diagram for cryptoauthlib.iface.ATCADeviceType:



Static Public Attributes

- int **ATSHA204A** = 0
- int **ATECC108A** = 1
- int **ATECC508A** = 2
- int **ATECC608A** = 3
- int **ATECC608B** = 3
- int **ATECC608** = 3
- int **ATSHA206A** = 4
- int **TA100** = 0x10
- int **TA101** = 0x11
- int **ECC204** = 0x20
- int **TA010** = 0x21
- int **ECC206** = 0x22
- int **RNG90** = 0x23
- int **SHA104** = 0x24
- int **SHA105** = 0x25
- int **SHA106** = 0x26
- int **ATCA_DEV_UNKNOWN** = 0x7E
- int **ATCA_DEV_INVALID** = 0x7F

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

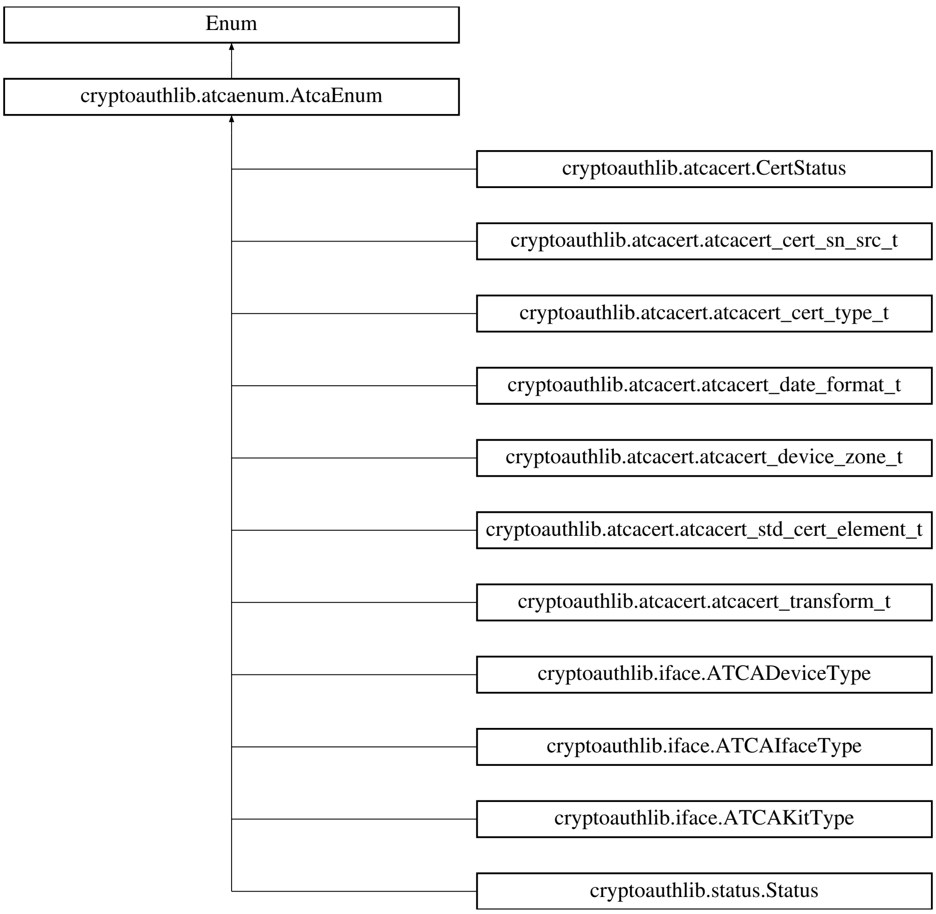
- **name**
- **value**

22.84.1 Detailed Description

```
Device Type Enumeration from atca_devtypes.h
```

22.85 cryptoauthlib.atcaenum.AtcaEnum Class Reference

Inheritance diagram for cryptoauthlib.atcaenum.AtcaEnum:



Public Member Functions

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields

- **name**
- **value**

22.85.1 Detailed Description

```
Overload of standard python enum for some additional convenience features. Assumes closer alignment to C style
where the value is always an integer
```

22.86 ATCAHAL_t Struct Reference

HAL Driver Structure.

`#include <lib/atca_iface.h>`

Data Fields

- ATCA_STATUS(∗ **halinit**)(ATCAIface iface, ATCAIfaceCfg ∗cfg)
- ATCA_STATUS(∗ **halpostinit**)(ATCAIface iface)
- ATCA_STATUS(∗ **halsend**)(ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)
- ATCA_STATUS(∗ **halreceive**)(ATCAIface iface, uint8_t word_address, uint8_t ∗rxdata, uint16_t ∗rxlength)
- ATCA_STATUS(∗ **halcontrol**)(ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)
- ATCA_STATUS(∗ **halrelease**)(void ∗hal_data)

22.86.1 Detailed Description

HAL Driver Structure.

22.87 atcaI2Cmaster Struct Reference

this is the hal_data for ATCA HAL for ASF SERCOM

`#include <lib/hal/hal_uc3_i2c_asf.h>`

Data Fields

- int **id**
- i2c_config_t **conf**
- int **ref_ct**
- uint8_t **twi_id**
- avr32_twi_t ∗ **twi_master_instance**
- int **bus_index**

22.87.1 Detailed Description

this is the hal_data for ATCA HAL for ASF SERCOM

22.88 ATCAIfaceCfg Struct Reference

Data Fields

- ATCAIfaceType **iface_type**
- ATCADeviceType **devtype**
-

```
union {
  struct {
    uint8_t address
    uint8_t bus
    uint32_t baud
  } atcai2c
  struct {
    uint8_t address
    uint8_t bus
  } atcaswi
  struct {
    uint8_t bus
    uint8_t select_pin
    uint32_t baud
  } atcaspi
  struct {
    ATCAKitType dev_interface
    uint8_t dev_identity
    uint8_t port
    uint32_t baud
    uint8_t wordsize
    uint8_t parity
    uint8_t stopbits
  } atcauart
  struct {
    int idx
    ATCAKitType dev_interface
    uint8_t dev_identity
    uint32_t vid
    uint32_t pid
    uint32_t packetsize
  } atcahid
  struct {
```

ATCAKitType **dev_interface**
uint8_t **dev_identity**
uint32_t **flags**
} **atcakit**
struct {
ATCA_STATUS(∗ **halinit**)(void ∗hal, void ∗cfg)
ATCA_STATUS(∗ **halpostinit**)(void ∗iface)
ATCA_STATUS(∗ **halsend**)(void ∗iface, uint8_t
word_address, uint8_t ∗txdata,
int txlength)
ATCA_STATUS(∗ **halreceive**)(void ∗iface, uint8_t
word_address, uint8_t ∗rxdata,
uint16_t ∗rxlength)
ATCA_STATUS(∗ **halwake**)(void ∗iface)
ATCA_STATUS(∗ **halidle**)(void ∗iface)
ATCA_STATUS(∗ **halsleep**)(void ∗iface)
ATCA_STATUS(∗ **halrelease**)(void ∗hal_data)
} **atcacustom**
} **cfg**

- uint16_t **wake_delay**
- int **rx_retries**
- void ∗ **cfg_data**

22.88.1 Field Documentation

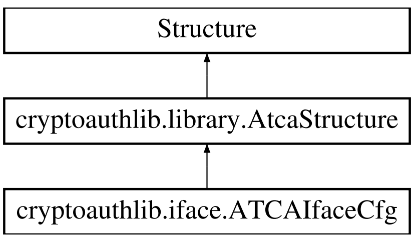
22.88.1.1 address

`uint8_t ATCAIfaceCfg::address`

Device address - the upper 7 bits are the I2c address bits

22.89 cryptoauthlib.iface.ATCAIfaceCfg Class Reference

Inheritance diagram for cryptoauthlib.iface.ATCAIfaceCfg:



Static Protected Attributes

- tuple **_anonymous_** = ('cfg',)
- dict _map_
- dict _def_

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, *args, **kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, **kwargs)
- def **update_from_buffer** (self, buffer)

22.89.1 Detailed Description

```
Interface configuration structure used by atcab_init()
```

22.89.2 Field Documentation

22.89.2.1 _def_

`dict cryptoauthlib.iface.ATCAIfaceCfg._def_ [static], [protected]`

Initial value:

```
= {
        'iface_type': (ATCAIfaceType,),
        'devtype': (ATCADeviceType,),
        'cfg': (_ATCAIfaceParams,),
        'wake_delay': (c_uint16,),
        'rx_retries': (c_int,),
        'cfg_data': (c_void_p,)
    }
```

22.89.2.2 _map_

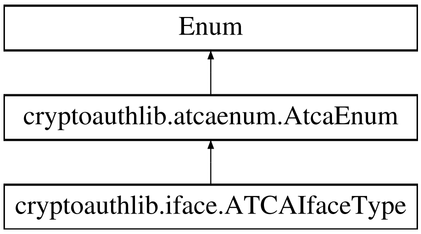
`dict cryptoauthlib.iface.ATCAIfaceCfg._map_ [static], [protected]`

Initial value:

```
= {
        'cfg': ('iface_type', {
            ATCAIfaceType.ATCA_I2C_IFACE: 'atcai2c',
            ATCAIfaceType.ATCA_SWI_IFACE: 'atcaswi',
            ATCAIfaceType.ATCA_UART_IFACE:'atcauart',
            ATCAIfaceType.ATCA_SPI_IFACE: 'atcaspi',
            ATCAIfaceType.ATCA_HID_IFACE: 'atcahid',
            ATCAIfaceType.ATCA_KIT_IFACE: 'atcakit',
            ATCAIfaceType.ATCA_CUSTOM_IFACE: 'atcacustom'
        })
    }
```

22.90 cryptoauthlib.iface.ATCAIfaceType Class Reference

Inheritance diagram for cryptoauthlib.iface.ATCAIfaceType:



Static Public Attributes

- int **ATCA_I2C_IFACE** = 0
- int **ATCA_SWI_IFACE** = 1
- int **ATCA_UART_IFACE** = 2
- int **ATCA_SPI_IFACE** = 3
- int **ATCA_HID_IFACE** = 4
- int **ATCA_KIT_IFACE** = 5
- int **ATCA_CUSTOM_IFACE** = 6
- int **ATCA_I2C_GPIO_IFACE** = 7
- int **ATCA_SWI_GPIO_IFACE** = 8
- int **ATCA_SPI_GPIO_IFACE** = 9
- int **ATCA_UNKNOWN_IFACE** = 0xFE

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

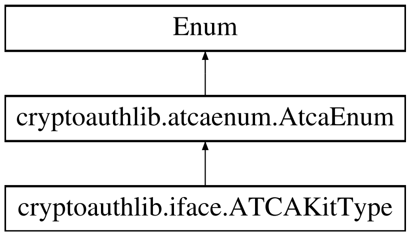
- **name**
- **value**

22.90.1 Detailed Description

```
Interface Type Enumerations from atca_iface.h
```

22.91 cryptoauthlib.iface.ATCAKitType Class Reference

Inheritance diagram for cryptoauthlib.iface.ATCAKitType:



Static Public Attributes

- int **ATCA_KIT_AUTO_IFACE** = 0
- int **ATCA_KIT_I2C_IFACE** = 1
- int **ATCA_KIT_SWI_IFACE** = 2
- int **ATCA_KIT_SPI_IFACE** = 3
- int **ATCA_KIT_UNKNOWN_IFACE** = 4

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def __**str**__ (self)
- def __**eq**__ (self, other)
- def __**ne**__ (self, other)
- def __**int**__ (self)
- def __**hash**__ (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

- **name**
- **value**

22.91.1 Detailed Description

```
Interface Type Enumerations for Kit devices
```

22.92 ATCAPacket Struct Reference

Data Fields

- uint8_t **reserved**
- uint8_t **txsize**
- uint8_t **opcode**
- uint8_t **param1**
- uint16_t **param2**
- uint8_t **data** [((198u)) - 6]
- uint8_t **execTime**

22.93 cryptoauthlib.library.AtcaReference Class Reference

Public Member Functions

- def __init__ (self, value)
- def __eq__ (self, other)
- def __ne__ (self, other)
- def __lt__ (self, other)
- def __le__ (self, other)
- def __gt__ (self, other)
- def __ge__ (self, other)
- def __int__ (self)
- def __str__ (self)

Data Fields

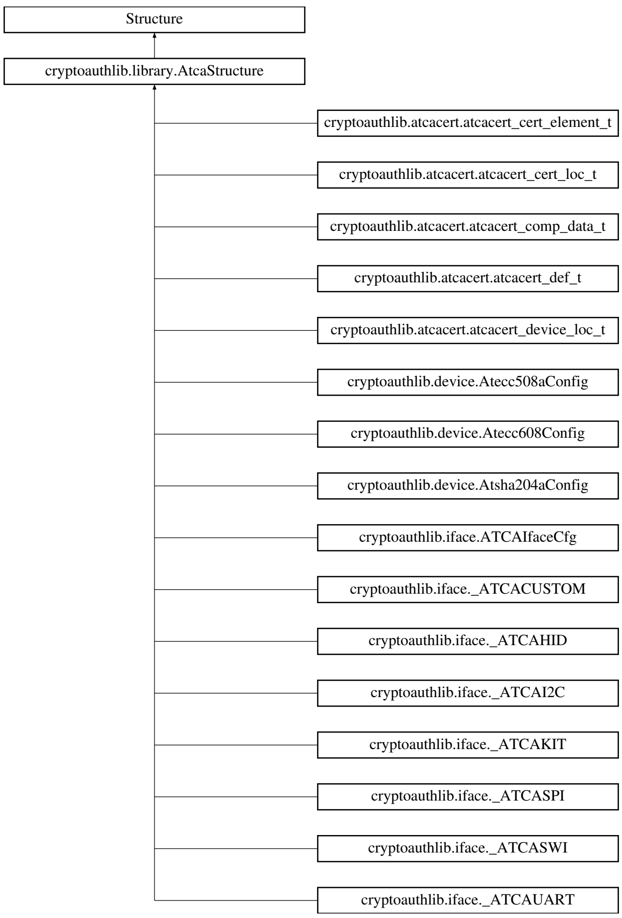
- **value**

22.93.1 Detailed Description

```
A simple wrapper to pass an immutable type to a function for return
```

22.94 cryptoauthlib.library.AtcaStructure Class Reference

Inheritance diagram for cryptoauthlib.library.AtcaStructure:



Public Member Functions

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.94.1 Detailed Description

```
An extended ctypes structure to accept complex inputs
```

22.94.2 Member Function Documentation

22.94.2.1 check_rationality()

```
def cryptoauthlib.library.AtcaStructure.check_rationality (
              cls )
```

```
Perform a rationality check on the structure definition against the expected definition by
checking structure sizes between the compiled library and the python library
```

22.94.2.2 from_definition()

```
def cryptoauthlib.library.AtcaStructure.from_definition (
              cls )
```

```
Trigger _field_ creation from the values provided in _def_ - must be run before the class
is instantiated
```

22.95 atcaSWImaster Struct Reference

this is the hal_data for ATCA HAL for ASF SERCOM

```
#include <lib/hal/swi_uart_start.h>
```

Data Fields

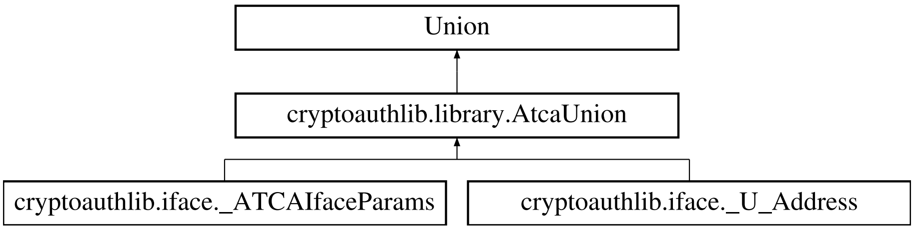
- struct usart_module **usart_instance**
- int **ref_ct**
- int **bus_index**
- struct usart_sync_descriptor **USART_SWI**
- uint32_t **sercom_core_freq**

22.95.1 Detailed Description

this is the hal_data for ATCA HAL for ASF SERCOM

22.96 cryptoauthlib.library.AtcaUnion Class Reference

Inheritance diagram for cryptoauthlib.library.AtcaUnion:



Public Member Functions

- def **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

Protected Attributes

- **_selected**

22.96.1 Detailed Description

```
An extended ctypes structure to accept complex inputs
```

22.96.2 Member Function Documentation

22.96.2.1 check_rationality()

```
def cryptoauthlib.library.AtcaUnion.check_rationality (
             cls )
```

```
Perform a rationality check on the structure definition against the expected definition by
checking structure sizes between the compiled library and the python library
```

22.96.2.2 from_definition()

```
def cryptoauthlib.library.AtcaUnion.from_definition (
             cls )
```

```
Trigger _field_ creation from the values provided in _def_ - must be run before the class
is instantiated
```

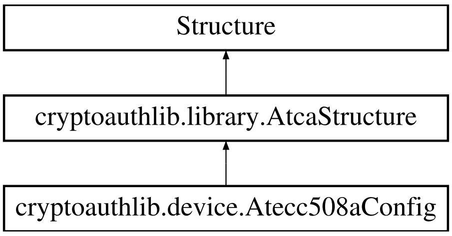
22.97 atecc508a_config_s Struct Reference

Data Fields

- uint32_t **SN03**
- uint32_t **RevNum**
- uint32_t **SN47**
- uint8_t **SN8**
- uint8_t **Reserved0**
- uint8_t **I2C_Enable**
- uint8_t **Reserved1**
- uint8_t **I2C_Address**
- uint8_t **Reserved2**
- uint8_t **OTPmode**
- uint8_t **ChipMode**
- uint16_t **SlotConfig** [16]
- uint8_t **Counter0** [8]
- uint8_t **Counter1** [8]
- uint8_t **LastKeyUse** [16]
- uint8_t **UserExtra**
- uint8_t **Selector**
- uint8_t **LockValue**
- uint8_t **LockConfig**
- uint16_t **SlotLocked**
- uint16_t **RFU**
- uint32_t **X509format**
- uint16_t **KeyConfig** [16]

22.98 cryptoauthlib.device.Atecc508aConfig Class Reference

Inheritance diagram for cryptoauthlib.device.Atecc508aConfig:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.98.1 Detailed Description

```
ATECC508A Config Zone Definition
```

22.98.2 Field Documentation

22.98.2.1 _fields_

```
list cryptoauthlib.device.Atecc508aConfig._fields_  [static], [protected]
```

Initial value:

```
=  [('SN03', c_uint8*4),
                ('RevNum', c_uint8*4),
                ('SN48', c_uint8*5),
                ('Reserved13', c_uint8),
                ('I2C_Enable', I2cEnable),
                ('Reserved15', c_uint8),
                ('I2C_Address', c_uint8),
                ('Reserved17', c_uint8),
                ('OTPmode', c_uint8),
                ('ChipMode', ChipMode508),
                ('SlotConfig', SlotConfig*16),
                ('Counter0', c_uint8*8),
                ('Counter1', c_uint8*8),
                ('LastKeyUse', c_uint8*16),
                ('UserExtra', c_uint8),
                ('Selector', c_uint8),
                ('LockValue', c_uint8),
                ('LockConfig', c_uint8),
                ('SlotLocked', c_uint16),
                ('RFU', c_uint16),
                ('X509format', X509Format*4),
                ('KeyConfig', KeyConfig*16)]
```

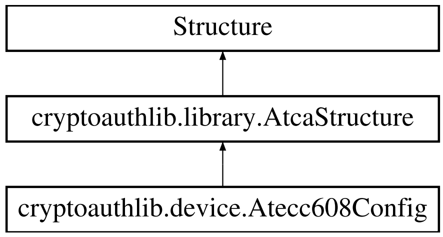
22.99 atecc608_config_s Struct Reference

Data Fields

- uint32_t **SN03**
- uint32_t **RevNum**
- uint32_t **SN47**
- uint8_t **SN8**
- uint8_t **AES_Enable**
- uint8_t **I2C_Enable**
- uint8_t **Reserved1**
- uint8_t **I2C_Address**
- uint8_t **Reserved2**
- uint8_t **CountMatch**
- uint8_t **ChipMode**
- uint16_t **SlotConfig** [16]
- uint8_t **Counter0** [8]
- uint8_t **Counter1** [8]
- uint8_t **UseLock**
- uint8_t **VolatileKeyPermission**
- uint16_t **SecureBoot**
- uint8_t **KdflvLoc**
- uint16_t **KdflvStr**
- uint8_t **Reserved3** [9]
- uint8_t **UserExtra**
- uint8_t **UserExtraAdd**
- uint8_t **LockValue**
- uint8_t **LockConfig**
- uint16_t **SlotLocked**
- uint16_t **ChipOptions**
- uint32_t **X509format**
- uint16_t **KeyConfig** [16]

22.100 cryptoauthlib.device.Atecc608Config Class Reference

Inheritance diagram for cryptoauthlib.device.Atecc608Config:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.100.1 Detailed Description

```
ATECC608 Config Zone Definition
```

22.100.2 Field Documentation

22.100.2.1 _fields_

```
list cryptoauthlib.device.Atecc608Config._fields_ [static], [protected]
```

Initial value:
```
=  [('SN03', c_uint8*4),
                ('RevNum', c_uint8*4),
                ('SN48', c_uint8*5),
                ('AES_Enable', AesEnable),
                ('I2C_Enable', I2cEnable),
                ('Reserved15', c_uint8),
                ('I2C_Address', c_uint8),
                ('Reserved17', c_uint8),
                ('CountMatch', CountMatch),
                ('ChipMode', ChipMode608),
                ('SlotConfig', SlotConfig*16),
                ('Counter0', c_uint8*8),
                ('Counter1', c_uint8*8),
                ('UseLock', UseLock),
                ('VolatileKeyPermission', VolatileKeyPermission),
                ('SecureBoot', SecureBoot),
                ('KdfIvLoc', c_uint8),
                ('KdfIvStr', c_uint8*2),
                ('Reserved68', c_uint8*9),
                ('UserExtra', c_uint8),
                ('UserExtraAdd', c_uint8),
                ('LockValue', c_uint8),
                ('LockConfig', c_uint8),
                ('SlotLocked', c_uint16),
                ('ChipOptions', ChipOptions),
                ('X509format', X509Format*4),
                ('KeyConfig', KeyConfig*16)]
```

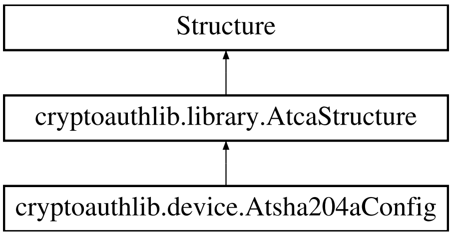
22.101 atsha204a_config_s Struct Reference

Data Fields

- uint32_t **SN03**
- uint32_t **RevNum**
- uint32_t **SN47**
- uint8_t **SN8**
- uint8_t **Reserved0**
- uint8_t **I2C_Enable**
- uint8_t **Reserved1**
- uint8_t **I2C_Address**
- uint8_t **Reserved2**
- uint8_t **OTPmode**
- uint8_t **ChipMode**
- uint16_t **SlotConfig** [16]
- uint16_t **Counter** [8]
- uint8_t **LastKeyUse** [16]
- uint8_t **UserExtra**
- uint8_t **Selector**
- uint8_t **LockValue**
- uint8_t **LockConfig**

22.102 cryptoauthlib.device.Atsha204aConfig Class Reference

Inheritance diagram for cryptoauthlib.device.Atsha204aConfig:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.library.AtcaStructure

- None **__init__** (self, ∗args, ∗∗kwargs)
- def from_definition (cls)
- def check_rationality (cls)
- def **get_field_definition** (cls, str name)
- Any **__getattribute__** (self, str name)
- def **__iter__** (self)
- def **__str__** (self)
- def **to_c_code** (self, name=None, ∗∗kwargs)
- def **update_from_buffer** (self, buffer)

22.102.1 Detailed Description

```
ATSHA204A Config Zone Definition
```

22.102.2 Field Documentation

22.102.2.1 _fields_

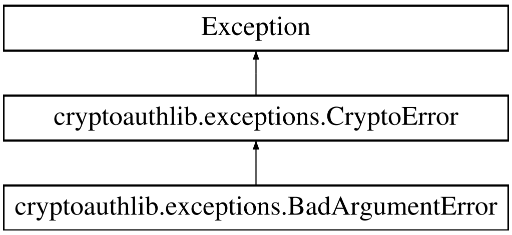
```
list cryptoauthlib.device.Atsha204aConfig._fields_ [static], [protected]
```

Initial value:

```
=  [('SN03', c_uint8*4),
                ('RevNum', c_uint8*4),
                ('SN48', c_uint8*5),
                ('Reserved13', c_uint8),
                ('I2C_Enable', I2cEnable),
                ('Reserved15', c_uint8),
                ('I2C_Address', c_uint8),
                ('CheckMacConfig', c_uint8),
                ('OTPmode', c_uint8),
                ('SelectorMode', c_uint8),
                ('SlotConfig', SlotConfig*16),
                ('Counter', Counter204*8),
                ('LastKeyUse', c_uint8*16),
                ('UserExtra', c_uint8),
                ('Selector', c_uint8),
                ('LockValue', c_uint8),
                ('LockConfig', c_uint8)]
```

22.103 cryptoauthlib.exceptions.BadArgumentError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.BadArgumentError:

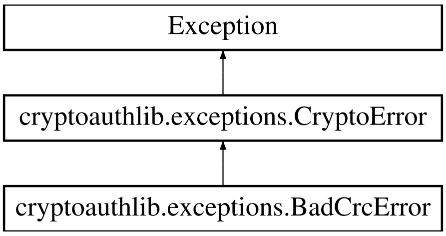


22.103.1 Detailed Description

```
bad argument (out of range, null pointer, etc.)
```

22.104 cryptoauthlib.exceptions.BadCrcError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.BadCrcError:

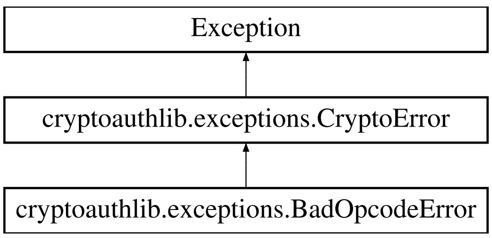


22.104.1 Detailed Description

```
incorrect CRC received
```

22.105 cryptoauthlib.exceptions.BadOpcodeError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.BadOpcodeError:

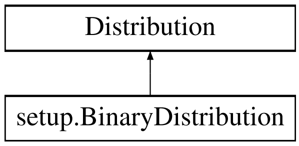


22.105.1 Detailed Description

```
Opcode is not supported by the device
```

22.106 setup.BinaryDistribution Class Reference

Inheritance diagram for setup.BinaryDistribution:



Public Member Functions

- def **has_ext_modules** (self)

22.107 cal_buffer_s Struct Reference

Data Fields

- size_t len
- uint8_t * buf

22.107.1 Field Documentation

22.107.1.1 buf

```
uint8_t* cal_buffer_s::buf
```

Pointer to the actual buffer

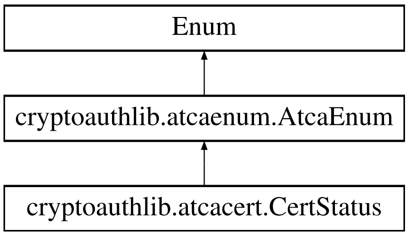
22.107.1.2 len

```
size_t cal_buffer_s::len
```

Length of the provided buffer

22.108 cryptoauthlib.atcacert.CertStatus Class Reference

Inheritance diagram for cryptoauthlib.atcacert.CertStatus:



Static Public Attributes

- int **ATCACERT_E_SUCCESS** = 0
- int **ATCACERT_E_ERROR** = 1
- int **ATCACERT_E_BAD_PARAMS** = 2
- int **ATCACERT_E_BUFFER_TOO_SMALL** = 3
- int **ATCACERT_E_DECODING_ERROR** = 4
- int **ATCACERT_E_INVALID_DATE** = 5
- int **ATCACERT_E_UNIMPLEMENTED** = 6
- int **ATCACERT_E_UNEXPECTED_ELEM_SIZE** = 7
- int **ATCACERT_E_ELEM_MISSING** = 8
- int **ATCACERT_E_ELEM_OUT_OF_BOUNDS** = 9
- int **ATCACERT_E_BAD_CERT** = 10
- int **ATCACERT_E_WRONG_CERT_DEF** = 11
- int **ATCACERT_E_VERIFY_FAILED** = 12

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def __**str**__ (self)
- def __**eq**__ (self, other)
- def __**ne**__ (self, other)
- def __**int**__ (self)
- def __**hash**__ (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

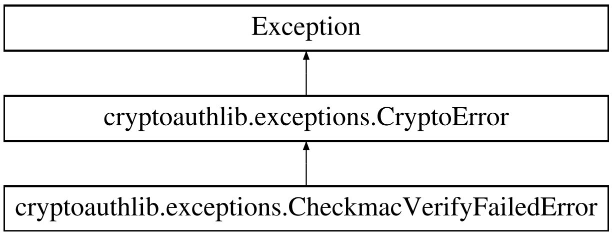
- **name**
- **value**

22.108.1 Detailed Description

```
Status codes returned from atcacert commands and their meanings. From atcacert.h
```

22.109 cryptoauthlib.exceptions.CheckmacVerifyFailedError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.CheckmacVerifyFailedError:

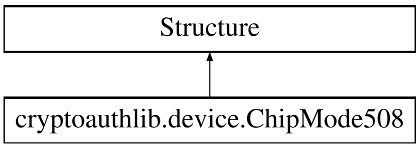


22.109.1 Detailed Description

```
response status byte indicates CheckMac failure (status byte = 0x01)
```

22.110 cryptoauthlib.device.ChipMode508 Class Reference

Inheritance diagram for cryptoauthlib.device.ChipMode508:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.110.1 Detailed Description

```
ChipMode for 508 Field Definition
```

22.110.2 Field Documentation

22.110.2.1 _fields_

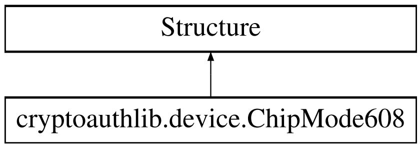
```
list cryptoauthlib.device.ChipMode508._fields_  [static], [protected]
```

Initial value:

```
=  [('UserExtraAdd', c_uint8, 1),
              ('TTLenable', c_uint8, 1),
              ('WatchdogDuration', c_uint8, 1)]
```

22.111 cryptoauthlib.device.ChipMode608 Class Reference

Inheritance diagram for cryptoauthlib.device.ChipMode608:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.111.1 Detailed Description

```
ChipMode for 608 Field Definition
```

22.111.2 Field Documentation

22.111.2.1 _fields_

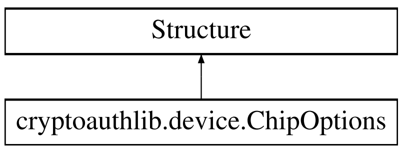
```
list cryptoauthlib.device.ChipMode608._fields_  [static], [protected]
```

Initial value:

```
=  [('UserExtraAdd', c_uint8, 1),
                 ('TTLenable', c_uint8, 1),
                 ('WatchdogDuration', c_uint8, 1),
                 ('ClockDivider', c_uint8, 5)]
```

22.112 cryptoauthlib.device.ChipOptions Class Reference

Inheritance diagram for cryptoauthlib.device.ChipOptions:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.112.1 Detailed Description

ChipOptions Field Definition

22.112.2 Field Documentation

22.112.2.1 _fields_

list cryptoauthlib.device.ChipOptions._fields_ [static], [protected]

Initial value:

```
=  [('PowerOnSelfTest', c_uint16, 1),
                ('IoProtectionKeyEnable', c_uint16, 1),
                ('KdfAesEnable', c_uint16, 1),
                ('AutoClearFirstFail', c_uint16, 1),
                ('Reserved', c_uint16, 4),
                ('EcdhProtectionBits', c_uint16, 2),
                ('KdfProtectionBits', c_uint16, 2),
                ('IoProtectionKey', c_uint16, 4)]
```

22.113 CK_AES_CBC_ENCRYPT_DATA_PARAMS Struct Reference

Data Fields

- CK_BYTE **iv** [16]
- CK_BYTE_PTR **pData**
- CK_ULONG **length**

22.114 CK_AES_CCM_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulDataLen**
- CK_BYTE_PTR **pNonce**
- CK_ULONG **ulNonceLen**
- CK_BYTE_PTR **pAAD**
- CK_ULONG **ulAADLen**
- CK_ULONG **ulMACLen**

22.115 CK_AES_CTR_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulCounterBits**
- CK_BYTE **cb** [16]

22.116 CK_AES_GCM_PARAMS Struct Reference

Data Fields

- CK_BYTE_PTR **pIv**
- CK_ULONG **ulIvLen**
- CK_ULONG **ulIvBits**
- CK_BYTE_PTR **pAAD**
- CK_ULONG **ulAADLen**
- CK_ULONG **ulTagBits**

22.117 CK_ARIA_CBC_ENCRYPT_DATA_PARAMS Struct Reference

Data Fields

- CK_BYTE **iv** [16]
- CK_BYTE_PTR **pData**
- CK_ULONG **length**

22.118 CK_ATTRIBUTE Struct Reference

Data Fields

- CK_ATTRIBUTE_TYPE **type**
- CK_VOID_PTR **pValue**
- CK_ULONG **ulValueLen**

22.119 CK_C_INITIALIZE_ARGS Struct Reference

Data Fields

- CK_CREATEMUTEX **CreateMutex**
- CK_DESTROYMUTEX **DestroyMutex**
- CK_LOCKMUTEX **LockMutex**
- CK_UNLOCKMUTEX **UnlockMutex**
- CK_FLAGS **flags**
- CK_VOID_PTR **pReserved**

22.120 CK_CAMELLIA_CBC_ENCRYPT_DATA_PARAMS Struct Reference

Data Fields

- CK_BYTE **iv** [16]
- CK_BYTE_PTR **pData**
- CK_ULONG **length**

22.121 CK_CAMELLIA_CTR_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulCounterBits**
- CK_BYTE **cb** [16]

22.122 CK_CCM_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulDataLen**
- CK_BYTE_PTR **pNonce**
- CK_ULONG **ulNonceLen**
- CK_BYTE_PTR **pAAD**
- CK_ULONG **ulAADLen**
- CK_ULONG **ulMACLen**

22.123 CK_CMS_SIG_PARAMS Struct Reference

Data Fields

- CK_OBJECT_HANDLE **certificateHandle**
- CK_MECHANISM_PTR **pSigningMechanism**
- CK_MECHANISM_PTR **pDigestMechanism**
- CK_UTF8CHAR_PTR **pContentType**
- CK_BYTE_PTR **pRequestedAttributes**
- CK_ULONG **ulRequestedAttributesLen**
- CK_BYTE_PTR **pRequiredAttributes**
- CK_ULONG **ulRequiredAttributesLen**

22.124 CK_DATE Struct Reference

Data Fields

- CK_CHAR **year** [4]
- CK_CHAR **month** [2]
- CK_CHAR **day** [2]

22.125 CK_DES_CBC_ENCRYPT_DATA_PARAMS Struct Reference

Data Fields

- CK_BYTE **iv** [8]
- CK_BYTE_PTR **pData**
- CK_ULONG **length**

22.126 CK_DSA_PARAMETER_GEN_PARAM Struct Reference

Data Fields

- CK_MECHANISM_TYPE **hash**
- CK_BYTE_PTR **pSeed**
- CK_ULONG **ulSeedLen**
- CK_ULONG **ulIndex**

22.127 CK_ECDH1_DERIVE_PARAMS Struct Reference

Data Fields

- CK_EC_KDF_TYPE **kdf**
- CK_ULONG **ulSharedDataLen**
- CK_BYTE_PTR **pSharedData**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**

22.128 CK_ECDH2_DERIVE_PARAMS Struct Reference

Data Fields

- CK_EC_KDF_TYPE **kdf**
- CK_ULONG **ulSharedDataLen**
- CK_BYTE_PTR **pSharedData**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**
- CK_ULONG **ulPrivateDataLen**
- CK_OBJECT_HANDLE **hPrivateData**
- CK_ULONG **ulPublicDataLen2**
- CK_BYTE_PTR **pPublicData2**

22.129 CK_ECDH_AES_KEY_WRAP_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulAESKeyBits**
- CK_EC_KDF_TYPE **kdf**
- CK_ULONG **ulSharedDataLen**
- CK_BYTE_PTR **pSharedData**

22.130 CK_ECMQV_DERIVE_PARAMS Struct Reference

Data Fields

- CK_EC_KDF_TYPE **kdf**
- CK_ULONG **ulSharedDataLen**
- CK_BYTE_PTR **pSharedData**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**
- CK_ULONG **ulPrivateDataLen**
- CK_OBJECT_HANDLE **hPrivateData**
- CK_ULONG **ulPublicDataLen2**
- CK_BYTE_PTR **pPublicData2**
- CK_OBJECT_HANDLE **publicKey**

22.131 CK_FUNCTION_LIST Struct Reference

Data Fields

- CK_VERSION **version**

22.132 CK_GCM_PARAMS Struct Reference

Data Fields

- CK_BYTE_PTR **pIv**
- CK_ULONG **ulIvLen**
- CK_ULONG **ulIvBits**
- CK_BYTE_PTR **pAAD**
- CK_ULONG **ulAADLen**
- CK_ULONG **ulTagBits**

22.133 CK_GOSTR3410_DERIVE_PARAMS Struct Reference

Data Fields

- CK_EC_KDF_TYPE **kdf**
- CK_BYTE_PTR **pPublicData**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pUKM**
- CK_ULONG **ulUKMLen**

22.134 CK_GOSTR3410_KEY_WRAP_PARAMS Struct Reference

Data Fields

- CK_BYTE_PTR **pWrapOID**
- CK_ULONG **ulWrapOIDLen**
- CK_BYTE_PTR **pUKM**
- CK_ULONG **ulUKMLen**
- CK_OBJECT_HANDLE **hKey**

22.135 CK_INFO Struct Reference

Data Fields

- CK_VERSION **cryptokiVersion**
- CK_UTF8CHAR **manufacturerID** [32]
- CK_FLAGS **flags**
- CK_UTF8CHAR **libraryDescription** [32]
- CK_VERSION **libraryVersion**

22.136 CK_KEA_DERIVE_PARAMS Struct Reference

Data Fields

- CK_BBOOL **isSender**
- CK_ULONG **ulRandomLen**
- CK_BYTE_PTR **pRandomA**
- CK_BYTE_PTR **pRandomB**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**

22.137 CK_KEY_DERIVATION_STRING_DATA Struct Reference

Data Fields

- CK_BYTE_PTR **pData**
- CK_ULONG **ulLen**

22.138 CK_KEY_WRAP_SET_OAEP_PARAMS Struct Reference

Data Fields

- CK_BYTE **bBC**
- CK_BYTE_PTR **pX**
- CK_ULONG **ulXLen**

22.139 CK_KIP_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_PTR **pMechanism**
- CK_OBJECT_HANDLE **hKey**
- CK_BYTE_PTR **pSeed**
- CK_ULONG **ulSeedLen**

22.140 CK_MECHANISM Struct Reference

Data Fields

- CK_MECHANISM_TYPE **mechanism**
- CK_VOID_PTR **pParameter**
- CK_ULONG **ulParameterLen**

22.141 CK_MECHANISM_INFO Struct Reference

Data Fields

- CK_ULONG **ulMinKeySize**
- CK_ULONG **ulMaxKeySize**
- CK_FLAGS **flags**

22.142 CK_OTP_PARAM Struct Reference

Data Fields

- CK_OTP_PARAM_TYPE **type**
- CK_VOID_PTR **pValue**
- CK_ULONG **ulValueLen**

22.143 CK_OTP_PARAMS Struct Reference

Data Fields

- CK_OTP_PARAM_PTR **pParams**
- CK_ULONG **ulCount**

22.144 CK_OTP_SIGNATURE_INFO Struct Reference

Data Fields

- CK_OTP_PARAM_PTR **pParams**
- CK_ULONG **ulCount**

22.145 CK_PBE_PARAMS Struct Reference

Data Fields

- CK_BYTE_PTR **pInitVector**
- CK_UTF8CHAR_PTR **pPassword**
- CK_ULONG **ulPasswordLen**
- CK_BYTE_PTR **pSalt**
- CK_ULONG **ulSaltLen**
- CK_ULONG **ulIteration**

22.146 CK_PKCS5_PBKD2_PARAMS Struct Reference

Data Fields

- CK_PKCS5_PBKDF2_SALT_SOURCE_TYPE **saltSource**
- CK_VOID_PTR **pSaltSourceData**
- CK_ULONG **ulSaltSourceDataLen**
- CK_ULONG **iterations**
- CK_PKCS5_PBKD2_PSEUDO_RANDOM_FUNCTION_TYPE **prf**
- CK_VOID_PTR **pPrfData**
- CK_ULONG **ulPrfDataLen**
- CK_UTF8CHAR_PTR **pPassword**
- CK_ULONG_PTR **ulPasswordLen**

22.147 CK_PKCS5_PBKD2_PARAMS2 Struct Reference

Data Fields

- CK_PKCS5_PBKDF2_SALT_SOURCE_TYPE **saltSource**
- CK_VOID_PTR **pSaltSourceData**
- CK_ULONG **ulSaltSourceDataLen**
- CK_ULONG **iterations**
- CK_PKCS5_PBKD2_PSEUDO_RANDOM_FUNCTION_TYPE **prf**
- CK_VOID_PTR **pPrfData**
- CK_ULONG **ulPrfDataLen**
- CK_UTF8CHAR_PTR **pPassword**
- CK_ULONG **ulPasswordLen**

22.148 CK_RC2_CBC_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulEffectiveBits**
- CK_BYTE **iv** [8]

22.149 CK_RC2_MAC_GENERAL_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulEffectiveBits**
- CK_ULONG **ulMacLength**

22.150 CK_RC5_CBC_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulWordsize**
- CK_ULONG **ulRounds**
- CK_BYTE_PTR **pIv**
- CK_ULONG **ulIvLen**

22.151 CK_RC5_MAC_GENERAL_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulWordsize**
- CK_ULONG **ulRounds**
- CK_ULONG **ulMacLength**

22.152 CK_RC5_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulWordsize**
- CK_ULONG **ulRounds**

22.153 CK_RSA_AES_KEY_WRAP_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulAESKeyBits**
- CK_RSA_PKCS_OAEP_PARAMS_PTR **pOAEPParams**

22.154 CK_RSA_PKCS_OAEP_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_TYPE **hashAlg**
- CK_RSA_PKCS_MGF_TYPE **mgf**
- CK_RSA_PKCS_OAEP_SOURCE_TYPE **source**
- CK_VOID_PTR **pSourceData**
- CK_ULONG **ulSourceDataLen**

22.155 CK_RSA_PKCS_PSS_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_TYPE **hashAlg**
- CK_RSA_PKCS_MGF_TYPE **mgf**
- CK_ULONG **sLen**

22.156 CK_SEED_CBC_ENCRYPT_DATA_PARAMS Struct Reference

Data Fields

- CK_BYTE **iv** [16]
- CK_BYTE_PTR **pData**
- CK_ULONG **length**

22.157 CK_SESSION_INFO Struct Reference

Data Fields

- CK_SLOT_ID **slotID**
- CK_STATE **state**
- CK_FLAGS **flags**
- CK_ULONG **ulDeviceError**

22.158 CK_SKIPJACK_PRIVATE_WRAP_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulPasswordLen**
- CK_BYTE_PTR **pPassword**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**
- CK_ULONG **ulPAndGLen**
- CK_ULONG **ulQLen**
- CK_ULONG **ulRandomLen**
- CK_BYTE_PTR **pRandomA**
- CK_BYTE_PTR **pPrimeP**
- CK_BYTE_PTR **pBaseG**
- CK_BYTE_PTR **pSubprimeQ**

22.159 CK_SKIPJACK_RELAYX_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulOldWrappedXLen**
- CK_BYTE_PTR **pOldWrappedX**
- CK_ULONG **ulOldPasswordLen**
- CK_BYTE_PTR **pOldPassword**
- CK_ULONG **ulOldPublicDataLen**
- CK_BYTE_PTR **pOldPublicData**
- CK_ULONG **ulOldRandomLen**
- CK_BYTE_PTR **pOldRandomA**
- CK_ULONG **ulNewPasswordLen**
- CK_BYTE_PTR **pNewPassword**
- CK_ULONG **ulNewPublicDataLen**
- CK_BYTE_PTR **pNewPublicData**
- CK_ULONG **ulNewRandomLen**
- CK_BYTE_PTR **pNewRandomA**

22.160 CK_SLOT_INFO Struct Reference

Data Fields

- CK_UTF8CHAR **slotDescription** [64]
- CK_UTF8CHAR **manufacturerID** [32]
- CK_FLAGS **flags**
- CK_VERSION **hardwareVersion**
- CK_VERSION **firmwareVersion**

22.161 CK_SSL3_KEY_MAT_OUT Struct Reference

Data Fields

- CK_OBJECT_HANDLE **hClientMacSecret**
- CK_OBJECT_HANDLE **hServerMacSecret**
- CK_OBJECT_HANDLE **hClientKey**
- CK_OBJECT_HANDLE **hServerKey**
- CK_BYTE_PTR **pIVClient**
- CK_BYTE_PTR **pIVServer**

22.162 CK_SSL3_KEY_MAT_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulMacSizeInBits**
- CK_ULONG **ulKeySizeInBits**
- CK_ULONG **ulIVSizeInBits**
- CK_BBOOL **bIsExport**
- CK_SSL3_RANDOM_DATA **RandomInfo**
- CK_SSL3_KEY_MAT_OUT_PTR **pReturnedKeyMaterial**

22.163 CK_SSL3_MASTER_KEY_DERIVE_PARAMS Struct Reference

Data Fields

- CK_SSL3_RANDOM_DATA **RandomInfo**
- CK_VERSION_PTR **pVersion**

22.164 CK_SSL3_RANDOM_DATA Struct Reference

Data Fields

- CK_BYTE_PTR **pClientRandom**
- CK_ULONG **ulClientRandomLen**
- CK_BYTE_PTR **pServerRandom**
- CK_ULONG **ulServerRandomLen**

22.165 CK_TLS12_KEY_MAT_PARAMS Struct Reference

Data Fields

- CK_ULONG **ulMacSizeInBits**
- CK_ULONG **ulKeySizeInBits**
- CK_ULONG **ulIVSizeInBits**
- CK_BBOOL **bIsExport**
- CK_SSL3_RANDOM_DATA **RandomInfo**
- CK_SSL3_KEY_MAT_OUT_PTR **pReturnedKeyMaterial**
- CK_MECHANISM_TYPE **prfHashMechanism**

22.166 CK_TLS12_MASTER_KEY_DERIVE_PARAMS Struct Reference

Data Fields

- CK_SSL3_RANDOM_DATA **RandomInfo**
- CK_VERSION_PTR **pVersion**
- CK_MECHANISM_TYPE **prfHashMechanism**

22.167 CK_TLS_KDF_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_TYPE **prfMechanism**
- CK_BYTE_PTR **pLabel**
- CK_ULONG **ulLabelLength**
- CK_SSL3_RANDOM_DATA **RandomInfo**
- CK_BYTE_PTR **pContextData**
- CK_ULONG **ulContextDataLength**

22.168 CK_TLS_MAC_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_TYPE **prfHashMechanism**
- CK_ULONG **ulMacLength**
- CK_ULONG **ulServerOrClient**

22.169 CK_TLS_PRF_PARAMS Struct Reference

Data Fields

- CK_BYTE_PTR **pSeed**
- CK_ULONG **ulSeedLen**
- CK_BYTE_PTR **pLabel**
- CK_ULONG **ulLabelLen**
- CK_BYTE_PTR **pOutput**
- CK_ULONG_PTR **pulOutputLen**

22.170 CK_TOKEN_INFO Struct Reference

Data Fields

- CK_UTF8CHAR **label** [32]
- CK_UTF8CHAR **manufacturerID** [32]
- CK_UTF8CHAR **model** [16]
- CK_CHAR **serialNumber** [16]
- CK_FLAGS **flags**
- CK_ULONG **ulMaxSessionCount**
- CK_ULONG **ulSessionCount**
- CK_ULONG **ulMaxRwSessionCount**
- CK_ULONG **ulRwSessionCount**
- CK_ULONG **ulMaxPinLen**
- CK_ULONG **ulMinPinLen**
- CK_ULONG **ulTotalPublicMemory**
- CK_ULONG **ulFreePublicMemory**
- CK_ULONG **ulTotalPrivateMemory**
- CK_ULONG **ulFreePrivateMemory**
- CK_VERSION **hardwareVersion**
- CK_VERSION **firmwareVersion**
- CK_CHAR **utcTime** [16]

22.171 CK_VERSION Struct Reference

Data Fields

- CK_BYTE **major**
- CK_BYTE **minor**

22.172 CK_WTLS_KEY_MAT_OUT Struct Reference

Data Fields

- CK_OBJECT_HANDLE **hMacSecret**
- CK_OBJECT_HANDLE **hKey**
- CK_BYTE_PTR **pIV**

22.173 CK_WTLS_KEY_MAT_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_TYPE **DigestMechanism**
- CK_ULONG **ulMacSizeInBits**
- CK_ULONG **ulKeySizeInBits**
- CK_ULONG **ulIVSizeInBits**
- CK_ULONG **ulSequenceNumber**
- CK_BBOOL **bIsExport**
- CK_WTLS_RANDOM_DATA **RandomInfo**
- CK_WTLS_KEY_MAT_OUT_PTR **pReturnedKeyMaterial**

22.174 CK_WTLS_MASTER_KEY_DERIVE_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_TYPE **DigestMechanism**
- CK_WTLS_RANDOM_DATA **RandomInfo**
- CK_BYTE_PTR **pVersion**

22.175 CK_WTLS_PRF_PARAMS Struct Reference

Data Fields

- CK_MECHANISM_TYPE **DigestMechanism**
- CK_BYTE_PTR **pSeed**
- CK_ULONG **ulSeedLen**
- CK_BYTE_PTR **pLabel**
- CK_ULONG **ulLabelLen**
- CK_BYTE_PTR **pOutput**
- CK_ULONG_PTR **pulOutputLen**

22.176 CK_WTLS_RANDOM_DATA Struct Reference

Data Fields

- CK_BYTE_PTR **pClientRandom**
- CK_ULONG **ulClientRandomLen**
- CK_BYTE_PTR **pServerRandom**
- CK_ULONG **ulServerRandomLen**

22.177 CK_X9_42_DH1_DERIVE_PARAMS Struct Reference

Data Fields

- CK_X9_42_DH_KDF_TYPE **kdf**
- CK_ULONG **ulOtherInfoLen**
- CK_BYTE_PTR **pOtherInfo**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**

22.178 CK_X9_42_DH2_DERIVE_PARAMS Struct Reference

Data Fields

- CK_X9_42_DH_KDF_TYPE **kdf**
- CK_ULONG **ulOtherInfoLen**
- CK_BYTE_PTR **pOtherInfo**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**
- CK_ULONG **ulPrivateDataLen**
- CK_OBJECT_HANDLE **hPrivateData**
- CK_ULONG **ulPublicDataLen2**
- CK_BYTE_PTR **pPublicData2**

22.179 CK_X9_42_MQV_DERIVE_PARAMS Struct Reference

Data Fields

- CK_X9_42_DH_KDF_TYPE **kdf**
- CK_ULONG **ulOtherInfoLen**
- CK_BYTE_PTR **pOtherInfo**
- CK_ULONG **ulPublicDataLen**
- CK_BYTE_PTR **pPublicData**
- CK_ULONG **ulPrivateDataLen**
- CK_OBJECT_HANDLE **hPrivateData**
- CK_ULONG **ulPublicDataLen2**
- CK_BYTE_PTR **pPublicData2**
- CK_OBJECT_HANDLE **publicKey**

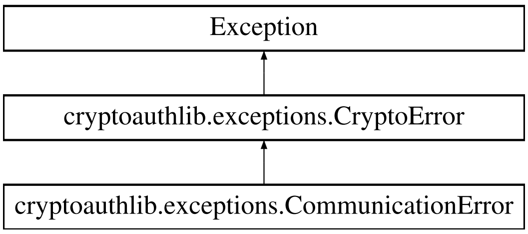
22.180 CL_HashContext Struct Reference

Data Fields

- uint32_t **h** [20/4]
- uint32_t **buf** [64/4]
- uint32_t **byteCount**
- uint32_t **byteCountHi**

22.181 cryptoauthlib.exceptions.CommunicationError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.CommunicationError:

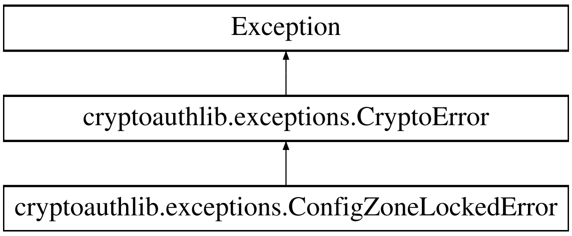


22.181.1 Detailed Description

```
Communication with device failed. Same as in hardware dependent modules.
```

22.182 cryptoauthlib.exceptions.ConfigZoneLockedError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ConfigZoneLockedError:

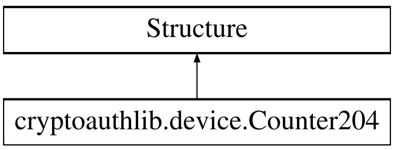


22.182.1 Detailed Description

```
Config Zone Locked
```

22.183 cryptoauthlib.device.Counter204 Class Reference

Inheritance diagram for cryptoauthlib.device.Counter204:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.183.1 Detailed Description

```
Counter Definition for SHA204
```

22.183.2 Field Documentation

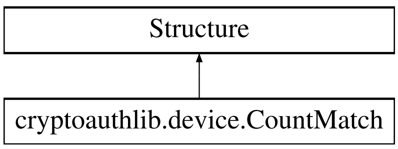
22.183.2.1 _fields_

```
list cryptoauthlib.device.Counter204._fields_ [static], [protected]
```

Initial value:
```
=  [('UseFlag', c_uint8),
                ('UpdateCount', c_uint8)]
```

22.184 cryptoauthlib.device.CountMatch Class Reference

Inheritance diagram for cryptoauthlib.device.CountMatch:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.184.1 Detailed Description

```
CountMatch (608) Field Definition
```

22.184.2 Field Documentation

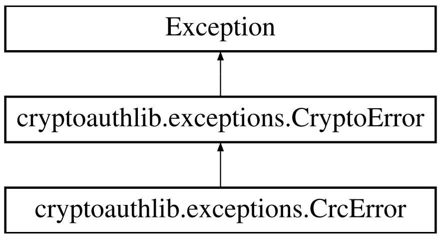
22.184.2.1 _fields_

```
list cryptoauthlib.device.CountMatch._fields_  [static], [protected]
```

Initial value:
```
=  [('Enable', c_uint8, 1),
                ('Reserved', c_uint8, 3),
                ('CountMatchKey', c_uint8, 4)]
```

22.185 cryptoauthlib.exceptions.CrcError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.CrcError:

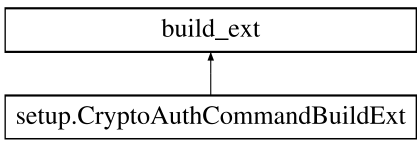


22.185.1 Detailed Description

```
response status byte indicates CRC error (status byte = 0xFF)
```

22.186 setup.CryptoAuthCommandBuildExt Class Reference

Inheritance diagram for setup.CryptoAuthCommandBuildExt:

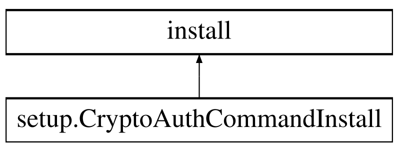


Public Member Functions

- def **build_extension** (self, ext)

22.187 setup.CryptoAuthCommandInstall Class Reference

Inheritance diagram for setup.CryptoAuthCommandInstall:

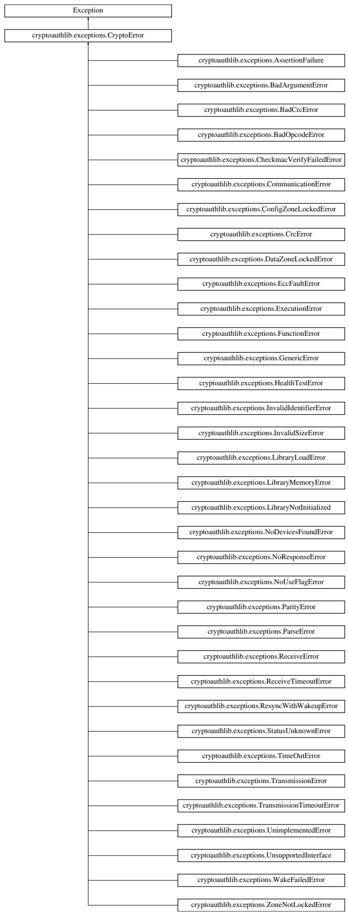


Public Member Functions

- def **run** (self)

22.188 cryptoauthlib.exceptions.CryptoError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.CryptoError:

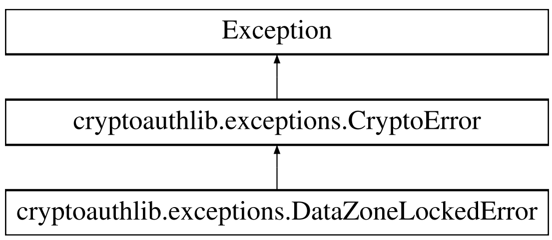


22.188.1 Detailed Description

```
Standard CryptoAuthLib Exceptions
```

22.189 cryptoauthlib.exceptions.DataZoneLockedError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.DataZoneLockedError:



22.189.1 Detailed Description

```
Configuration Enabled
```

22.190 device_execution_time_t Struct Reference

Structure to hold the device execution time and the opcode for the corresponding command.

```
#include <lib/calib/calib_execution.h>
```

Data Fields

- uint8_t **opcode**
- uint16_t **execution_time_msec**

22.190.1 Detailed Description

Structure to hold the device execution time and the opcode for the corresponding command.

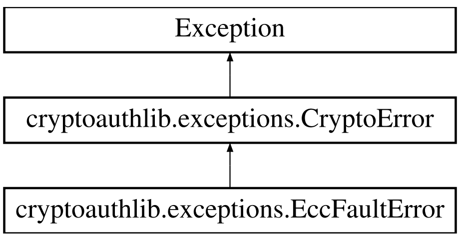
22.191 devtype_names_t Struct Reference

Data Fields

- ATCADeviceType **devtype**
- const char * **name**

22.192 cryptoauthlib.exceptions.EccFaultError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.EccFaultError:

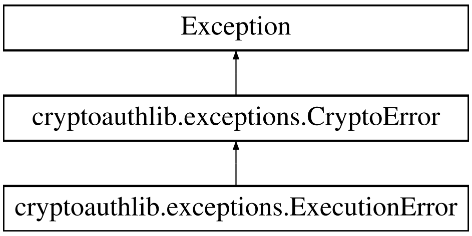


22.192.1 Detailed Description

```
response status byte is ECC fault (status byte = 0x05)
```

22.193 cryptoauthlib.exceptions.ExecutionError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ExecutionError:

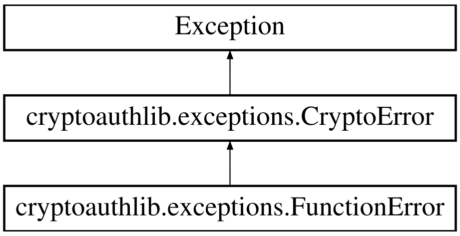


22.193.1 Detailed Description

```
chip was in a state where it could not execute the command, response
status byte indicates command execution error (status byte = 0x0F)
```

22.194 cryptoauthlib.exceptions.FunctionError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.FunctionError:

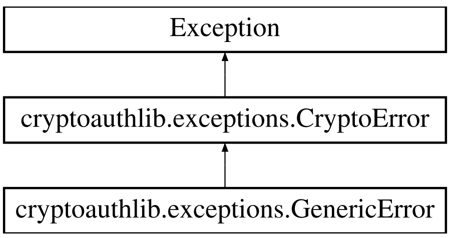


22.194.1 Detailed Description

```
Function could not execute due to incorrect condition / state.
```

22.195 cryptoauthlib.exceptions.GenericError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.GenericError:

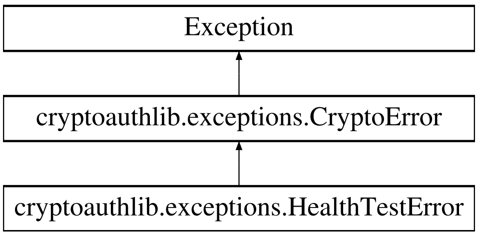


22.195.1 Detailed Description

```
unspecified error
```

22.196 cryptoauthlib.exceptions.HealthTestError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.HealthTestError:

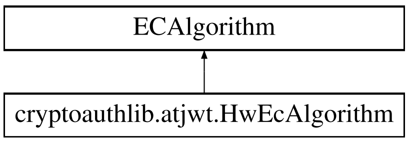


22.196.1 Detailed Description

```
Random number generator health test error
```

22.197 cryptoauthlib.atjwt.HwEcAlgorithm Class Reference

Inheritance diagram for cryptoauthlib.atjwt.HwEcAlgorithm:



Public Member Functions

- def **__init__** (self, hash_alg, slot, iface_cfg)
- def sign (self, msg, _)

Protected Attributes

- **_cfg**
- **_slot**

22.197.1 Detailed Description

```
Extended Algorithm with hardware based elliptic curve support
```

22.197.2 Member Function Documentation

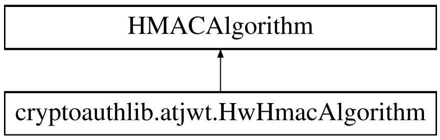
22.197.2.1 sign()

```
def cryptoauthlib.atjwt.HwEcAlgorithm.sign (
              self,
              msg,
              _ )
```

```
Return a signature of the JWT with hardware ECDSA
```

22.198 cryptoauthlib.atjwt.HwHmacAlgorithm Class Reference

Inheritance diagram for cryptoauthlib.atjwt.HwHmacAlgorithm:



Public Member Functions

- def **__init__** (self, hash_alg, slot, iface_cfg)
- def sign (self, msg, _)
- def verify (self, msg, key, sig)

Protected Attributes

- **_cfg**
- **_slot**

22.198.1 Detailed Description

```
Extended Algorithm with hardware based HMAC support
```

22.198.2 Member Function Documentation

22.198.2.1 sign()

```
def cryptoauthlib.atjwt.HwHmacAlgorithm.sign (
              self,
              msg,
              _ )
```

Return a signature of the JWT with hardware SHA256 HMAC and stored key

22.198.2.2 verify()

```
def cryptoauthlib.atjwt.HwHmacAlgorithm.verify (
              self,
              msg,
              key,
              sig )
```

Verify a signature using the software HMAC module

22.199 i2c_sam0_instance Struct Reference

Data Fields

- struct i2c_master_module ∗ **i2c_instance**
- sam0_change_baudrate **change_baudrate**

22.200 i2c_sam_instance Struct Reference

Data Fields

- Twi ∗ **i2c_instance**
- sam_change_baudrate **change_baudrate**

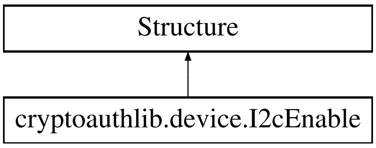
22.201 i2c_start_instance Struct Reference

Data Fields

- struct i2c_m_sync_desc ∗ **i2c_descriptor**
- start_change_baudrate **change_baudrate**

22.202 cryptoauthlib.device.I2cEnable Class Reference

Inheritance diagram for cryptoauthlib.device.I2cEnable:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.202.1 Detailed Description

```
I2C Enable Field Definition
```

22.202.2 Field Documentation

22.202.2.1 _fields_

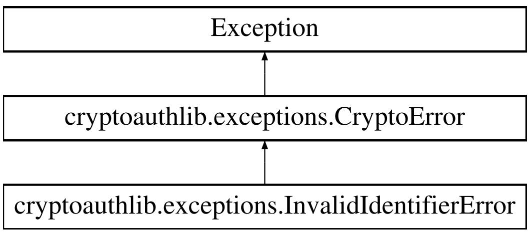
```
list cryptoauthlib.device.I2cEnable._fields_  [static], [protected]
```

Initial value:

```
=  [('Enable', c_uint8, 1),
               ('Reserved', c_uint8, 6)]
```

22.203 cryptoauthlib.exceptions.InvalidIdentifierError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.InvalidIdentifierError:

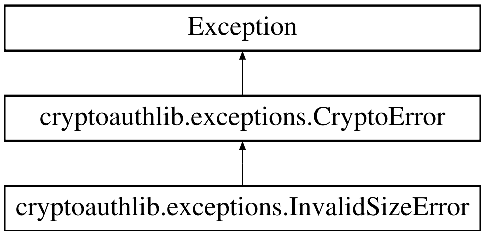


22.203.1 Detailed Description

```
invalid device id, id not set
```

22.204 cryptoauthlib.exceptions.InvalidSizeError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.InvalidSizeError:

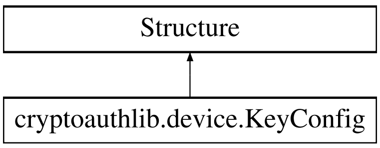


22.204.1 Detailed Description

```
Count value is out of range or greater than buffer size.
```

22.205 cryptoauthlib.device.KeyConfig Class Reference

Inheritance diagram for cryptoauthlib.device.KeyConfig:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.205.1 Detailed Description

```
KeyConfig Field Definition
```

22.205.2 Field Documentation

22.205.2.1 _fields_

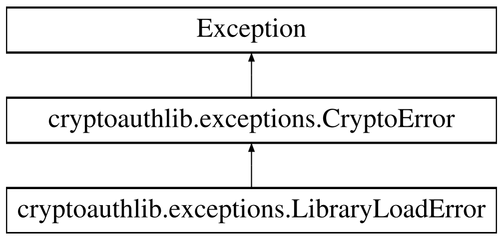
```
list cryptoauthlib.device.KeyConfig._fields_ [static], [protected]
```

Initial value:

```
=  [('Private', c_uint16, 1),
                ('PubInfo', c_uint16, 1),
                ('KeyType', c_uint16, 3),
                ('Lockable', c_uint16, 1),
                ('ReqRandom', c_uint16, 1),
                ('ReqAuth', c_uint16, 1),
                ('AuthKey', c_uint16, 4),
                ('PersistentDisable', c_uint16, 1),
                ('RFU', c_uint16, 1),
                ('X509id', c_uint16, 2)]
```

22.206 cryptoauthlib.exceptions.LibraryLoadError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.LibraryLoadError:

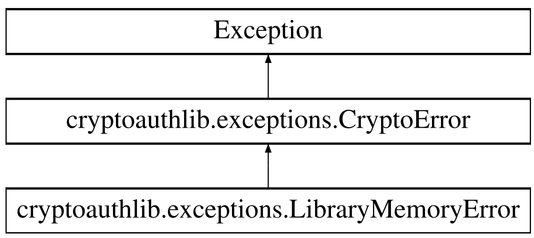


22.206.1 Detailed Description

```
CryptpAuthLib failed to Load
```

22.207 cryptoauthlib.exceptions.LibraryMemoryError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.LibraryMemoryError:

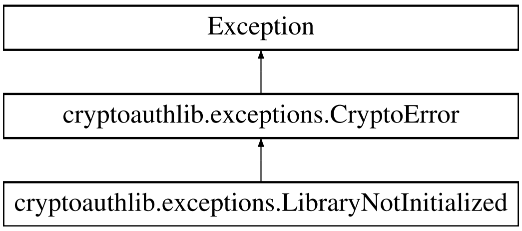


22.207.1 Detailed Description

```
CryptoAuthLib was unable to allocate memory
```

22.208 cryptoauthlib.exceptions.LibraryNotInitialized Class Reference

Inheritance diagram for cryptoauthlib.exceptions.LibraryNotInitialized:



22.208.1 Detailed Description

```
Indication that library or context was not initialized prior to an API call
```

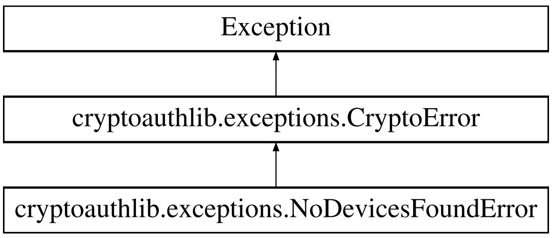
22.209 memory_parameters Struct Reference

Data Fields

- uint32_t **start_address**
- uint32_t **memory_size**
- uint32_t **version_info**
- uint8_t **reserved** [52]
- uint8_t **signature** [ATCA_SIG_SIZE]

22.210 cryptoauthlib.exceptions.NoDevicesFoundError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.NoDevicesFoundError:

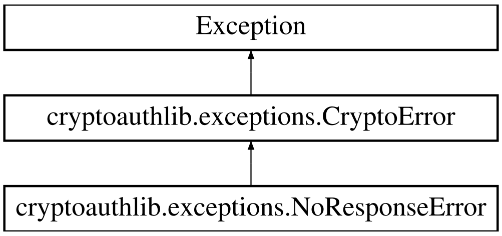


22.210.1 Detailed Description

```
For protocols that support device discovery (kit protocol), no devices were found
```

22.211 cryptoauthlib.exceptions.NoResponseError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.NoResponseError:

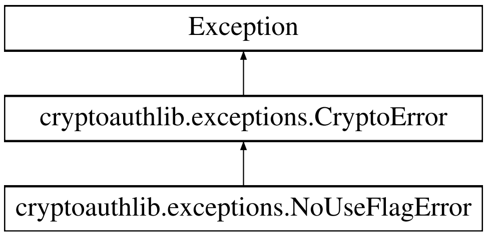


22.211.1 Detailed Description

```
error while the Command layer is polling for a command response.
```

22.212 cryptoauthlib.exceptions.NoUseFlagError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.NoUseFlagError:

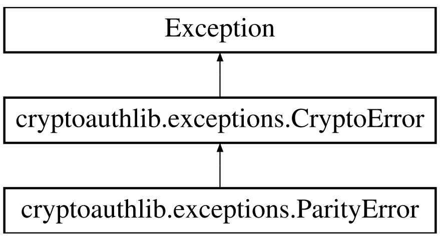


22.212.1 Detailed Description

```
Indication that no dk pk flag is available to perform
```

22.213 cryptoauthlib.exceptions.ParityError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ParityError:

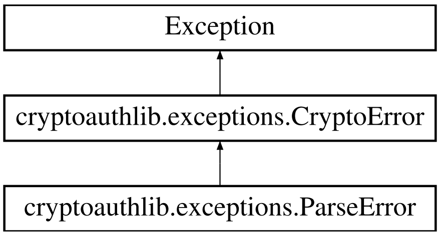


22.213.1 Detailed Description

```
for protocols needing parity
```

22.214 cryptoauthlib.exceptions.ParseError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ParseError:



22.214.1 Detailed Description

```
response status byte indicates parsing error (status byte = 0x03)
```

22.215 pcks11_mech_table_e Struct Reference

Data Fields

- CK_MECHANISM_TYPE **type**
- CK_MECHANISM_INFO **info**

22.216 pkcs11_attrib_model_s Struct Reference

Data Fields

- const CK_ATTRIBUTE_TYPE **type**
- const attrib_f **func**

22.217 pkcs11_conf_filedata_s Struct Reference

Data Fields

- bool **initialized**
- char **filename** [MAX_CONF_FILE_NAME_SIZE]

22.218 pkcs11_dev_ctx Struct Reference

```
#include <lib/pkcs11/pkcs11_init.h>
```

Data Fields

- CK_SESSION_HANDLE **session**

22.218.1 Detailed Description

Context Tracking Info

22.219 pkcs11_dev_res Struct Reference

```
#include <lib/pkcs11/pkcs11_init.h>
```

Data Fields

- pkcs11_dev_ctx **contexts** [(5u)]

22.219.1 Detailed Description

Reservable Device Resources

22.220 pkcs11_dev_state Struct Reference

```
#include <lib/pkcs11/pkcs11_init.h>
```

Data Fields

- hal_mutex_t dev_lock
- pkcs11_dev_res resources [PKCS11_MAX_SLOTS_ALLOWED]

22.220.1 Detailed Description

Device state tracker structure

22.220.2 Field Documentation

22.220.2.1 dev_lock

```
hal_mutex_t pkcs11_dev_state::dev_lock
```

Lock to protect concurent access to the device

22.220.2.2 resources

```
pkcs11_dev_res pkcs11_dev_state::resources[PKCS11_MAX_SLOTS_ALLOWED]
```

Track the usage of device resources

22.221 pkcs11_ecc_key_info_s Struct Reference

Data Fields

- CK_BYTE **ec_key_type**
- CK_BYTE **oid_size**
- CK_BYTE_PTR **curve_oid**
- CK_BYTE_PTR **ec_asn1_header**
- CK_BYTE_PTR **ec_x962_asn1_header**
- uint16_t **asn1_header_sz**
- CK_ULONG **pubkey_sz**
- CK_ULONG **min_msg_sz**
- CK_ULONG **sig_sz**

22.222 pkcs11_key_info_s Struct Reference

Data Fields

- const pkcs11_ecc_key_info_t ∗ **ecc_key_info**
- const pkcs11_rsa_key_info_t ∗ **rsa_key_info**

22.223 pkcs11_lib_ctx_s Struct Reference

```
#include <lib/pkcs11/pkcs11_init.h>
```

Data Fields

- CK_BBOOL initialized
- CK_C_INITIALIZE_ARGS init_args
- CK_VOID_PTR lib_lock
- pkcs11_dev_state ∗ dev_state
- CK_BBOOL dev_lock_enabled
- CK_VOID_PTR slots
- CK_ULONG slot_cnt
- CK_CHAR config_path [200]

22.223.1 Detailed Description

Library Context

22.223.2 Field Documentation

22.223.2.1 config_path

`CK_CHAR pkcs11_lib_ctx_s::config_path[200]`

Filesystem path where the base config is located

22.223.2.2 dev_lock_enabled

`CK_BBOOL pkcs11_lib_ctx_s::dev_lock_enabled`

Flag to indicate if a device lock is enabled and configured

22.223.2.3 dev_state

`pkcs11_dev_state* pkcs11_lib_ctx_s::dev_state`

Device State state and Lock (if configured)

22.223.2.4 init_args

`CK_C_INITIALIZE_ARGS pkcs11_lib_ctx_s::init_args`

Arguments provided by the app for C_Initialize

22.223.2.5 initialized

`CK_BBOOL pkcs11_lib_ctx_s::initialized`

Indicates that the library has been initialized

22.223.2.6 lib_lock

`CK_VOID_PTR pkcs11_lib_ctx_s::lib_lock`

Application Lock for concurrent access to the library if the application will be using threads

22.223.2.7 slot_cnt

```
CK_ULONG pkcs11_lib_ctx_s::slot_cnt
```

Number of configured slots

22.223.2.8 slots

```
CK_VOID_PTR pkcs11_lib_ctx_s::slots
```

Configured slots in the library

22.224 pkcs11_object_cache_s Struct Reference

Data Fields

- CK_OBJECT_HANDLE handle
- CK_SLOT_ID **slotid**
- pkcs11_object_ptr object

22.224.1 Field Documentation

22.224.1.1 handle

```
CK_OBJECT_HANDLE pkcs11_object_cache_s::handle
```

Arbitrary (but unique) non-null identifier for an object

22.224.1.2 object

```
pkcs11_object_ptr pkcs11_object_cache_s::object
```

The actual object

22.225 pkcs11_object_s Struct Reference

Data Fields

- CK_OBJECT_CLASS class_id
- CK_ULONG class_type
- pkcs11_attrib_model const ∗ attributes
- CK_ULONG count
- CK_ULONG **size**
- uint16_t **slot**
- CK_FLAGS **flags**
- CK_UTF8CHAR **name** [PKCS11_MAX_LABEL_SIZE+1]
- CK_VOID_PTR **config**
- CK_VOID_PTR **data**
- ta_element_attributes_t **handle_info**

22.225.1 Field Documentation

22.225.1.1 attributes

```
pkcs11_attrib_model const* pkcs11_object_s::attributes
```

List of attribute models this object possesses

22.225.1.2 class_id

```
CK_OBJECT_CLASS pkcs11_object_s::class_id
```

The Class Identifier

22.225.1.3 class_type

```
CK_ULONG pkcs11_object_s::class_type
```

The Class Type

22.225.1.4 count

```
CK_ULONG pkcs11_object_s::count
```

Count of attribute models

22.226 pkcs11_rsa_key_info_s Struct Reference

22.227 pkcs11_session_ctx_s Struct Reference

```
#include <lib/pkcs11/pkcs11_session.h>
```

Data Fields

- CK_BBOOL **initialized**
- pkcs11_slot_ctx_ptr **slot**
- CK_SESSION_HANDLE **handle**
- CK_STATE **state**
- CK_ULONG **error**
- CK_ATTRIBUTE_PTR **attrib_list**
- CK_ULONG **attrib_count**
- CK_ULONG **object_index**
- CK_ULONG **object_count**
- CK_OBJECT_HANDLE **active_object**
- CK_MECHANISM_TYPE **active_mech**
- pkcs11_session_mech_ctx **active_mech_data**

22.227.1 Detailed Description

Session Context

22.228 pkcs11_session_mech_ctx_s Struct Reference

Data Fields

- atcac_hmac_ctx_t **hmac**
- atcac_sha2_256_ctx_t **sha256**
- atca_aes_cmac_ctx_t **cmac**
- atca_aes_cbc_ctx_t **cbc**
-
  struct {
    atca_aes_gcm_ctx_t **context**
    CK_BYTE **tag_len**
  } **gcm**
-
  struct {
    uint8_t **iv** [TA_AES_GCM_IV_LENGTH]
    uint8_t **aad** [ATCA_AES128_BLOCK_SIZE]
    CK_BYTE **aad_len**
  } **gcm_single**

22.229 pkcs11_slot_ctx_s Struct Reference

```
#include <lib/pkcs11/pkcs11_slot.h>
```

Data Fields

- CK_BYTE **slot_state**
- CK_SLOT_ID **slot_id**
- ATCADevice **device_ctx**
- ATCAIfaceCfg **interface_config**
- CK_SESSION_HANDLE **session**
- atecc608_config_t **cfg_zone**
- CK_FLAGS **flags**
- uint16_t **user_pin_handle**
- uint16_t **so_pin_handle**
- CK_UTF8CHAR **label** [PKCS11_MAX_LABEL_SIZE+1]
- CK_BBOOL **logged_in**
- CK_BYTE read_key [32]

22.229.1 Detailed Description

Slot Context

22.229.2 Field Documentation

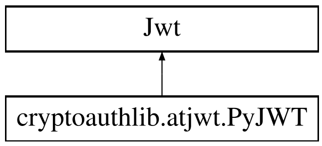
22.229.2.1 read_key

```
CK_BYTE pkcs11_slot_ctx_s::read_key[32]
```

Accepted through C_Login as the user pin

22.230 cryptoauthlib.atjwt.PyJWT Class Reference

Inheritance diagram for cryptoauthlib.atjwt.PyJWT:



Public Member Functions

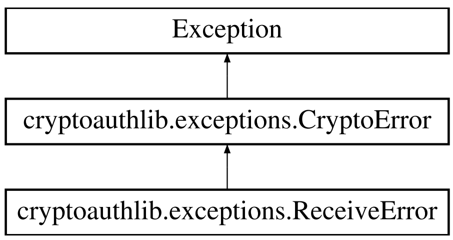
- def **__init__** (self, slot=0, iface_cfg=None, options=None)
- def **register_algorithm** (self, alg_id, algorithm)

22.230.1 Detailed Description

```
Extended PyJWT class from the pyjwt module
```

22.231 cryptoauthlib.exceptions.ReceiveError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ReceiveError:

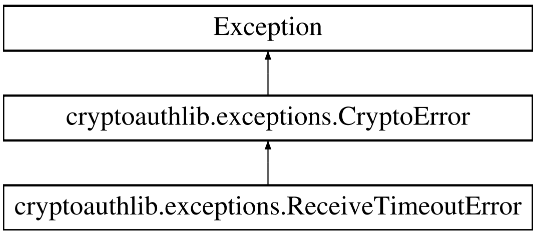


22.231.1 Detailed Description

```
Timed out while waiting for response. Number of bytes received is > 0.
```

22.232 cryptoauthlib.exceptions.ReceiveTimeoutError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ReceiveTimeoutError:

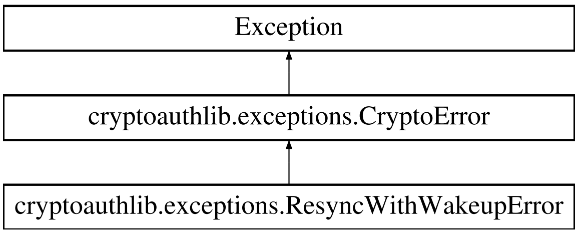


22.232.1 Detailed Description

```
for Microchip PHY protocol, timeout on receipt waiting for master
```

22.233 cryptoauthlib.exceptions.ResyncWithWakeupError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ResyncWithWakeupError:



22.233.1 Detailed Description

```
Re-synchronization succeeded, but only after generating a Wake-up
```

22.234 secure_boot_config_bits Struct Reference

Data Fields

- uint16_t **secure_boot_mode**: 2
- uint16_t **secure_boot_reserved1**: 1
- uint16_t **secure_boot_persistent_enable**: 1
- uint16_t **secure_boot_rand_nonce**: 1
- uint16_t **secure_boot_reserved2**: 3
- uint16_t **secure_boot_sig_dig**: 4
- uint16_t **secure_boot_pub_key**: 4

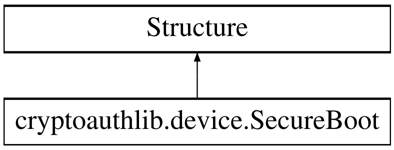
22.235 secure_boot_parameters Struct Reference

Data Fields

- memory_parameters **memory_params**
- atcac_sha2_256_ctx **s_sha_context**
- uint8_t **app_digest** [ATCA_SHA_DIGEST_SIZE]

22.236 cryptoauthlib.device.SecureBoot Class Reference

Inheritance diagram for cryptoauthlib.device.SecureBoot:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.236.1 Detailed Description

```
SecureBoot Field Definition
```

22.236.2 Field Documentation

22.236.2.1 _fields_

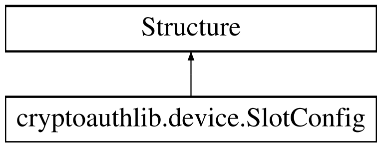
```
list cryptoauthlib.device.SecureBoot._fields_  [static], [protected]
```

Initial value:

```
=  [('SecureBootMode', c_uint16, 2),
                ('Reserved0', c_uint16, 1),
                ('SecureBootPersistentEnable', c_uint16, 1),
                ('SecureBootRandNonce', c_uint16, 1),
                ('Reserved1', c_uint16, 3),
                ('SecureBootSigDig', c_uint16, 4),
                ('SecureBootPubKey', c_uint16, 4)]
```

22.237 cryptoauthlib.device.SlotConfig Class Reference

Inheritance diagram for cryptoauthlib.device.SlotConfig:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.237.1 Detailed Description

```
Slot Configuration Field Definition
```

22.237.2 Field Documentation

22.237.2.1 _fields_

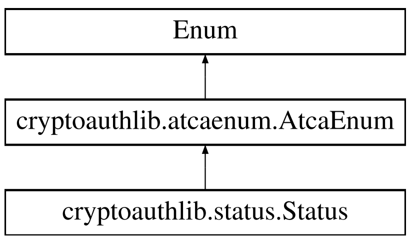
```
list cryptoauthlib.device.SlotConfig._fields_ [static], [protected]
```

Initial value:

```
=  [('ReadKey', c_uint16, 4),
                 ('NoMac', c_uint16, 1),
                 ('LimitedUse', c_uint16, 1),
                 ('EncryptRead', c_uint16, 1),
                 ('IsSecret', c_uint16, 1),
                 ('WriteKey', c_uint16, 4),
                 ('WriteConfig', c_uint16, 4)]
```

22.238 cryptoauthlib.status.Status Class Reference

Inheritance diagram for cryptoauthlib.status.Status:



Static Public Attributes

- int **ATCA_SUCCESS** = 0
- int **ATCA_CONFIG_ZONE_LOCKED** = 0x01
- int **ATCA_DATA_ZONE_LOCKED** = 0x02
- int **ATCA_WAKE_FAILED** = -48
- int **ATCA_CHECKMAC_VERIFY_FAILED** = -47
- int **ATCA_PARSE_ERROR** = -46
- int **ATCA_STATUS_CRC** = -44
- int **ATCA_STATUS_UNKNOWN** = -43
- int **ATCA_STATUS_ECC** = -42
- int **ATCA_STATUS_SELFTEST_ERROR** = -41
- int **ATCA_FUNC_FAIL** = -32
- int **ATCA_GEN_FAIL** = -31
- int **ATCA_BAD_PARAM** = -30
- int **ATCA_INVALID_ID** = -29
- int **ATCA_INVALID_SIZE** = -28
- int **ATCA_BAD_CRC** = -27
- int **ATCA_RX_FAIL** = -26
- int **ATCA_RX_NO_RESPONSE** = -25
- int **ATCA_RESYNC_WITH_WAKEUP** = -24
- int **ATCA_PARITY_ERROR** = -23
- int **ATCA_TX_TIMEOUT** = -22
- int **ATCA_RX_TIMEOUT** = -21
- int **ATCA_COMM_FAIL** = -16
- int **ATCA_TIMEOUT** = -15
- int **ATCA_BAD_OPCODE** = -14
- int **ATCA_WAKE_SUCCESS** = -13
- int **ATCA_EXECUTION_ERROR** = -12
- int **ATCA_UNIMPLEMENTED** = -11
- int **ATCA_ASSERT_FAILURE** = -10
- int **ATCA_TX_FAIL** = -9
- int **ATCA_NOT_LOCKED** = -8
- int **ATCA_NO_DEVICES** = -7
- int **ATCA_HEALTH_TEST_ERROR** = -6
- int **ATCA_ALLOC_FAILURE** = -5
- int **ATCA_USE_FLAGS_CONSUMED** = -4
- int **ATCA_NOT_INITIALIZED** = -3

Additional Inherited Members

Public Member Functions inherited from cryptoauthlib.atcaenum.AtcaEnum

- def **__str__** (self)
- def **__eq__** (self, other)
- def **__ne__** (self, other)
- def **__int__** (self)
- def **__hash__** (self)

Data Fields inherited from cryptoauthlib.atcaenum.AtcaEnum

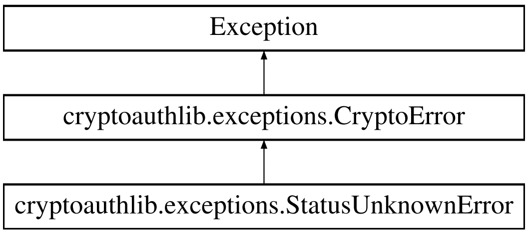
- **name**
- **value**

22.238.1 Detailed Description

```
Status codes returned from cryptoauthlib commands and their meanings. See atca_status.h
```

22.239 cryptoauthlib.exceptions.StatusUnknownError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.StatusUnknownError:

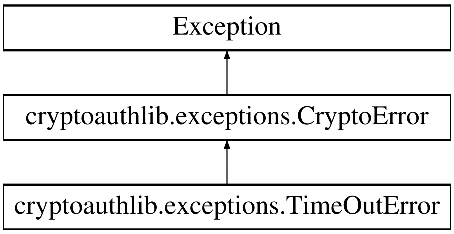


22.239.1 Detailed Description

```
Response status byte is unknown
```

22.240 cryptoauthlib.exceptions.TimeOutError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.TimeOutError:



22.240.1 Detailed Description

```
Timed out while waiting for response. Number of bytes received is 0.
```

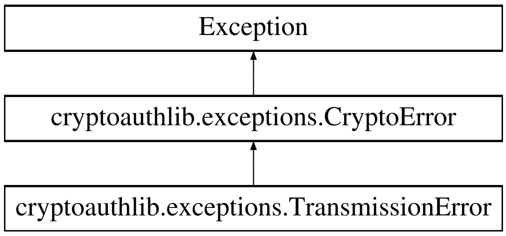
22.241 tng_cert_map_element Struct Reference

Data Fields

- const char ∗ **otpcode**
- const atcacert_def_t ∗ **cert_def**

22.242 cryptoauthlib.exceptions.TransmissionError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.TransmissionError:

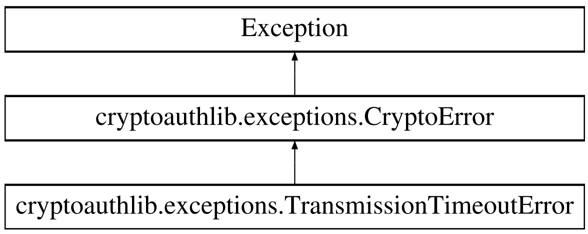


22.242.1 Detailed Description

```
Failed to write
```

22.243 cryptoauthlib.exceptions.TransmissionTimeoutError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.TransmissionTimeoutError:

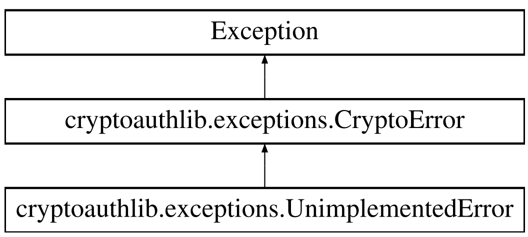


22.243.1 Detailed Description

```
for Microchip PHY protocol, timeout on transmission waiting for master
```

22.244 cryptoauthlib.exceptions.UnimplementedError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.UnimplementedError:

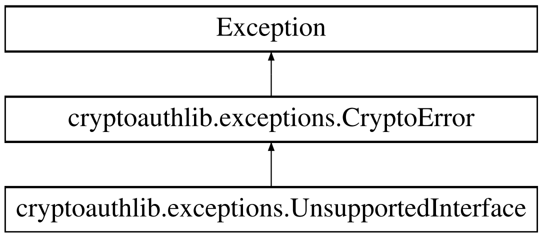


22.244.1 Detailed Description

```
Function or some element of it hasn't been implemented yet
```

22.245 cryptoauthlib.exceptions.UnsupportedInterface Class Reference

Inheritance diagram for cryptoauthlib.exceptions.UnsupportedInterface:

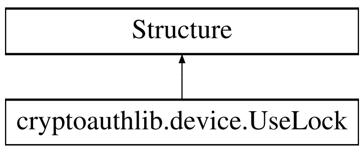


22.245.1 Detailed Description

```
"The selected interface is not supported by the library
```

22.246 cryptoauthlib.device.UseLock Class Reference

Inheritance diagram for cryptoauthlib.device.UseLock:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.246.1 Detailed Description

```
UseLock Field Definition
```

22.246.2 Field Documentation

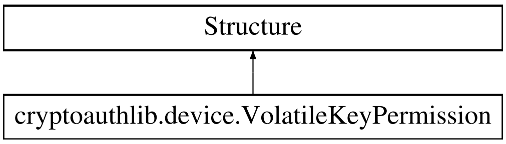
22.246.2.1 _fields_

```
list cryptoauthlib.device.UseLock._fields_  [static], [protected]
```

Initial value:
```
=  [('UseLockEnable', c_uint8, 4),
               ('UseLockKey', c_uint8, 4)]
```

22.247 cryptoauthlib.device.VolatileKeyPermission Class Reference

Inheritance diagram for cryptoauthlib.device.VolatileKeyPermission:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.247.1 Detailed Description

```
VolatileKeyPermission Field Definition
```

22.247.2 Field Documentation

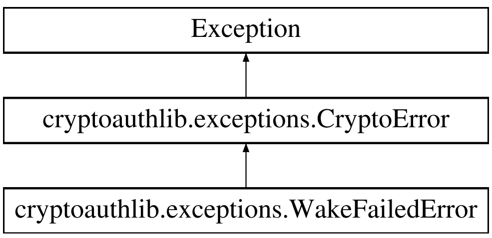
22.247.2.1 _fields_

```
list cryptoauthlib.device.VolatileKeyPermission._fields_  [static], [protected]
```

Initial value:
```
=  [('VolatileKeyPermitSlot', c_uint8, 4),
               ('Reserved', c_uint8, 3),
               ('VolatileKeyPermitEnable', c_uint8, 1)]
```

22.248 cryptoauthlib.exceptions.WakeFailedError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.WakeFailedError:

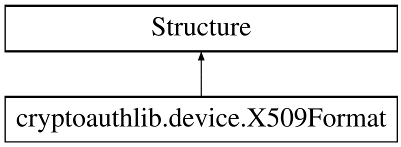


22.248.1 Detailed Description

```
Device Wake failed
```

22.249 cryptoauthlib.device.X509Format Class Reference

Inheritance diagram for cryptoauthlib.device.X509Format:



Static Protected Attributes

- list _fields_
- int **_pack_** = 1

22.249.1 Detailed Description

```
X509Format Field Definition
```

22.249.2 Field Documentation

22.249.2.1 _fields_

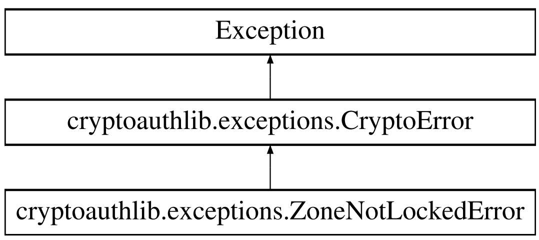
```
list cryptoauthlib.device.X509Format._fields_ [static], [protected]
```

Initial value:

```
=  [('PublicPosition', c_uint8, 4),
                   ('TemplateLength', c_uint8, 4)]
```

22.250 cryptoauthlib.exceptions.ZoneNotLockedError Class Reference

Inheritance diagram for cryptoauthlib.exceptions.ZoneNotLockedError:



22.250.1 Detailed Description

```
required zone was not locked
```

Chapter 23

File Documentation

23.1 api_206a.c File Reference

Provides APIs to use with ATSHA206A device.

```
#include <stdlib.h>
#include <stdio.h>
#include "cryptoauthlib.h"
#include "api_206a.h"
```

Functions

- ATCA_STATUS sha206a_diversify_parent_key (uint8_t *parent_key, uint8_t *diversified_key)

    Computes the diversified key based on the parent key provided and device serial number.
- ATCA_STATUS sha206a_generate_derive_key (uint8_t *parent_key, uint8_t *derived_key, uint8_t param1, uint16_t param2)

    Generates the derived key based on the parent key and other parameters provided.
- ATCA_STATUS sha206a_generate_challenge_response_pair (uint8_t *key, uint8_t *challenge, uint8_↩ t *response)

    Generates the response based on Key and Challenge provided.
- ATCA_STATUS sha206a_authenticate (uint8_t *challenge, uint8_t *expected_response, uint8_t *is_↩ authenticated)

    verifies the challenge and provided response using key in device
- ATCA_STATUS sha206a_verify_device_consumption (uint8_t *is_consumed)

    verifies the device is fully consumed or not based on Parent and Derived Key use flags.
- ATCA_STATUS sha206a_check_dk_useflag_validity (uint8_t *is_consumed)

    verifies Derived Key use flags for consumption
- ATCA_STATUS sha206a_check_pk_useflag_validity (uint8_t *is_consumed)

    verifies Parent Key use flags for consumption
- ATCA_STATUS sha206a_get_dk_useflag_count (uint8_t *dk_available_count)

    calculates available Derived Key use counts
- ATCA_STATUS sha206a_get_pk_useflag_count (uint8_t *pk_available_count)

    calculates available Parent Key use counts
- ATCA_STATUS sha206a_get_dk_update_count (uint8_t *dk_update_count)

    Read Derived Key slot update count. It will be wraps around 256.

- ATCA_STATUS sha206a_write_data_store (uint8_t slot, uint8_t ∗data, uint8_t block, uint8_t offset, uint8_t len, bool lock_after_write)

  Update the data store slot with user data and lock it if necessary.
- ATCA_STATUS sha206a_read_data_store (uint8_t slot, uint8_t ∗data, uint8_t offset, uint8_t len)

  Read the data stored in Data store.
- ATCA_STATUS sha206a_get_data_store_lock_status (uint8_t slot, uint8_t ∗is_locked)

  Returns the lock status of the given data store.

23.1.1 Detailed Description

Provides APIs to use with ATSHA206A device.

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23.1.2 Function Documentation

23.1.2.1 sha206a_authenticate()

```
ATCA_STATUS sha206a_authenticate (
            uint8_t * challenge,
            uint8_t * expected_response,
            uint8_t * is_authenticated )
```

verifies the challenge and provided response using key in device

Parameters

in	*challenge*	Challenge to be used in the response calculations
in	*expected_response*	Expected response from the device.
out	*is_authenticated*	result of expected of response and calcualted response

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.2 sha206a_check_dk_useflag_validity()

```
ATCA_STATUS sha206a_check_dk_useflag_validity (
            uint8_t * is_consumed )
```

verifies Derived Key use flags for consumption

Parameters

out	*is_consumed*	indicates if DK is available for consumption.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.3 sha206a_check_pk_useflag_validity()

```
ATCA_STATUS sha206a_check_pk_useflag_validity (
            uint8_t * is_consumed )
```

verifies Parent Key use flags for consumption

Parameters

out	*is_consumed*	indicates if PK is available for consumption

Returns

ATCA_SUCCESS on success, otherwise an error code

23.1.2.4 sha206a_diversify_parent_key()

```
ATCA_STATUS sha206a_diversify_parent_key (
            uint8_t * parent_key,
            uint8_t * diversified_key )
```

Computes the diversified key based on the parent key provided and device serial number.

Parameters

in	*parent_key*	parent key to be diversified
out	*diversified_key*	diversified parent key

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.5 sha206a_generate_challenge_response_pair()

```
ATCA_STATUS sha206a_generate_challenge_response_pair (
            uint8_t * key,
            uint8_t * challenge,
            uint8_t * response )
```

Generates the response based on Key and Challenge provided.

Parameters

in	*key*	Input data contains device's key
in	*challenge*	Input data to be used in challenge response calculation
out	*response*	response derived from key and challenge

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.6 sha206a_generate_derive_key()

```
ATCA_STATUS sha206a_generate_derive_key (
            uint8_t * parent_key,
            uint8_t * derived_key,
            uint8_t param1,
            uint16_t param2 )
```

Generates the derived key based on the parent key and other parameters provided.

Parameters

in	*parent_key*	Input data contains device's parent key
out	*derived_key*	Output data derived from parent key
in	*param1*	Input data to be used in derive key calculation
in	*param2*	Input data to be used in derive key calculation

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.7 sha206a_get_data_store_lock_status()

```
ATCA_STATUS sha206a_get_data_store_lock_status (
            uint8_t slot,
            uint8_t * is_locked )
```

Returns the lock status of the given data store.

Parameters

in	*slot*	Slot number of the data store
out	*is_locked*	lock status of the data store

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.8 sha206a_get_dk_update_count()

```
ATCA_STATUS sha206a_get_dk_update_count (
            uint8_t * dk_update_count )
```

Read Derived Key slot update count. It will be wraps around 256.

Parameters

out	*dk_update_count*	returns number of times the slot has been updated with derived key

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.9 sha206a_get_dk_useflag_count()

```
ATCA_STATUS sha206a_get_dk_useflag_count (
            uint8_t * dk_available_count )
```

calculates available Derived Key use counts

Parameters

out	*dk_available_count*	counts available bit's as 1

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.10 sha206a_get_pk_useflag_count()

```
ATCA_STATUS sha206a_get_pk_useflag_count (
            uint8_t * pk_available_count )
```

calculates available Parent Key use counts

Parameters

out	*pk_available_count*	counts available bit's as 1

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.11 sha206a_read_data_store()

```
ATCA_STATUS sha206a_read_data_store (
            uint8_t slot,
            uint8_t * data,
            uint8_t offset,
            uint8_t len )
```

Read the data stored in Data store.

Parameters

in	*slot*	Slot number to read from
in	*data*	Pointer to hold slot data data
in	*offset*	Byte offset within the zone to read from.
in	*len*	data length

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.12 sha206a_verify_device_consumption()

```
ATCA_STATUS sha206a_verify_device_consumption (
            uint8_t * is_consumed )
```

verifies the device is fully consumed or not based on Parent and Derived Key use flags.

Parameters

out	*is_consumed*	result of device consumption

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.1.2.13 sha206a_write_data_store()

```
ATCA_STATUS sha206a_write_data_store (
            uint8_t slot,
            uint8_t * data,
            uint8_t block,
            uint8_t offset,
            uint8_t len,
            bool lock_after_write )
```

Update the data store slot with user data and lock it if necessary.

Parameters

in	*slot*	Slot number to be written with data
in	*data*	Pointer that holds the data
in	*block*	32-byte block to write to.
in	*offset*	4-byte word within the specified block to write to. If performing a 32-byte write, this should be 0.
in	*len*	data length
in	*lock_after_write*	set 1 to lock slot after write, otherwise 0

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2 api_206a.h File Reference

Provides api interfaces to use with ATSHA206A device.

```
#include "atca_status.h"
```

Macros

- #define **ATCA_SHA206A_ZONE_WRITE_LOCK** 0x20u
- #define **ATCA_SHA206A_DKEY_CONSUMPTION_MASK** 0x01u
- #define **ATCA_SHA206A_PKEY_CONSUMPTION_MASK** 0x02u
- #define **ATCA_SHA206A_SYMMETRIC_KEY_ID_SLOT** 0X07u

Enumerations

- enum { **SHA206A_DATA_STORE0** =8 , **SHA206A_DATA_STORE1** , **SHA206A_DATA_STORE2** }

Functions

- ATCA_STATUS sha206a_diversify_parent_key (uint8_t *parent_key, uint8_t *diversified_key)

  Computes the diversified key based on the parent key provided and device serial number.
- ATCA_STATUS sha206a_generate_derive_key (uint8_t *parent_key, uint8_t *derived_key, uint8_t param1, uint16_t param2)

  Generates the derived key based on the parent key and other parameters provided.
- ATCA_STATUS sha206a_generate_challenge_response_pair (uint8_t *key, uint8_t *challenge, uint8_↩ t *response)

  Generates the response based on Key and Challenge provided.
- ATCA_STATUS sha206a_authenticate (uint8_t *challenge, uint8_t *expected_response, uint8_t *is_↩ authenticated)

  verifies the challenge and provided response using key in device
- ATCA_STATUS sha206a_verify_device_consumption (uint8_t *is_consumed)

  verifies the device is fully consumed or not based on Parent and Derived Key use flags.
- ATCA_STATUS sha206a_check_dk_useflag_validity (uint8_t *is_consumed)

  verifies Derived Key use flags for consumption
- ATCA_STATUS sha206a_check_pk_useflag_validity (uint8_t *is_consumed)

  verifies Parent Key use flags for consumption
- ATCA_STATUS sha206a_get_dk_useflag_count (uint8_t *dk_available_count)

  calculates available Derived Key use counts
- ATCA_STATUS sha206a_get_pk_useflag_count (uint8_t *pk_available_count)

  calculates available Parent Key use counts
- ATCA_STATUS sha206a_get_dk_update_count (uint8_t *dk_update_count)

  Read Derived Key slot update count. It will be wraps around 256.
- ATCA_STATUS sha206a_write_data_store (uint8_t slot, uint8_t *data, uint8_t block, uint8_t offset, uint8_t len, bool lock_after_write)

  Update the data store slot with user data and lock it if necessary.
- ATCA_STATUS sha206a_read_data_store (uint8_t slot, uint8_t *data, uint8_t offset, uint8_t len)

  Read the data stored in Data store.
- ATCA_STATUS sha206a_get_data_store_lock_status (uint8_t slot, uint8_t *is_locked)

  Returns the lock status of the given data store.

23.2.1 Detailed Description

Provides api interfaces to use with ATSHA206A device.

Copyright

23.2.2 Function Documentation

23.2.2.1 sha206a_authenticate()

```
ATCA_STATUS sha206a_authenticate (
            uint8_t * challenge,
            uint8_t * expected_response,
            uint8_t * is_authenticated )
```

verifies the challenge and provided response using key in device

Parameters

in	*challenge*	Challenge to be used in the response calculations
in	*expected_response*	Expected response from the device.
out	*is_authenticated*	result of expected of response and calcualted response

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.2 sha206a_check_dk_useflag_validity()

```
ATCA_STATUS sha206a_check_dk_useflag_validity (
            uint8_t * is_consumed )
```

verifies Derived Key use flags for consumption

Parameters

out	*is_consumed*	indicates if DK is available for consumption.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.3 sha206a_check_pk_useflag_validity()

```
ATCA_STATUS sha206a_check_pk_useflag_validity (
            uint8_t * is_consumed )
```

verifies Parent Key use flags for consumption

Parameters

out	*is_consumed*	indicates if PK is available for consumption

Returns

ATCA_SUCCESS on success, otherwise an error code

23.2.2.4 sha206a_diversify_parent_key()

```
ATCA_STATUS sha206a_diversify_parent_key (
            uint8_t * parent_key,
            uint8_t * diversified_key )
```

Computes the diversified key based on the parent key provided and device serial number.

Parameters

in	*parent_key*	parent key to be diversified
out	*diversified_key*	diversified parent key

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.5 sha206a_generate_challenge_response_pair()

```
ATCA_STATUS sha206a_generate_challenge_response_pair (
            uint8_t * key,
            uint8_t * challenge,
            uint8_t * response )
```

Generates the response based on Key and Challenge provided.

Parameters

in	*key*	Input data contains device's key
in	*challenge*	Input data to be used in challenge response calculation
out	*response*	response derived from key and challenge

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.6 sha206a_generate_derive_key()

```
ATCA_STATUS sha206a_generate_derive_key (
            uint8_t * parent_key,
            uint8_t * derived_key,
            uint8_t param1,
            uint16_t param2 )
```

Generates the derived key based on the parent key and other parameters provided.

Parameters

in	*parent_key*	Input data contains device's parent key
out	*derived_key*	Output data derived from parent key
in	*param1*	Input data to be used in derive key calculation
in	*param2*	Input data to be used in derive key calculation

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.7 sha206a_get_data_store_lock_status()

```
ATCA_STATUS sha206a_get_data_store_lock_status (
            uint8_t slot,
            uint8_t * is_locked )
```

Returns the lock status of the given data store.

Parameters

in	*slot*	Slot number of the data store
out	*is_locked*	lock status of the data store

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.8 sha206a_get_dk_update_count()

```
ATCA_STATUS sha206a_get_dk_update_count (
            uint8_t * dk_update_count )
```

Read Derived Key slot update count. It will be wraps around 256.

Parameters

out	*dk_update_count*	returns number of times the slot has been updated with derived key

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.9 sha206a_get_dk_useflag_count()

```
ATCA_STATUS sha206a_get_dk_useflag_count (
            uint8_t * dk_available_count )
```

calculates available Derived Key use counts

Parameters

out	*dk_available_count*	counts available bit's as 1

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.10 sha206a_get_pk_useflag_count()

```
ATCA_STATUS sha206a_get_pk_useflag_count (
            uint8_t * pk_available_count )
```

calculates available Parent Key use counts

Parameters

out	*pk_available_count*	counts available bit's as 1

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.11 sha206a_read_data_store()

```
ATCA_STATUS sha206a_read_data_store (
            uint8_t slot,
            uint8_t * data,
            uint8_t offset,
            uint8_t len )
```

Read the data stored in Data store.

Parameters

in	*slot*	Slot number to read from
in	*data*	Pointer to hold slot data data
in	*offset*	Byte offset within the zone to read from.
in	*len*	data length

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.12 sha206a_verify_device_consumption()

```
ATCA_STATUS sha206a_verify_device_consumption (
            uint8_t * is_consumed )
```

verifies the device is fully consumed or not based on Parent and Derived Key use flags.

Parameters

out	*is_consumed*	result of device consumption

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.2.2.13 sha206a_write_data_store()

```
ATCA_STATUS sha206a_write_data_store (
            uint8_t slot,
            uint8_t * data,
            uint8_t block,
            uint8_t offset,
            uint8_t len,
            bool lock_after_write )
```

Update the data store slot with user data and lock it if necessary.

Parameters

in	*slot*	Slot number to be written with data
in	*data*	Pointer that holds the data
in	*block*	32-byte block to write to.
in	*offset*	4-byte word within the specified block to write to. If performing a 32-byte write, this should be 0.
in	*len*	data length
in	*lock_after_write*	set 1 to lock slot after write, otherwise 0

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.3 symmetric_authentication.c File Reference

Contains API for performing the symmetric Authentication between the Host and the device.

```
#include "cryptoauthlib.h"
#include "host/atca_host.h"
#include "symmetric_authentication.h"
```

Functions

- ATCA_STATUS symmetric_authenticate (uint8_t slot, const uint8_t *master_key, const uint8_t *rand_number)

  Function which does the authentication between the host and device.

23.3.1 Detailed Description

Contains API for performing the symmetric Authentication between the Host and the device.

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23.3.2 Function Documentation

23.3.2.1 symmetric_authenticate()

```
ATCA_STATUS symmetric_authenticate (
            uint8_t slot,
            const uint8_t * master_key,
            const uint8_t * rand_number )
```

Function which does the authentication between the host and device.

Parameters

in	*slot*	The slot number used for the symmetric authentication.
in	*master_key*	The master key used for the calculating the symmetric key.
in	*rand_number*	The 20 byte rand_number from the host.

Returns

ATCA_SUCCESS on successful authentication, otherwise an error code.

23.4 symmetric_authentication.h File Reference

Contains API for performing the symmetric Authentication between the Host and the device.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS symmetric_authenticate (uint8_t slot, const uint8_t *master_key, const uint8_t *rand_↩ number)

  Function which does the authentication between the host and device.

23.4.1 Detailed Description

Contains API for performing the symmetric Authentication between the Host and the device.

Copyright

23.4.2 Function Documentation

23.4.2.1 symmetric_authenticate()

```
ATCA_STATUS symmetric_authenticate (
            uint8_t slot,
            const uint8_t * master_key,
            const uint8_t * rand_number )
```

Function which does the authentication between the host and device.

Parameters

in	*slot*	The slot number used for the symmetric authentication.
in	*master_key*	The master key used for the calculating the symmetric key.
in	*rand_number*	The 20 byte rand_number from the host.

Returns

ATCA_SUCCESS on successful authentication, otherwise an error code.

23.5 ascii_kit_host.c File Reference

KIT protocol intepreter.

```
#include <ctype.h>
#include "ascii_kit_host.h"
#include "hal/kit_protocol.h"
#include "talib/talib_fce.h"
```

Functions

- ATCA_STATUS kit_host_init_phy (atca_hal_kit_phy_t *phy, ATCAIface iface)

  Initializes a phy structure with a cryptoauthlib hal adapter.
- ATCA_STATUS kit_host_init (ascii_kit_host_context_t *ctx, ATCAIfaceCfg *iface[ ], const size_t iface_count, const atca_hal_kit_phy_t *phy, const uint32_t flags)

  Initializes the kit protocol parser context.
- size_t **kit_host_format_response** (uint8_t *response, size_t rlen, ATCA_STATUS status, uint8_t *data, size_t dlen)

  Format the status and data into the kit protocol response format.
- ATCA_STATUS **kit_host_process_cmd** (ascii_kit_host_context_t *ctx, const kit_host_map_entry_t *cmd_list, int argc, char *argv[ ], uint8_t *response, size_t *rlen)

  Iterate through a command list to match the given command and then will execute it.
- ATCA_STATUS **kit_host_process_ta** (ascii_kit_host_context_t *ctx, int argc, char *argv[ ], uint8_t *response, size_t *rlen)
- ATCA_STATUS **kit_host_process_line** (ascii_kit_host_context_t *ctx, uint8_t *input_line, size_t ilen, uint8_t *response, size_t *rlen)

  Parse a line as a kit protocol command. The kit protocol is printable ascii and each line ends with a newline character.
- void **kit_host_task** (ascii_kit_host_context_t *ctx)

  Non returning kit protocol runner using the configured physical interface that was provided when the context was initialized.

23.5.1 Detailed Description

KIT protocol intepreter.

Copyright

23.5.2 Function Documentation

23.5.2.1 kit_host_init()

```
ATCA_STATUS kit_host_init (
            ascii_kit_host_context_t * ctx,
            ATCAIfaceCfg * iface[ ],
            const size_t iface_count,
            const atca_hal_kit_phy_t * phy,
            const uint32_t flags )
```

Initializes the kit protocol parser context.

Returns

ATCA_SUCCESS on success, otherwise an error code

Parameters

ctx	Kit protocol parser context
iface	List of device configurations which will be used
iface_count	Number of configurations provided
phy	Kit protocol physical adapter
flags	Option Flags

23.5.2.2 kit_host_init_phy()

```
ATCA_STATUS kit_host_init_phy (
            atca_hal_kit_phy_t * phy,
            ATCAIface iface )
```

Initializes a phy structure with a cryptoauthlib hal adapter.

Returns

ATCA_SUCCESS on success, otherwise an error code

23.6 ascii_kit_host.h File Reference

KIT protocol intepreter.

```
#include "cryptoauthlib.h"
```

Data Structures

- struct _ascii_kit_host_context
- struct _kit_host_map_entry

Macros

- #define **KIT_LAYER_DELIMITER** ':'
- #define **KIT_DATA_BEGIN_DELIMITER** '('
- #define **KIT_DATA_END_DELIMITER** ')'
- #define **KIT_MESSAGE_DELIMITER** '\n'
- #define KIT_MESSAGE_SIZE_MAX (2500)

  The Kit Protocol maximum message size.
- #define **KIT_SECTION_NAME_SIZE_MAX** KIT_MESSAGE_SIZE_MAX
- #define **KIT_VERSION_SIZE_MAX** (32)
- #define **KIT_FIRMWARE_SIZE_MAX** (32)

Typedefs

- typedef struct _ascii_kit_host_context **ascii_kit_host_context_t**
- typedef struct _kit_host_map_entry kit_host_map_entry_t

Functions

- ATCA_STATUS kit_host_init_phy (atca_hal_kit_phy_t ∗phy, ATCAIface iface)

  Initializes a phy structure with a cryptoauthlib hal adapter.
- ATCA_STATUS kit_host_init (ascii_kit_host_context_t ∗ctx, ATCAIfaceCfg ∗iface[ ], const size_t iface_count, const atca_hal_kit_phy_t ∗phy, const uint32_t flags)

  Initializes the kit protocol parser context.
- size_t **kit_host_format_response** (uint8_t ∗response, size_t rlen, ATCA_STATUS status, uint8_t ∗data, size_t dlen)

  Format the status and data into the kit protocol response format.
- ATCA_STATUS **kit_host_process_cmd** (ascii_kit_host_context_t ∗ctx, const kit_host_map_entry_t ∗cmd←_list, int argc, char ∗argv[ ], uint8_t ∗response, size_t ∗rlen)

  Iterate through a command list to match the given command and then will execute it.
- ATCA_STATUS **kit_host_process_line** (ascii_kit_host_context_t ∗ctx, uint8_t ∗input_line, size_t ilen, uint8_t ∗response, size_t ∗rlen)

  Parse a line as a kit protocol command. The kit protocol is printable ascii and each line ends with a newline character.
- void **kit_host_task** (ascii_kit_host_context_t ∗ctx)

  Non returning kit protocol runner using the configured physical interface that was provided when the context was initialized.

23.6.1 Detailed Description

KIT protocol intepreter.

Copyright

23.6.2 Macro Definition Documentation

23.6.2.1 KIT_MESSAGE_SIZE_MAX

```
#define KIT_MESSAGE_SIZE_MAX (2500)
```

The Kit Protocol maximum message size.

Note

Send: <target>:<command>(optional hex bytes to send)
Receive: <status hex byte>(optional hex bytes of response)

23.6.3 Typedef Documentation

23.6.3.1 kit_host_map_entry_t

```
typedef struct _kit_host_map_entry kit_host_map_entry_t
```

Used to create command tables for the kit host parser

23.6.4 Function Documentation

23.6.4.1 kit_host_init()

```
ATCA_STATUS kit_host_init (
            ascii_kit_host_context_t * ctx,
            ATCAIfaceCfg * iface[ ],
            const size_t iface_count,
            const atca_hal_kit_phy_t * phy,
            const uint32_t flags )
```

Initializes the kit protocol parser context.

Returns

ATCA_SUCCESS on success, otherwise an error code

Parameters

ctx	Kit protocol parser context
iface	List of device configurations which will be used
iface_count	Number of configurations provided
phy	Kit protocol physical adapter
flags	Option Flags

23.6.4.2 kit_host_init_phy()

```
ATCA_STATUS kit_host_init_phy (
            atca_hal_kit_phy_t * phy,
            ATCAIface iface )
```

Initializes a phy structure with a cryptoauthlib hal adapter.

Returns

ATCA_SUCCESS on success, otherwise an error code

23.7 trust_pkcs11_config.c File Reference

PKCS11 Trust Platform Configuration.

```
#include "cryptoauthlib.h"
#include "pkcs11_config.h"
#include "pkcs11/pkcs11_object.h"
#include "pkcs11/pkcs11_slot.h"
```

23.7.1 Detailed Description

PKCS11 Trust Platform Configuration.

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23.8 io_protection_key.h File Reference

Provides required interface to access IO protection key.

```
#include "atca_status.h"
```

Functions

- ATCA_STATUS **io_protection_get_key** (uint8_t ∗io_key)
- ATCA_STATUS **io_protection_set_key** (uint8_t ∗io_key)

23.8.1 Detailed Description

Provides required interface to access IO protection key.

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23.9 secure_boot.c File Reference

Provides required APIs to manage secure boot under various scenarios.

```
#include <string.h>
#include "secure_boot.h"
#include "io_protection_key.h"
#include "basic/atca_basic.h"
```

Functions

- ATCA_STATUS secure_boot_process (void)
  Handles secure boot functionality through initialization, execution, and de-initialization.
- ATCA_STATUS bind_host_and_secure_element_with_io_protection (uint16_t slot)
  Binds host MCU and Secure element with IO protection key.

23.9.1 Detailed Description

Provides required APIs to manage secure boot under various scenarios.

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23.9.2 Function Documentation

23.9.2.1 bind_host_and_secure_element_with_io_protection()

```
ATCA_STATUS bind_host_and_secure_element_with_io_protection (
            uint16_t slot )
```

Binds host MCU and Secure element with IO protection key.

Parameters

in	*slot*	The slot number of IO protection Key.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.9.2.2 secure_boot_process()

```
ATCA_STATUS secure_boot_process (
            void  )
```

Handles secure boot functionality through initialization, execution, and de-initialization.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.10 secure_boot.h File Reference

Provides required APIs to manage secure boot under various scenarios.

```
#include "atca_status.h"
#include "secure_boot_memory.h"
#include "atca_command.h"
#include "crypto/atca_crypto_sw_sha2.h"
```

Data Structures

- struct secure_boot_config_bits
- struct secure_boot_parameters

Macros

- #define **SECURE_BOOT_CONFIG_DISABLE** 0
- #define **SECURE_BOOT_CONFIG_FULL_BOTH** 1
- #define **SECURE_BOOT_CONFIG_FULL_SIGN** 2
- #define **SECURE_BOOT_CONFIG_FULL_DIG** 3
- #define **SECURE_BOOT_CONFIGURATION** SECURE_BOOT_CONFIG_FULL_DIG
- #define **SECURE_BOOT_DIGEST_ENCRYPT_ENABLED** true
- #define **SECURE_BOOT_UPGRADE_SUPPORT** true

Functions

- ATCA_STATUS secure_boot_process (void)

  Handles secure boot functionality through initialization, execution, and de-initialization.
- ATCA_STATUS bind_host_and_secure_element_with_io_protection (uint16_t slot)

  Binds host MCU and Secure element with IO protection key.
- ATCA_STATUS **host_generate_random_number** (uint8_t *rand)

23.10.1 Detailed Description

Provides required APIs to manage secure boot under various scenarios.

Copyright

23.10.2 Function Documentation

23.10.2.1 bind_host_and_secure_element_with_io_protection()

```
ATCA_STATUS bind_host_and_secure_element_with_io_protection (
            uint16_t slot )
```

Binds host MCU and Secure element with IO protection key.

Parameters

in	*slot*	The slot number of IO protection Key.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.10.2.2 secure_boot_process()

```
ATCA_STATUS secure_boot_process (
            void )
```

Handles secure boot functionality through initialization, execution, and de-initialization.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.11 secure_boot_memory.h File Reference

Provides interface to memory component for the secure boot.

```
#include "atca_status.h"
#include "atca_command.h"
```

Data Structures

- struct memory_parameters

Functions

- ATCA_STATUS **secure_boot_init_memory** (memory_parameters *memory_params)
- ATCA_STATUS **secure_boot_read_memory** (uint8_t *pu8_data, uint32_t *pu32_target_length)
- ATCA_STATUS **secure_boot_write_memory** (uint8_t *pu8_data, uint32_t *pu32_target_length)
- void **secure_boot_deinit_memory** (memory_parameters *memory_params)
- ATCA_STATUS **secure_boot_mark_full_copy_completion** (void)
- bool **secure_boot_check_full_copy_completion** (void)

23.11.1 Detailed Description

Provides interface to memory component for the secure boot.

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23.12 tflxtls_cert_def_4_device.c File Reference

TNG TLS device certificate definition.

```
#include "atcacert/atcacert_def.h"
#include "tngtls_cert_def_1_signer.h"
#include "tflxtls_cert_def_4_device.h"
```

Variables

- const uint8_t **g_tflxtls_cert_template_4_device** [500]
- const atcacert_cert_element_t **g_tflxtls_cert_elements_4_device** [ ]
- const atcacert_def_t **g_tflxtls_cert_def_4_device**

23.12.1 Detailed Description

TNG TLS device certificate definition.

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23.13 tflxtls_cert_def_4_device.h File Reference

TNG TLS device certificate definition.

```
#include "atcacert/atcacert_def.h"
```

Variables

- const uint8_t **g_tflxtls_cert_template_4_device** [500]
- const atcacert_def_t **g_tflxtls_cert_def_4_device**
- const atcacert_cert_element_t **g_tflxtls_cert_elements_4_device** [ ]

23.13.1 Detailed Description

TNG TLS device certificate definition.

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23.14 tng_atca.c File Reference

TNG Helper Functions.

```
#include <string.h>
#include "cryptoauthlib.h"
#include "tng_atca.h"
#include "tnglora_cert_def_2_device.h"
#include "tnglora_cert_def_4_device.h"
#include "tngtls_cert_def_2_device.h"
#include "tngtls_cert_def_3_device.h"
#include "tflxtls_cert_def_4_device.h"
#include "atcacert/atcacert_def.h"
```

Data Structures

- struct tng_cert_map_element

Functions

- const atcacert_def_t * tng_map_get_device_cert_def (int index)
  Helper function to iterate through all trust cert definitions.
- ATCA_STATUS tng_get_device_cert_def_ext (ATCADevice device, const atcacert_def_t **cert_def)
  Get the TNG device certificate definition.
- ATCA_STATUS tng_get_device_cert_def (const atcacert_def_t **cert_def)
  Get the TNG device certificate definition.
- ATCA_STATUS tng_get_device_pubkey (uint8_t *public_key)
  Uses GenKey command to calculate the public key from the primary device public key.

23.14.1 Detailed Description

TNG Helper Functions.

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23.15 tng_atca.h File Reference

TNG Helper Functions.

```
#include "atca_basic.h"
#include "atcacert/atcacert_def.h"
```

Macros

- #define **ATCA_OTP_CODE_SIZE** (8u)

Functions

- const atcacert_def_t * tng_map_get_device_cert_def (int index)
  Helper function to iterate through all trust cert definitions.
- ATCA_STATUS tng_get_device_cert_def (const atcacert_def_t **cert_def)
  Get the TNG device certificate definition.
- ATCA_STATUS tng_get_device_cert_def_ext (ATCADevice device, const atcacert_def_t **cert_def)
  Get the TNG device certificate definition.
- ATCA_STATUS tng_get_device_pubkey (uint8_t *public_key)
  Uses GenKey command to calculate the public key from the primary device public key.

23.15.1 Detailed Description

TNG Helper Functions.

Copyright

23.16 tng_atcacert_client.c File Reference

Client side certificate I/O functions for TNG devices.

```
#include "tng_atca.h"
#include "atcacert/atcacert_client.h"
#include "tng_atcacert_client.h"
#include "tngtls_cert_def_1_signer.h"
#include "tng_root_cert.h"
#include <limits.h>
```

Functions

- int tng_atcacert_max_device_cert_size (size_t ∗max_cert_size)
    Return the maximum possible certificate size in bytes for a TNG device certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.
- int tng_atcacert_read_device_cert (uint8_t ∗cert, size_t ∗cert_size, const uint8_t ∗signer_cert)
    Reads the device certificate for a TNG device.
- int tng_atcacert_device_public_key (uint8_t ∗public_key, uint8_t ∗cert)
    Reads the device public key.
- int tng_atcacert_max_signer_cert_size (size_t ∗max_cert_size)
    Return the maximum possible certificate size in bytes for a TNG signer certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.
- int tng_atcacert_read_signer_cert (uint8_t ∗cert, size_t ∗cert_size)
    Reads the signer certificate for a TNG device.
- int tng_atcacert_signer_public_key (uint8_t ∗public_key, uint8_t ∗cert)
    Reads the signer public key.
- int tng_atcacert_root_cert_size (size_t ∗cert_size)
    Get the size of the TNG root cert.
- int tng_atcacert_root_cert (uint8_t ∗cert, size_t ∗cert_size)
    Get the TNG root cert.
- int tng_atcacert_root_public_key (uint8_t ∗public_key)
    Gets the root public key.

23.16.1 Detailed Description

Client side certificate I/O functions for TNG devices.

Copyright

23.16.2 Function Documentation

23.16.2.1 tng_atcacert_device_public_key()

```
int tng_atcacert_device_public_key (
            uint8_t * public_key,
            uint8_t * cert )
```

Reads the device public key.

Parameters

out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve.
in	*cert*	If supplied, the device public key is used from this certificate. If set to NULL, the device public key is read from the device.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.16.2.2 tng_atcacert_max_signer_cert_size()

```
int tng_atcacert_max_signer_cert_size (
            size_t * max_cert_size )
```

Return the maximum possible certificate size in bytes for a TNG signer certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.

Parameters

out	*max_cert_size*	Maximum certificate size will be returned here in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.16.2.3 tng_atcacert_read_device_cert()

```
int tng_atcacert_read_device_cert (
            uint8_t * cert,
            size_t * cert_size,
            const uint8_t * signer_cert )
```

Reads the device certificate for a TNG device.

Parameters

out	*cert*	Buffer to received the certificate (DER format).
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.
in	*signer_cert*	If supplied, the signer public key is used from this certificate. If set to NULL, the signer public key is read from the device.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.16.2.4 tng_atcacert_read_signer_cert()

```
int tng_atcacert_read_signer_cert (
            uint8_t * cert,
            size_t * cert_size )
```

Reads the signer certificate for a TNG device.

Parameters

out	*cert*	Buffer to received the certificate (DER format).
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.16.2.5 tng_atcacert_root_cert()

```
int tng_atcacert_root_cert (
            uint8_t * cert,
            size_t * cert_size )
```

Get the TNG root cert.

Parameters

out	*cert*	Buffer to received the certificate (DER format).
in,out	*cert_size*	As input, the size of the cert buffer in bytes. As output, the size of the certificate returned in cert in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.16.2.6 tng_atcacert_root_cert_size()

```
int tng_atcacert_root_cert_size (
            size_t * cert_size )
```

Get the size of the TNG root cert.

Parameters

out	*cert_size*	Certificate size will be returned here in bytes.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.16.2.7 tng_atcacert_root_public_key()

```
int tng_atcacert_root_public_key (
            uint8_t * public_key )
```

Gets the root public key.

Parameters

out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.16.2.8 tng_atcacert_signer_public_key()

```
int tng_atcacert_signer_public_key (
            uint8_t * public_key,
            uint8_t * cert )
```

Reads the signer public key.

Parameters

out	*public_key*	Public key will be returned here. Format will be the X and Y integers in big-endian format. 64 bytes for P256 curve.
in	*cert*	If supplied, the signer public key is used from this certificate. If set to NULL, the signer public key is read from the device.

Returns

ATCACERT_E_SUCCESS on success, otherwise an error code.

23.17 tng_atcacert_client.h File Reference

Client side certificate I/O functions for TNG devices.

```
#include <stdint.h>
#include "atcacert/atcacert.h"
```

Functions

- int tng_atcacert_max_device_cert_size (size_t *max_cert_size)

  Return the maximum possible certificate size in bytes for a TNG device certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.
- int tng_atcacert_read_device_cert (uint8_t *cert, size_t *cert_size, const uint8_t *signer_cert)

  Reads the device certificate for a TNG device.
- int tng_atcacert_device_public_key (uint8_t *public_key, uint8_t *cert)

  Reads the device public key.
- int tng_atcacert_max_signer_cert_size (size_t *max_cert_size)

  Return the maximum possible certificate size in bytes for a TNG signer certificate. Certificate can be variable size, so this gives an appropriate buffer size when reading the certificate.
- int tng_atcacert_read_signer_cert (uint8_t *cert, size_t *cert_size)

  Reads the signer certificate for a TNG device.
- int tng_atcacert_signer_public_key (uint8_t *public_key, uint8_t *cert)

  Reads the signer public key.
- int tng_atcacert_root_cert_size (size_t *cert_size)

  Get the size of the TNG root cert.
- int tng_atcacert_root_cert (uint8_t *cert, size_t *cert_size)

  Get the TNG root cert.
- int tng_atcacert_root_public_key (uint8_t *public_key)

  Gets the root public key.

23.17.1 Detailed Description

Client side certificate I/O functions for TNG devices.

Copyright

23.18 tng_root_cert.c File Reference

TNG root certificate (DER)

```
#include <stdint.h>
#include <stddef.h>
#include "tng_root_cert.h"
```

Variables

- const uint8_t **g_cryptoauth_root_ca_002_cert** [501]
- const size_t **g_cryptoauth_root_ca_002_cert_size** = sizeof(g_cryptoauth_root_ca_002_cert)

23.18.1 Detailed Description

TNG root certificate (DER)

Copyright

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23.19 tng_root_cert.h File Reference

TNG root certificate (DER)

```
#include <stdint.h>
```

- #define **CRYPTOAUTH_ROOT_CA_002_PUBLIC_KEY_OFFSET** 266
- const uint8_t **g_cryptoauth_root_ca_002_cert** [ ]
- const size_t **g_cryptoauth_root_ca_002_cert_size**

23.19.1 Detailed Description

TNG root certificate (DER)

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23.20 tnglora_cert_def_1_signer.c File Reference

TNG LORA signer certificate definition.

```
#include "atcacert/atcacert_def.h"
#include "tngtls_cert_def_1_signer.h"
#include "tnglora_cert_def_1_signer.h"
```

Variables

- SHARED_LIB_EXPORT const atcacert_def_t **g_tnglora_cert_def_1_signer**

23.20.1 Detailed Description

TNG LORA signer certificate definition.

Copyright

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23.21 tnglora_cert_def_1_signer.h File Reference

TNG LORA signer certificate definition.

```
#include "atcacert/atcacert_def.h"
```

Variables

- ATCA_DLL const atcacert_def_t **g_tnglora_cert_def_1_signer**

23.21.1 Detailed Description

TNG LORA signer certificate definition.

Copyright

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23.22 tnglora_cert_def_2_device.c File Reference

TNG LORA device certificate definition.

```
#include "atcacert/atcacert_def.h"
#include "tngtls_cert_def_2_device.h"
#include "tngtls_cert_def_1_signer.h"
#include "tnglora_cert_def_1_signer.h"
#include "tnglora_cert_def_2_device.h"
```

Variables

- SHARED_LIB_EXPORT const atcacert_def_t **g_tnglora_cert_def_2_device**

23.22.1 Detailed Description

TNG LORA device certificate definition.

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23.23 tnglora_cert_def_2_device.h File Reference

TNG LORA device certificate definition.

```
#include "atcacert/atcacert_def.h"
```

Variables

- ATCA_DLL const atcacert_def_t **g_tnglora_cert_def_2_device**

23.23.1 Detailed Description

TNG LORA device certificate definition.

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23.24 tnglora_cert_def_4_device.c File Reference

TNG LORA device certificate definition.

```
#include "atcacert/atcacert_def.h"
#include "tnglora_cert_def_4_device.h"
#include "tnglora_cert_def_1_signer.h"
```

Variables

- SHARED_LIB_EXPORT const uint8_t **g_tnglora_cert_template_4_device** [552]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tnglora_cert_elements_4_device** [ ]
- SHARED_LIB_EXPORT const atcacert_def_t **g_tnglora_cert_def_4_device**

23.24.1 Detailed Description

TNG LORA device certificate definition.

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23.25 tnglora_cert_def_4_device.h File Reference

TNG LORA device certificate definition.

```
#include "atcacert/atcacert_def.h"
```

- #define **TNGLORA_CERT_TEMPLATE_4_DEVICE_SIZE** 552
- ATCA_DLL const atcacert_def_t **g_tnglora_cert_def_4_device**
- SHARED_LIB_EXPORT const uint8_t **g_tnglora_cert_template_4_device** [ ]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tnglora_cert_elements_4_device** [ ]

23.25.1 Detailed Description

TNG LORA device certificate definition.

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23.26 tngtls_cert_def_1_signer.c File Reference

TNG TLS signer certificate definition.

```
#include "atcacert/atcacert_def.h"
#include "tngtls_cert_def_1_signer.h"
```

Variables

- SHARED_LIB_EXPORT const uint8_t **g_tngtls_cert_template_1_signer** [520]
- SHARED_LIB_EXPORT const atcacert_cert_element_t g_tngtls_cert_elements_1_signer [ ]
- SHARED_LIB_EXPORT const atcacert_def_t **g_tngtls_cert_def_1_signer**

23.26.1 Detailed Description

TNG TLS signer certificate definition.

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23.26.2 Variable Documentation

23.26.2.1 g_tngtls_cert_elements_1_signer

```
SHARED_LIB_EXPORT const atcacert_cert_element_t g_tngtls_cert_elements_1_signer[ ]
```

Initial value:
```
= {
    {
        .id = "subject",
        .device_loc ={
            .zone      = DEVZONE_NONE,
        },
        .cert_loc ={
            .offset = 158,
            .count  = 81
        }
    }
}
```

23.27 tngtls_cert_def_1_signer.h File Reference

TNG TLS signer certificate definition.

```
#include "atcacert/atcacert_def.h"
```

- #define **TNGTLS_CERT_TEMPLATE_1_SIGNER_SIZE** 520
- ATCA_DLL const atcacert_def_t **g_tngtls_cert_def_1_signer**
- SHARED_LIB_EXPORT const uint8_t **g_tngtls_cert_template_1_signer** [ ]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tngtls_cert_elements_1_signer** [ ]

23.27.1 Detailed Description

TNG TLS signer certificate definition.

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23.28 tngtls_cert_def_2_device.c File Reference

TNG TLS device certificate definition.

```
#include "atcacert/atcacert_def.h"
#include "tngtls_cert_def_2_device.h"
#include "tngtls_cert_def_1_signer.h"
```

Variables

- SHARED_LIB_EXPORT const uint8_t **g_tngtls_cert_template_2_device** [505]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tngtls_cert_elements_2_device** [2]
- SHARED_LIB_EXPORT const atcacert_def_t **g_tngtls_cert_def_2_device**

23.28.1 Detailed Description

TNG TLS device certificate definition.

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23.29 tngtls_cert_def_2_device.h File Reference

TNG TLS device certificate definition.

```
#include "atcacert/atcacert_def.h"
```

- #define **TNGTLS_CERT_TEMPLATE_2_DEVICE_SIZE** 505
- #define **TNGTLS_CERT_ELEMENTS_2_DEVICE_COUNT** 2
- ATCA_DLL const atcacert_def_t **g_tngtls_cert_def_2_device**
- SHARED_LIB_EXPORT const uint8_t **g_tngtls_cert_template_2_device** [ ]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tngtls_cert_elements_2_device** [ ]

23.29.1 Detailed Description

TNG TLS device certificate definition.

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23.30 tngtls_cert_def_3_device.c File Reference

TNG TLS device certificate definition.

```
#include "atcacert/atcacert_def.h"
#include "tngtls_cert_def_3_device.h"
#include "tngtls_cert_def_1_signer.h"
```

Variables

- SHARED_LIB_EXPORT const uint8_t **g_tngtls_cert_template_3_device** [546]
- SHARED_LIB_EXPORT const atcacert_cert_element_t **g_tngtls_cert_elements_3_device** [ ]
- SHARED_LIB_EXPORT const atcacert_def_t **g_tngtls_cert_def_3_device**

23.30.1 Detailed Description

TNG TLS device certificate definition.

Copyright

23.31 tngtls_cert_def_3_device.h File Reference

TNG TLS device certificate definition.

```
#include "atcacert/atcacert_def.h"
```

- #define **TNGTLS_CERT_TEMPLATE_3_DEVICE_SIZE** 546
- ATCA_DLL const atcacert_def_t **g_tngtls_cert_def_3_device**
- ATCA_DLL const uint8_t **g_tngtls_cert_template_3_device** [ ]
- ATCA_DLL const atcacert_cert_element_t **g_tngtls_cert_elements_3_device** [ ]

23.31.1 Detailed Description

TNG TLS device certificate definition.

Copyright

23.32 wpc_apis.c File Reference

Provides api interfaces for WPC authentication.

```
#include "cryptoauthlib.h"
#include "wpc_apis.h"
#include "wpccert_client.h"
#include "atcacert/atcacert_client.h"
```

23.32.1 Detailed Description

Provides api interfaces for WPC authentication.

Copyright

23.33 wpc_apis.h File Reference

Provides api interfaces for WPC authentication.

```
#include "wpc_check_config.h"
```

Macros

- #define **WPC_PROTOCOL_VERSION** 0x01
- #define **WPC_PROTOCOL_MAX_VERSION** 0x01
- #define **WPC_TBS_AUTH_PREFIX** 0x41
- #define **WPC_CONST_N_RH** ATCA_SHA256_DIGEST_SIZE
- #define **WPC_CONST_OS_MC** (2 + WPC_CONST_N_RH)
- #define **WPC_HEADER**(x) ((WPC_PROTOCOL_VERSION << 4) | x)
- #define **WPC_GET_DIGESTS_TYPE** 0x09
- #define **WPC_GET_DIGESTS_HEADER** WPC_HEADER(WPC_GET_DIGESTS_TYPE)
- #define **WPC_GET_DIGESTS_LENGTH** (2)
- #define **WPC_GET_CERTIFICATE_TYPE** 0x0A
- #define **WPC_GET_CERTIFICATE_HEADER** WPC_HEADER(WPC_GET_CERTIFICATE_TYPE)
- #define **WPC_GET_CERTIFICATE_LENGTH** (4)
- #define **WPC_CHALLENGE_TYPE** 0x0B
- #define **WPC_CHALLENGE_HEADER** WPC_HEADER(WPC_CHALLENGE_TYPE)
- #define **WPC_CHALLENGE_NONCE_LENGTH** (16)
- #define **WPC_CHALLENGE_LENGTH** (2 + WPC_CHALLENGE_NONCE_LENGTH)
- #define **WPC_DIGESTS_TYPE** 0x01
- #define **WPC_DIGESTS_HEADER** WPC_HEADER(WPC_DIGESTS_TYPE)
- #define **WPC_DIGESTS_LENGTH**(x) (2 + (ATCA_SHA256_DIGEST_SIZE * x))
- #define **WPC_CERTIFICATE_TYPE** 0x02
- #define **WPC_CERTIFICATE_HEADER** WPC_HEADER(WPC_CERTIFICATE_TYPE)
- #define **WPC_CERTIFICATE_LENGTH**(x) (1 + x)
- #define **WPC_CHALLENGE_AUTH_TYPE** 0x03
- #define **WPC_CHALLENGE_AUTH_HEADER** WPC_HEADER(WPC_CHALLENGE_AUTH_TYPE)
- #define **WPC_CHALLENGE_AUTH_LENGTH** (67)
- #define **WPC_ERROR_TYPE** 0x07
- #define **WPC_ERROR_HEADER** WPC_HEADER(WPC_ERROR_TYPE)
- #define **WPC_ERROR_LENGTH** (3)
- #define **WPC_ERROR_INVALID_REQUEST** (0x01)
- #define **WPC_ERROR_UNSUPPORTED_PROTOCOL** (0x02)
- #define **WPC_ERROR_BUSY** (0x03)
- #define **WPC_ERROR_UNSPECIFIED** (0x04)

Variables

- const uint8_t **g_root_ca_digest** [ ]

23.33.1 Detailed Description

Provides api interfaces for WPC authentication.

Copyright

23.34 wpccert_client.c File Reference

Provides api interfaces for accessing WPC certificates from device.

```
#include "wpc_check_config.h"
#include "wpccert_client.h"
#include "atcacert/atcacert_def.h"
#include "atcacert/atcacert_der.h"
#include "atcacert/atcacert_client.h"
#include "atca_basic.h"
```

Functions

- ATCA_STATUS **wpccert_read_cert_size** (ATCADevice device, const atcacert_def_t ∗cert_def, size_t ∗cert_size)
- ATCA_STATUS wpccert_read_cert (ATCADevice device, const atcacert_def_t ∗cert_def, uint8_t ∗cert, size_t ∗cert_size)

    WPC API -.
- ATCA_STATUS **wpccert_read_pdu_cert** (ATCADevice device, uint8_t ∗cert, size_t ∗cert_size, uint8_t slot)
- ATCA_STATUS wpccert_read_mfg_cert (ATCADevice device, uint8_t ∗cert, size_t ∗cert_size, uint8_t slot)
- ATCA_STATUS **wpccert_public_key** (const atcacert_def_t ∗cert_def, uint8_t ∗public_key, uint8_t ∗cert)

23.34.1 Detailed Description

Provides api interfaces for accessing WPC certificates from device.

Copyright

23.34.2 Function Documentation

23.34.2.1 wpccert_read_cert()

```
ATCA_STATUS wpccert_read_cert (
            ATCADevice device,
            const atcacert_def_t * cert_def,
            uint8_t * cert,
            size_t * cert_size )
```

WPC API -.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.34.2.2 wpccert_read_mfg_cert()

```
ATCA_STATUS wpccert_read_mfg_cert (
            ATCADevice device,
            uint8_t * cert,
            size_t * cert_size,
            uint8_t slot )
```

CA device MFG Cert

CA2 device MFG Cert

23.35 wpccert_client.h File Reference

Provides api interfaces for accessing WPC certificates from device.

```
#include "cryptoauthlib.h"
#include "atcacert/atcacert_def.h"
```

Functions

- uint8_t **wpccert_get_slots_populated** (void)
- uint8_t **wpccert_get_slot_count** (void)
- ATCA_STATUS **wpccert_get_slot_info** (uint16_t *dig_handle, const atcacert_def_t **def, uint8_t **mfg, uint8_t *root_dgst, uint8_t slot)
- ATCA_STATUS **wpccert_read_cert_size** (ATCADevice device, const atcacert_def_t *cert_def, size_t *cert_size)
- ATCA_STATUS wpccert_read_cert (ATCADevice device, const atcacert_def_t *cert_def, uint8_t *cert, size_t *cert_size)

  WPC API -.
- ATCA_STATUS **wpccert_write_cert** (ATCADevice device, const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size)
- ATCA_STATUS **wpccert_read_pdu_cert** (ATCADevice device, uint8_t *cert, size_t *cert_size, uint8_t slot)
- ATCA_STATUS wpccert_read_mfg_cert (ATCADevice device, uint8_t *cert, size_t *cert_size, uint8_t slot)
- ATCA_STATUS **wpccert_public_key** (const atcacert_def_t *cert_def, uint8_t *public_key, uint8_t *cert)

23.35.1 Detailed Description

Provides api interfaces for accessing WPC certificates from device.

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23.35.2 Function Documentation

23.35.2.1 wpccert_read_cert()

```
ATCA_STATUS wpccert_read_cert (
            ATCADevice device,
            const atcacert_def_t * cert_def,
            uint8_t * cert,
            size_t * cert_size )
```

WPC API -.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.35.2.2 wpccert_read_mfg_cert()

```
ATCA_STATUS wpccert_read_mfg_cert (
            ATCADevice device,
            uint8_t * cert,
            size_t * cert_size,
            uint8_t slot )
```

CA device MFG Cert

CA2 device MFG Cert

23.36 atca_basic.c File Reference

CryptoAuthLib Basic API methods. These methods provide a simpler way to access the core crypto methods.

```
#include "atca_basic.h"
#include "atca_version.h"
```

Functions

- ATCA_STATUS atcab_version (char ∗ver_str)

  basic API methods are all prefixed with atcab_ (CryptoAuthLib Basic) the fundamental premise of the basic API is it is based on a single interface instance and that instance is global, so all basic API commands assume that one global device is the one to operate on.
- ATCA_STATUS atcab_init_ext (ATCADevice ∗device, ATCAIfaceCfg ∗cfg)

  Creates and initializes a ATCADevice context.
- ATCA_STATUS atcab_init (ATCAIfaceCfg ∗cfg)

  Creates a global ATCADevice object used by Basic API.
- ATCA_STATUS atcab_init_device (ATCADevice ca_device)

  Initialize the global ATCADevice object to point to one of your choosing for use with all the atcab_ basic API.
- ATCA_STATUS atcab_release_ext (ATCADevice ∗device)

  release (free) the an ATCADevice instance.
- ATCA_STATUS atcab_release (void)

  release (free) the global ATCADevice instance. This must be called in order to release or free up the interface.
- ATCADevice atcab_get_device (void)

  Get the global device object.
- ATCADeviceType atcab_get_device_type_ext (ATCADevice device)

  Get the selected device type of rthe device context.
- ATCADeviceType atcab_get_device_type (void)

  Get the current device type configured for the global ATCADevice.
- uint8_t atcab_get_device_address (ATCADevice device)

  Get the current device address based on the configured device and interface.
- bool atcab_is_ca_device (ATCADeviceType dev_type)

  Check whether the device is cryptoauth device.
- bool atcab_is_ca2_device (ATCADeviceType dev_type)

  Check whether the device is cryptoauth device.
- bool atcab_is_ta_device (ATCADeviceType dev_type)

  Check whether the device is Trust Anchor device.
- ATCA_STATUS atcab_wakeup (void)

  wakeup the CryptoAuth device
- ATCA_STATUS atcab_idle (void)

  idle the CryptoAuth device
- ATCA_STATUS atcab_sleep (void)

  invoke sleep on the CryptoAuth device
- ATCA_STATUS atcab_get_zone_size_ext (ATCADevice device, uint8_t zone, uint16_t slot, size_t ∗size)

  Gets the size of the specified zone in bytes.
- ATCA_STATUS atcab_get_zone_size (uint8_t zone, uint16_t slot, size_t ∗size)

  Gets the size of the specified zone in bytes.
- ATCA_STATUS atcab_aes (uint8_t mode, uint16_t key_id, const uint8_t ∗aes_in, uint8_t ∗aes_out)

  Compute the AES-128 encrypt, decrypt, or GFM calculation.
- ATCA_STATUS atcab_aes_encrypt_ext (ATCADevice device, uint16_t key_id, uint8_t key_block, const uint8_t ∗plaintext, uint8_t ∗ciphertext)

  Perform an AES-128 encrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_encrypt (uint16_t key_id, uint8_t key_block, const uint8_t ∗plaintext, uint8_t ∗ciphertext)

  Perform an AES-128 encrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_decrypt_ext (ATCADevice device, uint16_t key_id, uint8_t key_block, const uint8_t ∗ciphertext, uint8_t ∗plaintext)

  Perform an AES-128 decrypt operation with a key in the device.

- ATCA_STATUS atcab_aes_decrypt (uint16_t key_id, uint8_t key_block, const uint8_t *ciphertext, uint8_↩ t *plaintext)

  Perform an AES-128 decrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_gfm (const uint8_t *h, const uint8_t *input, uint8_t *output)

  Perform a Galois Field Multiply (GFM) operation.
- ATCA_STATUS atcab_aes_gcm_init_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, uint16_t key_id, uint8_t key_block, const uint8_t *iv, size_t iv_size)

  Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.
- ATCA_STATUS atcab_aes_gcm_init (atca_aes_gcm_ctx_t *ctx, uint16_t key_id, uint8_t key_block, const uint8_t *iv, size_t iv_size)

  Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.
- ATCA_STATUS atcab_aes_gcm_init_rand (atca_aes_gcm_ctx_t *ctx, uint16_t key_id, uint8_t key_block, size_t rand_size, const uint8_t *free_field, size_t free_field_size, uint8_t *iv)

  Initialize context for AES GCM operation with a IV composed of a random and optional fixed(free) field, which is common when starting an encrypt operation.
- ATCA_STATUS atcab_aes_gcm_aad_update_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, const uint8_t *aad, uint32_t aad_size)

  Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.
- ATCA_STATUS atcab_aes_gcm_aad_update (atca_aes_gcm_ctx_t *ctx, const uint8_t *aad, uint32_t aad↩ _size)

  Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.
- ATCA_STATUS atcab_aes_gcm_encrypt_update_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, const uint8_t *plaintext, uint32_t plaintext_size, uint8_t *ciphertext)

  Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_encrypt_update (atca_aes_gcm_ctx_t *ctx, const uint8_t *plaintext, uint32_t plaintext_size, uint8_t *ciphertext)

  Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_encrypt_finish_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, uint8↩ _t *tag, size_t tag_size)

  Complete a GCM encrypt operation returning the authentication tag.
- ATCA_STATUS atcab_aes_gcm_encrypt_finish (atca_aes_gcm_ctx_t *ctx, uint8_t *tag, size_t tag_size)

  Complete a GCM encrypt operation returning the authentication tag.
- ATCA_STATUS atcab_aes_gcm_decrypt_update_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, const uint8_t *ciphertext, uint32_t ciphertext_size, uint8_t *plaintext)

  Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_decrypt_update (atca_aes_gcm_ctx_t *ctx, const uint8_t *ciphertext, uint32_t ciphertext_size, uint8_t *plaintext)

  Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_decrypt_finish_ext (ATCADevice device, atca_aes_gcm_ctx_t *ctx, const uint8_t *tag, size_t tag_size, bool *is_verified)

  Complete a GCM decrypt operation verifying the authentication tag.
- ATCA_STATUS atcab_aes_gcm_decrypt_finish (atca_aes_gcm_ctx_t *ctx, const uint8_t *tag, size_t tag_↩ size, bool *is_verified)

  Complete a GCM decrypt operation verifying the authentication tag.
- ATCA_STATUS atcab_checkmac (uint8_t mode, uint16_t key_id, const uint8_t *challenge, const uint8_↩ t *response, const uint8_t *other_data)

  Compares a MAC response with input values.
- ATCA_STATUS atcab_checkmac_with_response_mac (uint8_t mode, const uint8_t *challenge, const uint8↩ _t *response, const uint8_t *other_data, uint8_t *mac)

Compares a MAC response with input values.SHA105 device can generate optional mac Output response mac mode only supports in SHA105 device.

- ATCA_STATUS atcab_counter (uint8_t mode, uint16_t counter_id, uint32_t ∗counter_value)

  Compute the Counter functions.

- ATCA_STATUS atcab_counter_increment (uint16_t counter_id, uint32_t ∗counter_value)

  Increments one of the device's monotonic counters.

- ATCA_STATUS atcab_counter_read (uint16_t counter_id, uint32_t ∗counter_value)

  Read one of the device's monotonic counters.

- ATCA_STATUS atcab_derivekey_ext (ATCADevice device, uint8_t mode, uint16_t key_id, const uint8_t ∗mac)

  Executes the DeviveKey command for deriving a new key from a nonce (TempKey) and an existing key.

- ATCA_STATUS atcab_derivekey (uint8_t mode, uint16_t key_id, const uint8_t ∗mac)

  Executes the DeviveKey command for deriving a new key from a nonce (TempKey) and an existing key.

- ATCA_STATUS atcab_ecdh_base (uint8_t mode, uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, uint8_t ∗out_nonce)

  Base function for generating premaster secret key using ECDH.

- ATCA_STATUS atcab_ecdh (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms)

  ECDH command with a private key in a slot and the premaster secret is returned in the clear.

- ATCA_STATUS atcab_ecdh_enc (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗read_key, uint16_t read_key_id, const uint8_t num_in[(20)])

  ECDH command with a private key in a slot and the premaster secret is read from the next slot.

- ATCA_STATUS atcab_ecdh_ioenc (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗io_key)

  ECDH command with a private key in a slot and the premaster secret is returned encrypted using the IO protection key.

- ATCA_STATUS atcab_ecdh_tempkey (const uint8_t ∗public_key, uint8_t ∗pms)

  ECDH command with a private key in TempKey and the premaster secret is returned in the clear.

- ATCA_STATUS atcab_ecdh_tempkey_ioenc (const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗io_key)

  ECDH command with a private key in TempKey and the premaster secret is returned encrypted using the IO protection key.

- ATCA_STATUS atcab_gendig (uint8_t zone, uint16_t key_id, const uint8_t ∗other_data, uint8_t other_data_size)

  Issues a GenDig command, which performs a SHA256 hash on the source data indicated by zone with the contents of TempKey. See the CryptoAuth datasheet for your chip to see what the values of zone correspond to.

- ATCA_STATUS atcab_gendivkey (const uint8_t ∗other_data)

  Issues a GenDivKey command to generate the equivalent diversified key as that programmed into the client side device.

- ATCA_STATUS atcab_genkey_base (uint8_t mode, uint16_t key_id, const uint8_t ∗other_data, uint8_t ∗public_key)

  Issues GenKey command, which can generate a private key, compute a public key, nd/or compute a digest of a public key.

- ATCA_STATUS atcab_genkey_ext (ATCADevice device, uint16_t key_id, uint8_t ∗public_key)

  Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.

- ATCA_STATUS atcab_genkey (uint16_t key_id, uint8_t ∗public_key)

  Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.

- ATCA_STATUS atcab_get_pubkey_ext (ATCADevice device, uint16_t key_id, uint8_t ∗public_key)

  Uses GenKey command to calculate the public key from an existing private key in a slot.

- ATCA_STATUS atcab_get_pubkey (uint16_t key_id, uint8_t ∗public_key)

  Uses GenKey command to calculate the public key from an existing private key in a slot.

- ATCA_STATUS atcab_hmac (uint8_t mode, uint16_t key_id, uint8_t ∗digest)

  Issues a HMAC command, which computes an HMAC/SHA-256 digest of a key stored in the device, a challenge, and other information on the device.

- ATCA_STATUS atcab_info_base (uint8_t mode, uint16_t param2, uint8_t ∗out_data)

  Issues an Info command, which return internal device information and can control GPIO and the persistent latch.

- ATCA_STATUS atcab_info_ext (ATCADevice device, uint8_t ∗revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS atcab_info (uint8_t ∗revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS atcab_info_lock_status (uint16_t param2, uint8_t ∗is_locked)

  Use the Info command to get the lock status.
- ATCA_STATUS atcab_info_chip_status (uint8_t ∗chip_status)

  Use the Info command to get the chip status.
- ATCA_STATUS atcab_info_set_latch (bool state)

  Use the Info command to set the persistent latch state for an ATECC608 device.
- ATCA_STATUS atcab_info_get_latch (bool ∗state)

  Use the Info command to get the persistent latch current state for an ATECC608 device.
- ATCA_STATUS atcab_kdf (uint8_t mode, uint16_t key_id, const uint32_t details, const uint8_t ∗message, uint8_t ∗out_data, uint8_t ∗out_nonce)

  Executes the KDF command, which derives a new key in PRF, AES, or HKDF modes.
- ATCA_STATUS atcab_lock (uint8_t mode, uint16_t summary_crc)

  The Lock command prevents future modifications of the Configuration and/or Data and OTP zones. If the device is so configured, then this command can be used to lock individual data slots. This command fails if the designated area is already locked.
- ATCA_STATUS atcab_lock_config_zone_ext (ATCADevice device)

  Unconditionally (no CRC required) lock the config zone.
- ATCA_STATUS atcab_lock_config_zone (void)

  Unconditionally (no CRC required) lock the config zone.
- ATCA_STATUS atcab_lock_config_zone_crc (uint16_t summary_crc)

  Lock the config zone with summary CRC.
- ATCA_STATUS atcab_lock_data_zone_ext (ATCADevice device)

  Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.
- ATCA_STATUS atcab_lock_data_zone (void)

  Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.
- ATCA_STATUS atcab_lock_data_zone_crc (uint16_t summary_crc)

  Lock the data zone (slots and OTP) with summary CRC.
- ATCA_STATUS atcab_lock_data_slot_ext (ATCADevice device, uint16_t slot)

  Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).
- ATCA_STATUS atcab_lock_data_slot (uint16_t slot)

  Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).
- ATCA_STATUS atcab_mac (uint8_t mode, uint16_t key_id, const uint8_t ∗challenge, uint8_t ∗digest)

  Executes MAC command, which computes a SHA-256 digest of a key stored in the device, a challenge, and other information on the device.
- ATCA_STATUS atcab_nonce_base (uint8_t mode, uint16_t zero, const uint8_t ∗num_in, uint8_t ∗rand_out)

  Executes Nonce command, which loads a random or fixed nonce/data into the device for use by subsequent commands.
- ATCA_STATUS atcab_nonce (const uint8_t ∗num_in)

  Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.
- ATCA_STATUS atcab_nonce_load (uint8_t target, const uint8_t ∗num_in, uint16_t num_in_size)

  Execute a Nonce command in pass-through mode to load one of the device's internal buffers with a fixed value.
- ATCA_STATUS atcab_nonce_rand_ext (ATCADevice device, const uint8_t ∗num_in, uint8_t ∗rand_out)

Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.

- ATCA_STATUS atcab_nonce_rand (const uint8_t ∗num_in, uint8_t ∗rand_out)

  Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.
- ATCA_STATUS atcab_challenge (const uint8_t ∗num_in)

  Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.
- ATCA_STATUS atcab_challenge_seed_update (const uint8_t ∗num_in, uint8_t ∗rand_out)

  Execute a Nonce command to generate a random challenge combining a host nonce (num_in) and a device random number.
- ATCA_STATUS atcab_priv_write (uint16_t key_id, const uint8_t priv_key[36], uint16_t write_key_id, const uint8_t write_key[32], const uint8_t num_in[(20)])

  Executes PrivWrite command, to write externally generated ECC private keys into the device.
- ATCA_STATUS atcab_random_ext (ATCADevice device, uint8_t ∗rand_out)

  Executes Random command, which generates a 32 byte random number from the device.
- ATCA_STATUS atcab_random (uint8_t ∗rand_out)

  Executes Random command, which generates a 32 byte random number from the device.
- ATCA_STATUS atcab_read_zone_ext (ATCADevice device, uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint8_t ∗data, uint8_t len)

  Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.
- ATCA_STATUS atcab_read_zone (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint8_t ∗data, uint8_t len)

  Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.
- ATCA_STATUS atcab_is_locked (uint8_t zone, bool ∗is_locked)

  Executes Read command, which reads the configuration zone to see if the specified zone is locked.
- ATCA_STATUS atcab_is_config_locked_ext (ATCADevice device, bool ∗is_locked)

  This function check whether configuration zone is locked or not.
- ATCA_STATUS atcab_is_config_locked (bool ∗is_locked)

  This function check whether configuration zone is locked or not.
- ATCA_STATUS atcab_is_data_locked_ext (ATCADevice device, bool ∗is_locked)

  This function check whether data/setup zone is locked or not.
- ATCA_STATUS atcab_is_data_locked (bool ∗is_locked)

  This function check whether data/setup zone is locked or not.
- ATCA_STATUS atcab_is_slot_locked_ext (ATCADevice device, uint16_t slot, bool ∗is_locked)

  This function check whether slot/handle is locked or not.
- ATCA_STATUS atcab_is_slot_locked (uint16_t slot, bool ∗is_locked)

  This function check whether slot/handle is locked or not.
- ATCA_STATUS atcab_is_private_ext (ATCADevice device, uint16_t slot, bool ∗is_private)

  Check to see if the key is a private key or not.
- ATCA_STATUS **atcab_is_private** (uint16_t slot, bool ∗is_private)
- ATCA_STATUS **atcab_read_bytes_zone_ext** (ATCADevice device, uint8_t zone, uint16_t slot, size_t offset, uint8_t ∗data, size_t length)
- ATCA_STATUS atcab_read_bytes_zone (uint8_t zone, uint16_t slot, size_t offset, uint8_t ∗data, size_t length)

  Used to read an arbitrary number of bytes from any zone configured for clear reads.
- ATCA_STATUS atcab_read_serial_number_ext (ATCADevice device, uint8_t ∗serial_number)

  This function returns serial number of the device.
- ATCA_STATUS atcab_read_serial_number (uint8_t ∗serial_number)

  This function returns serial number of the device.
- ATCA_STATUS atcab_read_pubkey_ext (ATCADevice device, uint16_t slot, uint8_t ∗public_key)

  Executes Read command to read an ECC P256 public key from a slot configured for clear reads.

- ATCA_STATUS atcab_read_pubkey (uint16_t slot, uint8_t ∗public_key)

  Executes Read command to read an ECC P256 public key from a slot configured for clear reads.
- ATCA_STATUS atcab_read_sig (uint16_t slot, uint8_t ∗sig)

  Executes Read command to read a 64 byte ECDSA P256 signature from a slot configured for clear reads.
- ATCA_STATUS atcab_read_config_zone_ext (ATCADevice device, uint8_t ∗config_data)

  Executes Read command to read the complete device configuration zone.
- ATCA_STATUS atcab_read_config_zone (uint8_t ∗config_data)

  Executes Read command to read the complete device configuration zone.
- ATCA_STATUS atcab_cmp_config_zone (uint8_t ∗config_data, bool ∗same_config)

  Compares a specified configuration zone with the configuration zone currently on the device.
- ATCA_STATUS atcab_read_enc (uint16_t key_id, uint8_t block, uint8_t ∗data, const uint8_t ∗enc_key, const uint16_t enc_key_id, const uint8_t num_in[(20)])

  Executes Read command on a slot configured for encrypted reads and decrypts the data to return it as plaintext.
- ATCA_STATUS atcab_secureboot (uint8_t mode, uint16_t param2, const uint8_t ∗digest, const uint8_↩ t ∗signature, uint8_t ∗mac)

  Executes Secure Boot command, which provides support for secure boot of an external MCU or MPU.
- ATCA_STATUS atcab_secureboot_mac (uint8_t mode, const uint8_t ∗digest, const uint8_t ∗signature, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes Secure Boot command with encrypted digest and validated MAC response using the IO protection key.
- ATCA_STATUS atcab_selftest (uint8_t mode, uint16_t param2, uint8_t ∗result)

  Executes the SelfTest command, which performs a test of one or more of the cryptographic engines within the ATECC608 chip.
- ATCA_STATUS atcab_sha_base (uint8_t mode, uint16_t length, const uint8_t ∗data_in, uint8_t ∗data_out, uint16_t ∗data_out_size)

  Executes SHA command, which computes a SHA-256 or HMAC/SHA-256 digest for general purpose use by the host system.
- ATCA_STATUS atcab_sha_start (void)

  Executes SHA command to initialize SHA-256 calculation engine.
- ATCA_STATUS atcab_sha_update (const uint8_t ∗message)

  Executes SHA command to add 64 bytes of message data to the current context.
- ATCA_STATUS atcab_sha_end (uint8_t ∗digest, uint16_t length, const uint8_t ∗message)

  Executes SHA command to complete SHA-256 or HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_read_context (uint8_t ∗context, uint16_t ∗context_size)

  Executes SHA command to read the SHA-256 context back. Only for ATECC608 with SHA-256 contexts. HMAC not supported.
- ATCA_STATUS atcab_sha_write_context (const uint8_t ∗context, uint16_t context_size)

  Executes SHA command to write (restore) a SHA-256 context into the the device. Only supported for ATECC608 with SHA-256 contexts.
- ATCA_STATUS atcab_sha (uint16_t length, const uint8_t ∗message, uint8_t ∗digest)

  Use the SHA command to compute a SHA-256 digest.
- ATCA_STATUS atcab_hw_sha2_256 (const uint8_t ∗data, size_t data_size, uint8_t ∗digest)

  Use the SHA command to compute a SHA-256 digest.
- ATCA_STATUS atcab_hw_sha2_256_init (atca_sha256_ctx_t ∗ctx)

  Initialize a SHA context for performing a hardware SHA-256 operation on a device. Note that only one SHA operation can be run at a time.
- ATCA_STATUS atcab_hw_sha2_256_update (atca_sha256_ctx_t ∗ctx, const uint8_t ∗data, size_t data_size)

  Add message data to a SHA context for performing a hardware SHA-256 operation on a device.
- ATCA_STATUS atcab_hw_sha2_256_finish (atca_sha256_ctx_t ∗ctx, uint8_t ∗digest)

  Finish SHA-256 digest for a SHA context for performing a hardware SHA-256 operation on a device.
- ATCA_STATUS atcab_sha_hmac_init (atca_hmac_sha256_ctx_t ∗ctx, uint16_t key_slot)

  Executes SHA command to start an HMAC/SHA-256 operation.

- ATCA_STATUS atcab_sha_hmac_update (atca_hmac_sha256_ctx_t *ctx, const uint8_t *data, size_t data↩_size)

  Executes SHA command to add an arbitrary amount of message data to a HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_finish (atca_hmac_sha256_ctx_t *ctx, uint8_t *digest, uint8_t target)

  Executes SHA command to complete a HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_ext (ATCADevice device, const uint8_t *data, size_t data_size, uint16_t key_slot, uint8_t *digest, uint8_t target)

  Use the SHA command to compute an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac (const uint8_t *data, size_t data_size, uint16_t key_slot, uint8_t *digest, uint8_t target)

  Use the SHA command to compute an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sign_base (uint8_t mode, uint16_t key_id, uint8_t *signature)

  Executes the Sign command, which generates a signature using the ECDSA algorithm.
- ATCA_STATUS atcab_sign_ext (ATCADevice device, uint16_t key_id, const uint8_t *msg, uint8_t *signature)

  Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_sign (uint16_t key_id, const uint8_t *msg, uint8_t *signature)

  Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_sign_internal (uint16_t key_id, bool is_invalidate, bool is_full_sn, uint8_t *signature)

  Executes Sign command to sign an internally generated message.
- ATCA_STATUS atcab_updateextra (uint8_t mode, uint16_t new_value)

  Executes UpdateExtra command to update the values of the two extra bytes within the Configuration zone (bytes 84 and 85).
- ATCA_STATUS atcab_verify (uint8_t mode, uint16_t key_id, const uint8_t *signature, const uint8_t *public↩_key, const uint8_t *other_data, uint8_t *mac)

  Executes the Verify command, which takes an ECDSA [R,S] signature and verifies that it is correctly generated from a given message and public key. In all cases, the signature is an input to the command.
- ATCA_STATUS atcab_verify_extern_ext (ATCADevice device, const uint8_t *message, const uint8_↩t *signature, const uint8_t *public_key, bool *is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_verify_extern (const uint8_t *message, const uint8_t *signature, const uint8_↩t *public_key, bool *is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_verify_extern_mac (const uint8_t *message, const uint8_t *signature, const uint8_t *public_key, const uint8_t *num_in, const uint8_t *io_key, bool *is_verified)

  Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. This function is only available on the ATECC608.
- ATCA_STATUS atcab_verify_stored_ext (ATCADevice device, const uint8_t *message, const uint8_↩t *signature, uint16_t key_id, bool *is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or Temp↩Key for other devices.
- ATCA_STATUS atcab_verify_stored (const uint8_t *message, const uint8_t *signature, uint16_t key_id, bool *is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or Temp↩Key for other devices.
- ATCA_STATUS atcab_verify_stored_with_tempkey (const uint8_t *signature, uint16_t key_id, bool *is_↩verified)

Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. keyConfig.reqrandom bit should be set and the message to be signed should be already loaded into TempKey for all devices.
- ATCA_STATUS atcab_verify_stored_mac (const uint8_t ∗message, const uint8_t ∗signature, uint16_t key_id, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with a public key stored in the device. This function is only available on the ATECC608.
- ATCA_STATUS atcab_verify_validate (uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗other_data, bool ∗is_verified)

  Executes the Verify command in Validate mode to validate a public key stored in a slot.
- ATCA_STATUS atcab_verify_invalidate (uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗other_data, bool ∗is_verified)

  Executes the Verify command in Invalidate mode which invalidates a previously validated public key stored in a slot.
- ATCA_STATUS atcab_write (uint8_t zone, uint16_t address, const uint8_t ∗value, const uint8_t ∗mac)

  Executes the Write command, which writes either one four byte word or a 32-byte block to one of the EEPROM zones on the device. Depending upon the value of the WriteConfig byte for this slot, the data may be required to be encrypted by the system prior to being sent to the device. This command cannot be used to write slots configured as ECC private keys.
- ATCA_STATUS atcab_write_zone_ext (ATCADevice device, uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, const uint8_t ∗data, uint8_t len)

  Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.
- ATCA_STATUS atcab_write_zone (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, const uint8_t ∗data, uint8_t len)

  Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.
- ATCA_STATUS **atcab_write_bytes_zone_ext** (ATCADevice device, uint8_t zone, uint16_t slot, size_t offset_bytes, const uint8_t ∗data, size_t length)
- ATCA_STATUS atcab_write_bytes_zone (uint8_t zone, uint16_t slot, size_t offset_bytes, const uint8_t ∗data, size_t length)

  Executes the Write command, which writes data into the configuration, otp, or data zones with a given byte offset and length. Offset and length must be multiples of a word (4 bytes).
- ATCA_STATUS atcab_write_pubkey_ext (ATCADevice device, uint16_t slot, const uint8_t ∗public_key)

  Uses the write command to write a public key to a slot in the proper format.
- ATCA_STATUS atcab_write_pubkey (uint16_t slot, const uint8_t ∗public_key)

  Uses the write command to write a public key to a slot in the proper format.
- ATCA_STATUS atcab_write_config_zone_ext (ATCADevice device, const uint8_t ∗config_data)

  Executes the Write command, which writes the configuration zone.
- ATCA_STATUS atcab_write_config_zone (const uint8_t ∗config_data)

  Executes the Write command, which writes the configuration zone.
- ATCA_STATUS atcab_write_enc (uint16_t key_id, uint8_t block, const uint8_t ∗data, const uint8_t ∗enc_key, const uint16_t enc_key_id, const uint8_t num_in[(20)])

  Executes the Write command, which performs an encrypted write of a 32 byte block into given slot.
- ATCA_STATUS atcab_write_config_counter (uint16_t counter_id, uint32_t counter_value)

  Initialize one of the monotonic counters in device with a specific value.

Variables

- ATCADevice **g_atcab_device_ptr** = NULL

23.36.1 Detailed Description

CryptoAuthLib Basic API methods. These methods provide a simpler way to access the core crypto methods.

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23.37 atca_basic.h File Reference

CryptoAuthLib Basic API methods - a simple crypto authentication API. These methods manage a global ATCADevice object behind the scenes. They also manage the wake/idle state transitions so callers don't need to.

```
#include "cryptoauthlib.h"
#include "crypto/atca_crypto_sw_sha2.h"
#include "crypto/atca_crypto_hw_aes.h"
```

Macros

- #define **atcab_get_addr**(...) calib_get_addr(__VA_ARGS__)
- #define **atca_execute_command**(...) calib_execute_command(__VA_ARGS__)
- #define **SHA_CONTEXT_MAX_SIZE** (109)

Functions

- ATCA_STATUS atcab_version (char ∗ver_str)

  basic API methods are all prefixed with atcab_ (CryptoAuthLib Basic) the fundamental premise of the basic API is it is based on a single interface instance and that instance is global, so all basic API commands assume that one global device is the one to operate on.
- ATCA_STATUS atcab_init_ext (ATCADevice ∗device, ATCAIfaceCfg ∗cfg)

  Creates and initializes a ATCADevice context.
- ATCA_STATUS atcab_init (ATCAIfaceCfg ∗cfg)

  Creates a global ATCADevice object used by Basic API.
- ATCA_STATUS atcab_init_device (ATCADevice ca_device)

  Initialize the global ATCADevice object to point to one of your choosing for use with all the atcab_ basic API.
- ATCA_STATUS atcab_release_ext (ATCADevice ∗device)

  release (free) the an ATCADevice instance.
- ATCA_STATUS atcab_release (void)

  release (free) the global ATCADevice instance. This must be called in order to release or free up the interface.
- ATCADevice atcab_get_device (void)

  Get the global device object.
- ATCADeviceType atcab_get_device_type_ext (ATCADevice device)

  Get the selected device type of rthe device context.
- ATCADeviceType atcab_get_device_type (void)

  Get the current device type configured for the global ATCADevice.
- uint8_t atcab_get_device_address (ATCADevice device)

  Get the current device address based on the configured device and interface.
- bool atcab_is_ca_device (ATCADeviceType dev_type)

  Check whether the device is cryptoauth device.
- bool atcab_is_ca2_device (ATCADeviceType dev_type)

  Check whether the device is cryptoauth device.
- bool atcab_is_ta_device (ATCADeviceType dev_type)

  Check whether the device is Trust Anchor device.
- ATCA_STATUS **atcab_pbkdf2_sha256_ext** (ATCADevice device, const uint32_t iter, const uint16_t slot, const uint8_t ∗salt, const size_t salt_len, uint8_t ∗result, size_t result_len)
- ATCA_STATUS **atcab_pbkdf2_sha256** (const uint32_t iter, const uint16_t slot, const uint8_t ∗salt, const size_t salt_len, uint8_t ∗result, size_t result_len)
- ATCA_STATUS atcab_wakeup (void)

wakeup the CryptoAuth device

- ATCA_STATUS atcab_idle (void)

  idle the CryptoAuth device
- ATCA_STATUS atcab_sleep (void)

  invoke sleep on the CryptoAuth device
- ATCA_STATUS atcab_get_zone_size (uint8_t zone, uint16_t slot, size_t ∗size)

  Gets the size of the specified zone in bytes.
- ATCA_STATUS atcab_get_zone_size_ext (ATCADevice device, uint8_t zone, uint16_t slot, size_t ∗size)

  Gets the size of the specified zone in bytes.
- ATCA_STATUS atcab_aes (uint8_t mode, uint16_t key_id, const uint8_t ∗aes_in, uint8_t ∗aes_out)

  Compute the AES-128 encrypt, decrypt, or GFM calculation.
- ATCA_STATUS atcab_aes_encrypt (uint16_t key_id, uint8_t key_block, const uint8_t ∗plaintext, uint8_t ∗ciphertext)

  Perform an AES-128 encrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_encrypt_ext (ATCADevice device, uint16_t key_id, uint8_t key_block, const uint8_t ∗plaintext, uint8_t ∗ciphertext)

  Perform an AES-128 encrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_decrypt (uint16_t key_id, uint8_t key_block, const uint8_t ∗ciphertext, uint8_t ∗plaintext)

  Perform an AES-128 decrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_decrypt_ext (ATCADevice device, uint16_t key_id, uint8_t key_block, const uint8_t ∗ciphertext, uint8_t ∗plaintext)

  Perform an AES-128 decrypt operation with a key in the device.
- ATCA_STATUS atcab_aes_gfm (const uint8_t ∗h, const uint8_t ∗input, uint8_t ∗output)

  Perform a Galois Field Multiply (GFM) operation.
- ATCA_STATUS atcab_aes_gcm_init (atca_aes_gcm_ctx_t ∗ctx, uint16_t key_id, uint8_t key_block, const uint8_t ∗iv, size_t iv_size)

  Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.
- ATCA_STATUS atcab_aes_gcm_init_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, uint16_t key_id, uint8_t key_block, const uint8_t ∗iv, size_t iv_size)

  Initialize context for AES GCM operation with an existing IV, which is common when starting a decrypt operation.
- ATCA_STATUS atcab_aes_gcm_init_rand (atca_aes_gcm_ctx_t ∗ctx, uint16_t key_id, uint8_t key_block, size_t rand_size, const uint8_t ∗free_field, size_t free_field_size, uint8_t ∗iv)

  Initialize context for AES GCM operation with a IV composed of a random and optional fixed(free) field, which is common when starting an encrypt operation.
- ATCA_STATUS atcab_aes_gcm_aad_update (atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗aad, uint32_t aad_size)

  Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.
- ATCA_STATUS atcab_aes_gcm_aad_update_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗aad, uint32_t aad_size)

  Process Additional Authenticated Data (AAD) using GCM mode and a key within the ATECC608 device.
- ATCA_STATUS atcab_aes_gcm_encrypt_update (atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗plaintext, uint32_t plaintext_size, uint8_t ∗ciphertext)

  Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_encrypt_update_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗plaintext, uint32_t plaintext_size, uint8_t ∗ciphertext)

  Encrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.
- ATCA_STATUS atcab_aes_gcm_encrypt_finish (atca_aes_gcm_ctx_t ∗ctx, uint8_t ∗tag, size_t tag_size)

  Complete a GCM encrypt operation returning the authentication tag.
- ATCA_STATUS atcab_aes_gcm_encrypt_finish_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, uint8_t ∗tag, size_t tag_size)

Complete a GCM encrypt operation returning the authentication tag.

- ATCA_STATUS atcab_aes_gcm_decrypt_update (atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗ciphertext, uint32_t ciphertext_size, uint8_t ∗plaintext)

  Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

- ATCA_STATUS atcab_aes_gcm_decrypt_update_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗ciphertext, uint32_t ciphertext_size, uint8_t ∗plaintext)

  Decrypt data using GCM mode and a key within the ATECC608 device. atcab_aes_gcm_init() or atcab_aes_gcm_init_rand() should be called before the first use of this function.

- ATCA_STATUS atcab_aes_gcm_decrypt_finish (atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗tag, size_t tag_size, bool ∗is_verified)

  Complete a GCM decrypt operation verifying the authentication tag.

- ATCA_STATUS atcab_aes_gcm_decrypt_finish_ext (ATCADevice device, atca_aes_gcm_ctx_t ∗ctx, const uint8_t ∗tag, size_t tag_size, bool ∗is_verified)

  Complete a GCM decrypt operation verifying the authentication tag.

- ATCA_STATUS atcab_checkmac (uint8_t mode, uint16_t key_id, const uint8_t ∗challenge, const uint8_t ∗response, const uint8_t ∗other_data)

  Compares a MAC response with input values.

- ATCA_STATUS atcab_checkmac_with_response_mac (uint8_t mode, const uint8_t ∗challenge, const uint8_t ∗response, const uint8_t ∗other_data, uint8_t ∗mac)

  Compares a MAC response with input values.SHA105 device can generate optional mac Output response mac mode only supports in SHA105 device.

- ATCA_STATUS atcab_counter (uint8_t mode, uint16_t counter_id, uint32_t ∗counter_value)

  Compute the Counter functions.

- ATCA_STATUS atcab_counter_increment (uint16_t counter_id, uint32_t ∗counter_value)

  Increments one of the device's monotonic counters.

- ATCA_STATUS atcab_counter_read (uint16_t counter_id, uint32_t ∗counter_value)

  Read one of the device's monotonic counters.

- ATCA_STATUS atcab_derivekey (uint8_t mode, uint16_t key_id, const uint8_t ∗mac)

  Executes the DeviveKey command for deriving a new key from a nonce (TempKey) and an existing key.

- ATCA_STATUS atcab_derivekey_ext (ATCADevice device, uint8_t mode, uint16_t key_id, const uint8_t ∗mac)

  Executes the DeviveKey command for deriving a new key from a nonce (TempKey) and an existing key.

- ATCA_STATUS atcab_ecdh_base (uint8_t mode, uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, uint8_t ∗out_nonce)

  Base function for generating premaster secret key using ECDH.

- ATCA_STATUS atcab_ecdh (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms)

  ECDH command with a private key in a slot and the premaster secret is returned in the clear.

- ATCA_STATUS atcab_ecdh_enc (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗read_key, uint16_t read_key_id, const uint8_t num_in[(20)])

  ECDH command with a private key in a slot and the premaster secret is read from the next slot.

- ATCA_STATUS atcab_ecdh_ioenc (uint16_t key_id, const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗io_key)

  ECDH command with a private key in a slot and the premaster secret is returned encrypted using the IO protection key.

- ATCA_STATUS atcab_ecdh_tempkey (const uint8_t ∗public_key, uint8_t ∗pms)

  ECDH command with a private key in TempKey and the premaster secret is returned in the clear.

- ATCA_STATUS atcab_ecdh_tempkey_ioenc (const uint8_t ∗public_key, uint8_t ∗pms, const uint8_t ∗io_key)

  ECDH command with a private key in TempKey and the premaster secret is returned encrypted using the IO protection key.

- ATCA_STATUS atcab_gendig (uint8_t zone, uint16_t key_id, const uint8_t ∗other_data, uint8_t other_data_size)

  Issues a GenDig command, which performs a SHA256 hash on the source data indicated by zone with the contents of TempKey. See the CryptoAuth datasheet for your chip to see what the values of zone correspond to.

- ATCA_STATUS atcab_gendivkey (const uint8_t *other_data)

  Issues a GenDivKey command to generate the equivalent diversified key as that programmed into the client side device.
- ATCA_STATUS atcab_genkey_base (uint8_t mode, uint16_t key_id, const uint8_t *other_data, uint8_↩ t *public_key)

  Issues GenKey command, which can generate a private key, compute a public key, nd/or compute a digest of a public key.
- ATCA_STATUS atcab_genkey (uint16_t key_id, uint8_t *public_key)

  Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.
- ATCA_STATUS atcab_genkey_ext (ATCADevice device, uint16_t key_id, uint8_t *public_key)

  Issues GenKey command, which generates a new random private key in slot/handle and returns the public key.
- ATCA_STATUS atcab_get_pubkey (uint16_t key_id, uint8_t *public_key)

  Uses GenKey command to calculate the public key from an existing private key in a slot.
- ATCA_STATUS atcab_get_pubkey_ext (ATCADevice device, uint16_t key_id, uint8_t *public_key)

  Uses GenKey command to calculate the public key from an existing private key in a slot.
- ATCA_STATUS atcab_hmac (uint8_t mode, uint16_t key_id, uint8_t *digest)

  Issues a HMAC command, which computes an HMAC/SHA-256 digest of a key stored in the device, a challenge, and other information on the device.
- ATCA_STATUS atcab_info_base (uint8_t mode, uint16_t param2, uint8_t *out_data)

  Issues an Info command, which return internal device information and can control GPIO and the persistent latch.
- ATCA_STATUS atcab_info (uint8_t *revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS atcab_info_ext (ATCADevice device, uint8_t *revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS atcab_info_lock_status (uint16_t param2, uint8_t *is_locked)

  Use the Info command to get the lock status.
- ATCA_STATUS atcab_info_chip_status (uint8_t *chip_status)

  Use the Info command to get the chip status.
- ATCA_STATUS atcab_info_set_latch (bool state)

  Use the Info command to set the persistent latch state for an ATECC608 device.
- ATCA_STATUS atcab_info_get_latch (bool *state)

  Use the Info command to get the persistent latch current state for an ATECC608 device.
- ATCA_STATUS atcab_kdf (uint8_t mode, uint16_t key_id, const uint32_t details, const uint8_t *message, uint8_t *out_data, uint8_t *out_nonce)

  Executes the KDF command, which derives a new key in PRF, AES, or HKDF modes.
- ATCA_STATUS atcab_lock (uint8_t mode, uint16_t summary_crc)

  The Lock command prevents future modifications of the Configuration and/or Data and OTP zones. If the device is so configured, then this command can be used to lock individual data slots. This command fails if the designated area is already locked.
- ATCA_STATUS atcab_lock_config_zone (void)

  Unconditionally (no CRC required) lock the config zone.
- ATCA_STATUS atcab_lock_config_zone_ext (ATCADevice device)

  Unconditionally (no CRC required) lock the config zone.
- ATCA_STATUS atcab_lock_config_zone_crc (uint16_t summary_crc)

  Lock the config zone with summary CRC.
- ATCA_STATUS atcab_lock_data_zone (void)

  Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.
- ATCA_STATUS atcab_lock_data_zone_ext (ATCADevice device)

  Unconditionally (no CRC required) lock the data zone (slots and OTP). for CryptoAuth devices and lock the setup for Trust Anchor device.
- ATCA_STATUS atcab_lock_data_zone_crc (uint16_t summary_crc)

Lock the data zone (slots and OTP) with summary CRC.

- ATCA_STATUS atcab_lock_data_slot (uint16_t slot)

  Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).

- ATCA_STATUS atcab_lock_data_slot_ext (ATCADevice device, uint16_t slot)

  Lock an individual slot in the data zone on an ATECC device. Not available for ATSHA devices. Slot must be configured to be slot lockable (KeyConfig.Lockable=1) (for cryptoauth devices) or Lock an individual handle in shared data element on an Trust Anchor device (for Trust Anchor devices).

- ATCA_STATUS atcab_mac (uint8_t mode, uint16_t key_id, const uint8_t ∗challenge, uint8_t ∗digest)

  Executes MAC command, which computes a SHA-256 digest of a key stored in the device, a challenge, and other information on the device.

- ATCA_STATUS atcab_nonce_base (uint8_t mode, uint16_t zero, const uint8_t ∗num_in, uint8_t ∗rand_out)

  Executes Nonce command, which loads a random or fixed nonce/data into the device for use by subsequent commands.

- ATCA_STATUS atcab_nonce (const uint8_t ∗num_in)

  Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.

- ATCA_STATUS atcab_nonce_load (uint8_t target, const uint8_t ∗num_in, uint16_t num_in_size)

  Execute a Nonce command in pass-through mode to load one of the device's internal buffers with a fixed value.

- ATCA_STATUS atcab_nonce_rand (const uint8_t ∗num_in, uint8_t ∗rand_out)

  Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.

- ATCA_STATUS atcab_nonce_rand_ext (ATCADevice device, const uint8_t ∗num_in, uint8_t ∗rand_out)

  Execute a Nonce command to generate a random nonce combining a host nonce (num_in) and a device random number.

- ATCA_STATUS atcab_challenge (const uint8_t ∗num_in)

  Execute a Nonce command in pass-through mode to initialize TempKey to a specified value.

- ATCA_STATUS atcab_challenge_seed_update (const uint8_t ∗num_in, uint8_t ∗rand_out)

  Execute a Nonce command to generate a random challenge combining a host nonce (num_in) and a device random number.

- ATCA_STATUS atcab_priv_write (uint16_t key_id, const uint8_t priv_key[36], uint16_t write_key_id, const uint8_t write_key[32], const uint8_t num_in[(20)])

  Executes PrivWrite command, to write externally generated ECC private keys into the device.

- ATCA_STATUS atcab_random (uint8_t ∗rand_out)

  Executes Random command, which generates a 32 byte random number from the device.

- ATCA_STATUS atcab_random_ext (ATCADevice device, uint8_t ∗rand_out)

  Executes Random command, which generates a 32 byte random number from the device.

- ATCA_STATUS atcab_read_zone (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint8_t ∗data, uint8_t len)

  Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.

- ATCA_STATUS atcab_read_zone_ext (ATCADevice device, uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint8_t ∗data, uint8_t len)

  Executes Read command, which reads either 4 or 32 bytes of data from a given slot, configuration zone, or the OTP zone.

- ATCA_STATUS atcab_is_locked (uint8_t zone, bool ∗is_locked)

  Executes Read command, which reads the configuration zone to see if the specified zone is locked.

- ATCA_STATUS atcab_is_config_locked (bool ∗is_locked)

  This function check whether configuration zone is locked or not.

- ATCA_STATUS atcab_is_config_locked_ext (ATCADevice device, bool ∗is_locked)

  This function check whether configuration zone is locked or not.

- ATCA_STATUS atcab_is_data_locked (bool ∗is_locked)

  This function check whether data/setup zone is locked or not.

- ATCA_STATUS atcab_is_data_locked_ext (ATCADevice device, bool ∗is_locked)

  This function check whether data/setup zone is locked or not.
- ATCA_STATUS atcab_is_slot_locked (uint16_t slot, bool ∗is_locked)

  This function check whether slot/handle is locked or not.
- ATCA_STATUS atcab_is_slot_locked_ext (ATCADevice device, uint16_t slot, bool ∗is_locked)

  This function check whether slot/handle is locked or not.
- ATCA_STATUS atcab_is_private_ext (ATCADevice device, uint16_t slot, bool ∗is_private)

  Check to see if the key is a private key or not.
- ATCA_STATUS **atcab_is_private** (uint16_t slot, bool ∗is_private)
- ATCA_STATUS **atcab_read_bytes_zone_ext** (ATCADevice device, uint8_t zone, uint16_t slot, size_t offset, uint8_t ∗data, size_t length)
- ATCA_STATUS atcab_read_bytes_zone (uint8_t zone, uint16_t slot, size_t offset, uint8_t ∗data, size_t length)

  Used to read an arbitrary number of bytes from any zone configured for clear reads.
- ATCA_STATUS atcab_read_serial_number (uint8_t ∗serial_number)

  This function returns serial number of the device.
- ATCA_STATUS atcab_read_serial_number_ext (ATCADevice device, uint8_t ∗serial_number)

  This function returns serial number of the device.
- ATCA_STATUS atcab_read_pubkey (uint16_t slot, uint8_t ∗public_key)

  Executes Read command to read an ECC P256 public key from a slot configured for clear reads.
- ATCA_STATUS atcab_read_pubkey_ext (ATCADevice device, uint16_t slot, uint8_t ∗public_key)

  Executes Read command to read an ECC P256 public key from a slot configured for clear reads.
- ATCA_STATUS atcab_read_sig (uint16_t slot, uint8_t ∗sig)

  Executes Read command to read a 64 byte ECDSA P256 signature from a slot configured for clear reads.
- ATCA_STATUS atcab_read_config_zone (uint8_t ∗config_data)

  Executes Read command to read the complete device configuration zone.
- ATCA_STATUS atcab_read_config_zone_ext (ATCADevice device, uint8_t ∗config_data)

  Executes Read command to read the complete device configuration zone.
- ATCA_STATUS atcab_cmp_config_zone (uint8_t ∗config_data, bool ∗same_config)

  Compares a specified configuration zone with the configuration zone currently on the device.
- ATCA_STATUS atcab_read_enc (uint16_t key_id, uint8_t block, uint8_t ∗data, const uint8_t ∗enc_key, const uint16_t enc_key_id, const uint8_t num_in[(20)])

  Executes Read command on a slot configured for encrypted reads and decrypts the data to return it as plaintext.
- ATCA_STATUS atcab_secureboot (uint8_t mode, uint16_t param2, const uint8_t ∗digest, const uint8_↩ t ∗signature, uint8_t ∗mac)

  Executes Secure Boot command, which provides support for secure boot of an external MCU or MPU.
- ATCA_STATUS atcab_secureboot_mac (uint8_t mode, const uint8_t ∗digest, const uint8_t ∗signature, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes Secure Boot command with encrypted digest and validated MAC response using the IO protection key.
- ATCA_STATUS atcab_selftest (uint8_t mode, uint16_t param2, uint8_t ∗result)

  Executes the SelfTest command, which performs a test of one or more of the cryptographic engines within the ATECC608 chip.
- ATCA_STATUS atcab_sha_base (uint8_t mode, uint16_t length, const uint8_t ∗data_in, uint8_t ∗data_out, uint16_t ∗data_out_size)

  Executes SHA command, which computes a SHA-256 or HMAC/SHA-256 digest for general purpose use by the host system.
- ATCA_STATUS atcab_sha_start (void)

  Executes SHA command to initialize SHA-256 calculation engine.
- ATCA_STATUS atcab_sha_update (const uint8_t ∗message)

  Executes SHA command to add 64 bytes of message data to the current context.
- ATCA_STATUS atcab_sha_end (uint8_t ∗digest, uint16_t length, const uint8_t ∗message)

  Executes SHA command to complete SHA-256 or HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_read_context (uint8_t ∗context, uint16_t ∗context_size)

Executes SHA command to read the SHA-256 context back. Only for ATECC608 with SHA-256 contexts. HMAC not supported.

- ATCA_STATUS atcab_sha_write_context (const uint8_t ∗context, uint16_t context_size)

  Executes SHA command to write (restore) a SHA-256 context into the the device. Only supported for ATECC608 with SHA-256 contexts.
- ATCA_STATUS atcab_sha (uint16_t length, const uint8_t ∗message, uint8_t ∗digest)

  Use the SHA command to compute a SHA-256 digest.
- ATCA_STATUS atcab_hw_sha2_256 (const uint8_t ∗data, size_t data_size, uint8_t ∗digest)

  Use the SHA command to compute a SHA-256 digest.
- ATCA_STATUS atcab_hw_sha2_256_init (atca_sha256_ctx_t ∗ctx)

  Initialize a SHA context for performing a hardware SHA-256 operation on a device. Note that only one SHA operation can be run at a time.
- ATCA_STATUS atcab_hw_sha2_256_update (atca_sha256_ctx_t ∗ctx, const uint8_t ∗data, size_t data_size)

  Add message data to a SHA context for performing a hardware SHA-256 operation on a device.
- ATCA_STATUS atcab_hw_sha2_256_finish (atca_sha256_ctx_t ∗ctx, uint8_t ∗digest)

  Finish SHA-256 digest for a SHA context for performing a hardware SHA-256 operation on a device.
- ATCA_STATUS atcab_sha_hmac_init (atca_hmac_sha256_ctx_t ∗ctx, uint16_t key_slot)

  Executes SHA command to start an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_update (atca_hmac_sha256_ctx_t ∗ctx, const uint8_t ∗data, size_t data←_size)

  Executes SHA command to add an arbitrary amount of message data to a HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_finish (atca_hmac_sha256_ctx_t ∗ctx, uint8_t ∗digest, uint8_t target)

  Executes SHA command to complete a HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac (const uint8_t ∗data, size_t data_size, uint16_t key_slot, uint8_t ∗digest, uint8_t target)

  Use the SHA command to compute an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sha_hmac_ext (ATCADevice device, const uint8_t ∗data, size_t data_size, uint16_t key_slot, uint8_t ∗digest, uint8_t target)

  Use the SHA command to compute an HMAC/SHA-256 operation.
- ATCA_STATUS atcab_sign_base (uint8_t mode, uint16_t key_id, uint8_t ∗signature)

  Executes the Sign command, which generates a signature using the ECDSA algorithm.
- ATCA_STATUS atcab_sign (uint16_t key_id, const uint8_t ∗msg, uint8_t ∗signature)

  Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_sign_ext (ATCADevice device, uint16_t key_id, const uint8_t ∗msg, uint8_t ∗signature)

  Executes Sign command, to sign a 32-byte external message using the private key in the specified slot. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_sign_internal (uint16_t key_id, bool is_invalidate, bool is_full_sn, uint8_t ∗signature)

  Executes Sign command to sign an internally generated message.
- ATCA_STATUS atcab_updateextra (uint8_t mode, uint16_t new_value)

  Executes UpdateExtra command to update the values of the two extra bytes within the Configuration zone (bytes 84 and 85).
- ATCA_STATUS atcab_verify (uint8_t mode, uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗public←_key, const uint8_t ∗other_data, uint8_t ∗mac)

  Executes the Verify command, which takes an ECDSA [R,S] signature and verifies that it is correctly generated from a given message and public key. In all cases, the signature is an input to the command.
- ATCA_STATUS atcab_verify_extern (const uint8_t ∗message, const uint8_t ∗signature, const uint8_←t ∗public_key, bool ∗is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.
- ATCA_STATUS atcab_verify_extern_ext (ATCADevice device, const uint8_t ∗message, const uint8_←t ∗signature, const uint8_t ∗public_key, bool ∗is_verified)

Executes the Verify command, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or TempKey for other devices.

- ATCA_STATUS atcab_verify_extern_mac (const uint8_t ∗message, const uint8_t ∗signature, const uint8_t ∗public_key, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with all components (message, signature, and public key) supplied. This function is only available on the ATECC608.
- ATCA_STATUS atcab_verify_stored (const uint8_t ∗message, const uint8_t ∗signature, uint16_t key_id, bool ∗is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or Temp↩ Key for other devices.
- ATCA_STATUS atcab_verify_stored_ext (ATCADevice device, const uint8_t ∗message, const uint8_↩ t ∗signature, uint16_t key_id, bool ∗is_verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. The message to be signed will be loaded into the Message Digest Buffer to the ATECC608 device or Temp↩ Key for other devices.
- ATCA_STATUS atcab_verify_stored_with_tempkey (const uint8_t ∗signature, uint16_t key_id, bool ∗is_↩ verified)

  Executes the Verify command, which verifies a signature (ECDSA verify operation) with a public key stored in the device. keyConfig.reqrandom bit should be set and the message to be signed should be already loaded into Temp↩ Key for all devices.
- ATCA_STATUS atcab_verify_stored_mac (const uint8_t ∗message, const uint8_t ∗signature, uint16_t key_id, const uint8_t ∗num_in, const uint8_t ∗io_key, bool ∗is_verified)

  Executes the Verify command with verification MAC, which verifies a signature (ECDSA verify operation) with a public key stored in the device. This function is only available on the ATECC608.
- ATCA_STATUS atcab_verify_validate (uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗other_data, bool ∗is_verified)

  Executes the Verify command in Validate mode to validate a public key stored in a slot.
- ATCA_STATUS atcab_verify_invalidate (uint16_t key_id, const uint8_t ∗signature, const uint8_t ∗other_data, bool ∗is_verified)

  Executes the Verify command in Invalidate mode which invalidates a previously validated public key stored in a slot.
- ATCA_STATUS atcab_write (uint8_t zone, uint16_t address, const uint8_t ∗value, const uint8_t ∗mac)

  Executes the Write command, which writes either one four byte word or a 32-byte block to one of the EEPROM zones on the device. Depending upon the value of the WriteConfig byte for this slot, the data may be required to be encrypted by the system prior to being sent to the device. This command cannot be used to write slots configured as ECC private keys.
- ATCA_STATUS atcab_write_zone (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, const uint8_↩ t ∗data, uint8_t len)

  Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.
- ATCA_STATUS atcab_write_zone_ext (ATCADevice device, uint8_t zone, uint16_t slot, uint8_t block, uint8↩ _t offset, const uint8_t ∗data, uint8_t len)

  Executes the Write command, which writes either 4 or 32 bytes of data into a device zone.
- ATCA_STATUS **atcab_write_bytes_zone_ext** (ATCADevice device, uint8_t zone, uint16_t slot, size_↩ t offset_bytes, const uint8_t ∗data, size_t length)
- ATCA_STATUS atcab_write_bytes_zone (uint8_t zone, uint16_t slot, size_t offset_bytes, const uint8_t ∗data, size_t length)

  Executes the Write command, which writes data into the configuration, otp, or data zones with a given byte offset and length. Offset and length must be multiples of a word (4 bytes).
- ATCA_STATUS atcab_write_pubkey (uint16_t slot, const uint8_t ∗public_key)

  Uses the write command to write a public key to a slot in the proper format.
- ATCA_STATUS atcab_write_pubkey_ext (ATCADevice device, uint16_t slot, const uint8_t ∗public_key)

  Uses the write command to write a public key to a slot in the proper format.
- ATCA_STATUS atcab_write_config_zone (const uint8_t ∗config_data)

  Executes the Write command, which writes the configuration zone.

- ATCA_STATUS atcab_write_config_zone_ext (ATCADevice device, const uint8_t *config_data)

  Executes the Write command, which writes the configuration zone.
- ATCA_STATUS atcab_write_enc (uint16_t key_id, uint8_t block, const uint8_t *data, const uint8_t *enc_key, const uint16_t enc_key_id, const uint8_t num_in[(20)])

  Executes the Write command, which performs an encrypted write of a 32 byte block into given slot.
- ATCA_STATUS atcab_write_config_counter (uint16_t counter_id, uint32_t counter_value)

  Initialize one of the monotonic counters in device with a specific value.

Variables

- ATCADevice **g_atcab_device_ptr**

23.37.1 Detailed Description

CryptoAuthLib Basic API methods - a simple crypto authentication API. These methods manage a global ATCADevice object behind the scenes. They also manage the wake/idle state transitions so callers don't need to.

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23.38 atca_cfgs.c File Reference

a set of default configurations for various ATCA devices and interfaces

```
#include <stddef.h>
#include "cryptoauthlib.h"
#include "atca_cfgs.h"
#include "atca_iface.h"
#include "atca_device.h"
```

23.38.1 Detailed Description

a set of default configurations for various ATCA devices and interfaces

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23.39 atca_cfgs.h File Reference

a set of default configurations for various ATCA devices and interfaces

```
#include "atca_iface.h"
```

23.39.1 Detailed Description

a set of default configurations for various ATCA devices and interfaces

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23.40 atca_compiler.h File Reference

CryptoAuthLiub is meant to be portable across architectures, even non-Microchip architectures and compiler environments. This file is for isolating compiler specific macros.

```
#include <stdbool.h>
```

Macros

- #define **SHARED_LIB_EXPORT**
- #define **ATCA_DLL** extern
- #define **ATCA_PACKED**
- #define UNUSED_VAR(x)

23.40.1 Detailed Description

CryptoAuthLiub is meant to be portable across architectures, even non-Microchip architectures and compiler environments. This file is for isolating compiler specific macros.

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23.40.2 Macro Definition Documentation

23.40.2.1 UNUSED_VAR

```
#define UNUSED_VAR(
                x )
```

Enables removal of compiler warning due to unused variables

23.41 atca_config_check.h File Reference

Consistency checks for configuration options.

```
#include "atca_config.h"
```

Macros

- #define **FEATURE_ENABLED** (1)
- #define **FEATURE_DISABLED** (0)
- #define **DEFAULT_ENABLED** FEATURE_ENABLED
- #define **DEFAULT_DISABLED** FEATURE_DISABLED
- #define ATCA_SHA_SUPPORT 1
- #define **ATCA_ECC_SUPPORT** DEFAULT_ENABLED
- #define **ATCA_CA2_SUPPORT** DEFAULT_ENABLED
- #define **ATCA_CA2_CERT_SUPPORT** DEFAULT_ENABLED
- #define **ATCA_CA_SUPPORT** DEFAULT_ENABLED
- #define **ATCA_HOSTLIB_EN** DEFAULT_ENABLED
- #define ATCA_USE_ATCAB_FUNCTIONS
- #define **ATCA_CHECK_PARAMS_EN** DEFAULT_ENABLED
- #define ATCA_CHECK_INVALID_MSG(c, s, m) if (c) { return ATCA_TRACE(s, m); }
- #define **ATCA_CHECK_VALID_MSG**(c, m) if (!ATCA_TRACE(!(c), m))
- #define **ATCA_CHECK_INVALID**(c, s) ATCA_CHECK_INVALID_MSG(c, s, "")
- #define **ATCA_CHECK_VALID**(c) ATCA_CHECK_VALID_MSG(c, "")
- #define MULTIPART_BUF_EN (DEFAULT_DISABLED)
- #define ATCACERT_EN (DEFAULT_ENABLED)
- #define **ATCA_HEAP**
- #define ATCA_UNUSED_VAR_CHECK (DEFAULT_ENABLED)
- #define **ATCAB_AES_EN** (DEFAULT_ENABLED)
- #define ATCAB_AES_GFM_EN (DEFAULT_ENABLED)
- #define **ATCAB_AES_GCM_EN** (DEFAULT_ENABLED)
- #define **ATCAB_CHECKMAC_EN** (DEFAULT_ENABLED)
- #define **ATCAB_COUNTER_EN** (DEFAULT_ENABLED)
- #define **ATCAB_DERIVEKEY_EN** (DEFAULT_ENABLED)
- #define **ATCAB_ECDH_EN** (DEFAULT_ENABLED)
- #define **ATCAB_ECDH_ENC_EN** (DEFAULT_ENABLED)
- #define **ATCAB_GENDIG_EN** (DEFAULT_ENABLED)
- #define **ATCAB_GENKEY_EN** (DEFAULT_ENABLED)
- #define ATCAB_GENKEY_MAC_EN ATCAB_GENKEY_EN
- #define **ATCAB_HMAC_EN** (DEFAULT_ENABLED)
- #define ATCAB_INFO_LATCH_EN (DEFAULT_ENABLED)
- #define **ATCAB_KDF_EN** (DEFAULT_ENABLED)
- #define **ATCAB_LOCK_EN** (DEFAULT_ENABLED)
- #define **ATCAB_MAC_EN** (DEFAULT_ENABLED)
- #define **ATCAB_NONCE_EN** (DEFAULT_ENABLED)
- #define **ATCAB_PRIVWRITE_EN** (DEFAULT_ENABLED)
- #define **ATCAB_RANDOM_EN** (DEFAULT_ENABLED)
- #define **ATCAB_READ_EN** (DEFAULT_ENABLED)
- #define **ATCAB_READ_ENC_EN** ATCAB_READ_EN
- #define **ATCAB_SECUREBOOT_EN** (DEFAULT_ENABLED)
- #define **ATCAB_SECUREBOOT_MAC_EN** ATCAB_SECUREBOOT_EN
- #define **ATCAB_SELFTEST_EN** (DEFAULT_ENABLED)

- #define **ATCAB_SHA_EN** (DEFAULT_ENABLED)
- #define **ATCAB_SHA_HMAC_EN** ATCAB_SHA_EN
- #define **ATCAB_SHA_CONTEXT_EN** ATCAB_SHA_EN
- #define **ATCAB_SIGN_EN** (DEFAULT_ENABLED)
- #define **ATCAB_SIGN_INTERNAL_EN** ATCAB_SIGN_EN
- #define **ATCAB_UPDATEEXTRA_EN** (DEFAULT_ENABLED)
- #define **ATCAB_VERIFY_EN** (DEFAULT_ENABLED)
- #define **ATCAB_VERIFY_EXTERN_EN** ATCAB_VERIFY_EN
- #define ATCAB_VERIFY_MAC_EN ATCAB_VERIFY_EN
- #define **ATCAB_VERIFY_STORED_EN** ATCAB_VERIFY_EN
- #define **ATCAB_VERIFY_VALIDATE_EN** ATCAB_VERIFY_EN
- #define ATCAB_WRITE_EN (DEFAULT_ENABLED)
- #define **ATCAB_WRITE_ENC_EN** ATCAB_WRITE_EN
- #define ATCAC_SHA1_EN (DEFAULT_ENABLED)
- #define ATCAC_SHA256_EN (FEATURE_ENABLED)
- #define ATCAC_SHA384_EN (FEATURE_DISABLED)
- #define ATCAC_SHA512_EN (FEATURE_DISABLED)
- #define **ATCAC_SHA256_HMAC_EN** ATCAC_SHA256_EN
- #define **ATCAC_SHA256_HMAC_CTR_EN** ATCAC_SHA256_HMAC_EN
- #define ATCAC_RANDOM_EN ATCA_HOSTLIB_EN
- #define ATCAC_VERIFY_EN ATCA_HOSTLIB_EN
- #define ATCAC_SIGN_EN ATCA_HOSTLIB_EN

23.41.1 Detailed Description

Consistency checks for configuration options.

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23.41.2 Macro Definition Documentation

23.41.2.1 ATCA_CHECK_INVALID_MSG

```
#define ATCA_CHECK_INVALID_MSG(
              c,
              s,
              m ) if (c) { return ATCA_TRACE(s, m); }
```

Emits message and returns the status code when the condition is true

23.41.2.2 ATCA_SHA_SUPPORT

```
#define ATCA_SHA_SUPPORT 1
```

Library Configuration File - All build attributes should be included in atca_config.h

23.41.2.3 ATCA_UNUSED_VAR_CHECK

```
#define ATCA_UNUSED_VAR_CHECK (DEFAULT_ENABLED)
```

Enables removal of compiler warning due to unused variables

23.41.2.4 ATCA_USE_ATCAB_FUNCTIONS

```
#define ATCA_USE_ATCAB_FUNCTIONS
```

Does the atcab_ API layer need to be instantiated (adds a layer of abstraction)

23.41.2.5 ATCAB_AES_GFM_EN

```
#define ATCAB_AES_GFM_EN (DEFAULT_ENABLED)
```

Enable ATCAB_AES_GFM_EN to enabled Galois Field Multiply

Supported API's: atcab_aes

23.41.2.6 ATCAB_GENKEY_MAC_EN

```
#define ATCAB_GENKEY_MAC_EN ATCAB_GENKEY_EN
```

Requires: ATCAB_GENKEY_EN

Enable ATCAB_GENKEY_MAC_EN which provides for a mac with the genkey command

Supported API's: atcab_genkey_base

23.41.2.7 ATCAB_INFO_LATCH_EN

```
#define ATCAB_INFO_LATCH_EN (DEFAULT_ENABLED)
```

Enable ATCAB_INFO_LATCH_EN which enables control of GPIOs and the persistent latch

Supported API's: atcab_info_base

23.41.2.8 ATCAB_VERIFY_MAC_EN

```
#define ATCAB_VERIFY_MAC_EN ATCAB_VERIFY_EN
```

Requires: ATCAB_VERIFY

Executes verification command with verification MAC for the External or Stored Verify modes

Supported API's: atcab_verify_extern_mac, atcab_verify_stored_mac

23.41.2.9 ATCAB_WRITE_EN

```
#define ATCAB_WRITE_EN (DEFAULT_ENABLED)
```

Enable CALIB_WRITE which writes either one four byte word or a 32-byte block to one of the EEPROM zones on the device

Supported API's: calib_write

Supported ECC204 specific API's: calib_ca2_write

23.41.2.10 ATCAC_RANDOM_EN

```
#define ATCAC_RANDOM_EN ATCA_HOSTLIB_EN
```

Requires: ATCA_HOSTLIB_EN

Enable ATCAC_RANDOM_EN get random numbers from the host's implementation - generally assumed to come from the host's cryptographic library or peripheral driver

23.41.2.11 ATCAC_SHA1_EN

```
#define ATCAC_SHA1_EN (DEFAULT_ENABLED)
```

Enable ATCAC_SHA1_EN to enable sha1 host side api

Supported API's: atcab_write

23.41.2.12 ATCAC_SHA256_EN

```
#define ATCAC_SHA256_EN (FEATURE_ENABLED)
```

Enable ATCAC_SHA256_EN to enable sha256 host side api

23.41.2.13 ATCAC_SHA384_EN

```
#define ATCAC_SHA384_EN (FEATURE_DISABLED)
```

Enable ATCAC_SHA384_EN to enable sha384 host side api

Disabled by default. Enable ATCAC_SHA512_EN to use SHA384

23.41.2.14 ATCAC_SHA512_EN

```
#define ATCAC_SHA512_EN (FEATURE_DISABLED)
```

Enable ATCAC_SHA512_EN to enable sha512 host side api

Disabled by default. Use FEATURE_ENABLED to enable this feature

23.41.2.15 ATCAC_SIGN_EN

```
#define ATCAC_SIGN_EN ATCA_HOSTLIB_EN
```

Requires: ATCA_HOSTLIB_EN

Enable ATCAC_SIGN_EN to use the host's sign functions. Generally assumed to come from the host's cryptographic library or peripheral driver.

23.41.2.16 ATCAC_VERIFY_EN

```
#define ATCAC_VERIFY_EN ATCA_HOSTLIB_EN
```

Requires: ATCA_HOSTLIB_EN

Enable ATCAC_VERIFY_EN to use the host's verify functions. Generally assumed to come from the host's cryptographic library or peripheral driver.

23.41.2.17 ATCACERT_EN

```
#define ATCACERT_EN (DEFAULT_ENABLED)
```

Enables the ATCACERT x509 handling module

23.41.2.18 MULTIPART_BUF_EN

```
#define MULTIPART_BUF_EN (DEFAULT_DISABLED)
```

Enables multipart buffer handling (generally for small memory model platforms)

23.42 atca_debug.c File Reference

Debug/Trace for CryptoAuthLib calls.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS **atca_trace** (ATCA_STATUS status)

23.42.1 Detailed Description

Debug/Trace for CryptoAuthLib calls.

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23.43 atca_device.c File Reference

Microchip CryptoAuth device object.

```
#include "cryptoauthlib.h"
```

Functions

- ATCADevice newATCADevice (ATCAIfaceCfg *cfg)
  constructor for a Microchip CryptoAuth device
- void deleteATCADevice (ATCADevice *ca_dev)
  destructor for a device NULLs reference after object is freed
- ATCA_STATUS initATCADevice (ATCAIfaceCfg *cfg, ATCADevice ca_dev)
  Initializer for an Microchip CryptoAuth device.
- ATCAIface atGetIFace (ATCADevice dev)
  returns a reference to the ATCAIface interface object for the device
- ATCA_STATUS releaseATCADevice (ATCADevice ca_dev)
  Release any resources associated with the device.

23.43.1 Detailed Description

Microchip CryptoAuth device object.

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23.44 atca_device.h File Reference

Microchip Crypto Auth device object.

```
#include "atca_iface.h"
```

Data Structures

- struct atca_device
  atca_device is the C object backing ATCADevice. See the atca_device.h file for details on the ATCADevice methods

Typedefs

- typedef void(* **ctx_cb**) (void *ctx)
  Callback function to clean up the session context.
- typedef struct atca_device * **ATCADevice**

Enumerations

- enum ATCADeviceState { **ATCA_DEVICE_STATE_UNKNOWN** = 0 , **ATCA_DEVICE_STATE_SLEEP** , **ATCA_DEVICE_STATE_IDLE** , **ATCA_DEVICE_STATE_ACTIVE** }

    ATCADeviceState says about device state.

Functions

- ATCA_STATUS initATCADevice (ATCAIfaceCfg *cfg, ATCADevice ca_dev)

    Initializer for an Microchip CryptoAuth device.
- ATCADevice newATCADevice (ATCAIfaceCfg *cfg)

    constructor for a Microchip CryptoAuth device
- ATCA_STATUS releaseATCADevice (ATCADevice ca_dev)

    Release any resources associated with the device.
- void deleteATCADevice (ATCADevice *ca_dev)

    destructor for a device NULLs reference after object is freed
- ATCAIface atGetIFace (ATCADevice dev)

    returns a reference to the ATCAIface interface object for the device

23.44.1 Detailed Description

Microchip Crypto Auth device object.

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23.45 atca_devtypes.h File Reference

Microchip Crypto Auth.

```
#include <stdint.h>
```

Macros

- #define **ATSHA204A** (0U)

    The supported Device type in Cryptoauthlib library.
- #define **ATECC108A** (1U)
- #define **ATECC508A** (2U)
- #define **ATECC608A** (3U)
- #define **ATECC608B** (3U)
- #define **ATECC608** (3U)
- #define **ATSHA206A** (4U)
- #define **TA100** (0x10U)
- #define **TA101** (0x11U)
- #define **ECC204** (0x20U)
- #define **TA010** (0x21U)
- #define **ECC206** (0x22U)
- #define **RNG90** (0x23U)
- #define **SHA104** (0x24U)
- #define **SHA105** (0x25U)
- #define **SHA106** (0x26U)
- #define **ATCA_DEV_UNKNOWN** (0x7EU)
- #define **ATCA_DEV_INVALID** (0x7FU)

Typedefs

- typedef uint8_t **ATCADeviceType**

23.45.1 Detailed Description

Microchip Crypto Auth.

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23.46 atca_helpers.c File Reference

Helpers to support the CryptoAuthLib Basic API methods.

```
#include <stdlib.h>
#include <stdio.h>
#include <ctype.h>
#include <string.h>
#include "cryptoauthlib.h"
#include "atca_helpers.h"
```

Macros

- #define **B64_IS_EQUAL** (64u)
- #define **B64_IS_INVALID** (-1)

Functions

- const uint8_t * **atcab_b64rules_default** (void)
- const uint8_t * **atcab_b64rules_mime** (void)
- const uint8_t * **atcab_b64rules_urlsafe** (void)
- ATCA_STATUS atcab_bin2hex (const uint8_t *bin, size_t bin_size, char *hex, size_t *hex_size)

  Convert a binary buffer to a hex string for easy reading.
- ATCA_STATUS atcab_reversal (const uint8_t *bin, size_t bin_size, uint8_t *dest, size_t *dest_size)

  To reverse the input data.
- ATCA_STATUS atcab_bin2hex_ (const uint8_t *bin, size_t bin_size, char *hex, size_t *hex_size, bool is_↩ pretty, bool is_space, bool is_upper)

  Function that converts a binary buffer to a hex string suitable for easy reading.
- ATCA_STATUS **atcab_hex2bin_** (const char *hex, size_t hex_size, uint8_t *bin, size_t *bin_size, bool is↩ _space)
- ATCA_STATUS atcab_hex2bin (const char *ascii_hex, size_t ascii_hex_len, uint8_t *binary, size_t *bin_len)

  Function that converts a hex string to binary buffer.
- bool isDigit (char c)

  Checks to see if a character is an ASCII representation of a digit ((c ge '0') and (c le '9'))
- bool isBlankSpace (char c)

  Checks to see if a character is blank space.

- bool isAlpha (char c)

    Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))
- bool isHexAlpha (char c)

    Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))
- bool isHex (char c)

    Returns true if this character is a valid hex character or if this is blankspace (The character can be included in a valid hexstring).
- bool isHexDigit (char c)

    Returns true if this character is a valid hex character.
- ATCA_STATUS packHex (const char ∗ascii_hex, size_t ascii_hex_len, char ∗packed_hex, size_t ∗packed_len)

    Remove spaces from a ASCII hex string.
- bool isBase64 (char c, const uint8_t ∗rules)

    Returns true if this character is a valid base 64 character or if this is space (A character can be included in a valid base 64 string).
- bool isBase64Digit (char c, const uint8_t ∗rules)

    Returns true if this character is a valid base 64 character.
- ATCA_STATUS atcab_base64decode_ (const char ∗encoded, size_t encoded_size, uint8_t ∗data, size_t ∗data_size, const uint8_t ∗rules)

    Decode base64 string to data with ruleset option.
- ATCA_STATUS atcab_base64encode_ (const uint8_t ∗data, size_t data_size, char ∗encoded, size_t ∗encoded_size, const uint8_t ∗rules)

    Encode data as base64 string with ruleset option.
- ATCA_STATUS atcab_base64encode (const uint8_t ∗byte_array, size_t array_len, char ∗encoded, size_t ∗encoded_len)

    Encode data as base64 string.
- ATCA_STATUS atcab_base64decode (const char ∗encoded, size_t encoded_len, uint8_t ∗byte_array, size_t ∗array_len)

    Decode base64 string to data.
- size_t **atcab_pointer_delta** (const void ∗start, const void ∗end)

    Helper function to calculate the number of bytes between two pointers.
- int **atcab_memset_s** (void ∗dest, size_t destsz, int ch, size_t count)

    Guaranteed to perform memory writes regardless of optimization level. Matches memset_s signature.
- char **lib_toupper** (char c)

    Converts a character to uppercase.
- char **lib_tolower** (char c)

    Converts a character to lowercase.
- const char ∗ **lib_strcasestr** (const char ∗haystack, const char ∗needle)

    Search for a substring in a case insenstive format.

23.46.1 Detailed Description

Helpers to support the CryptoAuthLib Basic API methods.

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23.46.2 Function Documentation

23.46.2.1 atcab_base64decode()

```
ATCA_STATUS atcab_base64decode (
            const char * encoded,
            size_t encoded_len,
            uint8_t * byte_array,
            size_t * array_len )
```

Decode base64 string to data.

Parameters

in	*encoded*	Base64 string to be decoded.
in	*encoded_len*	Size of the base64 string in bytes.
out	*byte_array*	Decoded data will be returned here.
in,out	*array_len*	As input, the size of the byte_array buffer. As output, the length of the decoded data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.46.2.2 atcab_base64decode_()

```
ATCA_STATUS atcab_base64decode_ (
            const char * encoded,
            size_t encoded_size,
            uint8_t * data,
            size_t * data_size,
            const uint8_t * rules )
```

Decode base64 string to data with ruleset option.

Parameters

in	*encoded*	Base64 string to be decoded.
in	*encoded_size*	Size of the base64 string in bytes.
out	*data*	Decoded data will be returned here.
in,out	*data_size*	As input, the size of the byte_array buffer. As output, the length of the decoded data.
in	*rules*	base64 ruleset to use

23.46.2.3 atcab_base64encode()

```
ATCA_STATUS atcab_base64encode (
            const uint8_t * byte_array,
            size_t array_len,
```

```
            char * encoded,
            size_t * encoded_len )
```

Encode data as base64 string.

Parameters

in	*byte_array*	Data to be encode in base64.
in	*array_len*	Size of byte_array in bytes.
in	*encoded*	Base64 output is returned here.
in,out	*encoded_len*	As input, the size of the encoded buffer. As output, the length of the encoded base64 character string.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.46.2.4 atcab_base64encode_()

```
ATCA_STATUS atcab_base64encode_ (
            const uint8_t * data,
            size_t data_size,
            char * encoded,
            size_t * encoded_size,
            const uint8_t * rules )
```

Encode data as base64 string with ruleset option.

Parameters

in	*data*	The input byte array that will be converted to base 64 encoded characters
in	*data_size*	The length of the byte array
in	*encoded*	The output converted to base 64 encoded characters.
in,out	*encoded_size*	Input: The size of the encoded buffer, Output: The length of the encoded base 64 character string
in	*rules*	ruleset to use during encoding

23.46.2.5 atcab_bin2hex()

```
ATCA_STATUS atcab_bin2hex (
            const uint8_t * bin,
            size_t bin_size,
            char * hex,
            size_t * hex_size )
```

Convert a binary buffer to a hex string for easy reading.

Parameters

in	*bin*	Input data to convert.
in	*bin_size*	Size of data to convert.
out	*hex*	Buffer that receives hex string.
in,out	*hex_size*	As input, the size of the hex buffer. As output, the size of the output hex.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.46.2.6 atcab_bin2hex_()

```
ATCA_STATUS atcab_bin2hex_ (
            const uint8_t * bin,
            size_t bin_size,
            char * hex,
            size_t * hex_size,
            bool is_pretty,
            bool is_space,
            bool is_upper )
```

Function that converts a binary buffer to a hex string suitable for easy reading.

Parameters

in	*bin*	Input data to convert.
in	*bin_size*	Size of data to convert.
out	*hex*	Buffer that receives hex string.
in,out	*hex_size*	As input, the size of the hex buffer. As output, the size of the output hex.
in	*is_pretty*	Indicates whether new lines should be added for pretty printing.
in	*is_space*	Convert the output hex with space between it.
in	*is_upper*	Convert the output hex to upper case.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.46.2.7 atcab_hex2bin()

```
ATCA_STATUS atcab_hex2bin (
            const char * ascii_hex,
            size_t ascii_hex_len,
            uint8_t * binary,
            size_t * bin_len )
```

Function that converts a hex string to binary buffer.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ascii_hex*	Input buffer to convert
in	*ascii_hex_len*	Length of buffer to convert
out	*binary*	Buffer that receives binary
in,out	*bin_len*	As input, the size of the bin buffer. As output, the size of the bin data.

23.46.2.8 atcab_reversal()

```
ATCA_STATUS atcab_reversal (
            const uint8_t * bin,
            size_t bin_size,
            uint8_t * dest,
            size_t * dest_size )
```

To reverse the input data.

Parameters

in	*bin*	Input data to reverse.
in	*bin_size*	Size of data to reverse.
out	*dest*	Buffer to store reversed binary data.
in	*dest_size*	The size of the dest buffer.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.46.2.9 isAlpha()

```
bool isAlpha (
            char c )
```

Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))

Parameters

in	*c*	character to check

Returns

True if the character is a hex

23.46.2.10 isBase64()

```
bool isBase64 (
            char c,
            const uint8_t * rules )
```

Returns true if this character is a valid base 64 character or if this is space (A character can be included in a valid base 64 string).

Parameters

in	*c*	character to check
in	*rules*	base64 ruleset to use

Returns

True if the character can be included in a valid base 64 string

23.46.2.11 isBase64Digit()

```
bool isBase64Digit (
            char c,
            const uint8_t * rules )
```

Returns true if this character is a valid base 64 character.

Parameters

in	*c*	character to check
in	*rules*	base64 ruleset to use

Returns

True if the character can be included in a valid base 64 string

23.46.2.12 isBlankSpace()

```
bool isBlankSpace (
            char c )
```

Checks to see if a character is blank space.

Parameters

in	*c*	character to check

Returns

True if the character is blankspace

23.46.2.13 isDigit()

```
bool isDigit (
            char c )
```

Checks to see if a character is an ASCII representation of a digit ((c ge '0') and (c le '9'))

Parameters

in	*c*	character to check

Returns

True if the character is a digit

23.46.2.14 isHex()

```
bool isHex (
            char c )
```

Returns true if this character is a valid hex character or if this is blankspace (The character can be included in a valid hexstring).

Parameters

in	*c*	character to check

Returns

True if the character can be included in a valid hexstring

23.46.2.15 isHexAlpha()

```
bool isHexAlpha (
            char c )
```

Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))

Parameters

in	*c*	character to check

Returns

True if the character is a hex

23.46.2.16 isHexDigit()

```
bool isHexDigit (
            char c )
```

Returns true if this character is a valid hex character.

Parameters

in	*c*	character to check

Returns

True if the character can be included in a valid hexstring

23.46.2.17 packHex()

```
ATCA_STATUS packHex (
            const char * ascii_hex,
            size_t ascii_hex_len,
            char * packed_hex,
            size_t * packed_len )
```

Remove spaces from a ASCII hex string.

Parameters

in	*ascii_hex*	Initial hex string to remove blankspace from
in	*ascii_hex_len*	Length of the initial hex string
in	*packed_hex*	Resulting hex string without blankspace
in,out	*packed_len*	In: Size to packed_hex buffer Out: Number of bytes in the packed hex string

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.47 atca_helpers.h File Reference

Helpers to support the CryptoAuthLib Basic API methods.

```
#include "cryptoauthlib.h"
```

- #define **IS_ADD_SAFE_UINT16_T**(a, b) (((UINT16_MAX - (a)) >= (b)) ? true : false)
- #define **IS_ADD_SAFE_UINT32_T**(a, b) (((UINT32_MAX - (a)) >= (b)) ? true : false)
- #define **IS_ADD_SAFE_UINT64_T**(a, b) (((UINT64_MAX - (a)) >= (b)) ? true : false)
- #define **IS_ADD_SAFE_SIZE_T**(a, b) (((SIZE_MAX - (a)) >= (b)) ? true : false)
- #define **IS_MUL_SAFE_UINT16_T**(a, b) ((((a) <= UINT16_MAX / (b))) ? true : false)
- #define **IS_MUL_SAFE_UINT32_T**(a, b) ((((a) <= UINT32_MAX / (b))) ? true : false)
- #define **IS_MUL_SAFE_UINT64_T**(a, b) ((((a) <= UINT64_MAX / (b))) ? true : false)
- #define **IS_MUL_SAFE_SIZE_T**(a, b) ((((a) <= SIZE_MAX / (b))) ? true : false)
- ATCA_STATUS atcab_bin2hex (const uint8_t *bin, size_t bin_size, char *hex, size_t *hex_size)

    Convert a binary buffer to a hex string for easy reading.
- ATCA_STATUS atcab_bin2hex_ (const uint8_t *bin, size_t bin_size, char *hex, size_t *hex_size, bool is_↩ pretty, bool is_space, bool is_upper)

    Function that converts a binary buffer to a hex string suitable for easy reading.
- ATCA_STATUS atcab_hex2bin (const char *ascii_hex, size_t ascii_hex_len, uint8_t *binary, size_t *bin_len)

    Function that converts a hex string to binary buffer.
- ATCA_STATUS **atcab_hex2bin_** (const char *hex, size_t hex_size, uint8_t *bin, size_t *bin_size, bool is_↩ space)
- ATCA_STATUS packHex (const char *ascii_hex, size_t ascii_hex_len, char *packed_hex, size_t *packed↩ _len)

    Remove spaces from a ASCII hex string.
- bool isDigit (char c)

    Checks to see if a character is an ASCII representation of a digit ((c ge '0') and (c le '9'))
- bool isBlankSpace (char c)

    Checks to see if a character is blank space.
- bool isAlpha (char c)

    Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))
- bool isHexAlpha (char c)

    Checks to see if a character is an ASCII representation of hex ((c >= 'A') and (c <= 'F')) || ((c >= 'a') and (c <= 'f'))
- bool isHex (char c)

    Returns true if this character is a valid hex character or if this is blankspace (The character can be included in a valid hexstring).
- bool isHexDigit (char c)

    Returns true if this character is a valid hex character.
- bool isBase64 (char c, const uint8_t *rules)

    Returns true if this character is a valid base 64 character or if this is space (A character can be included in a valid base 64 string).
- bool isBase64Digit (char c, const uint8_t *rules)

    Returns true if this character is a valid base 64 character.
- const uint8_t * **atcab_b64rules_default** (void)
- const uint8_t * **atcab_b64rules_mime** (void)
- const uint8_t * **atcab_b64rules_urlsafe** (void)

- ATCA_STATUS atcab_base64decode_ (const char ∗encoded, size_t encoded_size, uint8_t ∗data, size_↩
  t ∗data_size, const uint8_t ∗rules)

  Decode base64 string to data with ruleset option.
- ATCA_STATUS atcab_base64encode (const uint8_t ∗byte_array, size_t array_len, char ∗encoded, size_↩
  t ∗encoded_len)

  Encode data as base64 string.
- ATCA_STATUS atcab_base64encode_ (const uint8_t ∗data, size_t data_size, char ∗encoded, size_↩
  t ∗encoded_size, const uint8_t ∗rules)

  Encode data as base64 string with ruleset option.
- ATCA_STATUS atcab_base64decode (const char ∗encoded, size_t encoded_len, uint8_t ∗byte_array, size↩
  _t ∗array_len)

  Decode base64 string to data.
- ATCA_STATUS atcab_reversal (const uint8_t ∗bin, size_t bin_size, uint8_t ∗dest, size_t ∗dest_size)

  To reverse the input data.
- int **atcab_memset_s** (void ∗dest, size_t destsz, int ch, size_t count)

  Guaranteed to perform memory writes regardless of optimization level. Matches memset_s signature.
- size_t **atcab_pointer_delta** (const void ∗start, const void ∗end)

  Helper function to calculate the number of bytes between two pointers.
- char **lib_toupper** (char c)

  Converts a character to uppercase.
- char **lib_tolower** (char c)

  Converts a character to lowercase.

23.47.1 Detailed Description

Helpers to support the CryptoAuthLib Basic API methods.

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23.48 atca_iface.c File Reference

Microchip CryptoAuthLib hardware interface object.

```
#include "cryptoauthlib.h"
#include <ctype.h>
```

Data Structures

- struct devtype_names_t

Functions

- ATCA_STATUS initATCAIface (ATCAIfaceCfg *cfg, ATCAIface ca_iface)

  Initializer for ATCAIface objects.
- ATCA_STATUS atinit (ATCAIface ca_iface)

  Performs the HAL initialization by calling intermediate HAL wrapper function. If using the basic API, the atcab_init() function should be called instead.
- ATCA_STATUS atsend (ATCAIface ca_iface, uint8_t word_address, uint8_t *txdata, int txlength)

  Sends the data to the device by calling intermediate HAL wrapper function.
- ATCA_STATUS atreceive (ATCAIface ca_iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)

  Receives data from the device by calling intermediate HAL wrapper function.
- ATCA_STATUS atcontrol (ATCAIface ca_iface, uint8_t option, void *param, size_t paramlen)

  Perform control operations with the underlying hal driver.
- ATCA_STATUS atwake (ATCAIface ca_iface)

  Wakes up the device by calling intermediate HAL wrapper function. The atcab_wakeup() function should be used instead.
- ATCA_STATUS atidle (ATCAIface ca_iface)

  Puts the device into idle state by calling intermediate HAL wrapper function. The atcab_idle() function should be used instead.
- ATCA_STATUS atsleep (ATCAIface ca_iface)

  Puts the device into sleep state by calling intermediate HAL wrapper function. The atcab_sleep() function should be used instead.
- ATCAIfaceCfg * atgetifacecfg (ATCAIface ca_iface)

  Returns the logical interface configuration for the device.
- void * atgetifacehaldat (ATCAIface ca_iface)

  Returns the HAL data pointer for the device.
- bool ifacetype_is_kit (ATCAIfaceType iface_type)

  Check if the given interface is a "kit protocol" one.
- bool atca_iface_is_kit (ATCAIface ca_iface)

  Check if the given interface is configured as a "kit protocol" one where transactions are atomic.
- bool atca_iface_is_swi (ATCAIface ca_iface)

  Check if the given interface is configured as a SWI.
- int **atca_iface_get_retries** (ATCAIface ca_iface)

  Retrive the number of retries for a configured interface.
- uint16_t **atca_iface_get_wake_delay** (ATCAIface ca_iface)

  Retrive the wake/retry delay for a configured interface/device.
- uint8_t **ifacecfg_get_address** (ATCAIfaceCfg *cfg)

  Retrieves the device address given an interface configuration.
- ATCA_STATUS ifacecfg_set_address (ATCAIfaceCfg *cfg, uint8_t address, ATCAKitType kitiface)

  Change the address of the selected device.
- ATCA_STATUS releaseATCAIface (ATCAIface ca_iface)

  Instruct the HAL driver to release any resources associated with this interface.
- void deleteATCAIface (ATCAIface *ca_iface)

  Instruct the HAL driver to release any resources associated with this interface, then delete the object.
- ATCADeviceType **iface_get_device_type_by_name** (const char *name)

  Get the ATCADeviceType for a string that looks like a part number.

23.48.1 Detailed Description

Microchip CryptoAuthLib hardware interface object.

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23.49 atca_iface.h File Reference

Microchip Crypto Auth hardware interface object.

```
#include <stdint.h>
#include <stddef.h>
#include "atca_devtypes.h"
#include "atca_status.h"
#include "atca_config.h"
```

Data Structures

- struct ATCAIfaceCfg
- struct ATCAHAL_t

  HAL Driver Structure.
- struct atca_iface

  atca_iface is the context structure for a configured interface

Macros

- #define **ATCA_IFACECFG_NAME**(x) (x)
- #define **ATCA_IFACECFG_I2C_ADDRESS**(c) (c)->cfg.atcai2c.address
- #define **ATCA_IFACECFG_I2C_BAUD**(c) (c)->cfg.atcai2c.baud
- #define **ATCA_IFACECFG_VALUE**(c, v) (c)->cfg.v

Typedefs

- typedef struct atca_iface ∗ **ATCAIface**
- typedef struct atca_iface **atca_iface_t**

  atca_iface is the context structure for a configured interface

Enumerations

- enum ATCAIfaceType {
  ATCA_I2C_IFACE = 0 , ATCA_SWI_IFACE = 1 , ATCA_UART_IFACE = 2 , ATCA_SPI_IFACE = 3 ,
  ATCA_HID_IFACE = 4 , ATCA_KIT_IFACE = 5 , ATCA_CUSTOM_IFACE = 6 , ATCA_I2C_GPIO_IFACE = 7 ,
  ATCA_SWI_GPIO_IFACE = 8 , ATCA_SPI_GPIO_IFACE = 9 , **ATCA_UNKNOWN_IFACE** = 0xFE }
- enum **ATCAKitType** {
  ATCA_KIT_AUTO_IFACE , **ATCA_KIT_I2C_IFACE** , **ATCA_KIT_SWI_IFACE** , **ATCA_KIT_SPI_IFACE** ,
  ATCA_KIT_UNKNOWN_IFACE }

Functions

- ATCA_STATUS initATCAIface (ATCAIfaceCfg *cfg, ATCAIface ca_iface)

  Initializer for ATCAIface objects.
- ATCA_STATUS releaseATCAIface (ATCAIface ca_iface)

  Instruct the HAL driver to release any resources associated with this interface.
- void deleteATCAIface (ATCAIface *ca_iface)

  Instruct the HAL driver to release any resources associated with this interface, then delete the object.
- ATCA_STATUS atinit (ATCAIface ca_iface)

  Performs the HAL initialization by calling intermediate HAL wrapper function. If using the basic API, the atcab_init() function should be called instead.
- ATCA_STATUS atsend (ATCAIface ca_iface, uint8_t word_address, uint8_t *txdata, int txlength)

  Sends the data to the device by calling intermediate HAL wrapper function.
- ATCA_STATUS atreceive (ATCAIface ca_iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)

  Receives data from the device by calling intermediate HAL wrapper function.
- ATCA_STATUS atcontrol (ATCAIface ca_iface, uint8_t option, void *param, size_t paramlen)

  Perform control operations with the underlying hal driver.
- ATCA_STATUS atwake (ATCAIface ca_iface)

  Wakes up the device by calling intermediate HAL wrapper function. The atcab_wakeup() function should be used instead.
- ATCA_STATUS atidle (ATCAIface ca_iface)

  Puts the device into idle state by calling intermediate HAL wrapper function. The atcab_idle() function should be used instead.
- ATCA_STATUS atsleep (ATCAIface ca_iface)

  Puts the device into sleep state by calling intermediate HAL wrapper function. The atcab_sleep() function should be used instead.
- ATCAIfaceCfg * atgetifacecfg (ATCAIface ca_iface)

  Returns the logical interface configuration for the device.
- void * atgetifacehaldat (ATCAIface ca_iface)

  Returns the HAL data pointer for the device.
- ATCA_STATUS ifacecfg_set_address (ATCAIfaceCfg *cfg, uint8_t address, ATCAKitType kitiface)

  Change the address of the selected device.
- uint8_t **ifacecfg_get_address** (ATCAIfaceCfg *cfg)

  Retrieves the device address given an interface configuration.
- bool ifacetype_is_kit (ATCAIfaceType iface_type)

  Check if the given interface is a "kit protocol" one.
- bool atca_iface_is_kit (ATCAIface ca_iface)

  Check if the given interface is configured as a "kit protocol" one where transactions are atomic.
- bool atca_iface_is_swi (ATCAIface ca_iface)

  Check if the given interface is configured as a SWI.
- int **atca_iface_get_retries** (ATCAIface ca_iface)

  Retrive the number of retries for a configured interface.
- uint16_t **atca_iface_get_wake_delay** (ATCAIface ca_iface)

  Retrive the wake/retry delay for a configured interface/device.
- ATCADeviceType **iface_get_device_type_by_name** (const char *name)

  Get the ATCADeviceType for a string that looks like a part number.

Variables

- struct {
  uint8_t address
  uint8_t **bus**
  uint32_t **baud**
  } **atcai2c**

- struct {
  uint8_t **address**
  uint8_t **bus**
  } **atcaswi**

- struct {
  uint8_t **bus**
  uint8_t **select_pin**
  uint32_t **baud**
  } **atcaspi**

- struct {
  ATCAKitType **dev_interface**
  uint8_t **dev_identity**
  uint8_t **port**
  uint32_t **baud**
  uint8_t **wordsize**
  uint8_t **parity**
  uint8_t **stopbits**
  } **atcauart**

- struct {
  int **idx**
  ATCAKitType **dev_interface**
  uint8_t **dev_identity**
  uint32_t **vid**
  uint32_t **pid**
  uint32_t **packetsize**
  } **atcahid**

- struct {
  ATCAKitType **dev_interface**
  uint8_t **dev_identity**
  uint32_t **flags**
  } **atcakit**

- struct {
  ATCA_STATUS(∗ **halinit**)(void ∗hal, void ∗cfg)
  ATCA_STATUS(∗ **halpostinit**)(void ∗iface)
  ATCA_STATUS(∗ **halsend**)(void ∗iface, uint8_t
  word_address, uint8_t ∗txdata,

int txlength)
ATCA_STATUS(∗ **halreceive**)(void ∗iface, uint8_t
word_address, uint8_t ∗rxdata,
uint16_t ∗rxlength)
ATCA_STATUS(∗ **halwake**)(void ∗iface)
ATCA_STATUS(∗ **halidle**)(void ∗iface)
ATCA_STATUS(∗ **halsleep**)(void ∗iface)
ATCA_STATUS(∗ **halrelease**)(void ∗hal_data)
} **atcacustom**

23.49.1 Detailed Description

Microchip Crypto Auth hardware interface object.

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23.49.2 Variable Documentation

23.49.2.1 address

```
uint8_t address
```

Device address - the upper 7 bits are the I2c address bits

23.50 atca_platform.h File Reference

Configure the platform interfaces for cryptoauthlib.

```
#include <stddef.h>
#include <string.h>
```

Macros

- #define **hal_memset_s** atcab_memset_s

Functions

- void ∗ **hal_malloc** (size_t size)
- void **hal_free** (void ∗ptr)
- const char ∗ **lib_strcasestr** (const char ∗haystack, const char ∗needle)

  Search for a substring in a case insenstive format.

23.50.1 Detailed Description

Configure the platform interfaces for cryptoauthlib.

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23.51 atca_status.h File Reference

Microchip Crypto Auth status codes.

```
#include <stdint.h>
#include "atca_compiler.h"
```

Macros

- #define ATCA_SUCCESS (0)
- #define **ATCA_CONFIG_ZONE_LOCKED** (0x01)
- #define **ATCA_DATA_ZONE_LOCKED** (0x02)
- #define ATCA_WAKE_FAILED (-48)
- #define ATCA_CHECKMAC_VERIFY_FAILED (-47)
- #define ATCA_PARSE_ERROR (-46)
- #define ATCA_STATUS_CRC (-44)
- #define ATCA_STATUS_UNKNOWN (-43)
- #define ATCA_STATUS_ECC (-42)
- #define ATCA_STATUS_SELFTEST_ERROR (-41)
- #define ATCA_FUNC_FAIL (-32)
- #define ATCA_GEN_FAIL (-31)
- #define ATCA_BAD_PARAM (-30)
- #define ATCA_INVALID_ID (-29)
- #define ATCA_INVALID_SIZE (-28)
- #define ATCA_RX_CRC_ERROR (-27)
- #define ATCA_RX_FAIL (-26)
- #define ATCA_RX_NO_RESPONSE (-25)
- #define ATCA_RESYNC_WITH_WAKEUP (-24)
- #define ATCA_PARITY_ERROR (-23)
- #define ATCA_TX_TIMEOUT (-22)
- #define ATCA_RX_TIMEOUT (-21)
- #define ATCA_TOO_MANY_COMM_RETRIES (-20)
- #define ATCA_SMALL_BUFFER (-19)
- #define ATCA_COMM_FAIL (-16)
- #define ATCA_TIMEOUT (-15)
- #define ATCA_BAD_OPCODE (-14)
- #define ATCA_WAKE_SUCCESS (-13)
- #define ATCA_EXECUTION_ERROR (-12)
- #define ATCA_UNIMPLEMENTED (-11)
- #define ATCA_ASSERT_FAILURE (-10)
- #define ATCA_TX_FAIL (-9)
- #define ATCA_NOT_LOCKED (-8)
- #define ATCA_NO_DEVICES (-7)
- #define ATCA_HEALTH_TEST_ERROR (-6)
- #define ATCA_ALLOC_FAILURE (-5)
- #define ATCA_USE_FLAGS_CONSUMED (-4)
- #define ATCA_NOT_INITIALIZED (-3)
- #define **ATCA_STATUS_AUTH_BIT** 0x40u
- #define **ATCA_STATUS_AUTH_BIT_COMPLEMENT** ∼(ATCA_STATUS_AUTH_BIT & 0xffu)

Typedefs

- typedef int **ATCA_STATUS**

23.51.1 Detailed Description

Microchip Crypto Auth status codes.

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23.51.2 Macro Definition Documentation

23.51.2.1 ATCA_ALLOC_FAILURE

```
#define ATCA_ALLOC_FAILURE (-5)
```

STATUS (0xFB): Couldn't allocate required memory

23.51.2.2 ATCA_ASSERT_FAILURE

```
#define ATCA_ASSERT_FAILURE (-10)
```

STATUS (0xF6): Code failed run-time consistency check

23.51.2.3 ATCA_BAD_OPCODE

```
#define ATCA_BAD_OPCODE (-14)
```

STATUS (0xF2): opcode is not supported by the device

23.51.2.4 ATCA_BAD_PARAM

```
#define ATCA_BAD_PARAM (-30)
```

STATUS (0xE2): bad argument (out of range, null pointer, etc.)

23.51.2.5 ATCA_CHECKMAC_VERIFY_FAILED

```
#define ATCA_CHECKMAC_VERIFY_FAILED (-47)
```

STATUS (0xD1): response status byte indicates CheckMac failure(status byte = 0x01)

23.51.2.6 ATCA_COMM_FAIL

```
#define ATCA_COMM_FAIL (-16)
```

STATUS (0xF0): Communication with device failed. Same as in hardware dependent modules.

23.51.2.7 ATCA_EXECUTION_ERROR

```
#define ATCA_EXECUTION_ERROR (-12)
```

STATUS (0xF4): chip was in a state where it could not execute the command, response status byte indicates command execution error (status byte = 0x0F)

23.51.2.8 ATCA_FUNC_FAIL

```
#define ATCA_FUNC_FAIL (-32)
```

STATUS (0xE0): Function could not execute due to incorrect condition / state.

23.51.2.9 ATCA_GEN_FAIL

```
#define ATCA_GEN_FAIL (-31)
```

STATUS (0xE1): unspecified error

23.51.2.10 ATCA_HEALTH_TEST_ERROR

```
#define ATCA_HEALTH_TEST_ERROR (-6)
```

STATUS (0xFA): random number generator health test error

23.51.2.11 ATCA_INVALID_ID

```
#define ATCA_INVALID_ID (-29)
```

STATUS (0xE3: invalid device id, id not set

23.51.2.12 ATCA_INVALID_SIZE

```
#define ATCA_INVALID_SIZE (-28)
```

STATUS (0xE4): Count value is out of range or greater than buffer size.

23.51.2.13 ATCA_NO_DEVICES

```
#define ATCA_NO_DEVICES (-7)
```

STATUS (0xF9): For protocols that support device discovery (kit protocol), no devices were found

23.51.2.14 ATCA_NOT_INITIALIZED

```
#define ATCA_NOT_INITIALIZED (-3)
```

STATUS (0xFD): The library has not been initialized so the command could not be executed

23.51.2.15 ATCA_NOT_LOCKED

```
#define ATCA_NOT_LOCKED (-8)
```

STATUS (0xF8): required zone was not locked

23.51.2.16 ATCA_PARITY_ERROR

```
#define ATCA_PARITY_ERROR (-23)
```

STATUS (0xE9): for protocols needing parity

23.51.2.17 ATCA_PARSE_ERROR

```
#define ATCA_PARSE_ERROR (-46)
```

STATUS (0xD2): response status byte indicates parsing error(status byte = 0x03)

23.51.2.18 ATCA_RESYNC_WITH_WAKEUP

```
#define ATCA_RESYNC_WITH_WAKEUP (-24)
```

STATUS (0xE8): Re-synchronization succeeded, but only after generating a Wake-up

23.51.2.19 ATCA_RX_CRC_ERROR

```
#define ATCA_RX_CRC_ERROR (-27)
```

STATUS (0xE5): CRC error in data received from device

23.51.2.20 ATCA_RX_FAIL

```
#define ATCA_RX_FAIL (-26)
```

STATUS (0xE6): Timed out while waiting for response. Number of bytes received is $>$ 0.

23.51.2.21 ATCA_RX_NO_RESPONSE

```
#define ATCA_RX_NO_RESPONSE (-25)
```

STATUS (0xE7): Not an error while the Command layer is polling for a command response.

23.51.2.22 ATCA_RX_TIMEOUT

```
#define ATCA_RX_TIMEOUT (-21)
```

STATUS (0xEB): for Microchip PHY protocol, timeout on receipt waiting for master

23.51.2.23 ATCA_SMALL_BUFFER

```
#define ATCA_SMALL_BUFFER (-19)
```

STATUS (0xED): Supplied buffer is too small for data required

23.51.2.24 ATCA_STATUS_CRC

```
#define ATCA_STATUS_CRC (-44)
```

STATUS (0xD4): response status byte indicates DEVICE did not receive data properly(status byte = 0xFF)

23.51.2.25 ATCA_STATUS_ECC

```
#define ATCA_STATUS_ECC (-42)
```

STATUS (0xD6): response status byte is ECC fault(status byte = 0x05)

23.51.2.26 ATCA_STATUS_SELFTEST_ERROR

```
#define ATCA_STATUS_SELFTEST_ERROR (-41)
```

STATUS (0xD7): response status byte is Self Test Error, chip in failure mode (status byte = 0x07)

23.51.2.27 ATCA_STATUS_UNKNOWN

```
#define ATCA_STATUS_UNKNOWN (-43)
```

STATUS (0xD5): response status byte is unknown

23.51.2.28 ATCA_SUCCESS

```
#define ATCA_SUCCESS (0)
```

STATUS (0x00): Function Successful

23.51.2.29 ATCA_TIMEOUT

```
#define ATCA_TIMEOUT (-15)
```

STATUS (0xF1): Timed out while waiting for response. Number of bytes received is 0.

23.51.2.30 ATCA_TOO_MANY_COMM_RETRIES

```
#define ATCA_TOO_MANY_COMM_RETRIES (-20)
```

STATUS (0xEC): Device did not respond too many times during a transmission. Could indicate no device present.

23.51.2.31 ATCA_TX_FAIL

```
#define ATCA_TX_FAIL (-9)
```

STATUS (0xF7): Failed to write

23.51.2.32 ATCA_TX_TIMEOUT

```
#define ATCA_TX_TIMEOUT (-22)
```

STATUS (0xEA): for Microchip PHY protocol, timeout on transmission waiting for master

23.51.2.33 ATCA_UNIMPLEMENTED

```
#define ATCA_UNIMPLEMENTED (-11)
```

STATUS (0xF5): Function or some element of it hasn't been implemented yet

23.51.2.34 ATCA_USE_FLAGS_CONSUMED

```
#define ATCA_USE_FLAGS_CONSUMED (-4)
```

STATUS (0xFC): Use flags on the device indicates its consumed fully

23.51.2.35 ATCA_WAKE_FAILED

```
#define ATCA_WAKE_FAILED (-48)
```

STATUS (0xD0): response status byte indicates CheckMac failure(status byte = 0x01)

23.51.2.36 ATCA_WAKE_SUCCESS

```
#define ATCA_WAKE_SUCCESS (-13)
```

STATUS (0xF3): received proper wake token

23.52 atca_utils_sizes.c File Reference

API to Return structure sizes of cryptoauthlib structures.

```
#include "cryptoauthlib.h"
#include "cal_internal.h"
#include "atcacert/atcacert_check_config.h"
#include "atcacert/atcacert_date.h"
#include "atcacert/atcacert_def.h"
#include "host/atca_host.h"
```

Macros

- #define **SIZE_OF_API_T**(x) size_t x ## _size(void); size_t x ## _size(void) { return sizeof(x); }
- #define **SIZE_OF_API_S**(x) size_t x ## _size(void); size_t x ## _size(void) { return sizeof(struct x); }

Functions

- size_t **atcacert_tm_utc_t_size** (void)
- size_t **atcacert_date_format_t_size** (void)
- size_t **atcacert_cert_type_t_size** (void)
- size_t **atcacert_cert_sn_src_t_size** (void)
- size_t **atcacert_device_zone_t_size** (void)
- size_t **atcacert_std_cert_element_t_size** (void)
- size_t **atcacert_device_loc_t_size** (void)
- size_t **atcacert_cert_loc_t_size** (void)
- size_t **atcacert_cert_element_t_size** (void)
- size_t **atcacert_def_t_size** (void)
- size_t **atcacert_build_state_t_size** (void)
- size_t **atca_temp_key_t_size** (void)
- size_t **atca_include_data_in_out_size** (void)
- size_t **atca_nonce_in_out_t_size** (void)
- size_t **atca_io_decrypt_in_out_t_size** (void)
- size_t **atca_verify_mac_in_out_t_size** (void)
- size_t **atca_secureboot_enc_in_out_t_size** (void)
- size_t **atca_secureboot_mac_in_out_t_size** (void)
- size_t **atca_mac_in_out_t_size** (void)
- size_t **atca_hmac_in_out_size** (void)
- size_t **atca_gen_dig_in_out_t_size** (void)
- size_t **atca_write_mac_in_out_t_size** (void)
- size_t **atca_derive_key_in_out_size** (void)
- size_t **atca_derive_key_mac_in_out_size** (void)
- size_t **atca_decrypt_in_out_size** (void)
- size_t **atca_check_mac_in_out_t_size** (void)
- size_t **atca_verify_in_out_t_size** (void)
- size_t **atca_gen_key_in_out_t_size** (void)
- size_t **atca_sign_internal_in_out_t_size** (void)
- size_t **bool_size** (void)
- size_t **ATCAPacket_size** (void)
- size_t **atca_device_size** (void)
- size_t **ATCADeviceType_size** (void)

- size_t **ATCAIfaceType_size** (void)
- size_t **ATCAIfaceCfg_size** (void)
- size_t **atca_iface_size** (void)
- size_t **ATCA_STATUS_size** (void)
- size_t **atcac_sha1_ctx_size** (void)
- size_t **atcac_sha1_ctx_t_size** (void)
- size_t **atcac_sha2_256_ctx_size** (void)
- size_t **atcac_sha2_256_ctx_t_size** (void)
- size_t **atcac_hmac_ctx_size** (void)
- size_t **atcac_hmac_ctx_t_size** (void)

23.52.1 Detailed Description

API to Return structure sizes of cryptoauthlib structures.

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23.53 atca_version.h File Reference

Microchip CryptoAuth Library Version.

Macros

- #define **ATCA_LIBRARY_VERSION_DATE** "20240926"
- #define **ATCA_LIBRARY_VERSION_MAJOR** 3
- #define **ATCA_LIBRARY_VERSION_MINOR** 7
- #define **ATCA_LIBRARY_VERSION_BUILD** 6

23.53.1 Detailed Description

Microchip CryptoAuth Library Version.

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23.54 atcacert.h File Reference

Declarations common to all atcacert code.

```
#include <stddef.h>
#include <stdint.h>
#include "atcacert_check_config.h"
#include "atca_status.h"
```

Macros

- #define **FALSE** (0)
- #define **TRUE** (1)
- #define ATCACERT_E_SUCCESS ATCA_SUCCESS
- #define ATCACERT_E_ERROR ATCA_GEN_FAIL
- #define ATCACERT_E_BAD_PARAMS ATCA_BAD_PARAM
- #define ATCACERT_E_BUFFER_TOO_SMALL ATCA_SMALL_BUFFER
- #define ATCACERT_E_UNIMPLEMENTED ATCA_UNIMPLEMENTED
- #define ATCACERT_E_DECODING_ERROR 4
- #define ATCACERT_E_INVALID_DATE 5
- #define ATCACERT_E_UNEXPECTED_ELEM_SIZE 7
- #define ATCACERT_E_ELEM_MISSING 8
- #define ATCACERT_E_ELEM_OUT_OF_BOUNDS 9
- #define ATCACERT_E_BAD_CERT 10
- #define **ATCACERT_E_WRONG_CERT_DEF** 11
- #define ATCACERT_E_VERIFY_FAILED 12
- #define ATCACERT_E_INVALID_TRANSFORM 13

23.54.1 Detailed Description

Declarations common to all atcacert code.

These are common definitions used by all the atcacert code.

Copyright

23.55 atcacert_check_config.h File Reference

Configuration check and defaults for the atcacert module.

```
#include "cryptoauthlib.h"
#include "crypto/atca_crypto_sw.h"
```

Macros

- #define **HOSTLIB_CERT_EN** DEFAULT_DISABLED
- #define **ATCACERT_INTEGRATION_EN** HOSTLIB_CERT_EN
- #define **ATCACERT_COMPCERT_EN** (CALIB_ECC_SUPPORT || CALIB_CA2_CERT_SUPPORT)
- #define **ATCACERT_HW_CHALLENGE_EN** (ATCAB_RANDOM_EN && (ATCA_ECC_SUPPORT || ATCA_TA_SUPPORT))
- #define **ATCACERT_HW_VERIFY_EN** (ATCAB_VERIFY_EXTERN_EN && (ATCA_ECC_SUPPORT || ATCA_TA_SUPPORT))
- #define **ATCACERT_DATEFMT_ISO_EN** DEFAULT_ENABLED
- #define **ATCACERT_DATEFMT_UTC_EN** DEFAULT_ENABLED
- #define **ATCACERT_DATEFMT_POSIX_EN** DEFAULT_ENABLED
- #define **ATCACERT_DATEFMT_GEN_EN** DEFAULT_ENABLED

23.55.1 Detailed Description

Configuration check and defaults for the atcacert module.

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23.56 atcacert_client.c File Reference

Client side cert i/o methods. These declarations deal with the client-side, the node being authenticated, of the authentication process. It is assumed the client has an ECC CryptoAuthentication device (e.g. ATECC508A) and the certificates are stored on that device.

```
#include <limits.h>
#include <stdlib.h>
#include "atcacert_client.h"
#include "atcacert_der.h"
#include "atcacert_pem.h"
#include "cryptoauthlib.h"
#include "calib/calib_basic.h"
#include "talib/talib_basic.h"
#include "talib/talib_internal.h"
```

Functions

- ATCA_STATUS atcacert_read_cert_ext (ATCADevice device, const atcacert_def_t ∗cert_def, const uint8_t ca_public_key[64], uint8_t ∗cert, size_t ∗cert_size)

  Reads the certificate specified by the certificate definition from the ATECC508A device.
- ATCA_STATUS atcacert_read_cert (const atcacert_def_t ∗cert_def, const uint8_t ca_public_key[64], uint8↩_t ∗cert, size_t ∗cert_size)

  Reads the certificate specified by the certificate definition from the ATECC508A device.
- ATCA_STATUS atcacert_read_cert_size_ext (ATCADevice device, const atcacert_def_t ∗cert_def, size_↩t ∗cert_size)

  Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.
- ATCA_STATUS atcacert_read_cert_size (const atcacert_def_t ∗cert_def, size_t ∗cert_size)

  Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.

23.56.1 Detailed Description

Client side cert i/o methods. These declarations deal with the client-side, the node being authenticated, of the authentication process. It is assumed the client has an ECC CryptoAuthentication device (e.g. ATECC508A) and the certificates are stored on that device.

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23.57 atcacert_client.h File Reference

Client side cert i/o methods. These declarations deal with the client-side, the node being authenticated, of the authentication process. It is assumed the client has an ECC CryptoAuthentication device (e.g. ATECC508A) and the certificates are stored on that device.

```
#include <stddef.h>
#include <stdint.h>
#include "atcacert_def.h"
```

Functions

- ATCA_STATUS atcacert_read_device_loc (const atcacert_device_loc_t *device_loc, uint8_t *data)

  Read the data from a device location.
- ATCA_STATUS atcacert_read_device_loc_ext (ATCADevice device, const atcacert_device_loc_t *device_←
loc, uint8_t *data)

  Read the data from a device location.
- ATCA_STATUS atcacert_read_cert (const atcacert_def_t *cert_def, const uint8_t ca_public_key[64], uint8←
_t *cert, size_t *cert_size)

  Reads the certificate specified by the certificate definition from the ATECC508A device.
- ATCA_STATUS atcacert_read_cert_ext (ATCADevice device, const atcacert_def_t *cert_def, const uint8_t ca_public_key[64], uint8_t *cert, size_t *cert_size)

  Reads the certificate specified by the certificate definition from the ATECC508A device.
- ATCA_STATUS atcacert_write_cert (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size)

  Take a full certificate and write it to the ATECC508A device according to the certificate definition.
- ATCA_STATUS atcacert_write_cert_ext (ATCADevice device, const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size)

  Take a full certificate and write it to the ATECC508A device according to the certificate definition.
- ATCA_STATUS atcacert_create_csr (const atcacert_def_t *csr_def, uint8_t *csr, size_t *csr_size)

  Creates a CSR specified by the CSR definition from the ATECC508A device. This process involves reading the dynamic CSR data from the device and combining it with the template found in the CSR definition, then signing it. Return the CSR int der format.
- ATCA_STATUS atcacert_create_csr_pem (const atcacert_def_t *csr_def, char *csr, size_t *csr_size)

  Creates a CSR specified by the CSR definition from the ATECC508A device. This process involves reading the dynamic CSR data from the device and combining it with the template found in the CSR definition, then signing it. Return the CSR int der format.
- ATCA_STATUS atcacert_get_response (uint8_t device_private_key_slot, const uint8_t challenge[32], uint8←
_t response[64])

  Calculates the response to a challenge sent from the host.
- ATCA_STATUS atcacert_read_subj_key_id (const atcacert_def_t *cert_def, uint8_t subj_key_id[20])

  Reads the subject key ID based on a certificate definition.
- ATCA_STATUS atcacert_read_subj_key_id_ext (ATCADevice device, const atcacert_def_t *cert_def, uint8←
_t subj_key_id[20])

  Reads the subject key ID based on a certificate definition.
- ATCA_STATUS atcacert_read_cert_size (const atcacert_def_t *cert_def, size_t *cert_size)

  Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.
- ATCA_STATUS atcacert_read_cert_size_ext (ATCADevice device, const atcacert_def_t *cert_def, size_←
t *cert_size)

  Return the actual certificate size in bytes for a given cert def. Certificate can be variable size, so this gives the absolute buffer size when reading the certificates.

23.57.1 Detailed Description

Client side cert i/o methods. These declarations deal with the client-side, the node being authenticated, of the authentication process. It is assumed the client has an ECC CryptoAuthentication device (e.g. ATECC508A) and the certificates are stored on that device.

Copyright

23.58 atcacert_date.c File Reference

Date handling with regard to certificates.

```
#include <string.h>
#include <limits.h>
#include "atcacert_date.h"
#include "atca_compiler.h"
```

Functions

- atcacert_date_format_t atcacert_date_from_asn1_tag (const uint8_t tag)

  Convert the asn1 tag for the supported time formats into the local time format.
- ATCA_STATUS atcacert_date_enc (atcacert_date_format_t format, const atcacert_tm_utc_t *timestamp, uint8_t *formatted_date, size_t *formatted_date_size)

  Format a timestamp according to the format type.
- ATCA_STATUS atcacert_date_dec (atcacert_date_format_t format, const uint8_t *formatted_date, size_t formatted_date_size, atcacert_tm_utc_t *timestamp)

  Parse a formatted timestamp according to the specified format.
- ATCA_STATUS atcacert_date_get_max_date (atcacert_date_format_t format, atcacert_tm_utc_t *timestamp)

  Return the maximum date available for the given format.
- ATCA_STATUS atcacert_date_enc_compcert (const atcacert_tm_utc_t *issue_date, uint8_t expire_years, uint8_t enc_dates[3])

  Encode the issue and expire dates in the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_enc_compcert_ext (const atcacert_tm_utc_t *issue_date, uint8_t expire_years, uint8_t comp_cert[72u])

  Encode the issue and expire dates in the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_dec_compcert (const uint8_t enc_dates[3], atcacert_date_format_t expire_date_format, atcacert_tm_utc_t *issue_date, atcacert_tm_utc_t *expire_date)

  Decode the issue and expire dates from the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_dec_compcert_ext (const uint8_t comp_cert[72u], atcacert_date_format_t expire_date_format, atcacert_tm_utc_t *issue_date, atcacert_tm_utc_t *expire_date)

  Decode the issue and expire dates from the format used by the compressed certificate.
- int atcacert_date_cmp (const atcacert_tm_utc_t *timestamp1, const atcacert_tm_utc_t *timestamp2)

  Compare two dates.

Variables

- const size_t ATCACERT_DATE_FORMAT_SIZES [5]

23.58.1 Detailed Description

Date handling with regard to certificates.

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23.59 atcacert_date.h File Reference

Declarations for date handling with regard to certificates.

```
#include <stddef.h>
#include "atcacert.h"
```

Data Structures

- struct atcacert_tm_utc_s

Macros

- #define DATEFMT_ISO8601_SEP (0U)
  ISO8601 full date YYYY-MM-DDThh:mm:ssZ.
- #define **DATEFMT_RFC5280_UTC** (1U)
  RFC 5280 (X.509) 4.1.2.5.1 UTCTime format YYMMDDhhmmssZ.
- #define **DATEFMT_POSIX_UINT32_BE** (2U)
  POSIX (aka UNIX) date format. Seconds since Jan 1, 1970. 32 bit unsigned integer, big endian.
- #define **DATEFMT_POSIX_UINT32_LE** (3U)
  POSIX (aka UNIX) date format. Seconds since Jan 1, 1970. 32 bit unsigned integer, little endian.
- #define **DATEFMT_RFC5280_GEN** (4U)
  RFC 5280 (X.509) 4.1.2.5.2 GeneralizedTime format YYYYMMDDhhmmssZ.
- #define **DATEFMT_INVALID** (0xFFU)
- #define **DATEFMT_ISO8601_SEP_SIZE** (20)
- #define **DATEFMT_RFC5280_UTC_SIZE** (13)
- #define **DATEFMT_POSIX_UINT32_BE_SIZE** (4)
- #define **DATEFMT_POSIX_UINT32_LE_SIZE** (4)
- #define **DATEFMT_RFC5280_GEN_SIZE** (15)
- #define **DATEFMT_MAX_SIZE** DATEFMT_ISO8601_SEP_SIZE
- #define **ATCACERT_DATE_FORMAT_SIZES_COUNT** 5
- #define **ATCACERT_COMP_CERT_MAX_SIZE** 72u
- #define **atcacert_date_enc_posix_uint32_be** atcacert_date_enc_posix_be
- #define **atcacert_date_dec_posix_uint32_be** atcacert_date_dec_posix_be
- #define **atcacert_date_enc_posix_uint32_le** atcacert_date_enc_posix_le
- #define **atcacert_date_dec_posix_uint32_le** atcacert_date_dec_posix_le

Typedefs

- typedef struct atcacert_tm_utc_s atcacert_tm_utc_t
- typedef uint8_t **atcacert_date_format_t**

Functions

- ATCA_STATUS atcacert_date_enc (atcacert_date_format_t format, const atcacert_tm_utc_t *timestamp, uint8_t *formatted_date, size_t *formatted_date_size)

  Format a timestamp according to the format type.
- ATCA_STATUS atcacert_date_dec (atcacert_date_format_t format, const uint8_t *formatted_date, size_t formatted_date_size, atcacert_tm_utc_t *timestamp)

  Parse a formatted timestamp according to the specified format.
- ATCA_STATUS atcacert_date_enc_compcert (const atcacert_tm_utc_t *issue_date, uint8_t expire_years, uint8_t enc_dates[3])

  Encode the issue and expire dates in the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_enc_compcert_ext (const atcacert_tm_utc_t *issue_date, uint8_t expire_years, uint8_t comp_cert[72u])

  Encode the issue and expire dates in the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_dec_compcert (const uint8_t enc_dates[3], atcacert_date_format_t expire_date_format, atcacert_tm_utc_t *issue_date, atcacert_tm_utc_t *expire_date)

  Decode the issue and expire dates from the format used by the compressed certificate.
- ATCA_STATUS atcacert_date_dec_compcert_ext (const uint8_t comp_cert[72u], atcacert_date_format_t expire_date_format, atcacert_tm_utc_t *issue_date, atcacert_tm_utc_t *expire_date)

  Decode the issue and expire dates from the format used by the compressed certificate.
- atcacert_date_format_t atcacert_date_from_asn1_tag (const uint8_t tag)

  Convert the asn1 tag for the supported time formats into the local time format.
- ATCA_STATUS atcacert_date_get_max_date (atcacert_date_format_t format, atcacert_tm_utc_t *timestamp)

  Return the maximum date available for the given format.
- ATCA_STATUS **atcacert_date_enc_iso8601_sep** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(20)])
- ATCA_STATUS **atcacert_date_dec_iso8601_sep** (const uint8_t formatted_date[(20)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_rfc5280_utc** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(13)])
- ATCA_STATUS **atcacert_date_dec_rfc5280_utc** (const uint8_t formatted_date[(13)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_rfc5280_gen** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(15)])
- ATCA_STATUS **atcacert_date_dec_rfc5280_gen** (const uint8_t formatted_date[(15)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_posix_be** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(4)])
- ATCA_STATUS **atcacert_date_dec_posix_be** (const uint8_t formatted_date[(4)], atcacert_tm_utc_t *timestamp)
- ATCA_STATUS **atcacert_date_enc_posix_le** (const atcacert_tm_utc_t *timestamp, uint8_t formatted_date[(4)])
- ATCA_STATUS **atcacert_date_dec_posix_le** (const uint8_t formatted_date[(4)], atcacert_tm_utc_t *timestamp)
- int atcacert_date_cmp (const atcacert_tm_utc_t *timestamp1, const atcacert_tm_utc_t *timestamp2)

  Compare two dates.

Variables

- const size_t **ATCACERT_DATE_FORMAT_SIZES** [5]

23.59.1 Detailed Description

Declarations for date handling with regard to certificates.

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23.60 atcacert_def.c File Reference

Main certificate definition implementation.

```
#include "atcacert_def.h"
#include "crypto/atca_crypto_sw.h"
#include "crypto/atca_crypto_sw_sha1.h"
#include "crypto/atca_crypto_sw_sha2.h"
#include "atcacert_der.h"
#include "atcacert_date.h"
#include <string.h>
#include "atca_helpers.h"
#include "cal_buffer.h"
```

Functions

- ATCA_STATUS atcacert_get_subject (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, cal_buffer *cert_subj_buf)

  Gets the subject name from a certificate.
- ATCA_STATUS atcacert_get_subj_public_key (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, cal_buffer *subj_public_key)

  Gets the subject public key from a certificate.
- ATCA_STATUS atcacert_get_subj_key_id (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t subj_key_id[20])

  Gets the subject key ID from a certificate.
- ATCA_STATUS atcacert_get_issuer (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t cert_issuer[128])

  Gets the issuer name of a certificate.
- ATCA_STATUS atcacert_get_issue_date (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, atcacert_tm_utc_t *timestamp)

  Gets the issue date from a certificate. Will be parsed according to the date format specified in the certificate definition.
- ATCA_STATUS atcacert_get_expire_date (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, atcacert_tm_utc_t *timestamp)

  Gets the expire date from a certificate. Will be parsed according to the date format specified in the certificate definition.
- ATCA_STATUS atcacert_get_cert_sn (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t *cert_sn, size_t *cert_sn_size)

  Gets the certificate serial number from a certificate.
- ATCA_STATUS atcacert_get_auth_key_id (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t auth_key_id[20])

  Gets the authority key ID from a certificate.
- int atcacert_calc_expire_years (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, int issue_tm_year, uint8_t *expire_years)

23.60.1 Detailed Description

Main certificate definition implementation.

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23.61 atcacert_def.h File Reference

Declarations for certificates related to ECC CryptoAuthentication devices. These are the definitions required to define a certificate and its various elements with regards to the CryptoAuthentication ECC devices.

```
#include <stddef.h>
#include <stdint.h>
#include "atca_compiler.h"
#include "atcacert.h"
#include "atcacert_date.h"
#include "atca_helpers.h"
#include "crypto/atca_crypto_sw.h"
#include "cal_buffer.h"
```

Data Structures

- struct atcacert_device_loc_s
- struct atcacert_cert_loc_s
- struct atcacert_cert_element_s
- struct atcacert_def_s
- struct atcacert_build_state_s

Macros

- #define **ATCA_MAX_TRANSFORMS** 2
- #define **CA_DEV_SN_SIZE** 9u
- #define **CA2_DEV_SN_SIZE_PART_1** 4u
- #define **CA2_DEV_SN_SIZE_PART_2** 5u
- #define **CA_DEV_SN_CONFIG_ZONE_OFFSET** 0u
- #define **CA2_DEV_SN_CONFIG_ZONE_OFFSET_PART_1** 0u
- #define **CA2_DEV_SN_CONFIG_ZONE_OFFSET_PART_2** 8u

Typedefs

- typedef enum atcacert_cert_type_e atcacert_cert_type_t
- typedef enum atcacert_cert_sn_src_e atcacert_cert_sn_src_t
- typedef enum atcacert_device_zone_e atcacert_device_zone_t
- typedef enum atcacert_transform_e **atcacert_transform_t**

  How to transform the data from the device to the certificate.
- typedef enum atcacert_std_cert_element_e atcacert_std_cert_element_t
- typedef struct ATCA_PACKED atcacert_device_loc_s atcacert_device_loc_t
- typedef struct ATCA_PACKED atcacert_cert_loc_s atcacert_cert_loc_t
- typedef struct ATCA_PACKED atcacert_cert_element_s atcacert_cert_element_t
- typedef struct atcacert_def_s atcacert_def_t
- typedef struct atcacert_build_state_s atcacert_build_state_t

Enumerations

- enum atcacert_cert_type_e { CERTTYPE_X509 , CERTTYPE_CUSTOM , CERTTYPE_X509_FULL_STORED }
- enum atcacert_cert_sn_src_e {
  SNSRC_STORED = 0x0 , SNSRC_STORED_DYNAMIC = 0x7 , SNSRC_DEVICE_SN = 0x8 , SNSRC_SIGNER_ID = 0x9 ,
  SNSRC_PUB_KEY_HASH = 0xA , SNSRC_DEVICE_SN_HASH = 0xB , SNSRC_PUB_KEY_HASH_POS = 0xC , SNSRC_DEVICE_SN_HASH_POS = 0xD ,
  SNSRC_PUB_KEY_HASH_RAW = 0xE , SNSRC_DEVICE_SN_HASH_RAW = 0xF }
- enum atcacert_device_zone_e {
  DEVZONE_CONFIG = 0x00 , DEVZONE_OTP = 0x01 , DEVZONE_DATA = 0x02 , DEVZONE_GENKEY = 0x03 ,
  DEVZONE_NONE = 0x07 }
- enum atcacert_transform_e {
  TF_NONE , TF_REVERSE , TF_BIN2HEX_UC , TF_BIN2HEX_LC ,
  TF_HEX2BIN_UC , TF_HEX2BIN_LC , TF_BIN2HEX_SPACE_UC , TF_BIN2HEX_SPACE_LC ,
  TF_HEX2BIN_SPACE_UC , TF_HEX2BIN_SPACE_LC }

  How to transform the data from the device to the certificate.
- enum atcacert_std_cert_element_e {
  STDCERT_PUBLIC_KEY , **STDCERT_SIGNATURE** , **STDCERT_ISSUE_DATE** , **STDCERT_EXPIRE_DATE** ,
  STDCERT_SIGNER_ID , **STDCERT_CERT_SN** , **STDCERT_AUTH_KEY_ID** , **STDCERT_SUBJ_KEY_ID** ,
  STDCERT_NUM_ELEMENTS }

Functions

- ATCA_STATUS atcacert_get_subject (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, cal_buffer *cert_subj_buf)

  Gets the subject name from a certificate.
- ATCA_STATUS atcacert_get_subj_public_key (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, cal_buffer *subj_public_key)

  Gets the subject public key from a certificate.
- ATCA_STATUS atcacert_get_subj_key_id (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t subj_key_id[20])

  Gets the subject key ID from a certificate.
- ATCA_STATUS atcacert_get_issuer (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t cert_issuer[128])

  Gets the issuer name of a certificate.
- ATCA_STATUS atcacert_get_issue_date (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, atcacert_tm_utc_t *timestamp)

  Gets the issue date from a certificate. Will be parsed according to the date format specified in the certificate definition.
- ATCA_STATUS atcacert_get_expire_date (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, atcacert_tm_utc_t *timestamp)

  Gets the expire date from a certificate. Will be parsed according to the date format specified in the certificate definition.
- ATCA_STATUS atcacert_get_cert_sn (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t *cert_sn, size_t *cert_sn_size)

  Gets the certificate serial number from a certificate.
- ATCA_STATUS atcacert_get_auth_key_id (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, uint8_t auth_key_id[20])

  Gets the authority key ID from a certificate.
- int atcacert_calc_expire_years (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, int issue_tm_year, uint8_t *expire_years)

23.61.1 Detailed Description

Declarations for certificates related to ECC CryptoAuthentication devices. These are the definitions required to define a certificate and its various elements with regards to the CryptoAuthentication ECC devices.

Only the dynamic elements of a certificate (the parts of the certificate that change from device to device) are stored on the ATECC device. The definitions here describe the form of the certificate, and where the dynamic elements can be found both on the ATECC device itself and in the certificate template.

This also defines utility functions for working with the certificates and their definitions.

Copyright

23.62 atcacert_der.c File Reference

functions required to work with DER encoded data related to X.509 certificates.

```
#include "cryptoauthlib.h"
#include "atcacert_der.h"
#include <string.h>
```

23.62.1 Detailed Description

functions required to work with DER encoded data related to X.509 certificates.

Copyright

23.63 atcacert_der.h File Reference

function declarations required to work with DER encoded data related to X.509 certificates.

```
#include <stddef.h>
#include <stdint.h>
#include "atcacert.h"
```

Functions

- ATCA_STATUS atcacert_der_enc_length (size_t length, uint8_t ∗der_length, size_t ∗der_length_size)
    Encode a length in DER format.
- ATCA_STATUS atcacert_der_dec_length (const uint8_t ∗der_length, size_t ∗der_length_size, size_t ∗length)
    Decode a DER format length.
- ATCA_STATUS **atcacert_der_adjust_length** (uint8_t ∗der_length, size_t ∗der_length_size, int delta_length, size_t ∗new_length)
- ATCA_STATUS atcacert_der_enc_integer (const uint8_t ∗int_data, size_t int_data_size, uint8_t is_unsigned, uint8_t ∗der_int, size_t ∗der_int_size)
    Encode an ASN.1 integer in DER format, including tag and length fields.
- ATCA_STATUS atcacert_der_dec_integer (const uint8_t ∗der_int, size_t ∗der_int_size, uint8_t ∗int_data, size_t ∗int_data_size)
    Decode an ASN.1 DER encoded integer.
- ATCA_STATUS atcacert_der_enc_ecdsa_sig_value (const uint8_t raw_sig[64], uint8_t ∗der_sig, size_↩ t ∗der_sig_size)
    Formats a raw ECDSA P256 signature in the DER encoding found in X.509 certificates.
- ATCA_STATUS atcacert_der_dec_ecdsa_sig_value (const uint8_t ∗der_sig, size_t ∗der_sig_size, uint8_↩ t raw_sig[64])
    Parses an ECDSA P256 signature in the DER encoding as found in X.509 certificates.

23.63.1 Detailed Description

function declarations required to work with DER encoded data related to X.509 certificates.

Copyright

23.64 atcacert_host_hw.c File Reference

host side methods using CryptoAuth hardware

```
#include "atcacert_host_hw.h"
#include "atca_basic.h"
#include "crypto/atca_crypto_sw_sha2.h"
```

23.64.1 Detailed Description

host side methods using CryptoAuth hardware

Copyright

23.65 atcacert_host_hw.h File Reference

host side methods using CryptoAuth hardware

```
#include <stddef.h>
#include <stdint.h>
#include "atcacert_def.h"
```

Functions

- ATCA_STATUS atcacert_verify_cert_hw (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, const uint8_t ca_public_key[64])

    Verify a certificate against its certificate authority's public key using the host's ATECC device for crypto functions.
- ATCA_STATUS atcacert_gen_challenge_hw (uint8_t challenge[32])

    Generate a random challenge to be sent to the client using the RNG on the host's ATECC device.
- ATCA_STATUS atcacert_verify_response_hw (const uint8_t device_public_key[64], const uint8_↩t challenge[32], const uint8_t response[64])

    Verify a client's response to a challenge using the host's ATECC device for crypto functions.

23.65.1 Detailed Description

host side methods using CryptoAuth hardware

Copyright

23.66 atcacert_host_sw.c File Reference

host side methods using software implementations

```
#include "atcacert_host_sw.h"
#include "crypto/atca_crypto_sw.h"
#include "cal_internal.h"
```

23.66.1 Detailed Description

host side methods using software implementations

Copyright

23.67 atcacert_host_sw.h File Reference

Host side methods using software implementations. host-side, the one authenticating a client, of the authentication process. Crypto functions are performed using a software library.

```
#include <stddef.h>
#include <stdint.h>
#include "atcacert_def.h"
```

Functions

- ATCA_STATUS atcacert_verify_cert_sw (const atcacert_def_t *cert_def, const uint8_t *cert, size_t cert_size, const uint8_t ca_public_key[64])

  Verify a certificate against its certificate authority's public key using software crypto functions.The function is currently not implemented.
- ATCA_STATUS atcacert_gen_challenge_sw (uint8_t challenge[32])

  Generate a random challenge to be sent to the client using a software PRNG.The function is currently not implemented.
- ATCA_STATUS atcacert_verify_response_sw (const uint8_t device_public_key[64], const uint8_t challenge[32], const uint8_t response[64])

  Verify a client's response to a challenge using software crypto functions.The function is currently not implemented.

23.67.1 Detailed Description

Host side methods using software implementations. host-side, the one authenticating a client, of the authentication process. Crypto functions are performed using a software library.

Copyright

23.68 atcacert_pem.c File Reference

Functions required to work with PEM encoded data related to X.509 certificates.

```
#include <string.h>
#include "atcacert.h"
#include "atcacert_pem.h"
#include "atca_helpers.h"
```

23.68.1 Detailed Description

Functions required to work with PEM encoded data related to X.509 certificates.

Copyright

23.69 atcacert_pem.h File Reference

Functions for converting between DER and PEM formats.

```
#include <stdint.h>
```

Macros

- #define **PEM_CERT_BEGIN** "-----BEGIN CERTIFICATE-----"
- #define **PEM_CERT_END** "-----END CERTIFICATE-----"
- #define **PEM_CSR_BEGIN** "-----BEGIN CERTIFICATE REQUEST-----"
- #define **PEM_CSR_END** "-----END CERTIFICATE REQUEST-----"

Functions

- ATCA_STATUS atcacert_encode_pem (const uint8_t *der, size_t der_size, char *pem, size_t *pem_size, const char *header, const char *footer)

  Encode a DER data in PEM format.
- ATCA_STATUS atcacert_decode_pem (const char *pem, size_t pem_size, uint8_t *der, size_t *der_size, const char *header, const char *footer)

  Decode PEM data into DER format.
- ATCA_STATUS atcacert_encode_pem_cert (const uint8_t *der_cert, size_t der_cert_size, char *pem_cert, size_t *pem_cert_size)

  Encode a DER certificate in PEM format.
- ATCA_STATUS atcacert_decode_pem_cert (const char *pem_cert, size_t pem_cert_size, uint8_t *der_cert, size_t *der_cert_size)

  Decode a PEM certificate into DER format.
- ATCA_STATUS atcacert_encode_pem_csr (const uint8_t *der_csr, size_t der_csr_size, char *pem_csr, size_t *pem_csr_size)

  Encode a DER CSR in PEM format.
- ATCA_STATUS atcacert_decode_pem_csr (const char *pem_csr, size_t pem_csr_size, uint8_t *der_csr, size_t *der_csr_size)

  Extract the CSR certificate bytes from a PEM encoded CSR certificate.

23.69.1 Detailed Description

Functions for converting between DER and PEM formats.

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23.69.2 Function Documentation

23.69.2.1 atcacert_decode_pem()

```
ATCA_STATUS atcacert_decode_pem (
            const char * pem,
            size_t pem_size,
            uint8_t * der,
            size_t * der_size,
            const char * header,
            const char * footer )
```

Decode PEM data into DER format.

Parameters

in	*pem*	PEM data to decode to DER.
in	*pem_size*	PEM data size in bytes.
out	*der*	DER data is returned here.
in,out	*der_size*	As input, the size of the der buffer. As output, the size of the DER data.
in	*header*	Header to find the beginning of the PEM data.
in	*footer*	Footer to find the end of the PEM data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.69.2.2 atcacert_decode_pem_cert()

```
ATCA_STATUS atcacert_decode_pem_cert (
            const char * pem_cert,
            size_t pem_cert_size,
            uint8_t * der_cert,
            size_t * der_cert_size )
```

Decode a PEM certificate into DER format.

Parameters

in	*pem_cert*	PEM certificate to decode to DER.
in	*pem_cert_size*	PEM certificate size in bytes.
out	*der_cert*	DER certificate is returned here.
in,out	*der_cert_size*	As input, the size of the der_cert buffer. As output, the size of the DER certificate.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.69.2.3 atcacert_decode_pem_csr()

```
ATCA_STATUS atcacert_decode_pem_csr (
            const char * pem_csr,
            size_t pem_csr_size,
            uint8_t * der_csr,
            size_t * der_csr_size )
```

Extract the CSR certificate bytes from a PEM encoded CSR certificate.

Parameters

in	*pem_csr*	PEM CSR to decode to DER.
in	*pem_csr_size*	PEM CSR size in bytes.
out	*der_csr*	DER CSR is returned here.
in,out	*der_csr_size*	As input, the size of the der_csr buffer. As output, the size of the DER CSR.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.69.2.4 atcacert_encode_pem()

```
ATCA_STATUS atcacert_encode_pem (
            const uint8_t * der,
            size_t der_size,
            char * pem,
            size_t * pem_size,
            const char * header,
            const char * footer )
```

Encode a DER data in PEM format.

Parameters

in	*der*	DER data to be encoded as PEM.
out	*der_size*	DER data size in bytes.
out	*pem*	PEM encoded data is returned here.
in,out	*pem_size*	As input, the size of the pem buffer. As output, the size of the PEM data.
in	*header*	Header to place at the beginning of the PEM data.
in	*footer*	Footer to place at the end of the PEM data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.69.2.5 atcacert_encode_pem_cert()

```
ATCA_STATUS atcacert_encode_pem_cert (
            const uint8_t * der_cert,
            size_t der_cert_size,
            char * pem_cert,
            size_t * pem_cert_size )
```

Encode a DER certificate in PEM format.

Parameters

in	*der_cert*	DER certificate to be encoded as PEM.
out	*der_cert_size*	DER certificate size in bytes.
out	*pem_cert*	PEM encoded certificate is returned here.
in,out	*pem_cert_size*	As input, the size of the pem_cert buffer. As output, the size of the PEM certificate.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.69.2.6 atcacert_encode_pem_csr()

```
ATCA_STATUS atcacert_encode_pem_csr (
            const uint8_t * der_csr,
            size_t der_csr_size,
            char * pem_csr,
            size_t * pem_csr_size )
```

Encode a DER CSR in PEM format.

Parameters

in	*der_csr*	DER CSR to be encoded as PEM.
out	*der_csr_size*	DER CSR size in bytes.
out	*pem_csr*	PEM encoded CSR is returned here.
in,out	*pem_csr_size*	As input, the size of the pem_csr buffer. As output, the size of the PEM CSR.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.70 cal_buffer.c File Reference

Cryptoauthlib buffer management system.

```
#include <string.h>
#include "cal_buffer.h"
```

Functions

- ATCA_STATUS cal_buf_read_bytes (cal_buffer ∗cab, size_t offset, void ∗dest, size_t length)
  Read bytes from a cal_buffer or cal_buffer linked list.
- ATCA_STATUS **cal_buf_read_byte** (cal_buffer ∗cab, size_t offset, uint8_t ∗value)
- ATCA_STATUS **cal_buf_write_byte** (cal_buffer ∗cab, size_t offset, uint8_t value)
- ATCA_STATUS cal_buf_write_bytes (cal_buffer ∗cab, size_t offset, const void ∗source, size_t length)
  Write bytes into a single cal_buffer structure or cal_buffer linked list.
- ATCA_STATUS cal_buf_read_number (cal_buffer ∗cab, size_t offset, void ∗dest, size_t num_size, bool buf↵_big_endian)
  Read a number from a cal_buffer or cal_buffer linked list This function does not reinterpet the number and signedness is only preserved if the destination is the same size as the representation in the buffer.
- ATCA_STATUS cal_buf_write_number (cal_buffer ∗cab, size_t offset, const void ∗source, size_t num_size, bool buf_big_endian)
  Write a number into a cal_buffer or cal_buffer linked list This function does not reinterpet the number and signedness is only preserved if the destination is the same size as the source.
- ATCA_STATUS **cal_buf_set_used** (cal_buffer ∗buf, size_t used)
- size_t **cal_buf_get_used** (cal_buffer ∗buf)
- ATCA_STATUS **cal_buf_copy** (cal_buffer ∗dst, size_t dst_offset, cal_buffer ∗src, size_t src_offset, size_t length)
- ATCA_STATUS **cal_buf_set** (cal_buffer ∗dst, size_t dst_offset, uint8_t value, size_t length)
- cal_buffer **cal_buf_init_const_ptr** (size_t len, const uint8_t ∗message)
  Initialize a cal buffer with constant pointer Returns the initialized cal buffer.

23.70.1 Detailed Description

Cryptoauthlib buffer management system.

Copyright

23.70.2 Function Documentation

23.70.2.1 cal_buf_read_bytes()

```
ATCA_STATUS cal_buf_read_bytes (
            cal_buffer * cab,
            size_t offset,
            void * dest,
            size_t length )
```

Read bytes from a cal_buffer or cal_buffer linked list.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Offset to start the read from
in	*dest*	Pointer to a destination buffer
in	*length*	Length of the read - assumes dest has sufficent memory to accept the bytes being read

23.70.2.2 cal_buf_read_number()

```
ATCA_STATUS cal_buf_read_number (
            cal_buffer * cab,
            size_t offset,
            void * dest,
            size_t num_size,
            bool buf_big_endian )
```

Read a number from a cal_buffer or cal_buffer linked list This function does not reinterpet the number and signedness is only preserved if the destination is the same size as the representation in the buffer.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Offset to start the read from
in	*dest*	Pointer to a destination number
in	*num_size*	Size of the number in bytes
in	*buf_big_endian*	Specifies the expected endianness representation within the buffer

23.70.2.3 cal_buf_write_bytes()

```
ATCA_STATUS cal_buf_write_bytes (
            cal_buffer * cab,
            size_t offset,
            const void * source,
            size_t length )
```

Write bytes into a single cal_buffer structure or cal_buffer linked list.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Target offset to start the write at
in	*source*	Pointer to a source buffer
in	*length*	Length of the write - assumes source is sufficently large to support this operation

23.70.2.4 cal_buf_write_number()

```
ATCA_STATUS cal_buf_write_number (
            cal_buffer * cab,
            size_t offset,
            const void * source,
            size_t num_size,
            bool buf_big_endian )
```

Write a number into a cal_buffer or cal_buffer linked list This function does not reinterpret the number and signedness is only preserved if the destination is the same size as the source.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Offset to start the write at
in	*source*	Pointer to a number to be written
in	*num_size*	Size of the number in bytes
in	*buf_big_endian*	Specifies the expected endianness representation within the buffer

23.71 cal_buffer.h File Reference

Cryptoauthlib buffer management system.

```
#include <stdint.h>
#include <stdlib.h>
#include <stdbool.h>
#include "atca_config_check.h"
#include "atca_status.h"
```

Data Structures

- struct cal_buffer_s

- #define **CAL_BUF_INIT**(s, b) { (size_t)(s), (uint8_t*)(b) }
- typedef struct cal_buffer_s **cal_buffer**
- ATCA_STATUS **cal_buf_read_byte** (cal_buffer *cab, size_t offset, uint8_t *value)
- ATCA_STATUS **cal_buf_write_byte** (cal_buffer *cab, size_t offset, uint8_t value)
- ATCA_STATUS cal_buf_read_bytes (cal_buffer *cab, size_t offset, void *dest, size_t length)

  Read bytes from a cal_buffer or cal_buffer linked list.
- ATCA_STATUS cal_buf_write_bytes (cal_buffer *cab, size_t offset, const void *source, size_t length)

  Write bytes into a single cal_buffer structure or cal_buffer linked list.
- ATCA_STATUS cal_buf_read_number (cal_buffer *cab, size_t offset, void *dest, size_t num_size, bool buf←_big_endian)

  Read a number from a cal_buffer or cal_buffer linked list This function does not reinterpret the number and signedness is only preserved if the destination is the same size as the representation in the buffer.
- ATCA_STATUS cal_buf_write_number (cal_buffer *cab, size_t offset, const void *source, size_t num_size, bool buf_big_endian)

Write a number into a cal_buffer or cal_buffer linked list This function does not reinterpet the number and signedness is only preserved if the destination is the same size as the source.

- ATCA_STATUS **cal_buf_copy** (cal_buffer ∗dst, size_t dst_offset, cal_buffer ∗src, size_t src_offset, size_t length)
- ATCA_STATUS **cal_buf_set** (cal_buffer ∗dst, size_t dst_offset, uint8_t value, size_t length)
- ATCA_STATUS **cal_buf_set_used** (cal_buffer ∗buf, size_t used)
- size_t **cal_buf_get_used** (cal_buffer ∗buf)
- cal_buffer **cal_buf_init_const_ptr** (size_t len, const uint8_t ∗message)

  Initialize a cal buffer with constant pointer Returns the initialized cal buffer.

23.71.1 Detailed Description

Cryptoauthlib buffer management system.

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23.71.2 Function Documentation

23.71.2.1 cal_buf_read_bytes()

```
ATCA_STATUS cal_buf_read_bytes (
            cal_buffer * cab,
            size_t offset,
            void * dest,
            size_t length )
```

Read bytes from a cal_buffer or cal_buffer linked list.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Offset to start the read from
in	*dest*	Pointer to a destination buffer
in	*length*	Length of the read - assumes dest has sufficent memory to accept the bytes being read

23.71.2.2 cal_buf_read_number()

```
ATCA_STATUS cal_buf_read_number (
            cal_buffer * cab,
            size_t offset,
            void * dest,
```

```
            size_t num_size,
            bool buf_big_endian )
```

Read a number from a cal_buffer or cal_buffer linked list This function does not reinterpet the number and signedness is only preserved if the destination is the same size as the representation in the buffer.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Offset to start the read from
in	*dest*	Pointer to a destination number
in	*num_size*	Size of the number in bytes
in	*buf_big_endian*	Specifies the expected endianness representation within the buffer

23.71.2.3 cal_buf_write_bytes()

```
ATCA_STATUS cal_buf_write_bytes (
            cal_buffer * cab,
            size_t offset,
            const void * source,
            size_t length )
```

Write bytes into a single cal_buffer structure or cal_buffer linked list.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Target offset to start the write at
in	*source*	Pointer to a source buffer
in	*length*	Length of the write - assumes source is sufficently large to support this operation

23.71.2.4 cal_buf_write_number()

```
ATCA_STATUS cal_buf_write_number (
            cal_buffer * cab,
            size_t offset,
            const void * source,
            size_t num_size,
            bool buf_big_endian )
```

Write a number into a cal_buffer or cal_buffer linked list This function does not reinterpet the number and signedness is only preserved if the destination is the same size as the source.

Parameters

in	*cab*	Pointer to a buffer structure or the head of a buffer structure linked list
in	*offset*	Offset to start the write at

Parameters

in	*source*	Pointer to a number to be written
in	*num_size*	Size of the number in bytes
in	*buf_big_endian*	Specifies the expected endianness representation within the buffer

23.72 cal_internal.h File Reference

Internal CryptoAuthLib Interfaces.

```
#include "atca_config_check.h"
#include "crypto/atca_crypto_sw.h"
#include "mbedtls/atca_mbedtls_wrap.h"
```

23.72.1 Detailed Description

Internal CryptoAuthLib Interfaces.

Copyright

23.73 calib_aes.c File Reference

CryptoAuthLib Basic API methods for AES command.

```
#include "cryptoauthlib.h"
```

23.73.1 Detailed Description

CryptoAuthLib Basic API methods for AES command.

The AES command supports 128-bit AES encryption or decryption of small messages or data packets in ECB mode. Also can perform GFM (Galois Field Multiply) calculation in support of AES-GCM.

Note

List of devices that support this command - ATECC608A/B. Refer to device edatasheet for full details.

Copyright

23.74 calib_aes_gcm.c File Reference

CryptoAuthLib Basic API methods for AES GCM mode.

```
#include "cryptoauthlib.h"
```

23.74.1 Detailed Description

CryptoAuthLib Basic API methods for AES GCM mode.

The AES command supports 128-bit AES encryption or decryption of small messages or data packets in ECB mode. Also can perform GFM (Galois Field Multiply) calculation in support of AES-GCM.

Note

List of devices that support this command - ATECC608A/B. Refer to device datasheet for full details.

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23.75 calib_aes_gcm.h File Reference

Unity tests for the cryptoauthlib AES GCM functions.

```
#include "calib_config_check.h"
```

23.75.1 Detailed Description

Unity tests for the cryptoauthlib AES GCM functions.

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23.76 calib_basic.c File Reference

CryptoAuthLib Basic API methods. These methods provide a simpler way to access the core crypto methods.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS calib_wakeup_i2c (ATCADevice device)

  basic API methods are all prefixed with atcab_ (CryptoAuthLib Basic) the fundamental premise of the basic API is it is based on a single interface instance and that instance is global, so all basic API commands assume that one global device is the one to operate on.
- ATCA_STATUS calib_wakeup (ATCADevice device)

  wakeup the CryptoAuth device
- ATCA_STATUS calib_idle (ATCADevice device)

  idle the CryptoAuth device
- ATCA_STATUS calib_sleep (ATCADevice device)

  invoke sleep on the CryptoAuth device
- ATCA_STATUS calib_exit (ATCADevice device)

  common cleanup code which idles the device after any operation
- ATCA_STATUS calib_get_addr (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint16_t ∗addr)

  Compute the address given the zone, slot, block, and offset.
- ATCA_STATUS calib_ca2_get_addr (uint8_t zone, uint16_t slot, uint8_t block, uint8_t offset, uint16_t ∗addr)

  Compute the address given the zone, slot, block, and offset for the device.
- ATCA_STATUS calib_get_zone_size (ATCADevice device, uint8_t zone, uint16_t slot, size_t ∗size)

  Gets the size of the specified zone in bytes.

23.76.1 Detailed Description

CryptoAuthLib Basic API methods. These methods provide a simpler way to access the core crypto methods.

Copyright

23.77 calib_checkmac.c File Reference

CryptoAuthLib Basic API methods for CheckMAC command.

```
#include "cryptoauthlib.h"
```

23.77.1 Detailed Description

CryptoAuthLib Basic API methods for CheckMAC command.

The CheckMac command calculates a MAC response that would have been generated on a different Crypto↩ Authentication device and then compares the result with input value.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.78 calib_command.c File Reference

Microchip CryptoAuthentication device command builder - this is the main object that builds the command byte strings for the given device. It does not execute the command. The basic flow is to call a command method to build the command you want given the parameters and then send that byte string through the device interface.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS atInfo (ATCADeviceType device_type, ATCAPacket *packet)

  ATCACommand Info method.
- ATCA_STATUS atPause (ATCADeviceType device_type, ATCAPacket *packet)

  ATCACommand Pause method.
- void atCRC (size_t length, const uint8_t *data, uint8_t *crc_le)

  Calculates CRC over the given raw data and returns the CRC in little-endian byte order.
- void atCalcCrc (ATCAPacket *packet)

  This function calculates CRC and adds it to the correct offset in the packet data.
- ATCA_STATUS atCheckCrc (const uint8_t *response)

  This function checks the consistency of a response.
- bool atIsSHAFamily (ATCADeviceType device_type)

  determines if a given device type is a SHA device or a superset of a SHA device
- bool atIsECCFamily (ATCADeviceType device_type)

  determines if a given device type is an ECC device or a superset of a ECC device
- ATCA_STATUS isATCAError (uint8_t *data)

  checks for basic error frame in data

23.78.1 Detailed Description

Microchip CryptoAuthentication device command builder - this is the main object that builds the command byte strings for the given device. It does not execute the command. The basic flow is to call a command method to build the command you want given the parameters and then send that byte string through the device interface.

The primary goal of the command builder is to wrap the given parameters with the correct packet size and CRC. The caller should first fill in the parameters required in the ATCAPacket parameter given to the command. The command builder will deal with the mechanics of creating a valid packet using the parameter information.

Copyright

23.78.2 Function Documentation

23.78.2.1 atCalcCrc()

```
void atCalcCrc (
            ATCAPacket * packet )
```

This function calculates CRC and adds it to the correct offset in the packet data.

Parameters

in	*packet*	Packet to calculate CRC data for

23.78.2.2 atCheckCrc()

```
ATCA_STATUS atCheckCrc (
            const uint8_t * response )
```

This function checks the consistency of a response.

Parameters

in	*response*	pointer to response

Returns

ATCA_SUCCESS on success, otherwise ATCA_RX_CRC_ERROR

23.78.2.3 atCRC()

```
void atCRC (
            size_t length,
            const uint8_t * data,
            uint8_t * crc_le )
```

Calculates CRC over the given raw data and returns the CRC in little-endian byte order.

Parameters

in	*length*	Size of data not including the CRC byte positions
in	*data*	Pointer to the data over which to compute the CRC
out	*crc_le*	Pointer to the place where the two-bytes of CRC will be returned in little-endian byte order.

23.78.2.4 atInfo()

```
ATCA_STATUS atInfo (
            ATCADeviceType device_type,
            ATCAPacket * packet )
```

ATCACommand Info method.

Parameters

in	*ca_cmd*	instance
in	*packet*	pointer to the packet containing the command being built

Returns

ATCA_SUCCESS

23.78.2.5 atIsECCFamily()

```
bool atIsECCFamily (
            ATCADeviceType device_type )
```

determines if a given device type is an ECC device or a superset of a ECC device

Parameters

in	*device_type*	Type of device to check for family type

Returns

boolean indicating whether the given device is an ECC family device.

23.78.2.6 atIsSHAFamily()

```
bool atIsSHAFamily (
            ATCADeviceType device_type )
```

determines if a given device type is a SHA device or a superset of a SHA device

Parameters

in	*device_type*	Type of device to check for family type

Returns

boolean indicating whether the given device is a SHA family device.

23.78.2.7 atPause()

```
ATCA_STATUS atPause (
            ATCADeviceType device_type,
            ATCAPacket * packet )
```

ATCACommand Pause method.

Parameters

in	*ca_cmd*	instance
in	*packet*	pointer to the packet containing the command being built

Returns

ATCA_SUCCESS

23.78.2.8 isATCAError()

```
ATCA_STATUS isATCAError (
            uint8_t * data )
```

checks for basic error frame in data

Parameters

in	*data*	pointer to received data - expected to be in the form of a CA device response frame

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.79 calib_command.h File Reference

Microchip Crypto Auth device command object - this is a command builder only, it does not send the command. The result of a command method is a fully formed packet, ready to send to the ATCAIFace object to dispatch.

```
#include <stddef.h>
#include "calib_config_check.h"
```

Data Structures

- struct ATCAPacket

Macros

- #define **ATCA_CMD_SIZE_MIN** (7u)

  minimum number of bytes in command (from count byte to second CRC byte)
- #define **ATCA_CMD_SIZE_MAX** ((uint8_t)4 ∗ 36 + 7)

  maximum size of command packet (Verify)
- #define **CMD_STATUS_SUCCESS** ((uint8_t)0x00)

  status byte for success
- #define **CMD_STATUS_WAKEUP** ((uint8_t)0x11)

  status byte after wake-up
- #define **CMD_STATUS_BYTE_PARSE** ((uint8_t)0x03)

  command parse error
- #define **CMD_STATUS_BYTE_ECC** ((uint8_t)0x05)

  command ECC error
- #define **CMD_STATUS_BYTE_EXEC** ((uint8_t)0x0F)

  command execution error
- #define **CMD_STATUS_BYTE_COMM** ((uint8_t)0xFF)

  communication error

Opcodes for Crypto Authentication device commands

- #define **ATCA_CHECKMAC** ((uint8_t)0x28)

  CheckMac command op-code.
- #define **ATCA_DERIVE_KEY** ((uint8_t)0x1C)

  DeriveKey command op-code.
- #define **ATCA_INFO** ((uint8_t)0x30)

  Info command op-code.
- #define **ATCA_GENDIG** ((uint8_t)0x15)

  GenDig command op-code.
- #define **ATCA_GENKEY** ((uint8_t)0x40)

  GenKey command op-code.
- #define **ATCA_HMAC** ((uint8_t)0x11)

  HMAC command op-code.
- #define **ATCA_LOCK** ((uint8_t)0x17)

  Lock command op-code.
- #define **ATCA_MAC** ((uint8_t)0x08)

  MAC command op-code.
- #define **ATCA_NONCE** ((uint8_t)0x16)

  Nonce command op-code.
- #define **ATCA_PAUSE** ((uint8_t)0x01)

  Pause command op-code.
- #define **ATCA_PRIVWRITE** ((uint8_t)0x46)

  PrivWrite command op-code.
- #define **ATCA_RANDOM** ((uint8_t)0x1B)

  Random command op-code.
- #define **ATCA_READ** ((uint8_t)0x02)

  Read command op-code.
- #define **ATCA_SIGN** ((uint8_t)0x41)

  Sign command op-code.
- #define **ATCA_UPDATE_EXTRA** ((uint8_t)0x20)

  UpdateExtra command op-code.
- #define **ATCA_VERIFY** ((uint8_t)0x45)

  GenKey command op-code.
- #define **ATCA_WRITE** ((uint8_t)0x12)

  Write command op-code.
- #define **ATCA_ECDH** ((uint8_t)0x43)

ECDH command op-code.
- #define **ATCA_COUNTER** ((uint8_t)0x24)
  Counter command op-code.
- #define **ATCA_DELETE** ((uint8_t)0x13)
  Delete command op-code.
- #define **ATCA_SHA** ((uint8_t)0x47)
  SHA command op-code.
- #define **ATCA_AES** ((uint8_t)0x51)
  AES command op-code.
- #define **ATCA_KDF** ((uint8_t)0x56)
  KDF command op-code.
- #define **ATCA_SECUREBOOT** ((uint8_t)0x80)
  Secure Boot command op-code.
- #define **ATCA_SELFTEST** ((uint8_t)0x77)
  Self test command op-code.

Definitions of Data and Packet Sizes

- #define **ATCA_BLOCK_SIZE** (32u)
  size of a block
- #define **ATCA_WORD_SIZE** (4u)
  size of a word
- #define **ATCA_PUB_KEY_PAD** (4u)
  size of the public key pad
- #define **ATCA_SERIAL_NUM_SIZE** (9u)
  number of bytes in the device serial number
- #define **ATCA_RSP_SIZE_VAL** ((uint8_t)7)
  size of response packet containing four bytes of data
- #define **ATCA_KEY_COUNT** (16u)
  number of keys
- #define **ATCA_ECC_CONFIG_SIZE** (128u)
  size of configuration zone
- #define **ATCA_SHA_CONFIG_SIZE** (88u)
  size of configuration zone
- #define **ATCA_CA2_CONFIG_SIZE** (64u)
  size of ECC204 configuration zone
- #define **ATCA_CA2_CONFIG_SLOT_SIZE** (16u)
  size of ECC204 configuration slot size
- #define **ATCA_OTP_SIZE** (64u)
  size of OTP zone
- #define **ATCA_DATA_SIZE** (ATCA_KEY_COUNT * ATCA_KEY_SIZE)
  size of data zone
- #define **ATCA_AES_GFM_SIZE** ATCA_BLOCK_SIZE
  size of GFM data
- #define **ATCA_CHIPMODE_OFFSET** (19u)
  ChipMode byte offset within the configuration zone.
- #define **ATCA_CHIPMODE_I2C_ADDRESS_FLAG** ((uint8_t)0x01)
  ChipMode I2C Address in UserExtraAdd flag.
- #define **ATCA_CHIPMODE_TTL_ENABLE_FLAG** ((uint8_t)0x02)
  ChipMode TTLenable flag.
- #define **ATCA_CHIPMODE_WATCHDOG_MASK** ((uint8_t)0x04)
  ChipMode watchdog duration mask.
- #define **ATCA_CHIPMODE_WATCHDOG_SHORT** ((uint8_t)0x00)
  ChipMode short watchdog (∼1.3s)
- #define **ATCA_CHIPMODE_WATCHDOG_LONG** ((uint8_t)0x04)
  ChipMode long watchdog (∼13s)
- #define **ATCA_CHIPMODE_CLOCK_DIV_MASK** ((uint8_t)0xF8)
  ChipMode clock divider mask.

- #define **ATCA_CHIPMODE_CLOCK_DIV_M0** ((uint8_t)0x00)
  ChipMode clock divider M0.
- #define **ATCA_CHIPMODE_CLOCK_DIV_M1** ((uint8_t)0x28)
  ChipMode clock divider M1.
- #define **ATCA_CHIPMODE_CLOCK_DIV_M2** ((uint8_t)0x68)
  ChipMode clock divider M2.
- #define **ATCA_COUNT_SIZE** (1u)
  Number of bytes in the command packet Count.
- #define **ATCA_CRC_SIZE** (2u)
  Number of bytes in the command packet CRC.
- #define **ATCA_PACKET_OVERHEAD** (ATCA_COUNT_SIZE + ATCA_CRC_SIZE)
  Number of bytes in the command packet.
- #define **ATCA_PUB_KEY_SIZE** (64u)
  size of a p256 public key
- #define **ATCA_PRIV_KEY_SIZE** (32u)
  size of a p256 private key
- #define **ATCA_SIG_SIZE** (64u)
  size of a p256 signature
- #define **ATCA_KEY_SIZE** (32u)
  size of a symmetric SHA key
- #define **RSA2048_KEY_SIZE** (256u)
  size of a RSA private key
- #define **ATCA_RSP_SIZE_MIN** ((uint8_t)4)
  minimum number of bytes in response
- #define **ATCA_RSP_SIZE_4** ((uint8_t)7)
  size of response packet containing 4 bytes data
- #define **ATCA_RSP_SIZE_72** ((uint8_t)75)
  size of response packet containing 64 bytes data
- #define **ATCA_RSP_SIZE_64** ((uint8_t)67)
  size of response packet containing 64 bytes data
- #define **ATCA_RSP_SIZE_32** (35u)
  size of response packet containing 32 bytes data
- #define **ATCA_RSP_SIZE_16** ((uint8_t)19)
  size of response packet containing 16 bytes data
- #define **ATCA_RSP_SIZE_MAX** ((uint8_t)75)
  maximum size of response packet (GenKey and Verify command)
- #define **OUTNONCE_SIZE** (32u)
  Size of the OutNonce response expected from several commands.

Definitions for Command Parameter Ranges

- #define **ATCA_KEY_ID_MAX** ((uint8_t)15)
  maximum value for key id
- #define **ATCA_OTP_BLOCK_MAX** ((uint8_t)1)
  maximum value for OTP block

Definitions for Indexes Common to All Commands

- #define **ATCA_COUNT_IDX** (0)
  command packet index for count
- #define **ATCA_OPCODE_IDX** (1)
  command packet index for op-code
- #define **ATCA_PARAM1_IDX** (2)
  command packet index for first parameter
- #define **ATCA_PARAM2_IDX** (3)
  command packet index for second parameter
- #define **ATCA_DATA_IDX** (5)
  command packet index for data load

- #define **ATCA_RSP_DATA_IDX** (1u)
  buffer index of data in response

Definitions for Zone and Address Parameters

- #define **ATCA_ZONE_MASK** ((uint8_t)0x03)
  Zone mask.
- #define **ATCA_ZONE_ENCRYPTED** ((uint8_t)0x40)
  Zone bit 6 set: Write is encrypted with an unlocked data zone.
- #define **ATCA_ZONE_READWRITE_32** ((uint8_t)0x80)
  Zone bit 7 set: Access 32 bytes, otherwise 4 bytes.
- #define **ATCA_ADDRESS_MASK_CONFIG** ((uint16_t)0x001F)
  Address bits 5 to 7 are 0 for Configuration zone.
- #define **ATCA_ADDRESS_MASK_OTP** ((uint16_t)0x000F)
  Address bits 4 to 7 are 0 for OTP zone.
- #define **ATCA_ADDRESS_MASK** ((uint16_t)0x007F)
  Address bit 7 to 15 are always 0.
- #define **ATCA_TEMPKEY_KEYID** ((uint16_t)0xFFFF)
  KeyID when referencing TempKey.

Definitions for Key types

- #define **ATCA_B283_KEY_TYPE** 0
  B283 NIST ECC key.
- #define **ATCA_K283_KEY_TYPE** 1
  K283 NIST ECC key.
- #define **ATCA_P256_KEY_TYPE** 4
  P256 NIST ECC key.
- #define **ATCA_AES_KEY_TYPE** 6
  AES-128 Key.
- #define **ATCA_SHA_KEY_TYPE** 7
  SHA key or other data.

Definitions for the AES Command

- #define **AES_MODE_IDX** ATCA_PARAM1_IDX
  AES command index for mode.
- #define **AES_KEYID_IDX** ATCA_PARAM2_IDX
  AES command index for key id.
- #define **AES_INPUT_IDX** ATCA_DATA_IDX
  AES command index for input data.
- #define **AES_COUNT** (23u)
  AES command packet size.
- #define **AES_MODE_MASK** ((uint8_t)0xC7)
  AES mode bits 3 to 5 are 0.
- #define **AES_MODE_KEY_BLOCK_MASK** ((uint8_t)0xC0)
  AES mode mask for key block field.
- #define **AES_MODE_OP_MASK** ((uint8_t)0x07)
  AES mode operation mask.
- #define **AES_MODE_ENCRYPT** ((uint8_t)0x00)
  AES mode: Encrypt.
- #define **AES_MODE_DECRYPT** ((uint8_t)0x01)
  AES mode: Decrypt.
- #define **AES_MODE_GFM** ((uint8_t)0x03)
  AES mode: GFM calculation.
- #define **AES_MODE_KEY_BLOCK_POS** (6u)
  Bit shift for key block in mode.

- #define **AES_DATA_SIZE** (16u)
    size of AES encrypt/decrypt data
- #define **AES_RSP_SIZE** ATCA_RSP_SIZE_16
    AES command response packet size.

Definitions for the CheckMac Command

- #define **CHECKMAC_MODE_IDX** ATCA_PARAM1_IDX
    CheckMAC command index for mode.
- #define **CHECKMAC_KEYID_IDX** ATCA_PARAM2_IDX
    CheckMAC command index for key identifier.
- #define **CHECKMAC_CLIENT_CHALLENGE_IDX** ATCA_DATA_IDX
    CheckMAC command index for client challenge.
- #define **CHECKMAC_CLIENT_RESPONSE_IDX** (37u)
    CheckMAC command index for client response.
- #define **CHECKMAC_DATA_IDX** (69u)
    CheckMAC command index for other data.
- #define **CHECKMAC_COUNT** (84u)
    CheckMAC command packet size.
- #define **CHECKMAC_MODE_CHALLENGE** ((uint8_t)0x00)
    CheckMAC mode 0: first SHA block from key id.
- #define **CHECKMAC_MODE_BLOCK2_TEMPKEY** ((uint8_t)0x01)
    CheckMAC mode bit 0: second SHA block from TempKey.
- #define **CHECKMAC_MODE_BLOCK1_TEMPKEY** ((uint8_t)0x02)
    CheckMAC mode bit 1: first SHA block from TempKey.
- #define **CHECKMAC_MODE_SOURCE_FLAG_MATCH** ((uint8_t)0x04)
    CheckMAC mode bit 2: match TempKey.SourceFlag.
- #define **CHECKMAC_MODE_INCLUDE_OTP_64** ((uint8_t)0x20)
    CheckMAC mode bit 5: include first 64 OTP bits.
- #define **CHECKMAC_MODE_MASK** ((uint8_t)0x27)
    CheckMAC mode bits 3, 4, 6, and 7 are 0.
- #define **CHECKMAC_MODE_OUTPUT_MAC_RESPONSE** ((uint8_t)0x08)
    CheckMAC mode bit 3: Single byte boolean response + 32 bytes mac in SHA105 device.
- #define **CHECKMAC_CLIENT_CHALLENGE_SIZE** (32u)
    CheckMAC size of client challenge.
- #define **CHECKMAC_CLIENT_RESPONSE_SIZE** (32u)
    CheckMAC size of client response.
- #define **CHECKMAC_OTHER_DATA_SIZE** (13u)
    CheckMAC size of "other data".
- #define **CHECKMAC_CLIENT_COMMAND_SIZE** (4u)
    CheckMAC size of client command header size inside "other data".
- #define **CHECKMAC_CMD_MATCH** (0u)
    CheckMAC return value when there is a match.
- #define **CHECKMAC_CMD_MISMATCH** (1u)
    CheckMAC return value when there is a mismatch.
- #define **CHECKMAC_RSP_SIZE** ATCA_RSP_SIZE_MIN
    CheckMAC response packet size.
- #define **CHECKMAC_SINGLE_BYTE_BOOL_RESP** (1u)
- #define **CHECKMAC_SHA105_DEFAULT_KEYID** ((uint16_t)0x0003)

Definitions for the Counter command

- #define **COUNTER_COUNT** ATCA_CMD_SIZE_MIN
- #define **COUNTER_MODE_IDX** ATCA_PARAM1_IDX
    Counter command index for mode.
- #define **COUNTER_KEYID_IDX** ATCA_PARAM2_IDX
    Counter command index for key id.
- #define **COUNTER_MODE_MASK** ((uint8_t)0x01)

Counter mode bits 1 to 7 are 0.

- #define **COUNTER_MAX_VALUE** ((uint32_t)2097151)

  Counter maximum value of the counter.
- #define **COUNTER_MODE_READ** ((uint8_t)0x00)

  Counter command mode for reading.
- #define **COUNTER_MODE_INCREMENT** ((uint8_t)0x01)

  Counter command mode for incrementing.
- #define **COUNTER_RSP_SIZE** ATCA_RSP_SIZE_4

  Counter command response packet size.
- #define **COUNTER_SIZE** ATCA_RSP_SIZE_MIN

  Counter size in binary.
- #define **COUNTER_MAX_VALUE_CA2** ((uint16_t)10000)

  Counter maximum value of the counter for ECC204.

Definitions for the Delete command

- #define **DELETE_COUNT** (39u)
- #define **DELETE_MODE** ((uint8_t)0x00)
- #define **DELETE_MAC_SIZE** (32u)
- #define **DELETE_NONCE_KEY_ID** ((uint16_t)0x8000)

Definitions for the DeriveKey Command

- #define **DERIVE_KEY_RANDOM_IDX** ATCA_PARAM1_IDX

  DeriveKey command index for random bit.
- #define **DERIVE_KEY_TARGETKEY_IDX** ATCA_PARAM2_IDX

  DeriveKey command index for target slot.
- #define **DERIVE_KEY_MAC_IDX** ATCA_DATA_IDX

  DeriveKey command index for optional MAC.
- #define **DERIVE_KEY_COUNT_SMALL** ATCA_CMD_SIZE_MIN

  DeriveKey command packet size without MAC.
- #define **DERIVE_KEY_MODE** ((uint8_t)0x04)

  DeriveKey command mode set to 4 as in datasheet.
- #define **DERIVE_KEY_COUNT_LARGE** (39u)

  DeriveKey command packet size with MAC.
- #define **DERIVE_KEY_RANDOM_FLAG** ((uint8_t)4)

  DeriveKey 1. parameter; has to match TempKey.SourceFlag.
- #define **DERIVE_KEY_MAC_SIZE** (32u)

  DeriveKey MAC size.
- #define **DERIVE_KEY_RSP_SIZE** ATCA_RSP_SIZE_MIN

  DeriveKey response packet size.

Definitions for the ECDH Command

- #define **ECDH_PREFIX_MODE** ((uint8_t)0x00)
- #define **ECDH_COUNT** (ATCA_CMD_SIZE_MIN + ATCA_PUB_KEY_SIZE)
- #define **ECDH_MODE_SOURCE_MASK** ((uint8_t)0x01)
- #define **ECDH_MODE_SOURCE_EEPROM_SLOT** ((uint8_t)0x00)
- #define **ECDH_MODE_SOURCE_TEMPKEY** ((uint8_t)0x01)
- #define **ECDH_MODE_OUTPUT_MASK** ((uint8_t)0x02)
- #define **ECDH_MODE_OUTPUT_CLEAR** ((uint8_t)0x00)
- #define **ECDH_MODE_OUTPUT_ENC** ((uint8_t)0x02)
- #define **ECDH_MODE_COPY_MASK** ((uint8_t)0x0C)
- #define **ECDH_MODE_COPY_COMPATIBLE** ((uint8_t)0x00)
- #define **ECDH_MODE_COPY_EEPROM_SLOT** ((uint8_t)0x04)
- #define **ECDH_MODE_COPY_TEMP_KEY** ((uint8_t)0x08)
- #define **ECDH_MODE_COPY_OUTPUT_BUFFER** ((uint8_t)0x0C)
- #define **ECDH_KEY_SIZE** ATCA_BLOCK_SIZE

  ECDH output data size.

- #define **ECDH_RSP_SIZE** ATCA_RSP_SIZE_64
  ECDH command packet size.

Definitions for the GenDig Command

- #define **GENDIG_ZONE_IDX** ATCA_PARAM1_IDX
  GenDig command index for zone.
- #define **GENDIG_KEYID_IDX** ATCA_PARAM2_IDX
  GenDig command index for key id.
- #define **GENDIG_DATA_IDX** ATCA_DATA_IDX
  GenDig command index for optional data.
- #define **GENDIG_COUNT** ATCA_CMD_SIZE_MIN
  GenDig command packet size without "other data".
- #define **GENDIG_ZONE_CONFIG** ((uint8_t)0)
  GenDig zone id config. Use KeyID to specify any of the four 256-bit blocks of the Configuration zone.
- #define **GENDIG_ZONE_OTP** ((uint8_t)1)
  GenDig zone id OTP. Use KeyID to specify either the first or second 256-bit block of the OTP zone.
- #define **GENDIG_ZONE_DATA** ((uint8_t)2)
  GenDig zone id data. Use KeyID to specify a slot in the Data zone or a transport key in the hardware array.
- #define **GENDIG_ZONE_SHARED_NONCE** ((uint8_t)3)
  GenDig zone id shared nonce. KeyID specifies the location of the input value in the message generation.
- #define **GENDIG_ZONE_COUNTER** ((uint8_t)4)
  GenDig zone id counter. KeyID specifies the monotonic counter ID to be included in the message generation.
- #define **GENDIG_ZONE_KEY_CONFIG** ((uint8_t)5)
  GenDig zone id key config. KeyID specifies the slot for which the configuration information is to be included in the message generation.
- #define **GENDIG_RSP_SIZE** ATCA_RSP_SIZE_MIN
  GenDig command response packet size.
- #define **GENDIG_USE_TEMPKEY_BIT** ((uint16_t)0x8000)
  Use temp key for GenDig command if bit 15 is 1.

Definitions for the GenDivKey Command

- #define **GENDIVKEY_MODE** ((uint8_t)2)
- #define **GENDIVKEY_OTHER_DATA_SIZE** ((uint8_t)4)
- #define **GENDIVKEY_DEFAULT_KEYID** ((uint16_t)0x0003)

Definitions for the GenKey Command

- #define **GENKEY_MODE_IDX** ATCA_PARAM1_IDX
  GenKey command index for mode.
- #define **GENKEY_KEYID_IDX** ATCA_PARAM2_IDX
  GenKey command index for key id.
- #define **GENKEY_DATA_IDX** (5u)
  GenKey command index for other data.
- #define **GENKEY_COUNT** ATCA_CMD_SIZE_MIN
  GenKey command packet size without "other data".
- #define **GENKEY_COUNT_DATA** (10u)
  GenKey command packet size with "other data".
- #define **GENKEY_OTHER_DATA_SIZE** (3u)
  GenKey size of "other data".
- #define **GENKEY_MODE_MASK** ((uint8_t)0x1C)
  GenKey mode bits 0 to 1 and 5 to 7 are 0.
- #define **GENKEY_MODE_PRIVATE** ((uint8_t)0x04)
  GenKey mode: private key generation.
- #define **GENKEY_MODE_PUBLIC** ((uint8_t)0x00)
  GenKey mode: public key calculation.

- #define **GENKEY_MODE_DIGEST** ((uint8_t)0x08)
  GenKey mode: PubKey digest will be created after the public key is calculated.
- #define **GENKEY_MODE_PUBKEY_DIGEST** ((uint8_t)0x10)
  GenKey mode: Calculate PubKey digest on the public key in KeyId.
- #define **GENKEY_MODE_MAC** ((uint8_t)0x20)
  Genkey mode: Calculate MAC of public key + session key.
- #define **GENKEY_PRIVATE_TO_TEMPKEY** ((uint16_t)0xFFFF)
  GenKey Create private key and store to tempkey (608 only)
- #define **GENKEY_RSP_SIZE_SHORT** ATCA_RSP_SIZE_MIN
  GenKey response packet size in Digest mode.
- #define **GENKEY_RSP_SIZE_LONG** ATCA_RSP_SIZE_64
  GenKey response packet size when returning a public key.

Definitions for the HMAC Command

- #define **HMAC_MODE_IDX** ATCA_PARAM1_IDX
  HMAC command index for mode.
- #define **HMAC_KEYID_IDX** ATCA_PARAM2_IDX
  HMAC command index for key id.
- #define **HMAC_COUNT** ATCA_CMD_SIZE_MIN
  HMAC command packet size.
- #define **HMAC_MODE_FLAG_TK_RAND** ((uint8_t)0x00)
  HMAC mode bit 2: The value of this bit must match the value in TempKey.SourceFlag or the command will return an error.
- #define **HMAC_MODE_FLAG_TK_NORAND** ((uint8_t)0x04)
  HMAC mode bit 2: The value of this bit must match the value in TempKey.SourceFlag or the command will return an error.
- #define **HMAC_MODE_FLAG_OTP88** ((uint8_t)0x10)
  HMAC mode bit 4: Include the first 88 OTP bits (OTP[0] through OTP[10]) in the message.; otherwise, the corresponding message bits are set to zero. Not applicable for ATECC508A.
- #define **HMAC_MODE_FLAG_OTP64** ((uint8_t)0x20)
  HMAC mode bit 5: Include the first 64 OTP bits (OTP[0] through OTP[7]) in the message.; otherwise, the corresponding message bits are set to zero. If Mode[4] is set, the value of this mode bit is ignored. Not applicable for ATECC508A.
- #define **HMAC_MODE_FLAG_FULLSN** ((uint8_t)0x40)
  HMAC mode bit 6: If set, include the 48 bits SN[2:3] and SN[4:7] in the message.; otherwise, the corresponding message bits are set to zero.
- #define **HMAC_MODE_MASK** ((uint8_t)0x74)
  HMAC mode bits 0, 1, 3, and 7 are 0.
- #define **HMAC_DIGEST_SIZE** (32u)
  HMAC size of digest response.
- #define **HMAC_RSP_SIZE** ATCA_RSP_SIZE_32
  HMAC command response packet size.

Definitions for the Info Command

- #define **INFO_PARAM1_IDX** ATCA_PARAM1_IDX
  Info command index for 1. parameter.
- #define **INFO_PARAM2_IDX** ATCA_PARAM2_IDX
  Info command index for 2. parameter.
- #define **INFO_COUNT** ATCA_CMD_SIZE_MIN
  Info command packet size.
- #define **INFO_MODE_REVISION** ((uint8_t)0x00)
  Info mode Revision.
- #define **INFO_MODE_KEY_VALID** ((uint8_t)0x01)
  Info mode KeyValid.
- #define **INFO_MODE_STATE** ((uint8_t)0x02)
  Info mode State.

- #define **INFO_MODE_LOCK_STATUS** ((uint8_t)0x02)
  Info mode Lock status for ECC204,TA010,SHA10x devices.
- #define **INFO_MODE_CHIP_STATUS** ((uint8_t)0xC5)
  Info mode Chip status for ECC204,TA010,SHA10x devices.
- #define **INFO_MODE_GPIO** ((uint8_t)0x03)
  Info mode GPIO.
- #define **INFO_MODE_VOL_KEY_PERMIT** ((uint8_t)0x04)
  Info mode GPIO.
- #define **INFO_MODE_MAX** ((uint8_t)0x03)
  Info mode maximum value.
- #define **INFO_NO_STATE** ((uint8_t)0x00)
  Info mode is not the state mode.
- #define **INFO_OUTPUT_STATE_MASK** ((uint8_t)0x01)
  Info output state mask.
- #define **INFO_DRIVER_STATE_MASK** ((uint8_t)0x02)
  Info driver state mask.
- #define **INFO_PARAM2_SET_LATCH_STATE** ((uint16_t)0x0002)
  Info param2 to set the persistent latch state.
- #define **INFO_PARAM2_LATCH_SET** ((uint16_t)0x0001)
  Info param2 to set the persistent latch.
- #define **INFO_PARAM2_LATCH_CLEAR** ((uint16_t)0x0000)
  Info param2 to clear the persistent latch.
- #define **INFO_SIZE** ((uint8_t)0x04)
  Info return size.
- #define **INFO_RSP_SIZE** ATCA_RSP_SIZE_VAL
  Info command response packet size.

Definitions for the KDF Command

- #define **KDF_MODE_IDX** ATCA_PARAM1_IDX
  KDF command index for mode.
- #define **KDF_KEYID_IDX** ATCA_PARAM2_IDX
  KDF command index for key id.
- #define **KDF_DETAILS_IDX** ATCA_DATA_IDX
  KDF command index for details.
- #define **KDF_DETAILS_SIZE** (4u)
  KDF details (param3) size.
- #define **KDF_MESSAGE_IDX** (ATCA_DATA_IDX + KDF_DETAILS_SIZE)
- #define **KDF_MODE_SOURCE_MASK** ((uint8_t)0x03)
  KDF mode source key mask.
- #define **KDF_MODE_SOURCE_TEMPKEY** ((uint8_t)0x00)
  KDF mode source key in TempKey.
- #define **KDF_MODE_SOURCE_TEMPKEY_UP** ((uint8_t)0x01)
  KDF mode source key in upper TempKey.
- #define **KDF_MODE_SOURCE_SLOT** ((uint8_t)0x02)
  KDF mode source key in a slot.
- #define **KDF_MODE_SOURCE_ALTKEYBUF** ((uint8_t)0x03)
  KDF mode source key in alternate key buffer.
- #define **KDF_MODE_TARGET_MASK** ((uint8_t)0x1C)
  KDF mode target key mask.
- #define **KDF_MODE_TARGET_TEMPKEY** ((uint8_t)0x00)
  KDF mode target key in TempKey.
- #define **KDF_MODE_TARGET_TEMPKEY_UP** ((uint8_t)0x04)
  KDF mode target key in upper TempKey.
- #define **KDF_MODE_TARGET_SLOT** ((uint8_t)0x08)
  KDF mode target key in slot.
- #define **KDF_MODE_TARGET_ALTKEYBUF** ((uint8_t)0x0C)
  KDF mode target key in alternate key buffer.

- #define **KDF_MODE_TARGET_OUTPUT** ((uint8_t)0x10)
  KDF mode target key in output buffer.
- #define **KDF_MODE_TARGET_OUTPUT_ENC** ((uint8_t)0x14)
  KDF mode target key encrypted in output buffer.
- #define **KDF_MODE_ALG_MASK** ((uint8_t)0x60)
  KDF mode algorithm mask.
- #define **KDF_MODE_ALG_PRF** ((uint8_t)0x00)
  KDF mode PRF algorithm.
- #define **KDF_MODE_ALG_AES** ((uint8_t)0x20)
  KDF mode AES algorithm.
- #define **KDF_MODE_ALG_HKDF** ((uint8_t)0x40)
  KDF mode HKDF algorithm.
- #define **KDF_DETAILS_PRF_KEY_LEN_MASK** ((uint32_t)0x00000003)
  KDF details for PRF, source key length mask.
- #define **KDF_DETAILS_PRF_KEY_LEN_16** ((uint32_t)0x00000000)
  KDF details for PRF, source key length is 16 bytes.
- #define **KDF_DETAILS_PRF_KEY_LEN_32** ((uint32_t)0x00000001)
  KDF details for PRF, source key length is 32 bytes.
- #define **KDF_DETAILS_PRF_KEY_LEN_48** ((uint32_t)0x00000002)
  KDF details for PRF, source key length is 48 bytes.
- #define **KDF_DETAILS_PRF_KEY_LEN_64** ((uint32_t)0x00000003)
  KDF details for PRF, source key length is 64 bytes.
- #define **KDF_DETAILS_PRF_TARGET_LEN_MASK** ((uint32_t)0x00000100)
  KDF details for PRF, target length mask.
- #define **KDF_DETAILS_PRF_TARGET_LEN_32** ((uint32_t)0x00000000)
  KDF details for PRF, target length is 32 bytes.
- #define **KDF_DETAILS_PRF_TARGET_LEN_64** ((uint32_t)0x00000100)
  KDF details for PRF, target length is 64 bytes.
- #define **KDF_DETAILS_PRF_AEAD_MASK** ((uint32_t)0x00000600)
  KDF details for PRF, AEAD processing mask.
- #define **KDF_DETAILS_PRF_AEAD_MODE0** ((uint32_t)0x00000000)
  KDF details for PRF, AEAD no processing.
- #define **KDF_DETAILS_PRF_AEAD_MODE1** ((uint32_t)0x00000200)
  KDF details for PRF, AEAD First 32 go to target, second 32 go to output buffer.
- #define **KDF_DETAILS_AES_KEY_LOC_MASK** ((uint32_t)0x00000003)
  KDF details for AES, key location mask.
- #define **KDF_DETAILS_HKDF_MSG_LOC_MASK** ((uint32_t)0x00000003)
  KDF details for HKDF, message location mask.
- #define **KDF_DETAILS_HKDF_MSG_LOC_SLOT** ((uint32_t)0x00000000)
  KDF details for HKDF, message location in slot.
- #define **KDF_DETAILS_HKDF_MSG_LOC_TEMPKEY** ((uint32_t)0x00000001)
  KDF details for HKDF, message location in TempKey.
- #define **KDF_DETAILS_HKDF_MSG_LOC_INPUT** ((uint32_t)0x00000002)
  KDF details for HKDF, message location in input parameter.
- #define **KDF_DETAILS_HKDF_MSG_LOC_IV** ((uint32_t)0x00000003)
  KDF details for HKDF, message location is a special IV function.
- #define **KDF_DETAILS_HKDF_ZERO_KEY** ((uint32_t)0x00000004)
  KDF details for HKDF, key is 32 bytes of zero.

Definitions for the Lock Command

- #define **LOCK_ZONE_IDX** ATCA_PARAM1_IDX
  Lock command index for zone.
- #define **LOCK_SUMMARY_IDX** ATCA_PARAM2_IDX
  Lock command index for summary.
- #define **LOCK_COUNT** ATCA_CMD_SIZE_MIN
  Lock command packet size.
- #define **LOCK_ZONE_CONFIG** ((uint8_t)0x00)

Lock zone is Config.
- #define **LOCK_ZONE_DATA** ((uint8_t)0x01)
  Lock zone is OTP or Data.
- #define **LOCK_ZONE_DATA_SLOT** ((uint8_t)0x02)
  Lock slot of Data.
- #define **LOCK_ZONE_CA2_DATA** ((uint8_t)0x00)
  Lock second gen Data zone by slot.
- #define **LOCK_ZONE_CA2_CONFIG** ((uint8_t)0x01)
  Lock second gen configuration zone by slot.
- #define **LOCK_ZONE_NO_CRC** ((uint8_t)0x80)
  Lock command: Ignore summary.
- #define **LOCK_ZONE_MASK** ((uint8_t)0xBF)
  Lock parameter 1 bits 6 are 0.
- #define **ATCA_UNLOCKED** ((uint8_t)0x55)
  Value indicating an unlocked zone.
- #define **ATCA_LOCKED** ((uint8_t)0x00)
  Value indicating a locked zone.
- #define **LOCK_RSP_SIZE** ATCA_RSP_SIZE_MIN
  Lock command response packet size.

Definitions for the MAC Command

- #define **MAC_MODE_IDX** ATCA_PARAM1_IDX
  MAC command index for mode.
- #define **MAC_KEYID_IDX** ATCA_PARAM2_IDX
  MAC command index for key id.
- #define **MAC_CHALLENGE_IDX** ATCA_DATA_IDX
  MAC command index for optional challenge.
- #define **MAC_COUNT_SHORT** ATCA_CMD_SIZE_MIN
  MAC command packet size without challenge.
- #define **MAC_COUNT_LONG** (39u)
  MAC command packet size with challenge.
- #define **MAC_MODE_CHALLENGE** ((uint8_t)0x00)
  MAC mode 0: first SHA block from data slot.
- #define **MAC_MODE_BLOCK2_TEMPKEY** ((uint8_t)0x01)
  MAC mode bit 0: second SHA block from TempKey.
- #define **MAC_MODE_BLOCK1_TEMPKEY** ((uint8_t)0x02)
  MAC mode bit 1: first SHA block from TempKey.
- #define **MAC_MODE_SOURCE_FLAG_MATCH** ((uint8_t)0x04)
  MAC mode bit 2: match TempKey.SourceFlag.
- #define **MAC_MODE_PTNONCE_TEMPKEY** ((uint8_t)0x06)
  MAC mode bit 0: second SHA block from TempKey.
- #define **MAC_MODE_PASSTHROUGH** ((uint8_t)0x07)
  MAC mode bit 0-2: pass-through mode.
- #define **MAC_MODE_INCLUDE_OTP_88** ((uint8_t)0x10)
  MAC mode bit 4: include first 88 OTP bits.
- #define **MAC_MODE_INCLUDE_OTP_64** ((uint8_t)0x20)
  MAC mode bit 5: include first 64 OTP bits.
- #define **MAC_MODE_INCLUDE_SN** ((uint8_t)0x40)
  MAC mode bit 6: include serial number.
- #define **MAC_CHALLENGE_SIZE** (32u)
  MAC size of challenge.
- #define **MAC_SIZE** (32u)
  MAC size of response.
- #define **MAC_MODE_MASK** ((uint8_t)0x77)
  MAC mode bits 3 and 7 are 0.
- #define **MAC_RSP_SIZE** ATCA_RSP_SIZE_32
  MAC command response packet size.

- #define **MAC_SHA104_DEFAULT_KEYID** ((uint16_t)0x0003)

Definitions for the Nonce Command

- #define **NONCE_MODE_IDX** ATCA_PARAM1_IDX
  Nonce command index for mode.
- #define **NONCE_PARAM2_IDX** ATCA_PARAM2_IDX
  Nonce command index for 2. parameter.
- #define **NONCE_INPUT_IDX** ATCA_DATA_IDX
  Nonce command index for input data.
- #define **NONCE_COUNT_SHORT** (ATCA_CMD_SIZE_MIN + 20u)
  Nonce command packet size for 20 bytes of NumIn.
- #define **NONCE_COUNT_LONG** (ATCA_CMD_SIZE_MIN + 32u)
  Nonce command packet size for 32 bytes of NumIn.
- #define **NONCE_COUNT_LONG_64** (ATCA_CMD_SIZE_MIN + 64u)
  Nonce command packet size for 64 bytes of NumIn.
- #define **NONCE_MODE_MASK** ((uint8_t)0x03)
  Nonce mode bits 2 to 7 are 0.
- #define **NONCE_MODE_SEED_UPDATE** ((uint8_t)0x00)
  Nonce mode: update seed.
- #define **NONCE_MODE_NO_SEED_UPDATE** ((uint8_t)0x01)
  Nonce mode: do not update seed.
- #define **NONCE_MODE_INVALID** ((uint8_t)0x02)
  Nonce mode 2 is invalid.
- #define **NONCE_MODE_PASSTHROUGH** ((uint8_t)0x03)
  Nonce mode: pass-through.
- #define **NONCE_MODE_GEN_SESSION_KEY** ((uint8_t)0x02)
  NOnce mode: Generate session key in ECC204 device.
- #define **NONCE_MODE_INPUT_LEN_MASK** ((uint8_t)0x20)
  Nonce mode: input size mask.
- #define **NONCE_MODE_INPUT_LEN_32** ((uint8_t)0x00)
  Nonce mode: input size is 32 bytes.
- #define **NONCE_MODE_INPUT_LEN_64** ((uint8_t)0x20)
  Nonce mode: input size is 64 bytes.
- #define **NONCE_MODE_TARGET_MASK** ((uint8_t)0xC0)
  Nonce mode: target mask.
- #define **NONCE_MODE_TARGET_TEMPKEY** ((uint8_t)0x00)
  Nonce mode: target is TempKey.
- #define **NONCE_MODE_TARGET_MSGDIGBUF** ((uint8_t)0x40)
  Nonce mode: target is Message Digest Buffer.
- #define **NONCE_MODE_TARGET_ALTKEYBUF** ((uint8_t)0x80)
  Nonce mode: target is Alternate Key Buffer.
- #define **NONCE_ZERO_CALC_MASK** ((uint16_t)0x8000)
  Nonce zero (param2): calculation mode mask.
- #define **NONCE_ZERO_CALC_RANDOM** ((uint16_t)0x0000)
  Nonce zero (param2): calculation mode random, use RNG in calculation and return RNG output.
- #define **NONCE_ZERO_CALC_TEMPKEY** ((uint16_t)0x8000)
  Nonce zero (param2): calculation mode TempKey, use TempKey in calculation and return new TempKey value.
- #define **NONCE_NUMIN_SIZE** (20)
  Nonce NumIn size for random modes.
- #define **NONCE_NUMIN_SIZE_PASSTHROUGH** (32)
  Nonce NumIn size for 32-byte pass-through mode.
- #define **NONCE_RSP_SIZE_SHORT** ATCA_RSP_SIZE_MIN
  Nonce command response packet size with no output.
- #define **NONCE_RSP_SIZE_LONG** ATCA_RSP_SIZE_32
  Nonce command response packet size with output.

Definitions for the Pause Command

- #define **PAUSE_SELECT_IDX** ATCA_PARAM1_IDX
  Pause command index for Selector.
- #define **PAUSE_PARAM2_IDX** ATCA_PARAM2_IDX
  Pause command index for 2. parameter.
- #define **PAUSE_COUNT** ATCA_CMD_SIZE_MIN
  Pause command packet size.
- #define **PAUSE_RSP_SIZE** ATCA_RSP_SIZE_MIN
  Pause command response packet size.

Definitions for the PrivWrite Command

- #define **PRIVWRITE_ZONE_IDX** ATCA_PARAM1_IDX
  PrivWrite command index for zone.
- #define **PRIVWRITE_KEYID_IDX** ATCA_PARAM2_IDX
  PrivWrite command index for KeyID.
- #define **PRIVWRITE_VALUE_IDX** (5)
  PrivWrite command index for value.
- #define **PRIVWRITE_MAC_IDX** (41)
  PrivWrite command index for MAC.
- #define **PRIVWRITE_COUNT** (75)
  PrivWrite command packet size.
- #define **PRIVWRITE_ZONE_MASK** ((uint8_t)0x40)
  PrivWrite zone bits 0 to 5 and 7 are 0.
- #define **PRIVWRITE_MODE_ENCRYPT** ((uint8_t)0x40)
  PrivWrite mode: encrypted.
- #define **PRIVWRITE_RSP_SIZE** ATCA_RSP_SIZE_MIN
  PrivWrite command response packet size.

Definitions for the Random Command

- #define **RANDOM_MODE_IDX** ATCA_PARAM1_IDX
  Random command index for mode.
- #define **RANDOM_PARAM2_IDX** ATCA_PARAM2_IDX
  Random command index for 2. parameter.
- #define **RANDOM_COUNT** ATCA_CMD_SIZE_MIN
  Random command packet size.
- #define **RANDOM_SEED_UPDATE** ((uint8_t)0x00)
  Random mode for automatic seed update.
- #define **RANDOM_NO_SEED_UPDATE** ((uint8_t)0x01)
  Random mode for no seed update.
- #define **RANDOM_NUM_SIZE** ((uint8_t)32)
  Number of bytes in the data packet of a random command.
- #define **RANDOM_RSP_SIZE** ATCA_RSP_SIZE_32
  Random command response packet size.

Definitions for the Read Command

- #define **READ_ZONE_IDX** ATCA_PARAM1_IDX
  Read command index for zone.
- #define **READ_ADDR_IDX** ATCA_PARAM2_IDX
  Read command index for address.
- #define **READ_COUNT** ATCA_CMD_SIZE_MIN
  Read command packet size.
- #define **READ_ZONE_MASK** ((uint8_t)0x83)
  Read zone bits 2 to 6 are 0.
- #define **READ_4_RSP_SIZE** ATCA_RSP_SIZE_VAL
  Read command response packet size when reading 4 bytes.

- #define **READ_32_RSP_SIZE** ATCA_RSP_SIZE_32
  Read command response packet size when reading 32 bytes.

Definitions for the SecureBoot Command

- #define **SECUREBOOT_MODE_IDX** ATCA_PARAM1_IDX
  SecureBoot command index for mode.
- #define **SECUREBOOT_DIGEST_SIZE** (32u)
  SecureBoot digest input size.
- #define **SECUREBOOT_SIGNATURE_SIZE** (64u)
  SecureBoot signature input size.
- #define **SECUREBOOT_COUNT_DIG** (ATCA_CMD_SIZE_MIN + SECUREBOOT_DIGEST_SIZE)
  SecureBoot command packet size for just a digest.
- #define **SECUREBOOT_COUNT_DIG_SIG** (ATCA_CMD_SIZE_MIN + SECUREBOOT_DIGEST_SIZE + SECUREBOOT_SIGNATURE_SIZE)
  SecureBoot command packet size for a digest and signature.
- #define **SECUREBOOT_MAC_SIZE** (32u)
  SecureBoot MAC output size.
- #define **SECUREBOOT_RSP_SIZE_NO_MAC** ATCA_RSP_SIZE_MIN
  SecureBoot response packet size for no MAC.
- #define **SECUREBOOT_RSP_SIZE_MAC** (ATCA_PACKET_OVERHEAD + SECUREBOOT_MAC_SIZE)
  SecureBoot response packet size with MAC.
- #define **SECUREBOOT_MODE_MASK** ((uint8_t)0x07)
  SecureBoot mode mask.
- #define **SECUREBOOT_MODE_FULL** ((uint8_t)0x05)
  SecureBoot mode Full.
- #define **SECUREBOOT_MODE_FULL_STORE** ((uint8_t)0x06)
  SecureBoot mode FullStore.
- #define **SECUREBOOT_MODE_FULL_COPY** ((uint8_t)0x07)
  SecureBoot mode FullCopy.
- #define **SECUREBOOT_MODE_PROHIBIT_FLAG** ((uint8_t)0x40)
  SecureBoot mode flag to prohibit SecureBoot until next power cycle.
- #define **SECUREBOOT_MODE_ENC_MAC_FLAG** ((uint8_t)0x80)
  SecureBoot mode flag for encrypted digest and returning validating MAC.
- #define **SECUREBOOTCONFIG_OFFSET** (70)
  SecureBootConfig byte offset into the configuration zone.
- #define **SECUREBOOTCONFIG_MODE_MASK** ((uint16_t)0x0003)
  Mask for SecureBootMode field in SecureBootConfig value.
- #define **SECUREBOOTCONFIG_MODE_DISABLED** ((uint16_t)0x0000)
  Disabled SecureBootMode in SecureBootConfig value.
- #define **SECUREBOOTCONFIG_MODE_FULL_BOTH** ((uint16_t)0x0001)
  Both digest and signature always required SecureBootMode in SecureBootConfig value.
- #define **SECUREBOOTCONFIG_MODE_FULL_SIG** ((uint16_t)0x0002)
  Signature stored SecureBootMode in SecureBootConfig value.
- #define **SECUREBOOTCONFIG_MODE_FULL_DIG** ((uint16_t)0x0003)
  Digest stored SecureBootMode in SecureBootConfig value.

Definitions for the SelfTest Command

- #define **SELFTEST_MODE_IDX** ATCA_PARAM1_IDX
  SelfTest command index for mode.
- #define **SELFTEST_COUNT** ATCA_CMD_SIZE_MIN
  SelfTest command packet size.
- #define **SELFTEST_MODE_RNG** ((uint8_t)0x01)
  SelfTest mode RNG DRBG function.
- #define **SELFTEST_MODE_ECDSA_SIGN_VERIFY** ((uint8_t)0x04)
  SelfTest mode ECDSA verify function.
- #define **SELFTEST_MODE_ECDH** ((uint8_t)0x08)

SelfTest mode ECDH function.
- #define **SELFTEST_MODE_AES** ((uint8_t)0x10)
  SelfTest mode AES encrypt function.
- #define **SELFTEST_MODE_SHA** ((uint8_t)0x20)
  SelfTest mode SHA function.
- #define **SELFTEST_MODE_ALL** ((uint8_t)0x3B)
  SelfTest mode all algorithms.
- #define **SELFTEST_RSP_SIZE** ATCA_RSP_SIZE_MIN
  SelfTest command response packet size.

Definitions for the SHA Command

- #define **SHA_COUNT_SHORT** ATCA_CMD_SIZE_MIN
- #define **SHA_COUNT_LONG** ATCA_CMD_SIZE_MIN
  Just a starting size.
- #define **ATCA_SHA_DIGEST_SIZE** (32u)
- #define **SHA_DATA_MAX** (64)
- #define **SHA_MODE_MASK** ((uint8_t)0x07)
  Mask the bit 0-2.
- #define **SHA_MODE_SHA256_START** ((uint8_t)0x00)
  Initialization, does not accept a message.
- #define **SHA_MODE_SHA256_UPDATE** ((uint8_t)0x01)
  Add 64 bytes in the meesage to the SHA context.
- #define **SHA_MODE_SHA256_END** ((uint8_t)0x02)
  Complete the calculation and return the digest.
- #define **SHA_MODE_SHA256_PUBLIC** ((uint8_t)0x03)
  Add 64 byte ECC public key in the slot to the SHA context.
- #define **SHA_MODE_HMAC_START** ((uint8_t)0x04)
  Initialization, HMAC calculation.
- #define **SHA_MODE_ECC204_HMAC_START** ((uint8_t)0x03)
  Initialization, HMAC calculation for ECC204.
- #define **SHA_MODE_HMAC_UPDATE** ((uint8_t)0x01)
  Add 64 bytes in the meesage to the SHA context.
- #define **SHA_MODE_HMAC_END** ((uint8_t)0x05)
  Complete the HMAC computation and return digest.
- #define **SHA_MODE_608_HMAC_END** ((uint8_t)0x02)
  Complete the HMAC computation and return digest... Different command on 608.
- #define **SHA_MODE_ECC204_HMAC_END** ((uint8_t)0x02)
  Complete the HMAC computation and return digest... Different mode on ECC204.
- #define **SHA_MODE_READ_CONTEXT** ((uint8_t)0x06)
  Read current SHA-256 context out of the device.
- #define **SHA_MODE_WRITE_CONTEXT** ((uint8_t)0x07)
  Restore a SHA-256 context into the device.
- #define **SHA_MODE_TARGET_MASK** ((uint8_t)0xC0)
  Resulting digest target location mask.
- #define **SHA_RSP_SIZE** ATCA_RSP_SIZE_32
  SHA command response packet size.
- #define **SHA_RSP_SIZE_SHORT** ATCA_RSP_SIZE_MIN
  SHA command response packet size only status code.
- #define **SHA_RSP_SIZE_LONG** ATCA_RSP_SIZE_32
  SHA command response packet size.

Definitions for the Sign Command

- #define **SIGN_MODE_IDX** ATCA_PARAM1_IDX
  Sign command index for mode.
- #define **SIGN_KEYID_IDX** ATCA_PARAM2_IDX
  Sign command index for key id.

- #define **SIGN_COUNT** ATCA_CMD_SIZE_MIN
  Sign command packet size.
- #define **SIGN_MODE_MASK** ((uint8_t)0xE1)
  Sign mode bits 1 to 4 are 0.
- #define **SIGN_MODE_INTERNAL** ((uint8_t)0x00)
  Sign mode 0: internal.
- #define **SIGN_MODE_INVALIDATE** ((uint8_t)0x01)
  Sign mode bit 1: Signature will be used for Verify(Invalidate)
- #define **SIGN_MODE_INCLUDE_SN** ((uint8_t)0x40)
  Sign mode bit 6: include serial number.
- #define **SIGN_MODE_EXTERNAL** ((uint8_t)0x80)
  Sign mode bit 7: external.
- #define **SIGN_MODE_SOURCE_MASK** ((uint8_t)0x20)
  Sign mode message source mask.
- #define **SIGN_MODE_SOURCE_TEMPKEY** ((uint8_t)0x00)
  Sign mode message source is TempKey.
- #define **SIGN_MODE_SOURCE_MSGDIGBUF** ((uint8_t)0x20)
  Sign mode message source is the Message Digest Buffer.
- #define **SIGN_RSP_SIZE** ATCA_RSP_SIZE_MAX
  Sign command response packet size.

Definitions for the UpdateExtra Command

- #define **UPDATE_MODE_IDX** ATCA_PARAM1_IDX
  UpdateExtra command index for mode.
- #define **UPDATE_VALUE_IDX** ATCA_PARAM2_IDX
  UpdateExtra command index for new value.
- #define **UPDATE_COUNT** ATCA_CMD_SIZE_MIN
  UpdateExtra command packet size.
- #define **UPDATE_MODE_USER_EXTRA** ((uint8_t)0x00)
  UpdateExtra mode update UserExtra (config byte 84)
- #define **UPDATE_MODE_SELECTOR** ((uint8_t)0x01)
  UpdateExtra mode update Selector (config byte 85)
- #define **UPDATE_MODE_USER_EXTRA_ADD** UPDATE_MODE_SELECTOR
  UpdateExtra mode update UserExtraAdd (config byte 85)
- #define **UPDATE_MODE_DEC_COUNTER** ((uint8_t)0x02)
  UpdateExtra mode: decrement counter.
- #define **UPDATE_RSP_SIZE** ATCA_RSP_SIZE_MIN
  UpdateExtra command response packet size.

Definitions for the Verify Command

- #define **VERIFY_MODE_IDX** ATCA_PARAM1_IDX
  Verify command index for mode.
- #define **VERIFY_KEYID_IDX** ATCA_PARAM2_IDX
  Verify command index for key id.
- #define **VERIFY_DATA_IDX** (5)
  Verify command index for data.
- #define **VERIFY_256_STORED_COUNT** (71)
  Verify command packet size for 256-bit key in stored mode.
- #define **VERIFY_283_STORED_COUNT** (79)
  Verify command packet size for 283-bit key in stored mode.
- #define **VERIFY_256_VALIDATE_COUNT** (90)
  Verify command packet size for 256-bit key in validate mode.
- #define **VERIFY_283_VALIDATE_COUNT** (98)
  Verify command packet size for 283-bit key in validate mode.
- #define **VERIFY_256_EXTERNAL_COUNT** (135)
  Verify command packet size for 256-bit key in external mode.

- #define **VERIFY_283_EXTERNAL_COUNT** (151)
  Verify command packet size for 283-bit key in external mode.
- #define **VERIFY_256_KEY_SIZE** (64)
  Verify key size for 256-bit key.
- #define **VERIFY_283_KEY_SIZE** (72)
  Verify key size for 283-bit key.
- #define **VERIFY_256_SIGNATURE_SIZE** (64)
  Verify signature size for 256-bit key.
- #define **VERIFY_283_SIGNATURE_SIZE** (72)
  Verify signature size for 283-bit key.
- #define **VERIFY_OTHER_DATA_SIZE** (19u)
  Verify size of "other data".
- #define **VERIFY_MODE_MASK** ((uint8_t)0x07)
  Verify mode bits 3 to 7 are 0.
- #define **VERIFY_MODE_STORED** ((uint8_t)0x00)
  Verify mode: stored.
- #define **VERIFY_MODE_VALIDATE_EXTERNAL** ((uint8_t)0x01)
  Verify mode: validate external.
- #define **VERIFY_MODE_EXTERNAL** ((uint8_t)0x02)
  Verify mode: external.
- #define **VERIFY_MODE_VALIDATE** ((uint8_t)0x03)
  Verify mode: validate.
- #define **VERIFY_MODE_INVALIDATE** ((uint8_t)0x07)
  Verify mode: invalidate.
- #define **VERIFY_MODE_SOURCE_MASK** ((uint8_t)0x20)
  Verify mode message source mask.
- #define **VERIFY_MODE_SOURCE_TEMPKEY** ((uint8_t)0x00)
  Verify mode message source is TempKey.
- #define **VERIFY_MODE_SOURCE_MSGDIGBUF** ((uint8_t)0x20)
  Verify mode message source is the Message Digest Buffer.
- #define **VERIFY_MODE_MAC_FLAG** ((uint8_t)0x80)
  Verify mode: MAC.
- #define **VERIFY_KEY_B283** ((uint16_t)0x0000)
  Verify key type: B283.
- #define **VERIFY_KEY_K283** ((uint16_t)0x0001)
  Verify key type: K283.
- #define **VERIFY_KEY_P256** ((uint16_t)0x0004)
  Verify key type: P256.
- #define **VERIFY_RSP_SIZE** ATCA_RSP_SIZE_MIN
  Verify command response packet size.
- #define **VERIFY_RSP_SIZE_MAC** ATCA_RSP_SIZE_32
  Verify command response packet size with validating MAC.

Definitions for the Write Command

- #define **WRITE_ZONE_IDX** ATCA_PARAM1_IDX
  Write command index for zone.
- #define **WRITE_ADDR_IDX** ATCA_PARAM2_IDX
  Write command index for address.
- #define **WRITE_VALUE_IDX** ATCA_DATA_IDX
  Write command index for data.
- #define **WRITE_MAC_VS_IDX** (9)
  Write command index for MAC following short data.
- #define **WRITE_MAC_VL_IDX** (37)
  Write command index for MAC following long data.
- #define **WRITE_MAC_SIZE** (32u)
  Write MAC size.
- #define **WRITE_ZONE_MASK** ((uint8_t)0xC3)

Write zone bits 2 to 5 are 0.
- #define **WRITE_ZONE_WITH_MAC** ((uint8_t)0x40)

  Write zone bit 6: write encrypted with MAC.
- #define **WRITE_ZONE_OTP** ((uint8_t)1)

  Write zone id OTP.
- #define **WRITE_ZONE_DATA** ((uint8_t)2)

  Write zone id data.
- #define **WRITE_RSP_SIZE** ATCA_RSP_SIZE_MIN

  Write command response packet size.

Functions

- ATCA_STATUS atInfo (ATCADeviceType device_type, ATCAPacket *packet)

  ATCACommand Info method.
- ATCA_STATUS atPause (ATCADeviceType device_type, ATCAPacket *packet)

  ATCACommand Pause method.
- bool atIsSHAFamily (ATCADeviceType device_type)

  determines if a given device type is a SHA device or a superset of a SHA device
- bool atIsECCFamily (ATCADeviceType device_type)

  determines if a given device type is an ECC device or a superset of a ECC device
- ATCA_STATUS isATCAError (uint8_t *data)

  checks for basic error frame in data
- void atCRC (size_t length, const uint8_t *data, uint8_t *crc_le)

  Calculates CRC over the given raw data and returns the CRC in little-endian byte order.
- void atCalcCrc (ATCAPacket *packet)

  This function calculates CRC and adds it to the correct offset in the packet data.
- ATCA_STATUS atCheckCrc (const uint8_t *response)

  This function checks the consistency of a response.

23.79.1 Detailed Description

Microchip Crypto Auth device command object - this is a command builder only, it does not send the command. The result of a command method is a fully formed packet, ready to send to the ATCAIFace object to dispatch.

This command object supports the ATSHA and ATECC device family. The command list is a superset of all device commands for this family. The command object differentiates the packet contents based on specific device type within the family.

Copyright

23.79.2 Function Documentation

23.79.2.1 atCalcCrc()

```
void atCalcCrc (
            ATCAPacket * packet )
```

This function calculates CRC and adds it to the correct offset in the packet data.

Parameters

in	*packet*	Packet to calculate CRC data for

23.79.2.2 atCheckCrc()

```
ATCA_STATUS atCheckCrc (
            const uint8_t * response )
```

This function checks the consistency of a response.

Parameters

in	*response*	pointer to response

Returns

ATCA_SUCCESS on success, otherwise ATCA_RX_CRC_ERROR

23.79.2.3 atCRC()

```
void atCRC (
            size_t length,
            const uint8_t * data,
            uint8_t * crc_le )
```

Calculates CRC over the given raw data and returns the CRC in little-endian byte order.

Parameters

in	*length*	Size of data not including the CRC byte positions
in	*data*	Pointer to the data over which to compute the CRC
out	*crc_le*	Pointer to the place where the two-bytes of CRC will be returned in little-endian byte order.

23.79.2.4 atInfo()

```
ATCA_STATUS atInfo (
            ATCADeviceType device_type,
            ATCAPacket * packet )
```

ATCACommand Info method.

Parameters

in	*ca_cmd*	instance
in	*packet*	pointer to the packet containing the command being built

Returns

ATCA_SUCCESS

23.79.2.5 atIsECCFamily()

```
bool atIsECCFamily (
            ATCADeviceType device_type )
```

determines if a given device type is an ECC device or a superset of a ECC device

Parameters

in	*device_type*	Type of device to check for family type

Returns

boolean indicating whether the given device is an ECC family device.

23.79.2.6 atIsSHAFamily()

```
bool atIsSHAFamily (
            ATCADeviceType device_type )
```

determines if a given device type is a SHA device or a superset of a SHA device

Parameters

in	*device_type*	Type of device to check for family type

Returns

boolean indicating whether the given device is a SHA family device.

23.79.2.7 atPause()

```
ATCA_STATUS atPause (
            ATCADeviceType device_type,
            ATCAPacket * packet )
```

ATCACommand Pause method.

Parameters

in	*ca_cmd*	instance
in	*packet*	pointer to the packet containing the command being built

Returns

ATCA_SUCCESS

23.79.2.8 isATCAError()

```
ATCA_STATUS isATCAError (
            uint8_t * data )
```

checks for basic error frame in data

Parameters

in	*data*	pointer to received data - expected to be in the form of a CA device response frame

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.80 calib_config_check.h File Reference

Consistency checks for configuration options.

```
#include "atca_config_check.h"
#include "crypto/crypto_sw_config_check.h"
```

Macros

- #define **CALIB_SHA204_EN** DEFAULT_ENABLED
- #define **CALIB_SHA206_EN** DEFAULT_ENABLED
- #define **CALIB_ECC108_EN** DEFAULT_DISABLED
- #define **CALIB_ECC508_EN** DEFAULT_ENABLED

- #define **CALIB_ECC608_EN** DEFAULT_ENABLED
- #define **CALIB_ECC204_EN** DEFAULT_ENABLED
- #define **CALIB_TA010_EN** DEFAULT_ENABLED
- #define **CALIB_SHA104_EN** DEFAULT_ENABLED
- #define **CALIB_SHA105_EN** DEFAULT_ENABLED
- #define **CALIB_FULL_FEATURE** (CALIB_SHA204_EN || CALIB_ECC108_EN || CALIB_ECC508_EN || CALIB_ECC608_EN)
- #define **CALIB_ECC_SUPPORT** (CALIB_ECC108_EN || CALIB_ECC508_EN || CALIB_ECC608_EN || CALIB_ECC204_EN || CALIB_TA010_EN)
- #define **CALIB_CA2_SUPPORT** (CALIB_ECC204_EN || CALIB_TA010_EN || CALIB_SHA104_EN || CALIB_SHA105_EN)
- #define **CALIB_CA2_CERT_SUPPORT** (CALIB_ECC204_EN || CALIB_TA010_EN)
- #define **CALIB_SHA206_ONLY** (CALIB_SHA206_EN && !(CALIB_FULL_FEATURE || ATCA_CA2_↩ SUPPORT))
- #define **DEFAULT_CA_MAX_PACKET_SIZE** (198u)
- #define **CA_MAX_PACKET_SIZE** (DEFAULT_CA_MAX_PACKET_SIZE)
- #define **CALIB_AES_EN** (ATCAB_AES_EN && CALIB_ECC608_EN)
- #define **CALIB_AES_GCM_EN** (ATCAB_AES_GCM_EN && CALIB_AES_EN && CALIB_ECC608_EN)
- #define **CALIB_CHECKMAC_EN** (ATCAB_CHECKMAC_EN && (CALIB_FULL_FEATURE || CALIB_↩ SHA105_EN))
- #define **CALIB_COUNTER_EN** (ATCAB_COUNTER_EN && (CALIB_ECC_SUPPORT || CALIB_SHA104↩ _EN || CALIB_SHA105_EN))
- #define **CALIB_DELETE_EN** (DEFAULT_DISABLED)
- #define **CALIB_DERIVEKEY_EN** (ATCAB_DERIVEKEY_EN && (CALIB_FULL_FEATURE || CALIB_↩ SHA206_EN))
- #define **CALIB_ECDH_EN** (ATCAB_ECDH_EN && (CALIB_ECC508_EN || CALIB_ECC608_EN))
- #define **CALIB_ECDH_ENC_EN** (ATCAB_ECDH_ENC_EN && (CALIB_ECC508_EN || CALIB_ECC608↩ _EN))
- #define **CALIB_GENDIG_EN** (ATCAB_GENDIG_EN && (CALIB_FULL_FEATURE || CALIB_SHA105_EN))
- #define **CALIB_GENDIVKEY_EN** (ATCAB_GENDIG_EN && CALIB_SHA105_EN)
- #define **CALIB_GENKEY_EN** (ATCAB_GENKEY_EN && CALIB_ECC_SUPPORT)
- #define **CALIB_GENKEY_MAC_EN** (ATCAB_GENKEY_MAC_EN && CALIB_ECC_SUPPORT)
- #define **CALIB_HMAC_EN** (ATCAB_HMAC_EN && (CALIB_SHA204_EN || CALIB_ECC108_EN || CALIB↩ _ECC508_EN))
- #define CALIB_INFO_LATCH_EN ATCAB_INFO_LATCH_EN
- #define **CALIB_KDF_EN** (ATCAB_KDF_EN && CALIB_ECC608_EN)
- #define CALIB_LOCK_EN (ATCAB_LOCK_EN && CALIB_FULL_FEATURE)
- #define CALIB_LOCK_CA2_EN (ATCAB_LOCK_EN && ATCA_CA2_SUPPORT)
- #define **CALIB_MAC_EN** (ATCAB_MAC_EN && (CALIB_FULL_FEATURE || CALIB_SHA206_EN || CALIB_SHA104_EN))
- #define **CALIB_NONCE_EN** (ATCAB_NONCE_EN && (CALIB_FULL_FEATURE || CALIB_CA2_↩ SUPPORT))
- #define **CALIB_PRIVWRITE_EN** (ATCAB_PRIVWRITE_EN && (CALIB_ECC108_EN || CALIB_ECC508↩ _EN || CALIB_ECC608_EN))
- #define **CALIB_RANDOM_EN** (ATCAB_RANDOM_EN && CALIB_FULL_FEATURE)
- #define CALIB_READ_EN (ATCAB_READ_EN && (CALIB_FULL_FEATURE || CALIB_SHA206_EN))
- #define **CALIB_READ_CA2_EN** (ATCAB_READ_EN && CALIB_CA2_SUPPORT)
- #define **CALIB_READ_ENC_EN** (ATCAB_READ_ENC_EN && CALIB_FULL_FEATURE)
- #define **CALIB_SECUREBOOT_EN** (ATCAB_SECUREBOOT_EN && CALIB_ECC608_EN)
- #define **CALIB_SECUREBOOT_MAC_EN** (ATCAB_SECUREBOOT_MAC_EN && CALIB_ECC608_EN)
- #define **CALIB_SELFTEST_EN** (ATCAB_SELFTEST_EN && (CALIB_ECC608_EN || CALIB_CA2_↩ SUPPORT))
- #define CALIB_SHA_EN (ATCAB_SHA_EN && (CALIB_FULL_FEATURE || CALIB_CA2_SUPPORT))
- #define CALIB_SHA_HMAC_EN (ATCAB_SHA_HMAC_EN && CALIB_ECC_SUPPORT)
- #define CALIB_SHA_CONTEXT_EN (ATCAB_SHA_CONTEXT_EN && CALIB_ECC608_EN)

- #define CALIB_SIGN_EN (ATCAB_SIGN_EN && (CALIB_ECC108_EN || CALIB_ECC508_EN || CALIB_↩ ECC608_EN))
- #define CALIB_SIGN_CA2_EN (ATCAB_SIGN_EN && (CALIB_ECC204_EN || CALIB_TA010_EN))
- #define **CALIB_SIGN_INTERNAL_EN** (ATCAB_SIGN_INTERNAL_EN && CALIB_SIGN_EN)
- #define CALIB_UPDATEEXTRA_EN (ATCAB_UPDATEEXTRA_EN && CALIB_FULL_FEATURE)
- #define CALIB_VERIFY_EN (ATCAB_VERIFY_EN && (CALIB_ECC108_EN || CALIB_ECC508_EN || CALIB_ECC608_EN))
- #define CALIB_VERIFY_MAC_EN (ATCAB_VERIFY_MAC_EN && CALIB_ECC608_EN)
- #define **CALIB_VERIFY_EXTERN_EN** (ATCAB_VERIFY_EXTERN_EN && CALIB_VERIFY_EN)
- #define CALIB_VERIFY_STORED_EN (ATCAB_VERIFY_STORED_EN && CALIB_VERIFY_EN)
- #define **CALIB_VERIFY_VALIDATE_EN** (ATCAB_VERIFY_VALIDATE_EN && CALIB_VERIFY_EN)
- #define **CALIB_WRITE_EN** (ATCAB_WRITE_EN && (CALIB_FULL_FEATURE || CALIB_SHA206_EN))
- #define CALIB_WRITE_ENC_EN (ATCAB_WRITE_ENC_EN && CALIB_FULL_FEATURE)
- #define **CALIB_WRITE_CA2_EN** (ATCAB_WRITE_EN && CALIB_CA2_SUPPORT)

23.80.1 Detailed Description

Consistency checks for configuration options.

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23.80.2 Macro Definition Documentation

23.80.2.1 CALIB_INFO_LATCH_EN

```
#define CALIB_INFO_LATCH_EN ATCAB_INFO_LATCH_EN
```

Supported API's: calib_info_get_latch calib_info_set_latch

ECC204 specific api: calib_info_lock_status

23.80.2.2 CALIB_LOCK_CA2_EN

```
#define CALIB_LOCK_CA2_EN (ATCAB_LOCK_EN && ATCA_CA2_SUPPORT)
```

Enable CALIB_LOCK_CA2_EN which enables the lock command for the ecc204 and ta010 devices

Supported API's: calib_lock

23.80.2.3 CALIB_LOCK_EN

```
#define CALIB_LOCK_EN (ATCAB_LOCK_EN && CALIB_FULL_FEATURE)
```

Enable CALIB_LOCK_EN to enable the lock commands for the classic cryptoauth parts

Supported API's: calib_lock

23.80.2.4 CALIB_READ_EN

```
#define CALIB_READ_EN (ATCAB_READ_EN && (CALIB_FULL_FEATURE || CALIB_SHA206_EN))
```

Enable CALIB_READ_EN which enables the read commands

Supported API's: calib_read_zone

23.80.2.5 CALIB_SHA_CONTEXT_EN

```
#define CALIB_SHA_CONTEXT_EN (ATCAB_SHA_CONTEXT_EN && CALIB_ECC608_EN)
```

Requires: CALIB_SHA_BASE

Use the SHA command to compute an HMAC/SHA-256 operation

Supported API's: calib_sha_read_context

23.80.2.6 CALIB_SHA_EN

```
#define CALIB_SHA_EN (ATCAB_SHA_EN && (CALIB_FULL_FEATURE || CALIB_CA2_SUPPORT))
```

Enable CALIB_SHA_EN to compute a SHA-256 or HMAC/SHA-256 digest for general purpose use by the host system

Supported API's: calib_sha_base

23.80.2.7 CALIB_SHA_HMAC_EN

```
#define CALIB_SHA_HMAC_EN (ATCAB_SHA_HMAC_EN && CALIB_ECC_SUPPORT)
```

Requires: CALIB_SHA_HMAC CALIB_SHA_BASE

Use the SHA command to compute an HMAC/SHA-256 operation

Supported API's: calib_sha_hmac,calib_sha_hmac_init, calib_sha_hmac_update, calib_sha_hmac_finish

23.80.2.8 CALIB_SIGN_CA2_EN

```
#define CALIB_SIGN_CA2_EN (ATCAB_SIGN_EN && (CALIB_ECC204_EN || CALIB_TA010_EN))
```

Enable CALIB_SIGN_CA2_EN to generate a signature using the ECDSA algorithm

Supported API's: calib_sign_base

23.80.2.9 CALIB_SIGN_EN

```
#define CALIB_SIGN_EN (ATCAB_SIGN_EN && (CALIB_ECC108_EN || CALIB_ECC508_EN || CALIB_ECC608_EN))
```

Enable CALIB_SIGN_EN to generate a signature using the ECDSA algorithm

Supported API's: calib_sign

23.80.2.10 CALIB_UPDATEEXTRA_EN

```
#define CALIB_UPDATEEXTRA_EN (ATCAB_UPDATEEXTRA_EN && CALIB_FULL_FEATURE)
```

Enable CALIB_UPDATEEXTRA_EN to update the values of the two extra bytes within the configuration zone (bytes 84 and 85)

Supported API's: calib_updateextra

23.80.2.11 CALIB_VERIFY_EN

```
#define CALIB_VERIFY_EN (ATCAB_VERIFY_EN && (CALIB_ECC108_EN || CALIB_ECC508_EN || CALIB_ECC608←
_EN))
```

Enable CALIB_VERIFY_EN which takes an ECDSA [R,S] signature and verifies that it is correctly generated from a given message and public key. In all cases, the signature is an input to the command

Supported API's: calib_verify

23.80.2.12 CALIB_VERIFY_MAC_EN

```
#define CALIB_VERIFY_MAC_EN (ATCAB_VERIFY_MAC_EN && CALIB_ECC608_EN)
```

Requires: CALIB_NONCE_MODE_ENCODING CALIB_NONCE_BASE ATCAH_VERIFY_MAC ATCAC_SW_←
SHA2_256 CALIB_VERIFY

Executes verification command with verification MAC for the External or Stored Verify modes

Supported API's: calib_verify_extern_stored_mac, calib_verify_extern_mac, calib_verify_stored_mac

23.80.2.13 CALIB_VERIFY_STORED_EN

```
#define CALIB_VERIFY_STORED_EN (ATCAB_VERIFY_STORED_EN && CALIB_VERIFY_EN)
```

Requires: CALIB_NONCE_MODE_ENCODING CALIB_NONCE_BASE CALIB_VERIFY

Verifies a signature (ECDSA verify operation) with a public key stored in the device

Supported API's: calib_verify_stored

23.80.2.14 CALIB_WRITE_ENC_EN

```
#define CALIB_WRITE_ENC_EN (ATCAB_WRITE_ENC_EN && CALIB_FULL_FEATURE)
```

Requires: CALIB_NONCE_MODE_ENCODING CALIB_NONCE_BASE CALIB_READ_ZONE CALIB_GENDIG ATCAH_GENDIG ATCAH_WRITE_AUTH_MAC ATCAH_NONCE ATCAC_SW_SHA2_256 CALIB_WRITE ATCAH_GEN_SESSION_KEY

Performs an encrypted write of a 32 byte block into given slot

Supported API's: calib_write_enc

23.81 calib_counter.c File Reference

CryptoAuthLib Basic API methods for Counter command.

```
#include "cryptoauthlib.h"
```

23.81.1 Detailed Description

CryptoAuthLib Basic API methods for Counter command.

The Counter command reads or increments the binary count value for one of the two monotonic counters

Note

List of devices that support this command - ATECC508A and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.82 calib_delete.c File Reference

CryptoAuthLib Basic API methods for Delete command.

```
#include "cryptoauthlib.h"
#include "host/atca_host.h"
```

23.82.1 Detailed Description

CryptoAuthLib Basic API methods for Delete command.

The Delete command, when executed, will clear all of the Data zone slots and set all bytes of each slot to 0xFF.The Configuration zone will be untouched, except for the value of the Primary_Deleted byte.

Note

List of devices that support this command - ECC204, TA010, SHA10x.Refer to device datasheets for full details.

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23.83 calib_derivekey.c File Reference

CryptoAuthLib Basic API methods for DeriveKey command.

```
#include "cryptoauthlib.h"
```

23.83.1 Detailed Description

CryptoAuthLib Basic API methods for DeriveKey command.

The DeriveKey command combines the current value of a key with the nonce stored in TempKey using SHA-256 and derives a new key.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.84 calib_device.h File Reference

Microchip Crypto Auth Device Data.

```
#include <stdint.h>
#include "atca_compiler.h"
```

Data Structures

- struct atsha204a_config_s
- struct atecc508a_config_s
- struct atecc608_config_s

Macros

- #define **ATCA_AES_ENABLE_EN_SHIFT** (0)
- #define **ATCA_AES_ENABLE_EN_MASK** (0x01u << ATCA_AES_ENABLE_EN_SHIFT)
- #define **ATCA_I2C_ENABLE_EN_SHIFT** (0)
- #define **ATCA_I2C_ENABLE_EN_MASK** (0x01u << ATCA_I2C_ENABLE_EN_SHIFT)
- #define **ATCA_COUNTER_MATCH_EN_SHIFT** (0)
- #define **ATCA_COUNTER_MATCH_EN_MASK** (0x01u << ATCA_COUNTER_MATCH_EN_SHIFT)
- #define **ATCA_COUNTER_MATCH_KEY_SHIFT** (4)
- #define **ATCA_COUNTER_MATCH_KEY_MASK** (0x0Fu << ATCA_COUNTER_MATCH_KEY_SHIFT)
- #define **ATCA_COUNTER_MATCH_KEY**(v) (ATCA_COUNTER_MATCH_KEY_MASK & (v << ATCA_COUNTER_MATCH_KEY_SHIFT))
- #define **ATCA_CHIP_MODE_I2C_EXTRA_SHIFT** (0)
- #define **ATCA_CHIP_MODE_I2C_EXTRA_MASK** (0x01u << ATCA_CHIP_MODE_I2C_EXTRA_SHIFT)
- #define **ATCA_CHIP_MODE_TTL_EN_SHIFT** (1)
- #define **ATCA_CHIP_MODE_TTL_EN_MASK** (0x01u << ATCA_CHIP_MODE_TTL_EN_SHIFT)
- #define **ATCA_CHIP_MODE_WDG_LONG_SHIFT** (2)
- #define **ATCA_CHIP_MODE_WDG_LONG_MASK** (0x01u << ATCA_CHIP_MODE_WDG_LONG_SHIFT)
- #define **ATCA_CHIP_MODE_CLK_DIV_SHIFT** (3)
- #define **ATCA_CHIP_MODE_CLK_DIV_MASK** (0x1Fu << ATCA_CHIP_MODE_CLK_DIV_SHIFT)
- #define **ATCA_CHIP_MODE_CLK_DIV**(v) (ATCA_CHIP_MODE_CLK_DIV_MASK & (v << ATCA_CHIP_MODE_CLK_DIV_SHIFT))
- #define **ATCA_SLOT_CONFIG_READKEY_SHIFT** (0)
- #define **ATCA_SLOT_CONFIG_READKEY_MASK** (0x0Fu << ATCA_SLOT_CONFIG_READKEY_SHIFT)
- #define **ATCA_SLOT_CONFIG_READKEY**(v) (ATCA_SLOT_CONFIG_READKEY_MASK & (v << ATCA_SLOT_CONFIG_READKEY_SHIFT))
- #define **ATCA_SLOT_CONFIG_NOMAC_SHIFT** (4)
- #define **ATCA_SLOT_CONFIG_NOMAC_MASK** (0x01u << ATCA_SLOT_CONFIG_NOMAC_SHIFT)
- #define **ATCA_SLOT_CONFIG_LIMITED_USE_SHIFT** (5)
- #define **ATCA_SLOT_CONFIG_LIMITED_USE_MASK** (0x01u << ATCA_SLOT_CONFIG_LIMITED_USE_SHIFT)
- #define **ATCA_SLOT_CONFIG_ENC_READ_SHIFT** (6)
- #define **ATCA_SLOT_CONFIG_ENC_READ_MASK** (0x01u << ATCA_SLOT_CONFIG_ENC_READ_SHIFT)
- #define **ATCA_SLOT_CONFIG_IS_SECRET_SHIFT** (7)
- #define **ATCA_SLOT_CONFIG_IS_SECRET_MASK** (0x01u << ATCA_SLOT_CONFIG_IS_SECRET_SHIFT)
- #define **ATCA_SLOT_CONFIG_WRITE_KEY_SHIFT** (8)
- #define **ATCA_SLOT_CONFIG_WRITE_KEY_MASK** ((uint32_t)0x0Fu << ATCA_SLOT_CONFIG_WRITE_KEY_SHIFT)
- #define **ATCA_SLOT_CONFIG_WRITE_KEY**(v) (ATCA_SLOT_CONFIG_WRITE_KEY_MASK & (v << ATCA_SLOT_CONFIG_WRITE_KEY_SHIFT))
- #define **ATCA_SLOT_CONFIG_WRITE_CONFIG_SHIFT** (12)
- #define **ATCA_SLOT_CONFIG_WRITE_CONFIG_MASK** (((uint32_t)0x0Fu << ATCA_SLOT_CONFIG_WRITE_CONFIG_SHIFT))
- #define **ATCA_SLOT_CONFIG_WRITE_CONFIG**(v) ((ATCA_SLOT_CONFIG_WRITE_CONFIG_MASK & ((uint32_t)(v) << ATCA_SLOT_CONFIG_WRITE_CONFIG_SHIFT)))
- #define **ATCA_SLOT_CONFIG_EXT_SIG_SHIFT** (0)
- #define **ATCA_SLOT_CONFIG_EXT_SIG_MASK** (0x01u << ATCA_SLOT_CONFIG_EXT_SIG_SHIFT)
- #define **ATCA_SLOT_CONFIG_INT_SIG_SHIFT** (1)
- #define **ATCA_SLOT_CONFIG_INT_SIG_MASK** (0x01u << ATCA_SLOT_CONFIG_INT_SIG_SHIFT)
- #define **ATCA_SLOT_CONFIG_ECDH_SHIFT** (2)
- #define **ATCA_SLOT_CONFIG_ECDH_MASK** (0x01u << ATCA_SLOT_CONFIG_ECDH_SHIFT)
- #define **ATCA_SLOT_CONFIG_WRITE_ECDH_SHIFT** (3)

- #define **ATCA_SLOT_CONFIG_WRITE_ECDH_MASK** (0x01u << ATCA_SLOT_CONFIG_WRITE_ECDH_SHIFT)
- #define **ATCA_SLOT_CONFIG_GEN_KEY_SHIFT** (8)
- #define **ATCA_SLOT_CONFIG_GEN_KEY_MASK** (0x01u << ATCA_SLOT_CONFIG_GEN_KEY_SHIFT)
- #define **ATCA_SLOT_CONFIG_PRIV_WRITE_SHIFT** (9)
- #define **ATCA_SLOT_CONFIG_PRIV_WRITE_MASK** (0x01u << ATCA_SLOT_CONFIG_PRIV_WRITE_SHIFT)
- #define **ATCA_USE_LOCK_ENABLE_SHIFT** (0)
- #define **ATCA_USE_LOCK_ENABLE_MASK** (0x0Fu << ATCA_USE_LOCK_ENABLE_SHIFT)
- #define **ATCA_USE_LOCK_KEY_SHIFT** (4)
- #define **ATCA_USE_LOCK_KEY_MASK** (0x0Fu << ATCA_USE_LOCK_KEY_SHIFT)
- #define **ATCA_VOL_KEY_PERM_SLOT_SHIFT** (0)
- #define **ATCA_VOL_KEY_PERM_SLOT_MASK** (0x0Fu << ATCA_VOL_KEY_PERM_SLOT_SHIFT)
- #define **ATCA_VOL_KEY_PERM_SLOT**(v) (ATCA_VOL_KEY_PERM_SLOT_MASK & (v << ATCA_VOL_KEY_PERM_SLOT_SHIFT))
- #define **ATCA_VOL_KEY_PERM_EN_SHIFT** (7)
- #define **ATCA_VOL_KEY_PERM_EN_MASK** (0x01u << ATCA_VOL_KEY_PERM_EN_SHIFT)
- #define **ATCA_SECURE_BOOT_MODE_SHIFT** (0)
- #define **ATCA_SECURE_BOOT_MODE_MASK** (0x03u << ATCA_SECURE_BOOT_MODE_SHIFT)
- #define **ATCA_SECURE_BOOT_MODE**(v) (ATCA_SECURE_BOOT_MODE_MASK & (v << ATCA_SECURE_BOOT_MODE_SHIFT))
- #define **ATCA_SECURE_BOOT_PERSIST_EN_SHIFT** (3)
- #define **ATCA_SECURE_BOOT_PERSIST_EN_MASK** (0x01u << ATCA_SECURE_BOOT_PERSIST_EN_SHIFT)
- #define **ATCA_SECURE_BOOT_RAND_NONCE_SHIFT** (4)
- #define **ATCA_SECURE_BOOT_RAND_NONCE_MASK** (0x01u << ATCA_SECURE_BOOT_RAND_NONCE_SHIFT)
- #define **ATCA_SECURE_BOOT_DIGEST_SHIFT** (8)
- #define **ATCA_SECURE_BOOT_DIGEST_MASK** (0x0Fu << ATCA_SECURE_BOOT_DIGEST_SHIFT)
- #define **ATCA_SECURE_BOOT_DIGEST**(v) (ATCA_SECURE_BOOT_DIGEST_MASK & (v << ATCA_SECURE_BOOT_DIGEST_SHIFT))
- #define **ATCA_SECURE_BOOT_PUB_KEY_SHIFT** (12)
- #define **ATCA_SECURE_BOOT_PUB_KEY_MASK** (0x0Fu << ATCA_SECURE_BOOT_PUB_KEY_SHIFT)
- #define **ATCA_SECURE_BOOT_PUB_KEY**(v) (ATCA_SECURE_BOOT_PUB_KEY_MASK & (v << ATCA_SECURE_BOOT_PUB_KEY_SHIFT))
- #define **ATCA_SLOT_LOCKED**(v) ((0x01 << v) & 0xFFFFu)
- #define **ATCA_CHIP_OPT_POST_EN_SHIFT** (0)
- #define **ATCA_CHIP_OPT_POST_EN_MASK** (0x01u << ATCA_CHIP_OPT_POST_EN_SHIFT)
- #define **ATCA_CHIP_OPT_IO_PROT_EN_SHIFT** (1)
- #define **ATCA_CHIP_OPT_IO_PROT_EN_MASK** (0x01u << ATCA_CHIP_OPT_IO_PROT_EN_SHIFT)
- #define **ATCA_CHIP_OPT_KDF_AES_EN_SHIFT** (2)
- #define **ATCA_CHIP_OPT_KDF_AES_EN_MASK** (0x01u << ATCA_CHIP_OPT_KDF_AES_EN_SHIFT)
- #define **ATCA_CHIP_OPT_ECDH_PROT_SHIFT** (8)
- #define **ATCA_CHIP_OPT_ECDH_PROT_MASK** (0x03u << ATCA_CHIP_OPT_ECDH_PROT_SHIFT)
- #define **ATCA_CHIP_OPT_ECDH_PROT**(v) (ATCA_CHIP_OPT_ECDH_PROT_MASK & (v << ATCA_CHIP_OPT_ECDH_PROT_SHIFT))
- #define **ATCA_CHIP_OPT_KDF_PROT_SHIFT** (10)
- #define **ATCA_CHIP_OPT_KDF_PROT_MASK** (0x03u << ATCA_CHIP_OPT_KDF_PROT_SHIFT)
- #define **ATCA_CHIP_OPT_KDF_PROT**(v) (ATCA_CHIP_OPT_KDF_PROT_MASK & (v << ATCA_CHIP_OPT_KDF_PROT_SHIFT))
- #define **ATCA_CHIP_OPT_IO_PROT_KEY_SHIFT** (12)
- #define **ATCA_CHIP_OPT_IO_PROT_KEY_MASK** ((uint16_t)0x0Fu << ATCA_CHIP_OPT_IO_PROT_KEY_SHIFT)
- #define **ATCA_CHIP_OPT_IO_PROT_KEY**(v) (ATCA_CHIP_OPT_IO_PROT_KEY_MASK & (v << ATCA_CHIP_OPT_IO_PROT_KEY_SHIFT))

- #define **ATCA_KEY_CONFIG_OFFSET**(x) (96UL + (x) * 2u)
- #define **ATCA_KEY_CONFIG_PRIVATE_SHIFT** (0)
- #define **ATCA_KEY_CONFIG_PRIVATE_MASK** (0x01u << ATCA_KEY_CONFIG_PRIVATE_SHIFT)
- #define **ATCA_KEY_CONFIG_PUB_INFO_SHIFT** (1)
- #define **ATCA_KEY_CONFIG_PUB_INFO_MASK** (0x01u << ATCA_KEY_CONFIG_PUB_INFO_SHIFT)
- #define **ATCA_KEY_CONFIG_KEY_TYPE_SHIFT** (2)
- #define **ATCA_KEY_CONFIG_KEY_TYPE_MASK** ((0x07u << ATCA_KEY_CONFIG_KEY_TYPE_SHIFT))
- #define **ATCA_KEY_CONFIG_KEY_TYPE**(v) ((ATCA_KEY_CONFIG_KEY_TYPE_MASK & ((v) << ATCA_KEY_CONFIG_KEY_TYPE_SHIFT)))
- #define **ATCA_KEY_CONFIG_LOCKABLE_SHIFT** (5)
- #define **ATCA_KEY_CONFIG_LOCKABLE_MASK** (0x01u << ATCA_KEY_CONFIG_LOCKABLE_SHIFT)
- #define **ATCA_KEY_CONFIG_REQ_RANDOM_SHIFT** (6)
- #define **ATCA_KEY_CONFIG_REQ_RANDOM_MASK** (0x01u << ATCA_KEY_CONFIG_REQ_←RANDOM_SHIFT)
- #define **ATCA_KEY_CONFIG_REQ_AUTH_SHIFT** (7)
- #define **ATCA_KEY_CONFIG_REQ_AUTH_MASK** (0x01u << ATCA_KEY_CONFIG_REQ_AUTH_SHIFT)
- #define **ATCA_KEY_CONFIG_AUTH_KEY_SHIFT** (8)
- #define **ATCA_KEY_CONFIG_AUTH_KEY_MASK** (0x0Fu << ATCA_KEY_CONFIG_AUTH_KEY_SHIFT)
- #define **ATCA_KEY_CONFIG_AUTH_KEY**(v) (ATCA_KEY_CONFIG_AUTH_KEY_MASK & (v << ATCA←_KEY_CONFIG_AUTH_KEY_SHIFT))
- #define **ATCA_KEY_CONFIG_PERSIST_DIS_SHIFT** (12)
- #define **ATCA_KEY_CONFIG_PERSIST_DIS_MASK** (0x01u << ATCA_KEY_CONFIG_PERSIST_DIS_←SHIFT)
- #define **ATCA_KEY_CONFIG_RFU_SHIFT** (13)
- #define **ATCA_KEY_CONFIG_RFU_MASK** (0x01u << ATCA_KEY_CONFIG_RFU_SHIFT)
- #define **ATCA_KEY_CONFIG_X509_ID_SHIFT** (14)
- #define **ATCA_KEY_CONFIG_X509_ID_MASK** (0x03u << ATCA_KEY_CONFIG_X509_ID_SHIFT)
- #define **ATCA_KEY_CONFIG_X509_ID**(v) (ATCA_KEY_CONFIG_X509_ID_MASK & (v << ATCA_KEY_←CONFIG_X509_ID_SHIFT))

Typedefs

- typedef struct ATCA_PACKED atsha204a_config_s **atsha204a_config_t**
- typedef struct ATCA_PACKED atecc508a_config_s **atecc508a_config_t**
- typedef struct ATCA_PACKED atecc608_config_s **atecc608_config_t**

23.84.1 Detailed Description

Microchip Crypto Auth Device Data.

Copyright

23.85 calib_ecdh.c File Reference

CryptoAuthLib Basic API methods for ECDH command.

```
#include "cryptoauthlib.h"
#include "host/atca_host.h"
```

23.85.1 Detailed Description

CryptoAuthLib Basic API methods for ECDH command.

The ECDH command implements the Elliptic Curve Diffie-Hellman algorithm to combine an internal private key with an external public key to calculate a shared secret.

Note

List of devices that support this command - ATECC508A, ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.86 calib_execution.c File Reference

Implements an execution handler that executes a given command on a device and returns the results.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS calib_get_execution_time (uint8_t opcode, ATCADevice device)

  return the typical execution time for the given command
- ATCA_STATUS **calib_execute_send** (ATCADevice device, uint8_t word_address, uint8_t ∗txdata, uint16_t txlength)
- ATCA_STATUS **calib_execute_receive** (ATCADevice device, uint8_t device_address, uint8_t ∗rxdata, uint16_t ∗rxlength)
- ATCA_STATUS calib_execute_command (ATCAPacket ∗packet, ATCADevice device)

  Wakes up device, sends the packet, waits for command completion, receives response, and puts the device into the idle state.

23.86.1 Detailed Description

Implements an execution handler that executes a given command on a device and returns the results.

This implementation wraps Polling and No polling (simple wait) schemes into a single method and use it across the library. Polling is used by default, however, by defining the ATCA_NO_POLL symbol the code will instead wait an estimated max execution time before requesting the result.

Copyright

23.86.2 Function Documentation

23.86.2.1 calib_execute_command()

```
ATCA_STATUS calib_execute_command (
            ATCAPacket ∗ packet,
            ATCADevice device )
```

Wakes up device, sends the packet, waits for command completion, receives response, and puts the device into the idle state.

Parameters

in,out	*packet*	As input, the packet to be sent. As output, the data buffer in the packet structure will contain the response.
in	*device*	CryptoAuthentication device to send the command to.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.86.2.2 calib_get_execution_time()

```
ATCA_STATUS calib_get_execution_time (
            uint8_t opcode,
            ATCADevice device )
```

return the typical execution time for the given command

Parameters

in	*opcode*	Opcode value of the command
in	*ca_cmd*	Command object for which the execution times are associated

Returns

ATCA_SUCCESS

23.87 calib_execution.h File Reference

Defines an execution handler that executes a given command on a device and returns the results.

```
#include "atca_status.h"
#include "calib_command.h"
#include "atca_device.h"
#include "atca_config.h"
```

Data Structures

- struct device_execution_time_t

  Structure to hold the device execution time and the opcode for the corresponding command.

Macros

- #define **ATCA_UNSUPPORTED_CMD** ((uint16_t)0xFFFF)
- #define **CALIB_SWI_FLAG_WAKE** 0x00

  flag preceding a command
- #define **CALIB_SWI_FLAG_CMD** 0x77

  flag preceding a command
- #define **CALIB_SWI_FLAG_TX** 0x88

  flag requesting a response
- #define **CALIB_SWI_FLAG_IDLE** 0xBB

  flag requesting to go into Idle mode
- #define **CALIB_SWI_FLAG_SLEEP** 0xCC

  flag requesting to go into Sleep mode

Functions

- ATCA_STATUS calib_get_execution_time (uint8_t opcode, ATCADevice device)

  return the typical execution time for the given command
- ATCA_STATUS **calib_execute_send** (ATCADevice device, uint8_t word_address, uint8_t ∗txdata, uint16_t txlength)
- ATCA_STATUS **calib_execute_receive** (ATCADevice device, uint8_t device_address, uint8_t ∗rxdata, uint16_t ∗rxlength)
- ATCA_STATUS calib_execute_command (ATCAPacket ∗packet, ATCADevice device)

  Wakes up device, sends the packet, waits for command completion, receives response, and puts the device into the idle state.

23.87.1 Detailed Description

Defines an execution handler that executes a given command on a device and returns the results.

The basic flow is to wake the device, send the command, wait/poll for completion, and finally receives the response from the device and does basic checks before returning to caller.

This handler supports the ATSHA and ATECC device family.

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23.87.2 Function Documentation

23.87.2.1 calib_execute_command()

```
ATCA_STATUS calib_execute_command (
            ATCAPacket * packet,
            ATCADevice device )
```

Wakes up device, sends the packet, waits for command completion, receives response, and puts the device into the idle state.

Parameters

in,out	*packet*	As input, the packet to be sent. As output, the data buffer in the packet structure will contain the response.
in	*device*	CryptoAuthentication device to send the command to.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.87.2.2 calib_get_execution_time()

```
ATCA_STATUS calib_get_execution_time (
            uint8_t opcode,
            ATCADevice device )
```

return the typical execution time for the given command

Parameters

in	*opcode*	Opcode value of the command
in	*ca_cmd*	Command object for which the execution times are associated

Returns

ATCA_SUCCESS

23.88 calib_gendig.c File Reference

CryptoAuthLib Basic API methods for GenDig command.

```
#include "cryptoauthlib.h"
```

23.88.1 Detailed Description

CryptoAuthLib Basic API methods for GenDig command.

The GenDig command uses SHA-256 to combine a stored value with the contents of TempKey, which must have been valid prior to the execution of this command.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.89 calib_genkey.c File Reference

CryptoAuthLib Basic API methods for GenKey command.

```
#include "cryptoauthlib.h"
```

23.89.1 Detailed Description

CryptoAuthLib Basic API methods for GenKey command.

The GenKey command is used for creating ECC private keys, generating ECC public keys, and for digest calculations involving public keys.

Note

List of devices that support this command - ATECC108A, ATECC508A, ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.90 calib_helpers.c File Reference

CryptoAuthLib Basic API - Helper Functions to.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS calib_ca2_is_config_locked (ATCADevice device, bool ∗is_locked)

  Executes Read command, which reads the configuration zone to see if the specified slot is locked.
- ATCA_STATUS calib_ca2_is_data_locked (ATCADevice device, bool ∗is_locked)

  Use Info command to check ECC204 Data zone lock status.
- ATCA_STATUS calib_ca2_is_locked (ATCADevice device, uint8_t zone, bool ∗is_locked)

  Use Info command to check config/data is locked or not.
- ATCADeviceType **calib_get_devicetype** (uint8_t revision[4])

  Parse the revision field to get the device type.
- ATCADeviceType **calib_get_devicetype_with_device_id** (uint8_t device_id, uint8_t device_revision)

23.90.1 Detailed Description

CryptoAuthLib Basic API - Helper Functions to.

Copyright

23.91 calib_hmac.c File Reference

CryptoAuthLib Basic API methods for HMAC command.

```
#include "cryptoauthlib.h"
```

23.91.1 Detailed Description

CryptoAuthLib Basic API methods for HMAC command.

The HMAC command computes an HMAC/SHA-256 digest using a key stored in the device over a challenge stored in the TempKey register, and/or other information stored within the device.

Note

List of devices that support this command - ATSHA204A, ATECC108A, and ATECC508A . There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.92 calib_info.c File Reference

CryptoAuthLib Basic API methods for Info command.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS calib_info_base (ATCADevice device, uint8_t mode, uint16_t param2, uint8_t ∗out_data)

  Issues an Info command, which return internal device information and can control GPIO and the persistent latch.
- ATCA_STATUS calib_info (ATCADevice device, uint8_t ∗revision)

  Use the Info command to get the device revision (DevRev).
- ATCA_STATUS calib_info_privkey_valid (ATCADevice device, uint16_t key_id, uint8_t ∗is_valid)

  Use Info command to check ECC Private key stored in key slot is valid or not.
- ATCA_STATUS calib_info_lock_status (ATCADevice device, uint16_t param2, uint8_t ∗is_locked)

  Use Info command to ECC204,TA010 config/data zone lock status.
- ATCA_STATUS calib_info_chip_status (ATCADevice device, uint8_t ∗chip_status)

  Use Info command to get ECC204,TA010,SHA10x chip status.

23.92.1 Detailed Description

CryptoAuthLib Basic API methods for Info command.

Info command returns a variety of static and dynamic information about the device and its state. Also is used to control the GPIO pin and the persistent latch.

Note

The ATSHA204A refers to this command as DevRev instead of Info, however, the OpCode and operation is the same.

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A & ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.93 calib_kdf.c File Reference

CryptoAuthLib Basic API methods for KDF command.

```
#include "cryptoauthlib.h"
```

23.93.1 Detailed Description

CryptoAuthLib Basic API methods for KDF command.

The KDF command implements one of a number of Key Derivation Functions (KDF). Generally this function combines a source key with an input string and creates a result key/digest/array. Three algorithms are currently supported: PRF, HKDF and AES.

Note

List of devices that support this command - ATECC608A/B. Refer to device datasheet for full details.

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23.94 calib_lock.c File Reference

CryptoAuthLib Basic API methods for Lock command.

```
#include "cryptoauthlib.h"
```

23.94.1 Detailed Description

CryptoAuthLib Basic API methods for Lock command.

The Lock command prevents future modifications of the Configuration zone, enables configured policies for Data and OTP zones, and can render individual slots read-only regardless of configuration.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.95 calib_mac.c File Reference

CryptoAuthLib Basic API methods for MAC command.

```
#include "cryptoauthlib.h"
```

23.95.1 Detailed Description

CryptoAuthLib Basic API methods for MAC command.

The MAC command computes a SHA-256 digest of a key stored in the device, a challenge, and other information on the device. The output of this command is the digest of this message.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.96 calib_nonce.c File Reference

CryptoAuthLib Basic API methods for Nonce command.

```
#include "cryptoauthlib.h"
```

23.96.1 Detailed Description

CryptoAuthLib Basic API methods for Nonce command.

The Nonce command generates a nonce for use by a subsequent commands of the device by combining an internally generated random number with an input value from the system.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.97 calib_packet.c File Reference

CryptoAuthLib API for packet allocation.

```
#include "cryptoauthlib.h"
#include "calib_packet.h"
```

Functions

- ATCAPacket * **calib_packet_alloc** (void)
- void **calib_packet_free** (ATCAPacket *packet)

23.97.1 Detailed Description

CryptoAuthLib API for packet allocation.

The APIs are used for allocating packets in heap or bss according to atcab heap availability. Corresponding memory free is done

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, ATECC608A/B

Copyright

23.98 calib_packet.h File Reference

Defines packet allocation functions.

```
#include "calib_command.h"
#include "atca_device.h"
#include "atca_config.h"
```

Functions

- ATCAPacket ∗ **calib_packet_alloc** (void)
- void **calib_packet_free** (ATCAPacket ∗packet)

23.98.1 Detailed Description

Defines packet allocation functions.

The APIs are used for allocating packets in heap or bss according to atcab heap availability. Corresponding memory free is done

This supports the ATECC device family.

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23.99 calib_privwrite.c File Reference

CryptoAuthLib Basic API methods for PrivWrite command.

```
#include "cryptoauthlib.h"
```

23.99.1 Detailed Description

CryptoAuthLib Basic API methods for PrivWrite command.

The PrivWrite command is used to write externally generated ECC private keys into the device.

Note

List of devices that support this command - ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.100 calib_random.c File Reference

CryptoAuthLib Basic API methods for Random command.

```
#include "cryptoauthlib.h"
```

23.100.1 Detailed Description

CryptoAuthLib Basic API methods for Random command.

The Random command generates a random number for use by the system.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.101 calib_read.c File Reference

CryptoAuthLib Basic API methods for Read command.

```
#include "cryptoauthlib.h"
```

23.101.1 Detailed Description

CryptoAuthLib Basic API methods for Read command.

The Read command reads words either 4-byte words or 32-byte blocks from one of the memory zones of the device. The data may optionally be encrypted before being returned to the system.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

Copyright

23.102 calib_secureboot.c File Reference

CryptoAuthLib Basic API methods for SecureBoot command.

```
#include "cryptoauthlib.h"
```

23.102.1 Detailed Description

CryptoAuthLib Basic API methods for SecureBoot command.

The SecureBoot command provides support for secure boot of an external MCU or MPU.

Note

List of devices that support this command - ATECC608A/B. Refer to device datasheet for full details.

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23.103 calib_selftest.c File Reference

CryptoAuthLib Basic API methods for SelfTest command.

```
#include "cryptoauthlib.h"
```

23.103.1 Detailed Description

CryptoAuthLib Basic API methods for SelfTest command.

The SelfTest command performs a test of one or more of the cryptographic engines within the device.

Note

List of devices that support this command - ATECC608A/B. Refer to device datasheet for full details.

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23.104 calib_sha.c File Reference

CryptoAuthLib Basic API methods for SHA command.

```
#include "cryptoauthlib.h"
```

23.104.1 Detailed Description

CryptoAuthLib Basic API methods for SHA command.

The SHA command Computes a SHA-256 or HMAC/SHA digest for general purpose use by the host system.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.105 calib_sign.c File Reference

CryptoAuthLib Basic API methods for Sign command.

```
#include "cryptoauthlib.h"
```

23.105.1 Detailed Description

CryptoAuthLib Basic API methods for Sign command.

The Sign command generates a signature using the private key in slot with ECDSA algorithm.

Note

List of devices that support this command - ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.106 calib_updateextra.c File Reference

CryptoAuthLib Basic API methods for UpdateExtra command.

```
#include "cryptoauthlib.h"
```

23.106.1 Detailed Description

CryptoAuthLib Basic API methods for UpdateExtra command.

The UpdateExtra command is used to update the values of the two extra bytes within the Configuration zone after the Configuration zone has been locked.

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.107 calib_verify.c File Reference

CryptoAuthLib Basic API methods for Verify command.

```
#include "cryptoauthlib.h"
#include "host/atca_host.h"
```

23.107.1 Detailed Description

CryptoAuthLib Basic API methods for Verify command.

The Verify command takes an ECDSA [R,S] signature and verifies that it is correctly generated given an input message digest and public key.

Note

List of devices that support this command - ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheet for full details.

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23.108 calib_write.c File Reference

CryptoAuthLib Basic API methods for Write command.

```
#include "cryptoauthlib.h"
#include "host/atca_host.h"
```

23.108.1 Detailed Description

CryptoAuthLib Basic API methods for Write command.

The Write command writes either one 4-byte word or a 32-byte block to one of the EEPROM zones on the device. Depending upon the value of the WriteConfig byte for a slot, the data may be required to be encrypted by the system prior to being sent to the device

Note

List of devices that support this command - ATSHA204A, ATECC108A, ATECC508A, and ATECC608A/B. There are differences in the modes that they support. Refer to device datasheets for full details.

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23.109 atca_crypto_hw_aes.h File Reference

AES CTR, CBC & CMAC structure definitions.

```
#include "cryptoauthlib.h"
#include "crypto_hw_config_check.h"
```

23.109.1 Detailed Description

AES CTR, CBC & CMAC structure definitions.

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23.110 atca_crypto_hw_aes_cbc.c File Reference

CryptoAuthLib Basic API methods for AES CBC mode.

```
#include "cryptoauthlib.h"
#include "atca_crypto_hw_aes.h"
```

23.110.1 Detailed Description

CryptoAuthLib Basic API methods for AES CBC mode.

The AES command supports 128-bit AES encryption or decryption of small messages or data packets in ECB mode.

Note

List of devices that support this command - ATECC608A, ATECC608B, & TA10x. Refer to device datasheet for full details.

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23.111 atca_crypto_hw_aes_cbcmac.c File Reference

CryptoAuthLib Basic API methods for AES CBC_MAC mode.

```
#include "cryptoauthlib.h"
#include "crypto_hw_config_check.h"
```

23.111.1 Detailed Description

CryptoAuthLib Basic API methods for AES CBC_MAC mode.

The AES command supports 128-bit AES encryption or decryption of small messages or data packets in ECB mode. Also can perform GFM (Galois Field Multiply) calculation in support of AES-GCM.

Note

List of devices that support this command - ATECC608A. Refer to device datasheet for full details.

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23.112 atca_crypto_hw_aes_ccm.c File Reference

CryptoAuthLib Basic API methods for AES CCM mode.

```
#include "cryptoauthlib.h"
```

23.112.1 Detailed Description

CryptoAuthLib Basic API methods for AES CCM mode.

The AES command supports 128-bit AES encryption or decryption of small messages or data packets in ECB mode. CCM mode provides security and authenticity to the message being processed.

Note

List of devices that support this command - ATECC608A. Refer to device datasheet for full details.

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23.113 atca_crypto_hw_aes_cmac.c File Reference

CryptoAuthLib Basic API methods for AES CBC_MAC mode.

```
#include "cryptoauthlib.h"
#include "atca_crypto_hw_aes.h"
```

23.113.1 Detailed Description

CryptoAuthLib Basic API methods for AES CBC_MAC mode.

The AES command supports 128-bit AES encryption or decryption of small messages or data packets in ECB mode.

Note

List of devices that support this command - ATECC608A, ATECC608B, & TA10x. Refer to device datasheet for full details.

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23.114 atca_crypto_hw_aes_ctr.c File Reference

CryptoAuthLib Basic API methods for AES CTR mode.

```
#include "cryptoauthlib.h"
#include "atca_crypto_hw_aes.h"
```

23.114.1 Detailed Description

CryptoAuthLib Basic API methods for AES CTR mode.

The AES command supports 128-bit AES encryption or decryption of small messages or data packets in ECB mode.

Note

List of devices that support this command - ATECC608A, ATECC608B, & TA100. Refer to device datasheet for full details.

Copyright

23.115 atca_crypto_pad.c File Reference

Implementation of PKCS7 Padding for block encryption.

```
#include "cryptoauthlib.h"
#include "atca_crypto_sw.h"
```

23.115.1 Detailed Description

Implementation of PKCS7 Padding for block encryption.

Copyright

23.116 atca_crypto_pbkdf2.c File Reference

Implementation of the PBKDF2 algorithm for use in generating password hashes.

```
#include "cryptoauthlib.h"
#include "cal_internal.h"
```

23.116.1 Detailed Description

Implementation of the PBKDF2 algorithm for use in generating password hashes.

Copyright

23.117 atca_crypto_sw.h File Reference

Common defines for CryptoAuthLib software crypto wrappers.

```
#include <stdint.h>
#include <stdlib.h>
#include "crypto/crypto_sw_config_check.h"
#include "atca_status.h"
```

Macros

- #define **ATCA_SHA1_DIGEST_SIZE** (20U)
- #define **ATCA_SHA2_256_DIGEST_SIZE** (32U)
- #define **ATCA_SHA2_256_BLOCK_SIZE** (64U)
- #define **ATCA_SHA2_384_DIGEST_SIZE** (48U)
- #define **ATCA_SHA2_384_BLOCK_SIZE** (128U)
- #define **ATCA_SHA2_512_DIGEST_SIZE** (64U)
- #define **ATCA_SHA2_512_BLOCK_SIZE** (128U)

23.117.1 Detailed Description

Common defines for CryptoAuthLib software crypto wrappers.

Copyright

23.118 atca_crypto_sw_aes_cmac.c File Reference

Common Wrapper for host side AES-CMAC implementations that feature update APIs rather than an all at once implementation.

```
#include "atca_crypto_sw.h"
```

23.118.1 Detailed Description

Common Wrapper for host side AES-CMAC implementations that feature update APIs rather than an all at once implementation.

Copyright

23.119 atca_crypto_sw_aes_gcm.c File Reference

Common Wrapper for host side AES-GCM implementations that feature update APIs rather than an all at once implementation.

```
#include "atca_crypto_sw.h"
```

23.119.1 Detailed Description

Common Wrapper for host side AES-GCM implementations that feature update APIs rather than an all at once implementation.

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23.120 atca_crypto_sw_sha1.c File Reference

Wrapper API for SHA 1 routines.

```
#include "atca_crypto_sw_sha1.h"
#include "hashes/sha1_routines.h"
#include "cryptoauthlib.h"
#include "cal_internal.h"
```

23.120.1 Detailed Description

Wrapper API for SHA 1 routines.

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23.121 atca_crypto_sw_sha1.h File Reference

Wrapper API for SHA 1 routines.

```
#include "atca_crypto_sw.h"
#include <stddef.h>
#include <stdint.h>
```

Functions

- ATCA_STATUS **atcac_sw_sha1** (const uint8_t ∗data, size_t data_size, uint8_t digest[(20U)])

23.121.1 Detailed Description

Wrapper API for SHA 1 routines.

Copyright

23.122 atca_crypto_sw_sha2.c File Reference

Wrapper API for software SHA 256 routines.

```
#include "cryptoauthlib.h"
#include "atca_crypto_sw_sha2.h"
#include "cal_internal.h"
```

23.122.1 Detailed Description

Wrapper API for software SHA 256 routines.

Copyright

23.123 atca_crypto_sw_sha2.h File Reference

Wrapper API for software SHA 256 routines.

```
#include "atca_crypto_sw.h"
#include <stddef.h>
#include <stdint.h>
```

Functions

- ATCA_STATUS **atcac_sha256_hmac_ctr_iteration** (struct atcac_hmac_ctx *ctx, uint8_t iteration, uint16_t length, const uint8_t *label, size_t label_len, const uint8_t *data, size_t data_len, uint8_t digest[(32U)])
- ATCA_STATUS **atcac_sha256_hmac_counter** (uint8_t *key, size_t key_len, const uint8_t *label, size_t label_len, const uint8_t *data, size_t data_len, uint8_t *digest, size_t diglen)

23.123.1 Detailed Description

Wrapper API for software SHA 256 routines.

Copyright

23.124 crypto_hw_config_check.h File Reference

Consistency checks for configuration options.

```
#include "atca_config_check.h"
#include "calib/calib_config_check.h"
#include "talib/talib_config_check.h"
```

Macros

- #define ATCAB_AES_EXTRAS_EN (CALIB_AES_EN || TALIB_AES_EN)
- #define **ATCAB_AES_RANDOM_IV_EN** (ATCA_HOSTLIB_EN || CALIB_RANDOM_EN || TALIB_↩ RANDOM_EN)
- #define ATCAB_AES_UPDATE_EN ATCAB_AES_EXTRAS_EN
- #define ATCAB_AES_CBC_ENCRYPT_EN ATCAB_AES_EXTRAS_EN
- #define ATCAB_AES_CBC_DECRYPT_EN ATCAB_AES_EXTRAS_EN
- #define **ATCAB_AES_CBC_UPDATE_EN** ATCAB_AES_UPDATE_EN
- #define ATCAB_AES_CBCMAC_EN ATCAB_AES_CBC_ENCRYPT_EN
- #define ATCAB_AES_CTR_EN ATCAB_AES_EXTRAS_EN
- #define ATCAB_AES_CTR_RAND_IV_EN (ATCAB_AES_CTR_EN && ATCAB_AES_RANDOM_IV_EN)
- #define ATCAB_AES_CCM_EN (ATCAB_AES_CBCMAC_EN && ATCAB_AES_CTR_EN)
- #define **ATCAB_AES_CCM_RAND_IV_EN** (ATCAB_AES_CCM_EN && ATCAB_AES_RANDOM_IV_EN)
- #define **ATCAB_AES_CMAC_EN** ATCAB_AES_CBC_ENCRYPT_EN
- #define **ATCAC_PKCS7_PAD_EN** ATCAB_AES_EXTRAS_EN

23.124.1 Detailed Description

Consistency checks for configuration options.

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23.124.2 Macro Definition Documentation

23.124.2.1 ATCAB_AES_CBC_DECRYPT_EN

```
#define ATCAB_AES_CBC_DECRYPT_EN ATCAB_AES_EXTRAS_EN
```

Requires: ATCAB_AES_EN

Enable ATCAB_AES_CBC_DECRYPT to decrypt a block of data using CBC mode and a key within the device. atcab_aes_cbc_init() should be called before the first use of this function

Supported API's: atcab_aes_cbc_decrypt_block, atcab_aes_cbc_init_ext, atcab_aes_cbc_init

23.124.2.2 ATCAB_AES_CBC_ENCRYPT_EN

```
#define ATCAB_AES_CBC_ENCRYPT_EN ATCAB_AES_EXTRAS_EN
```

Requires: ATCAB_AES_EN

Enable ATCAB_AES_CBC_ENCRYPT_EN to encrypt a block of data using CBC mode and a key within the device. atcab_aes_cbc_init() should be called before the first use of this function

Supported API's: atcab_aes_cbc_encrypt_block , atcab_aes_cbc_init_ext, atcab_aes_cbc_init

23.124.2.3 ATCAB_AES_CBCMAC_EN

```
#define ATCAB_AES_CBCMAC_EN ATCAB_AES_CBC_ENCRYPT_EN
```

Requires: ATCAB_AES_CBCMAC ATCAB_AES_CBC_ENCRYPT ATCAB_AES_MODE_ENCODING CALIB_AES_MODE_ENCODING CALIB_AES

Enable ATCAB_AES_CBCMAC to initialize context for AES CBC-MAC operation Enable ATCAB_AES_CBCMAC to calculate AES CBC-MAC with key stored within ECC608 device Enable ATCAB_AES_CBCMAC to finish a CBC-MAC operation returning the CBC-MAC value

Supported API's: atcab_aes_cbcmac_init_ext atcab_aes_cbcmac_init, atcab_aes_cbcmac_init_update, atcab_aes_cbcmac_finish

23.124.2.4 ATCAB_AES_CCM_EN

```
#define ATCAB_AES_CCM_EN (ATCAB_AES_CBCMAC_EN && ATCAB_AES_CTR_EN)
```

Requires: ATCAB_AES_EN ATCAB_AES_CTR_EN

Enable ATCAB_AES_CCM_EN to enable AES CCM operation

23.124.2.5 ATCAB_AES_CTR_EN

```
#define ATCAB_AES_CTR_EN ATCAB_AES_EXTRAS_EN
```

Requires: ATCAB_AES_EN

Enable ATCAB_AES_CTR_EN to support AES-CTR mode

23.124.2.6 ATCAB_AES_CTR_RAND_IV_EN

```
#define ATCAB_AES_CTR_RAND_IV_EN (ATCAB_AES_CTR_EN && ATCAB_AES_RANDOM_IV_EN)
```

Requires: ATCAB_AES_CTR_EN ATCAB_RANDOM_EN

Enable ATCAB_AES_CTR_RAND_IV_EN to initialize context for AES CTR operation with a random nonce and counter set to 0 as the IV, which is common when starting an encrypt operation

Supported API's: atcab_aes_ctr_init_rand_ext, atcab_aes_ctr_init_rand

23.124.2.7 ATCAB_AES_EXTRAS_EN

```
#define ATCAB_AES_EXTRAS_EN (CALIB_AES_EN || TALIB_AES_EN)
```

Automatically set base on other configuation options but can be overridden to disable all CBC, CBCMAC, CTR, & CCM modes at once rather than individually

23.124.2.8 ATCAB_AES_UPDATE_EN

```
#define ATCAB_AES_UPDATE_EN ATCAB_AES_EXTRAS_EN
```

Enable update/finalize APIs for block ciphers

23.125 crypto_sw_config_check.h File Reference

Consistency checks for configuration options.

```
#include "atca_config_check.h"
```

Macros

- #define ATCAC_SHA1_EN (DEFAULT_ENABLED)
- #define ATCAC_SHA256_EN (FEATURE_ENABLED)
- #define ATCAC_SHA384_EN (FEATURE_DISABLED)
- #define ATCAC_SHA512_EN (FEATURE_DISABLED)
- #define **ATCAC_SHA256_HMAC_EN** ATCAC_SHA256_EN
- #define **ATCAC_SHA256_HMAC_CTR_EN** ATCAC_SHA256_HMAC_EN
- #define ATCAC_RANDOM_EN ATCA_HOSTLIB_EN
- #define ATCAC_VERIFY_EN ATCA_HOSTLIB_EN
- #define ATCAC_SIGN_EN ATCA_HOSTLIB_EN
- #define ATCA_CRYPTO_SHA1_EN (ATCAC_SHA1_EN && !ATCA_HOSTLIB_EN)
- #define ATCA_CRYPTO_SHA256_EN ((ATCAC_SHA256_EN) && !ATCA_HOSTLIB_EN)
- #define ATCA_CRYPTO_SHA384_EN ((ATCAC_SHA384_EN) && !ATCA_HOSTLIB_EN)
- #define ATCA_CRYPTO_SHA512_EN ((ATCAC_SHA512_EN) && !ATCA_HOSTLIB_EN)
- #define ATCA_CRYPTO_SHA2_EN (ATCA_CRYPTO_SHA256_EN || ATCA_CRYPTO_SHA384_EN || ATCA_CRYPTO_SHA512_EN)
- #define ATCA_CRYPTO_SHA2_HMAC_EN (ATCAC_SHA256_HMAC_EN && !ATCA_HOSTLIB_EN)
- #define ATCA_CRYPTO_SHA2_HMAC_CTR_EN ATCAC_SHA256_HMAC_CTR_EN
- #define ATCAC_PBKDF2_SHA256_EN ATCAC_SHA256_HMAC_EN
- #define ATCAB_PBKDF2_SHA256_EN (CALIB_SHA_HMAC_EN || TALIB_SHA_HMAC_EN)
- #define ATCAC_AES_GCM_EN (ATCA_HOSTLIB_EN)
- #define ATCA_CRYPTO_AES_GCM_EN (!ATCA_HOSTLIB_EN)
- #define ATCAC_AES_CMAC_EN (ATCA_HOSTLIB_EN)
- #define ATCA_CRYPTO_AES_CMAC_EN (!ATCA_HOSTLIB_EN)

23.125.1 Detailed Description

Consistency checks for configuration options.

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23.125.2 Macro Definition Documentation

23.125.2.1 ATCA_CRYPTO_AES_CMAC_EN

```
#define ATCA_CRYPTO_AES_CMAC_EN (!ATCA_HOSTLIB_EN)
```

Enable ATCA_CRYPTO_AES_CMAC_EN to enable AES CMAC host side api

23.125.2.2 ATCA_CRYPTO_AES_GCM_EN

```
#define ATCA_CRYPTO_AES_GCM_EN (!ATCA_HOSTLIB_EN)
```

Enable ATCA_CRYPTO_AES_GCM_EN to enable AES GCM host side api

23.125.2.3 ATCA_CRYPTO_SHA1_EN

```
#define ATCA_CRYPTO_SHA1_EN (ATCAC_SHA1_EN && !ATCA_HOSTLIB_EN)
```

Enable ATCAC_SHA1_EN to enable sha1 host side api

Supported API's: atcab_write

23.125.2.4 ATCA_CRYPTO_SHA256_EN

```
#define ATCA_CRYPTO_SHA256_EN ((ATCAC_SHA256_EN) && !ATCA_HOSTLIB_EN)
```

Enable ATCA_CRYPTO_SHA256_EN to enable SHA2 host side api

23.125.2.5 ATCA_CRYPTO_SHA2_EN

```
#define ATCA_CRYPTO_SHA2_EN (ATCA_CRYPTO_SHA256_EN || ATCA_CRYPTO_SHA384_EN || ATCA_CRYPTO_SHA512_EN)
```

Enable ATCAC_SHA2_EN to enable sha2 host side api

23.125.2.6 ATCA_CRYPTO_SHA2_HMAC_CTR_EN

```
#define ATCA_CRYPTO_SHA2_HMAC_CTR_EN ATCAC_SHA256_HMAC_CTR_EN
```

Requires: ATCAC_SHA256_HMAC_EN

Enable ATCAC_SHA256_HMAC_COUNTER to implement SHA256 HMAC-Counter per NIST SP 800-108 used for KDF like operations

Supported API's: atcac_sha256_hmac_counter

23.125.2.7 ATCA_CRYPTO_SHA2_HMAC_EN

```
#define ATCA_CRYPTO_SHA2_HMAC_EN (ATCAC_SHA256_HMAC_EN && !ATCA_HOSTLIB_EN)
```

Requires: ATCAC_SHA256_EN

Enable ATCAC_SHA256_HMAC to initialize context for performing HMAC (sha256) in software

Supported API's: atcac_sha256_hmac_init, atcac_sha256_hmac_update, atcac_sha256_hmac_finish

23.125.2.8 ATCA_CRYPTO_SHA384_EN

```
#define ATCA_CRYPTO_SHA384_EN ((ATCAC_SHA384_EN) && !ATCA_HOSTLIB_EN)
```

Enable ATCA_CRYPTO_SHA384_EN to enable SHA384 host side api

23.125.2.9 ATCA_CRYPTO_SHA512_EN

```
#define ATCA_CRYPTO_SHA512_EN ((ATCAC_SHA512_EN) && !ATCA_HOSTLIB_EN)
```

Enable ATCA_CRYPTO_SHA512_EN to enable SHA2512 host side api

23.125.2.10 ATCAB_PBKDF2_SHA256_EN

```
#define ATCAB_PBKDF2_SHA256_EN (CALIB_SHA_HMAC_EN || TALIB_SHA_HMAC_EN)
```

Requires: CALIB_SHA_HMAC_EN

Enable ATCAB_PBKDF2_SHA256_EN to calculate a PBKDF2 password hash using a stored key inside a device. The key length is determined by the device being used. ECCx08: 32 bytes, TA100: 16-64 bytes

Supported API's: atcab_pbkdf2_256, atcab_pbkdf2_256_ext

23.125.2.11 ATCAC_AES_CMAC_EN

```
#define ATCAC_AES_CMAC_EN (ATCA_HOSTLIB_EN)
```

Indicates if this module is a provider of an AES-CMAC implementation

23.125.2.12 ATCAC_AES_GCM_EN

```
#define ATCAC_AES_GCM_EN (ATCA_HOSTLIB_EN)
```

Indicates if this module is a provider of an AES-GCM implementation

23.125.2.13 ATCAC_PBKDF2_SHA256_EN

```
#define ATCAC_PBKDF2_SHA256_EN ATCAC_SHA256_HMAC_EN
```

Requires: ATCAC_SHA256_EN ATCAC_SHA256_HMAC_EN

Enable ATCAC_PBKDF2_SHA256_EN to calculate a PBKDF2 hash of a given password and salt

Supported API's: atcac_pbkdf2_256

23.125.2.14 ATCAC_RANDOM_EN

```
#define ATCAC_RANDOM_EN ATCA_HOSTLIB_EN
```

Requires: ATCA_HOSTLIB_EN

Enable ATCAC_RANDOM_EN get random numbers from the host's implementation - generally assumed to come from the host's cryptographic library or peripheral driver

23.125.2.15 ATCAC_SHA1_EN

```
#define ATCAC_SHA1_EN (DEFAULT_ENABLED)
```

Enable ATCAC_SHA1_EN to enable sha1 host side api

Supported API's: atcab_write

23.125.2.16 ATCAC_SHA256_EN

```
#define ATCAC_SHA256_EN (FEATURE_ENABLED)
```

Enable ATCAC_SHA256_EN to enable sha256 host side api

23.125.2.17 ATCAC_SHA384_EN

```
#define ATCAC_SHA384_EN (FEATURE_DISABLED)
```

Enable ATCAC_SHA384_EN to enable sha384 host side api

Disabled by default. Enable ATCAC_SHA512_EN to use SHA384

23.125.2.18 ATCAC_SHA512_EN

```
#define ATCAC_SHA512_EN (FEATURE_DISABLED)
```

Enable ATCAC_SHA512_EN to enable sha512 host side api

Disabled by default. Use FEATURE_ENABLED to enable this feature

23.125.2.19 ATCAC_SIGN_EN

```
#define ATCAC_SIGN_EN ATCA_HOSTLIB_EN
```

Requires: ATCA_HOSTLIB_EN

Enable ATCAC_SIGN_EN to use the host's sign functions. Generally assumed to come from the host's cryptographic library or peripheral driver.

23.125.2.20 ATCAC_VERIFY_EN

```
#define ATCAC_VERIFY_EN ATCA_HOSTLIB_EN
```

Requires: ATCA_HOSTLIB_EN

Enable ATCAC_VERIFY_EN to use the host's verify functions. Generally assumed to come from the host's cryptographic library or peripheral driver.

23.126 sha1_routines.c File Reference

Software implementation of the SHA1 algorithm.

```
#include "sha1_routines.h"
#include <string.h>
#include "atca_compiler.h"
#include "cryptoauthlib.h"
```

23.126.1 Detailed Description

Software implementation of the SHA1 algorithm.

Copyright

23.127 sha1_routines.h File Reference

Software implementation of the SHA1 algorithm.

```
#include "atca_compiler.h"
#include <stdio.h>
#include <stdlib.h>
#include <stddef.h>
#include <stdint.h>
```

Data Structures

- struct CL_HashContext

Macros

- #define **U8** uint8_t
- #define **U16** uint16_t
- #define **U32** uint32_t
- #define **memcpy_P** memmove
- #define **strcpy_P** strcpy
- #define **_WDRESET**()
- #define **_NOP**()
- #define **leftRotate**(x, n) (x) = (((x) << (n)) | ((x) >> (32 - (n))))

Functions

- void **shaEngine** (uint32_t *buf, uint32_t *h)
- void **CL_hashInit** (CL_HashContext *ctx)
- void **CL_hashUpdate** (CL_HashContext *ctx, const uint8_t *src, int nbytes)
- void **CL_hashFinal** (CL_HashContext *ctx, uint8_t *dest)
- void **CL_hash** (uint8_t *msg, int msgBytes, uint8_t *dest)

23.127.1 Detailed Description

Software implementation of the SHA1 algorithm.

Copyright

23.128 sha2_routines.c File Reference

Software implementation of the SHA256, SHA384 and SHA512 algorithm.

```
#include "cryptoauthlib.h"
#include "sha2_routines.h"
```

Macros

- #define **rotate_right**(value, places) (((value) >> (places)) | ((value) << (32U - (places))))
- #define **rotate_right_64bit**(value, places) (((value) >> (places)) | ((value) << (64U - (places))))

23.128.1 Detailed Description

Software implementation of the SHA256, SHA384 and SHA512 algorithm.

Copyright

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23.129 sha2_routines.h File Reference

Software implementation of the SHA256, SHA384 and SHA512 algorithm.

```
#include <stdint.h>
```

Macros

- #define **SHA256_DIGEST_SIZE** (32U)
- #define **SHA512_DIGEST_SIZE** (64U)
- #define **SHA384_DIGEST_SIZE** (48U)
- #define **SHA256_BLOCK_SIZE** (64U)
- #define **SHA384_BLOCK_SIZE** (128U)
- #define **SHA512_BLOCK_SIZE** (128U)

23.129.1 Detailed Description

Software implementation of the SHA256, SHA384 and SHA512 algorithm.

Copyright

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23.130 cryptoauthlib.h File Reference

Single aggregation point for all CryptoAuthLib header files.

```
#include <stdio.h>
#include <stdint.h>
#include <stddef.h>
#include <stdlib.h>
#include <string.h>
#include <stdarg.h>
#include "atca_config_check.h"
#include "atca_compiler.h"
#include "atca_version.h"
#include "atca_platform.h"
#include "atca_status.h"
#include "atca_debug.h"
#include "cal_buffer.h"
#include "atca_iface.h"
#include "atca_device.h"
#include "atca_helpers.h"
#include "hal/atca_hal.h"
#include "atca_cfgs.h"
#include "calib/calib_basic.h"
#include "calib/calib_command.h"
#include "calib/calib_aes_gcm.h"
#include "calib/calib_packet.h"
#include "talib/talib_status.h"
#include "talib/talib_basic.h"
#include "atca_basic.h"
```

Macros

- #define ATCA_SHA256_BLOCK_SIZE (64u)
- #define **ATCA_SHA256_DIGEST_SIZE** (32u)
- #define **ATCA_SHA384_BLOCK_SIZE** (128u)
- #define **ATCA_SHA384_DIGEST_SIZE** (48u)
- #define **ATCA_SHA512_BLOCK_SIZE** (128u)
- #define **ATCA_SHA512_DIGEST_SIZE** (64u)
- #define **ATCA_AES128_BLOCK_SIZE** (16u)
- #define **ATCA_AES128_KEY_SIZE** (16)
- #define **ATCA_AES256_BLOCK_SIZE** (16u)
- #define **ATCA_AES256_KEY_SIZE** (32u)
- #define **ATCA_ECCP256_MSG_SIZE** (32u)
- #define **ATCA_KEY_TYPE_ECCP256** (0u)
- #define **ATCA_ECCP256_KEY_SIZE** (32u)
- #define **ATCA_ECCP256_PUBKEY_SIZE** (64u)
- #define **ATCA_ECCP256_PVTKEY_SIZE** (32u)
- #define **ATCA_ECCP256_SIG_SIZE** (64u)
- #define **ATCA_ECCP256_OID_SIZE** (10u)
- #define **ATCA_ECCP256_ASN1_HDR_SIZE** (27u)
- #define **ATCA_MAX_ECC_RSA_PB_KEY_SIZE** (512u)
- #define **ATCA_RSA4K_ASN1_HDR_SIZE** (33u)
- #define **ATCA_ECC_UNCOMPRESSED_TYPE** ((uint8_t)0x04)
- #define **ATCA_ECC_UNCOMPRESSED_TYPE_OFFSET** (1u)

- #define **ATCA_ZONE_CONFIG** ((uint8_t)0x00)
- #define **ATCA_ZONE_OTP** ((uint8_t)0x01)
- #define **ATCA_ZONE_DATA** ((uint8_t)0x02)
- #define **DEVICE_PRODUCT_ID_LOCATION** 0
- #define **DEVICE_IDENTIFIER_LOCATION** 1
- #define **DEVICE_PART_LOCATION** 2
- #define **DEVICE_REVISION_LOCATION** 3
- #define **ATCA_ZONE_CA2_DATA** ((uint8_t)0x00)
- #define **ATCA_ZONE_CA2_CONFIG** ((uint8_t)0x01)
- #define **ATCA_ECC204_DEVICE_ID** ((uint8_t)0x5A)
- #define **ATCA_TA010_DEVICE_ID** ((uint8_t)0x6A)
- #define **ATCA_SHA104_DEVICE_ID** ((uint8_t)0x35)
- #define **ATCA_SHA105_DEVICE_ID** ((uint8_t)0x3B)
- #define SHA_MODE_TARGET_TEMPKEY ((uint8_t)0x00)
- #define SHA_MODE_TARGET_MSGDIGBUF ((uint8_t)0x40)
- #define SHA_MODE_TARGET_OUT_ONLY ((uint8_t)0xC0)
- #define **ATCA_STRINGIFY**(x) #x
- #define **ATCA_TOSTRING**(x) ATCA_STRINGIFY(x)
- #define **ATCA_TRACE**(s, m) atca_trace(s)

23.130.1 Detailed Description

Single aggregation point for all CryptoAuthLib header files.

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23.130.2 Macro Definition Documentation

23.130.2.1 ATCA_SHA256_BLOCK_SIZE

```
#define ATCA_SHA256_BLOCK_SIZE (64u)
```

Library Configuration File - All build attributes should be included in atca_config.h

23.130.2.2 SHA_MODE_TARGET_MSGDIGBUF

```
#define SHA_MODE_TARGET_MSGDIGBUF ((uint8_t)0x40)
```

Place resulting digest both in Output buffer and Message Digest Buffer

23.130.2.3 SHA_MODE_TARGET_OUT_ONLY

```
#define SHA_MODE_TARGET_OUT_ONLY ((uint8_t)0xC0)
```

Place resulting digest both in Output buffer ONLY

23.130.2.4 SHA_MODE_TARGET_TEMPKEY

```
#define SHA_MODE_TARGET_TEMPKEY ((uint8_t)0x00)
```

Place resulting digest both in Output buffer and TempKey

23.131 atca_hal.c File Reference

low-level HAL - methods used to setup indirection to physical layer interface. this level does the dirty work of abstracting the higher level ATCAIFace methods from the low-level physical interfaces. Its main goal is to keep low-level details from bleeding into the logical interface implemetation.

```
#include "cryptoauthlib.h"
#include "atca_hal.h"
```

Data Structures

- struct atca_hal_list_entry_t

  Structure that holds the hal/phy maping for different interface types.

Functions

- ATCA_STATUS hal_iface_register_hal (ATCAIfaceType iface_type, ATCAHAL_t *hal, ATCAHAL_t **old_hal, ATCAHAL_t *phy, ATCAHAL_t **old_phy)

  Register/Replace a HAL with a.
- ATCA_STATUS hal_iface_init (ATCAIfaceCfg *cfg, ATCAHAL_t **hal, ATCAHAL_t **phy)

  Standard HAL API for ATCA to initialize a physical interface.
- ATCA_STATUS hal_iface_release (ATCAIfaceType iface_type, void *hal_data)

  releases a physical interface, HAL knows how to interpret hal_data
- ATCA_STATUS hal_check_wake (const uint8_t *response, int response_size)

  Utility function for hal_wake to check the reply.
- uint8_t hal_is_command_word (uint8_t word_address)

  Utility function for hal_wake to check the reply.

23.131.1 Detailed Description

low-level HAL - methods used to setup indirection to physical layer interface. this level does the dirty work of abstracting the higher level ATCAIFace methods from the low-level physical interfaces. Its main goal is to keep low-level details from bleeding into the logical interface implemetation.

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23.132 atca_hal.h File Reference

low-level HAL - methods used to setup indirection to physical layer interface

```
#include <stdlib.h>
#include "atca_config.h"
#include "atca_status.h"
#include "atca_iface.h"
```

Data Structures

- struct atca_hal_kit_phy_t
- struct atca_hal_shm_t

Macros

- #define **ATCA_POLLING_INIT_TIME_MSEC** 1
- #define **ATCA_POLLING_FREQUENCY_TIME_MSEC** 2
- #define **ATCA_POLLING_MAX_TIME_MSEC** 2500
- #define **ATCA_HAL_CONTROL_WAKE** (0U)

  Execute the hardware specific wake - generally only for kits.
- #define **ATCA_HAL_CONTROL_IDLE** (1U)

  Execute the hardware specific idle - generally only for kits.
- #define **ATCA_HAL_CONTROL_SLEEP** (2U)

  Execute the hardware specific sleep - generally only for kits.
- #define **ATCA_HAL_CONTROL_RESET** (3U)

  Execute the hardware specific reset - generally only for kits.
- #define **ATCA_HAL_CONTROL_SELECT** (4U)

  Select the device - assert CS, open device, etc.
- #define **ATCA_HAL_CONTROL_DESELECT** (5U)

  Select the device - de-assert CS, release device, etc.
- #define **ATCA_HAL_CHANGE_BAUD** (6U)

  Change the datarate of the phy.
- #define **ATCA_HAL_FLUSH_BUFFER** (7U)

  If the phy has a buffer make sure all bytes are transmitted.
- #define **ATCA_HAL_CONTROL_DIRECTION** (8U)

  Set the PIN mode (in vs out)

Typedefs

- typedef void ∗ **hal_mutex_t**

  Generic mutex type definition for most systems.

Functions

- ATCA_STATUS hal_iface_init (ATCAIfaceCfg *cfg, ATCAHAL_t **hal, ATCAHAL_t **phy)

  Standard HAL API for ATCA to initialize a physical interface.
- ATCA_STATUS hal_iface_release (ATCAIfaceType iface_type, void *hal_data)

  releases a physical interface, HAL knows how to interpret hal_data
- ATCA_STATUS hal_check_wake (const uint8_t *response, int response_size)

  Utility function for hal_wake to check the reply.
- void atca_delay_ms (uint32_t ms)

  Timer API for legacy implementations.
- void atca_delay_us (uint32_t delay)

  This function delays for a number of microseconds.
- void hal_delay_ms (uint32_t delay)

  Timer API implemented at the HAL level.
- void hal_delay_us (uint32_t delay)

  This function delays for a number of microseconds.
- ATCA_STATUS hal_create_mutex (void **ppMutex, const char *pName)

  Optional hal interfaces.
- ATCA_STATUS **hal_init_mutex** (void *pMutex, bool shared)
- ATCA_STATUS **hal_destroy_mutex** (void *pMutex)
- ATCA_STATUS **hal_lock_mutex** (void *pMutex)
- ATCA_STATUS **hal_unlock_mutex** (void *pMutex)
- ATCA_STATUS **hal_alloc_shared** (void **pShared, size_t size, const char *pName, bool *initialized)
- ATCA_STATUS **hal_free_shared** (void *pShared, size_t size)
- ATCA_STATUS hal_iface_register_hal (ATCAIfaceType iface_type, ATCAHAL_t *hal, ATCAHAL_t **old_hal, ATCAHAL_t *phy, ATCAHAL_t **old_phy)

  Register/Replace a HAL with a.
- uint8_t hal_is_command_word (uint8_t word_address)

  Utility function for hal_wake to check the reply.

23.132.1 Detailed Description

low-level HAL - methods used to setup indirection to physical layer interface

Copyright

23.133 hal_all_platforms_kit_hidapi.c File Reference

HAL for kit protocol over HID for any platform.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include "hidapi.h"
#include "atca_hal.h"
#include "hal/kit_protocol.h"
```

Functions

- ATCA_STATUS hal_kit_hid_init (ATCAIface iface, ATCAIfaceCfg *cfg)

  HAL implementation of Kit USB HID init.
- ATCA_STATUS hal_kit_hid_post_init (ATCAIface iface)

  HAL implementation of Kit HID post init.
- ATCA_STATUS hal_kit_hid_send (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)

  HAL implementation of kit protocol send over USB HID.
- ATCA_STATUS hal_kit_hid_receive (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)

  HAL implementation of send over USB HID.
- ATCA_STATUS hal_kit_hid_control (ATCAIface iface, uint8_t option, void *param, size_t paramlen)

  Perform control operations for the kit protocol.
- ATCA_STATUS hal_kit_hid_release (void *hal_data)

  Close the physical port for HID.

23.133.1 Detailed Description

HAL for kit protocol over HID for any platform.

Copyright

23.134 hal_freertos.c File Reference

FreeRTOS Hardware/OS Abstration Layer.

```
#include "atca_hal.h"
#include "FreeRTOS.h"
#include "semphr.h"
#include "task.h"
```

Macros

- #define **ATCA_MUTEX_TIMEOUT** portMAX_DELAY

Functions

- void * **hal_malloc** (size_t size)
- void **hal_free** (void *ptr)
- void hal_rtos_delay_ms (uint32_t delay)

  This function delays for a number of milliseconds.
- ATCA_STATUS hal_create_mutex (void **ppMutex, const char *pName)

  Optional hal interfaces.
- ATCA_STATUS **hal_destroy_mutex** (void *pMutex)
- ATCA_STATUS **hal_lock_mutex** (void *pMutex)
- ATCA_STATUS **hal_unlock_mutex** (void *pMutex)

23.134.1 Detailed Description

FreeRTOS Hardware/OS Abstration Layer.

Copyright

23.135 hal_gpio_harmony.c File Reference

ATCA Hardware abstraction layer for GPIO.

```
#include "atca_hal.h"
```

Functions

- ATCA_STATUS hal_gpio_init (ATCAIface iface, ATCAIfaceCfg *cfg)

  Initialize a gpio interface using given config.
- ATCA_STATUS hal_gpio_post_init (ATCAIface iface)

  Post Init for gpio hal.
- ATCA_STATUS hal_gpio_send (ATCAIface iface, uint8_t word_address, uint8_t *pin_state, int unused_param)

  Set the state of the pin.
- ATCA_STATUS hal_gpio_receive (ATCAIface iface, uint8_t word_address, uint8_t *pin_state, uint16_t *unused_param)

  Read the state of the pin.
- ATCA_STATUS **hal_gpio_control** (ATCAIface iface, uint8_t option, void *param, size_t paramlen)
- ATCA_STATUS hal_gpio_release (void *hal_data)

  Release and clean up the HAL.

23.135.1 Detailed Description

ATCA Hardware abstraction layer for GPIO.

Copyright

23.135.2 Function Documentation

23.135.2.1 hal_gpio_init()

```
ATCA_STATUS hal_gpio_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

Initialize a gpio interface using given config.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.135.2.2 hal_gpio_post_init()

```
ATCA_STATUS hal_gpio_post_init (
            ATCAIface iface )
```

Post Init for gpio hal.

Returns

ATCA_SUCCESS

23.135.2.3 hal_gpio_receive()

```
ATCA_STATUS hal_gpio_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * pin_state,
            uint16_t * unused_param )
```

Read the state of the pin.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

iface	Interface context
word_address	Unused parameter
pin_state	Pin state to output
unused_param	Unused parameter

23.135.2.4 hal_gpio_release()

```
ATCA_STATUS hal_gpio_release (
            void * hal_data )
```

Release and clean up the HAL.

Parameters

in	*hal_data*	opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS

23.135.2.5 hal_gpio_send()

```
ATCA_STATUS hal_gpio_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * pin_state,
            int unused_param )
```

Set the state of the pin.

Returns

ATCA_SUCCESS

Parameters

iface	Interface context
word_address	Unused parameter
pin_state	Pin state to output
unused_param	Unused parameter

23.136 hal_i2c_harmony.c File Reference

ATCA Hardware abstraction layer for SAMD21 I2C over Harmony PLIB.

```
#include <string.h>
#include <stdio.h>
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS hal_i2c_discover_buses (int i2c_buses[ ], int max_buses)

  discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-prior knowledge
- ATCA_STATUS hal_i2c_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int ∗found)

  discover any CryptoAuth devices on a given logical bus number
- ATCA_STATUS hal_i2c_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.
- ATCA_STATUS hal_i2c_post_init (ATCAIface iface)

  HAL implementation of I2C post init.
- ATCA_STATUS hal_i2c_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of I2C send over START.
- ATCA_STATUS hal_i2c_receive (ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of I2C receive function for START I2C.
- ATCA_STATUS change_i2c_speed (ATCAIface iface, uint32_t speed)

  method to change the bus speec of I2C
- ATCA_STATUS hal_i2c_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Perform control operations for the kit protocol.
- ATCA_STATUS hal_i2c_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.136.1 Detailed Description

ATCA Hardware abstraction layer for SAMD21 I2C over Harmony PLIB.

This code is structured in two parts. Part 1 is the connection of the ATCA HAL API to the physical I2C implementation. Part 2 is the Harmony I2C primitives to set up the interface.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

Copyright

23.137 hal_i2c_start.c File Reference

ATCA Hardware abstraction layer for SAMD21 I2C over START drivers.

```
#include <string.h>
#include <stdio.h>
#include <atmel_start.h>
#include <hal_gpio.h>
#include <hal_delay.h>
#include "hal_i2c_start.h"
#include "atca_start_config.h"
#include "atca_start_iface.h"
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS hal_i2c_discover_buses (int i2c_buses[ ], int max_buses)

  discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-prior knowledge
- ATCA_STATUS hal_i2c_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int ∗found)

  discover any CryptoAuth devices on a given logical bus number
- ATCA_STATUS hal_i2c_init (void ∗hal, ATCAIfaceCfg ∗cfg)

  hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.
- ATCA_STATUS hal_i2c_post_init (ATCAIface iface)

  HAL implementation of I2C post init.
- ATCA_STATUS hal_i2c_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of I2C send over START.
- ATCA_STATUS hal_i2c_receive (ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of I2C receive function for START I2C.
- ATCA_STATUS hal_i2c_wake (ATCAIface iface)

  wake up CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_idle (ATCAIface iface)

  idle CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_sleep (ATCAIface iface)

  sleep CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.137.1 Detailed Description

ATCA Hardware abstraction layer for SAMD21 I2C over START drivers.

This code is structured in two parts. Part 1 is the connection of the ATCA HAL API to the physical I2C implementation. Part 2 is the START I2C primitives to set up the interface.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

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23.138 hal_i2c_start.h File Reference

ATCA Hardware abstraction layer for SAMD21 I2C over START drivers.

```
#include "atmel_start.h"
#include <stdlib.h>
#include "cryptoauthlib.h"
```

Data Structures

- struct i2c_start_instance

Typedefs

- typedef void(∗ **start_change_baudrate**) (ATCAIface iface, uint32_t speed)
- typedef struct i2c_start_instance **i2c_start_instance_t**

23.138.1 Detailed Description

ATCA Hardware abstraction layer for SAMD21 I2C over START drivers.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

Copyright

23.139 hal_kit_bridge.c File Reference

Kit Bridging HAL for cryptoauthlib. This is not intended to be a zero copy driver. It should work with any interface that confirms to a few basic requirements: a) will accept an arbitrary number of bytes and packetize it if necessary for transmission, b) will block for the duration of the transmit.

```
#include "cryptoauthlib.h"
#include "atca_hal.h"
#include "hal_kit_bridge.h"
```

Functions

- ATCA_STATUS hal_kit_attach_phy (ATCAIfaceCfg ∗cfg, atca_hal_kit_phy_t ∗phy)

  Helper function that connects a physical layer context structure that will be used by the kit protocol bridge.
- ATCA_STATUS hal_kit_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  HAL implementation of Kit USB HID init.
- ATCA_STATUS hal_kit_post_init (ATCAIface iface)

  HAL implementation of Kit HID post init.
- ATCA_STATUS hal_kit_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of kit protocol send over USB HID.
- ATCA_STATUS hal_kit_receive (ATCAIface iface, uint8_t word_address, uint8_t ∗rxdata, uint16_t ∗rxsize)

  HAL implementation of send over USB HID.
- ATCA_STATUS hal_kit_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Kit Protocol Control.
- ATCA_STATUS hal_kit_release (void ∗hal_data)

  Close the physical port for HID.

23.139.1 Detailed Description

Kit Bridging HAL for cryptoauthlib. This is not intended to be a zero copy driver. It should work with any interface that confirms to a few basic requirements: a) will accept an arbitrary number of bytes and packetize it if necessary for transmission, b) will block for the duration of the transmit.

23.140 hal_kit_bridge.h File Reference

Kit Bridging HAL for cryptoauthlib. This is not intended to be a zero copy driver. It should work with any interface that confirms to a few basic requirements: a) will accept an arbitrary number of bytes and packetize it if necessary for transmission, b) will block for the duration of the transmit.

Macros

- #define **BRIDGE_PROTOCOL_VERSION** (2)
- #define **HAL_KIT_COMMAND_SEND** 0x01
- #define **HAL_KIT_COMMAND_RECV** 0x02
- #define **HAL_KIT_COMMAND_WAKE** 0x03
- #define **HAL_KIT_COMMAND_IDLE** 0x04
- #define **HAL_KIT_COMMAND_SLEEP** 0x05
- #define **HAL_KIT_HEADER_LEN** (3)

Functions

- ATCA_STATUS hal_kit_attach_phy (ATCAIfaceCfg ∗cfg, atca_hal_kit_phy_t ∗phy)

  Helper function that connects a physical layer context structure that will be used by the kit protocol bridge.

23.140.1 Detailed Description

Kit Bridging HAL for cryptoauthlib. This is not intended to be a zero copy driver. It should work with any interface that confirms to a few basic requirements: a) will accept an arbitrary number of bytes and packetize it if necessary for transmission, b) will block for the duration of the transmit.

23.141 hal_linux.c File Reference

Timer Utility Functions for Linux.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <stdint.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>
#include <errno.h>
#include "atca_hal.h"
```

Functions

- void hal_delay_us (uint32_t delay)

    This function delays for a number of microseconds.
- void hal_delay_ms (uint32_t delay)

    Timer API implemented at the HAL level.
- ATCA_STATUS hal_create_mutex (void **ppMutex, const char *pName)

    Optional hal interfaces.
- ATCA_STATUS **hal_destroy_mutex** (void *pMutex)
- ATCA_STATUS **hal_lock_mutex** (void *pMutex)
- ATCA_STATUS **hal_unlock_mutex** (void *pMutex)
- ATCA_STATUS **hal_check_pid** (hal_pid_t pid)

    Check if the pid exists in the system.

23.141.1 Detailed Description

Timer Utility Functions for Linux.

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23.142 hal_linux_i2c_userspace.c File Reference

ATCA Hardware abstraction layer for Linux using I2C.

```
#include <cryptoauthlib.h>
#include <linux/i2c-dev.h>
#include <unistd.h>
#include <sys/ioctl.h>
#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>
#include <errno.h>
#include <string.h>
#include <stdint.h>
#include <stdio.h>
#include <stdlib.h>
#include <limits.h>
#include "atca_hal.h"
```

Data Structures

- struct atca_i2c_host_s

Typedefs

- typedef struct atca_i2c_host_s **atca_i2c_host_t**

Functions

- ATCA_STATUS hal_i2c_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.
- ATCA_STATUS hal_i2c_post_init (ATCAIface iface)

  HAL implementation of I2C post init.
- ATCA_STATUS hal_i2c_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of I2C send over START.
- ATCA_STATUS hal_i2c_receive (ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of I2C receive function for START I2C.
- ATCA_STATUS hal_i2c_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Perform control operations for the kit protocol.
- ATCA_STATUS hal_i2c_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.142.1 Detailed Description

ATCA Hardware abstraction layer for Linux using I2C.

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23.143 hal_linux_uart_userspace.c File Reference

ATCA Hardware abstraction layer for Linux using UART.

```
#include "cryptoauthlib.h"
#include "atca_hal.h"
#include <unistd.h>
#include <fcntl.h>
#include <sys/ioctl.h>
#include <termios.h>
```

Data Structures

- struct atca_uart_host_s

Typedefs

- typedef struct atca_uart_host_s **atca_uart_host_t**

Functions

- ATCA_STATUS hal_uart_init (ATCAIface iface, ATCAIfaceCfg *cfg)

  HAL implementation of UART init.
- ATCA_STATUS hal_uart_post_init (ATCAIface iface)

  HAL implementation of UART post init.
- ATCA_STATUS hal_uart_send (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)

  HAL implementation of UART send.
- ATCA_STATUS hal_uart_receive (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)

  HAL implementation of UART receive function.
- ATCA_STATUS hal_uart_control (ATCAIface iface, uint8_t option, void *param, size_t paramlen)

  Perform control operations for the UART.
- ATCA_STATUS hal_uart_release (void *hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.143.1 Detailed Description

ATCA Hardware abstraction layer for Linux using UART.

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23.143.2 Function Documentation

23.143.2.1 hal_uart_control()

```
ATCA_STATUS hal_uart_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations for the UART.

Parameters

in	*iface*	Interface to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.143.2.2 hal_uart_init()

```
ATCA_STATUS hal_uart_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

HAL implementation of UART init.

this implementation assumes UART SERIAL PORT peripheral has been enabled by user . It only initialize an UART interface using given config.

Parameters

in	*hal*	pointer to HAL specific data that is maintained by this HAL
in	*cfg*	pointer to HAL specific configuration data that is used to initialize this HAL

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.143.2.3 hal_uart_post_init()

```
ATCA_STATUS hal_uart_post_init (
            ATCAIface iface )
```

HAL implementation of UART post init.

Parameters

in	*iface*	instance

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.143.2.4 hal_uart_receive()

```
ATCA_STATUS hal_uart_receive (
            ATCAIface iface,
```

```
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

HAL implementation of UART receive function.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.143.2.5 hal_uart_release()

```
ATCA_STATUS hal_uart_release (
            void * hal_data )
```

manages reference count on given bus and releases resource if no more refences exist

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.143.2.6 hal_uart_send()

```
ATCA_STATUS hal_uart_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of UART send.

Parameters

in	*iface*	instance
in	*word_address*	transaction type
in	*txdata*	data to be send to device
in	*txdata*	pointer to space to bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.144 hal_sam0_i2c_asf.c File Reference

ATCA Hardware abstraction layer for SAMD21 I2C over ASF drivers.

```
#include <asf.h>
#include <string.h>
#include <stdio.h>
#include "hal_sam0_i2c_asf.h"
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS hal_i2c_discover_buses (int i2c_buses[ ], int max_buses)
  discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-prior knowledge
- ATCA_STATUS hal_i2c_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int ∗found)
  discover any CryptoAuth devices on a given logical bus number
- ATCA_STATUS hal_i2c_init (void ∗hal, ATCAIfaceCfg ∗cfg)
  hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.
- ATCA_STATUS hal_i2c_post_init (ATCAIface iface)
  HAL implementation of I2C post init.
- ATCA_STATUS hal_i2c_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)
  HAL implementation of I2C send over START.
- ATCA_STATUS hal_i2c_receive (ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength)
  HAL implementation of I2C receive function for START I2C.
- ATCA_STATUS hal_i2c_wake (ATCAIface iface)
  wake up CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_idle (ATCAIface iface)
  idle CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_sleep (ATCAIface iface)
  sleep CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_release (void ∗hal_data)
  manages reference count on given bus and releases resource if no more refences exist

23.144.1 Detailed Description

ATCA Hardware abstraction layer for SAMD21 I2C over ASF drivers.

This code is structured in two parts. Part 1 is the connection of the ATCA HAL API to the physical I2C implementation. Part 2 is the ASF I2C primitives to set up the interface.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

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23.145 hal_sam0_i2c_asf.h File Reference

ATCA Hardware abstraction layer for SAMD21 I2C over ASF drivers.

```
#include <asf.h>
#include "cryptoauthlib.h"
```

Data Structures

- struct i2c_sam0_instance

Typedefs

- typedef void(∗ **sam0_change_baudrate**) (ATCAIface iface, uint32_t speed)
- typedef struct i2c_sam0_instance **i2c_sam0_instance_t**

23.145.1 Detailed Description

ATCA Hardware abstraction layer for SAMD21 I2C over ASF drivers.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

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23.146 hal_sam_i2c_asf.c File Reference

ATCA Hardware abstraction layer for SAM flexcom & twi I2C over ASF drivers.

```
#include <asf.h>
#include <string.h>
#include <stdio.h>
#include "cryptoauthlib.h"
#include "hal_sam_i2c_asf.h"
```

Functions

- ATCA_STATUS hal_i2c_discover_buses (int i2c_buses[ ], int max_buses)

  discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-prior knowledge
- ATCA_STATUS hal_i2c_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int ∗found)

  discover any CryptoAuth devices on a given logical bus number
- ATCA_STATUS hal_i2c_init (void ∗hal, ATCAIfaceCfg ∗cfg)

  hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.
- ATCA_STATUS hal_i2c_post_init (ATCAIface iface)

  HAL implementation of I2C post init.
- ATCA_STATUS hal_i2c_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of I2C send over START.
- ATCA_STATUS hal_i2c_receive (ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of I2C receive function for START I2C.
- ATCA_STATUS hal_i2c_wake (ATCAIface iface)

  wake up CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_idle (ATCAIface iface)

  idle CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_sleep (ATCAIface iface)

  sleep CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.146.1 Detailed Description

ATCA Hardware abstraction layer for SAM flexcom & twi I2C over ASF drivers.

This code is structured in two parts. Part 1 is the connection of the ATCA HAL API to the physical I2C implementation. Part 2 is the ASF I2C primitives to set up the interface.

Prerequisite: add "TWI - Two-Wire Interface (Common API) (service)" module to application in Atmel Studio

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23.147 hal_sam_i2c_asf.h File Reference

ATCA Hardware abstraction layer for SAMG55 I2C over ASF drivers.

```
#include <asf.h>
#include "cryptoauthlib.h"
```

Data Structures

- struct i2c_sam_instance

Typedefs

- typedef void(∗ **sam_change_baudrate**) (ATCAIface iface, uint32_t speed)
- typedef struct i2c_sam_instance **i2c_sam_instance_t**

23.147.1 Detailed Description

ATCA Hardware abstraction layer for SAMG55 I2C over ASF drivers.

Prerequisite: add "TWI - Two-Wire Interface (Common API) (service)" module to application in Atmel Studio

Copyright

23.148 hal_sam_timer_asf.c File Reference

ATCA Hardware abstraction layer for SAMD21 timer/delay over ASF drivers.

```
#include <asf.h>
#include <delay.h>
#include "atca_hal.h"
```

Functions

- void atca_delay_10us (uint32_t delay)

  This function delays for a number of tens of microseconds.
- void atca_delay_us (uint32_t delay)

  This function delays for a number of microseconds.
- void atca_delay_ms (uint32_t ms)

  Timer API for legacy implementations.

23.148.1 Detailed Description

ATCA Hardware abstraction layer for SAMD21 timer/delay over ASF drivers.

Copyright

23.149 hal_spi_harmony.c File Reference

ATCA Hardware abstraction layer for SPI over Harmony PLIB.

```
#include <string.h>
#include <stdio.h>
#include "atca_config.h"
#include "cryptoauthlib.h"
#include "atca_hal.h"
#include "atca_device.h"
#include "definitions.h"
#include "talib/talib_defines.h"
#include "talib/talib_fce.h"
```

Functions

- ATCA_STATUS hal_spi_discover_buses (int spi_buses[ ], int max_buses)

  discover spi buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge
- ATCA_STATUS hal_spi_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int ∗found)

  discover any TA10x devices on a given logical bus number
- ATCA_STATUS hal_spi_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  initialize an SPI interface using given config
- ATCA_STATUS hal_spi_post_init (ATCAIface iface)

  HAL implementation of SPI post init.
- ATCA_STATUS hal_spi_select (ATCAIface iface)

  HAL implementation to assert the device chip select.
- ATCA_STATUS hal_spi_deselect (ATCAIface iface)

  HAL implementation to deassert the device chip select.
- ATCA_STATUS hal_spi_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of SPI send over Harmony.
- ATCA_STATUS hal_spi_receive (ATCAIface iface, uint8_t word_address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of SPI receive function for HARMONY SPI.
- ATCA_STATUS hal_spi_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Perform control operations for the kit protocol.
- ATCA_STATUS hal_spi_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.149.1 Detailed Description

ATCA Hardware abstraction layer for SPI over Harmony PLIB.

This code is structured in two parts. Part 1 is the connection of the ATCA HAL API to the physical SPI implementation. Part 2 is the Harmony SPI primitives to set up the interface.

Prerequisite: add SERCOM SPI Master Interrupt support to application in Mplab Harmony 3

Copyright

23.150 hal_swi_gpio.c File Reference

ATCA Hardware abstraction layer for 1WIRE or SWI over GPIO.

```
#include "cryptoauthlib.h"
#include "hal_swi_gpio.h"
```

Functions

- ATCA_STATUS hal_swi_gpio_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  initialize an GPIO interface using given config
- ATCA_STATUS hal_swi_gpio_post_init (ATCAIface iface)

  HAL implementation of GPIO post init.
- ATCA_STATUS hal_swi_gpio_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of bit banging send over Harmony.
- ATCA_STATUS hal_swi_gpio_receive (ATCAIface iface, uint8_t word_address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of bit banging receive from HARMONY.
- ATCA_STATUS hal_swi_gpio_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Perform control operations.
- ATCA_STATUS hal_swi_gpio_release (void ∗hal_data)

  releases resource if no more communication

23.150.1 Detailed Description

ATCA Hardware abstraction layer for 1WIRE or SWI over GPIO.

Copyright

23.150.2 Function Documentation

23.150.2.1 hal_swi_gpio_control()

```
ATCA_STATUS hal_swi_gpio_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations.

Parameters

in	*iface*	Interface to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.150.2.2 hal_swi_gpio_init()

```
ATCA_STATUS hal_swi_gpio_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

initialize an GPIO interface using given config

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.150.2.3 hal_swi_gpio_post_init()

```
ATCA_STATUS hal_swi_gpio_post_init (
            ATCAIface iface )
```

HAL implementation of GPIO post init.

Parameters

in	*iface*	ATCAIface instance

Returns

ATCA_SUCCESS

23.150.2.4 hal_swi_gpio_receive()

```
ATCA_STATUS hal_swi_gpio_receive (
            ATCAIface iface,
```

```
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

HAL implementation of bit banging receive from HARMONY.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.150.2.5 hal_swi_gpio_release()

```
ATCA_STATUS hal_swi_gpio_release (
            void * hal_data )
```

releases resource if no more communication

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.150.2.6 hal_swi_gpio_send()

```
ATCA_STATUS hal_swi_gpio_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of bit banging send over Harmony.

Parameters

in	*iface*	instance
in	*word_address*	device transaction type
in	*txdata*	pointer to space to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.151 hal_swi_gpio.h File Reference

ATCA Hardware abstraction layer for SWI over GPIO drivers.

```
#include <stdlib.h>
#include "cryptoauthlib.h"
#include "atca_status.h"
#include "atca_hal.h"
#include "atca_config.h"
```

Macros

Macros for Bit-Banged 1WIRE Timing

Times to drive bits at 230.4 kbps.

- #define **tPUP** 0
- #define **tDSCHG** 150
- #define **tRESET** 96
- #define **tRRT** 1
- #define **tDRR** 1
- #define **tMSDR** 2
- #define **tHTSS** 150
- #define **tDACK** 2
- #define **tDACK_DLY** atca_delay_us(tDACK)
- #define **tRRT_DLY** atca_delay_ms(tRRT)
- #define **tDRR_DLY** atca_delay_us(tDRR)
- #define **tMSDR_DLY** atca_delay_us(tMSDR)
- #define **tDSCHG_DLY** atca_delay_us(tDSCHG)
- #define **tRESET_DLY** atca_delay_us(tRESET)
- #define **tHTSS_DLY** atca_delay_us(tHTSS)
- #define **tLOW0_MIN** 6
- #define **tLOW0_MAX** 16
- #define **tLOW1_MIN** 1
- #define **tLOW1_MAX** 2
- #define **tRCV_MIN** 4
- #define **tRCV_MAX** 6
- #define **tBIT_MIN** (tLOW0_MIN + tPUP + tRCV_MIN)
- #define **tBIT_MAX** 75
- #define **tWAKEUP** 1
- #define **tLOW0_TYPICAL** (tLOW0_MIN + ((tLOW0_MAX - tLOW0_MIN) / 2))
- #define **tLOW1_TYPICAL** (tLOW1_MIN + ((tLOW1_MAX - tLOW1_MIN) / 2))
- #define **tBIT_TYPICAL** (tBIT_MIN + ((tBIT_MAX - tBIT_MIN) / 2))
- #define **tLOW0_HDLY** atca_delay_us(11)
- #define **tRD_HDLY** atca_delay_us(1)
- #define **tLOW1_HDLY** atca_delay_us(1)
- #define **tRCV0_HDLY** atca_delay_us(11)
- #define **tRCV1_HDLY** atca_delay_us(14)
- #define **tRD_DLY** atca_delay_us(1)
- #define **tHIGH_SPEED_DLY** atca_delay_us(1)
- #define **tSWIN_DLY** atca_delay_us(1)
- #define **tLOW0_DLY** atca_delay_us(tLOW0_TYPICAL)
- #define **tLOW1_DLY** atca_delay_us(tLOW1_TYPICAL)
- #define **tBIT_DLY** atca_delay_us(tBIT_TYPICAL)
- #define **tRCV0_DLY** atca_delay_us(tBIT_TYPICAL - tLOW0_TYPICAL)

- #define **tRCV1_DLY** atca_delay_us(tBIT_TYPICAL - tLOW1_TYPICAL)
- #define **send_logic0_1wire**(...) send_logic_bit(__VA_ARGS__, ATCA_GPIO_LOGIC_BIT0)
- #define **send_logic1_1wire**(...) send_logic_bit(__VA_ARGS__, ATCA_GPIO_LOGIC_BIT1)
- #define **send_ACK_1wire**(...) send_logic0_1wire(__VA_ARGS__)
- #define **send_NACK_1wire**(...) send_logic1_1wire(__VA_ARGS__)
- #define **ATCA_1WIRE_RESET_WORD_ADDR** 0x00
- #define **ATCA_1WIRE_SLEEP_WORD_ADDR** 0x01
- #define **ATCA_1WIRE_SLEEP_WORD_ADDR_ALTERNATE** 0x02
- #define **ATCA_1WIRE_COMMAND_WORD_ADDR** 0x03
- #define **ATCA_1WIRE_RESPONSE_LENGTH_SIZE** 0x01
- #define **ATCA_1WIRE_BIT_MASK** 0x80
- #define **ATCA_GPIO_WRITE** 0
- #define **ATCA_GPIO_READ** 1
- #define **ATCA_GPIO_INPUT_DIR** 0
- #define **ATCA_GPIO_OUTPUT_DIR** 1
- #define **ATCA_GPIO_LOGIC_BIT0** 0
- #define **ATCA_GPIO_LOGIC_BIT1** 1
- #define **ATCA_GPIO_ACK** ATCA_GPIO_LOGIC_BIT0
- #define **ATCA_GPIO_CLEAR** 0
- #define **ATCA_GPIO_SET** 1
- #define **ATCA_MIN_RESPONSE_LENGTH** 4
- #define **PIN_INPUT_DIR**(pin) PORT_GroupInputEnable(GET_PORT_GROUP(pin), GET_PIN_↩ MASK(pin))
- #define **PIN_OUTPUT_DIR**(pin) PORT_GroupOutputEnable(GET_PORT_GROUP(pin), GET_PIN_↩ MASK(pin))

Macros for Bit-Banged SWI Timing

Times to drive bits at 230.4 kbps.

- #define BIT_DELAY_1L atca_delay_us(4)
- #define **BIT_DELAY_1H** atca_delay_us(4)

  should be 4.34 us, is 4.05us
- #define BIT_DELAY_5 atca_delay_us(26)
- #define BIT_DELAY_7 atca_delay_us(34)
- #define RX_TX_DELAY atca_delay_us(65)
- #define ATCA_SWI_WAKE_WORD_ADDR ((uint8_t)0x00)
- #define **ATCA_SWI_CMD_WORD_ADDR** ((uint8_t)0x77)
- #define **ATCA_SWI_TX_WORD_ADDR** ((uint8_t)0x88)
- #define **ATCA_SWI_IDLE_WORD_ADDR** ((uint8_t)0xBB)
- #define **ATCA_SWI_SLEEP_WORD_ADDR** ((uint8_t)0xCC)
- #define **ATCA_SWI_BIT_MASK** 0x01
- enum **protocol_type** { **ATCA_PROTOCOL_1WIRE** , **ATCA_PROTOCOL_SWI** , **NO_OF_PROTOCOL** }
- enum **delay_type** {
  LOGIC0_1 , **LOGIC0_2** , **LOGIC0_3** , **LOGIC0_4** ,
  LOGIC1_1 , **LOGIC1_2** , **NO_OF_DELAYS** }

23.151.1 Detailed Description

ATCA Hardware abstraction layer for SWI over GPIO drivers.

Copyright

23.151.2 Macro Definition Documentation

23.151.2.1 ATCA_SWI_WAKE_WORD_ADDR

```
#define ATCA_SWI_WAKE_WORD_ADDR ((uint8_t)0x00)
```

SWI WORD Address

23.151.2.2 BIT_DELAY_1L

```
#define BIT_DELAY_1L atca_delay_us(4)
```

delay macro for width of one pulse (start pulse or zero pulse) should be 4.34 us, is 4.05 us

23.151.2.3 BIT_DELAY_5

```
#define BIT_DELAY_5 atca_delay_us(26)
```

time to keep pin high for five pulses plus stop bit (used to bit-bang CryptoAuth 'zero' bit) should be 26.04 us, is 26.92 us

23.151.2.4 BIT_DELAY_7

```
#define BIT_DELAY_7 atca_delay_us(34)
```

time to keep pin high for seven bits plus stop bit (used to bit-bang CryptoAuth 'one' bit) should be 34.72 us, is 35.13 us

23.151.2.5 RX_TX_DELAY

```
#define RX_TX_DELAY atca_delay_us(65)
```

turn around time when switching from receive to transmit should be 93 us (Setting little less value as there would be other process before these steps)

23.152 hal_swi_uart.c File Reference

ATCA Hardware abstraction layer for SWI over UART drivers.

```
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS hal_swi_init (ATCAIface iface, ATCAIfaceCfg *cfg)
  initialize an SWI interface using given config
- ATCA_STATUS hal_swi_post_init (ATCAIface iface)
  HAL implementation of SWI post init.
- ATCA_STATUS hal_swi_send (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)
  HAL implementation of SWI send command over UART.
- ATCA_STATUS hal_swi_receive (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)
  HAL implementation of SWI receive function over UART.
- ATCA_STATUS hal_swi_wake (ATCAIface iface)
  Send Wake flag via SWI.
- ATCA_STATUS hal_swi_sleep (ATCAIface iface)
  Send Sleep flag via SWI.
- ATCA_STATUS hal_swi_idle (ATCAIface iface)
  Send Idle flag via SWI.
- ATCA_STATUS hal_swi_control (ATCAIface iface, uint8_t option, void *param, size_t paramlen)
  Perform control operations for the kit protocol.
- ATCA_STATUS hal_swi_release (void *hal_data)
  manages reference count on given bus and releases resource if no more refences exist

23.152.1 Detailed Description

ATCA Hardware abstraction layer for SWI over UART drivers.

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23.153 hal_timer_start.c File Reference

ATCA Hardware abstraction layer for SAMD21 I2C over START drivers.

```
#include <hal_delay.h>
#include "atca_hal.h"
```

Functions

- void atca_delay_us (uint32_t delay)
  This function delays for a number of microseconds.
- void atca_delay_10us (uint32_t delay)
  This function delays for a number of tens of microseconds.
- void atca_delay_ms (uint32_t ms)
  Timer API for legacy implementations.

23.153.1 Detailed Description

ATCA Hardware abstraction layer for SAMD21 I2C over START drivers.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

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23.154 hal_uart_harmony.c File Reference

ATCA Hardware abstraction layer for SWI uart over Harmony PLIB.

```
#include "atca_config.h"
#include "cryptoauthlib.h"
```

Functions

- ATCA_STATUS hal_uart_init (ATCAIface iface, ATCAIfaceCfg *cfg)
  Initialize an uart interface using given config.
- ATCA_STATUS hal_uart_post_init (ATCAIface iface)
  HAL implementation of SWI post init.
- ATCA_STATUS hal_uart_send (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)
  Send byte(s) via SWI.
- ATCA_STATUS hal_uart_receive (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxlength)
  Receive byte(s) via SWI.
- ATCA_STATUS **hal_uart_control** (ATCAIface iface, uint8_t option, void *param, size_t paramlen)
- ATCA_STATUS hal_uart_release (void *hal_data)
  Manages reference count on given bus and releases resource if no more reference(s) exist.

Variables

- PLIB_SWI_SERIAL_SETUP serial_setup

23.154.1 Detailed Description

ATCA Hardware abstraction layer for SWI uart over Harmony PLIB.

This code is structured in two parts. Part 1 is the connection of the ATCA HAL API to the physical I2C implementation. Part 2 is the Harmony UART (ring buffer mode) primitives to set up the interface.

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23.154.2 Function Documentation

23.154.2.1 hal_uart_init()

```
ATCA_STATUS hal_uart_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

Initialize an uart interface using given config.

Parameters

in	*hal*	opaque pointer to HAL data
in	*cfg*	interface configuration

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.154.2.2 hal_uart_post_init()

```
ATCA_STATUS hal_uart_post_init (
            ATCAIface iface )
```

HAL implementation of SWI post init.

Parameters

in	*iface*	ATCAIface instance

Returns

ATCA_SUCCESS

23.154.2.3 hal_uart_receive()

```
ATCA_STATUS hal_uart_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

Receive byte(s) via SWI.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.154.2.4 hal_uart_release()

```
ATCA_STATUS hal_uart_release (
            void * hal_data )
```

Manages reference count on given bus and releases resource if no more reference(s) exist.

Parameters

in	*hal_data*	opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS

23.154.2.5 hal_uart_send()

```
ATCA_STATUS hal_uart_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

Send byte(s) via SWI.

Parameters

in	*iface*	interface of the logical device to send data to
in	*word_address*	device transaction type
in	*txdata*	pointer to bytes to send
in	*txlength*	number of bytes to send

Returns

ATCA_SUCCESS

23.154.3 Variable Documentation

23.154.3.1 serial_setup

```
PLIB_SWI_SERIAL_SETUP serial_setup
```

Initial value:
```
= {
    .parity    = PLIB_SWI_PARITY_NONE,
    .dataWidth = PLIB_SWI_DATA_WIDTH,
    .stopBits  = PLIB_SWI_STOP_BIT
}
```

23.155 hal_uc3_i2c_asf.c File Reference

ATCA Hardware abstraction layer for SAMV71 I2C over ASF drivers.

```
#include <asf.h>
#include <string.h>
#include <stdio.h>
#include "cryptoauthlib.h"
#include "hal_uc3_i2c_asf.h"
```

Functions

- ATCA_STATUS hal_i2c_discover_buses (int i2c_buses[ ], int max_buses)

  discover i2c buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-prior knowledge
- ATCA_STATUS hal_i2c_discover_devices (int bus_num, ATCAIfaceCfg cfg[ ], int ∗found)

  discover any CryptoAuth devices on a given logical bus number
- ATCA_STATUS hal_i2c_init (void ∗hal, ATCAIfaceCfg ∗cfg)

  hal_i2c_init manages requests to initialize a physical interface. it manages use counts so when an interface has released the physical layer, it will disable the interface for some other use. You can have multiple ATCAIFace instances using the same bus, and you can have multiple ATCAIFace instances on multiple i2c buses, so hal_i2c_init manages these things and ATCAIFace is abstracted from the physical details.
- ATCA_STATUS hal_i2c_post_init (ATCAIface iface)

  HAL implementation of I2C post init.
- ATCA_STATUS hal_i2c_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of I2C send over START.
- ATCA_STATUS hal_i2c_receive (ATCAIface iface, uint8_t address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of I2C receive function for START I2C.
- ATCA_STATUS change_i2c_speed (ATCAIface iface, uint32_t speed)

  method to change the bus speec of I2C
- ATCA_STATUS hal_i2c_wake (ATCAIface iface)

  wake up CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_idle (ATCAIface iface)

  idle CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_sleep (ATCAIface iface)

  sleep CryptoAuth device using I2C bus
- ATCA_STATUS hal_i2c_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.155.1 Detailed Description

ATCA Hardware abstraction layer for SAMV71 I2C over ASF drivers.

This code is structured in two parts. Part 1 is the connection of the ATCA HAL API to the physical I2C implementation. Part 2 is the ASF I2C primitives to set up the interface.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

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23.156 hal_uc3_i2c_asf.h File Reference

ATCA Hardware abstraction layer for SAMV71 I2C over ASF drivers.

```
#include <asf.h>
#include "twi.h"
```

Data Structures

- struct atcaI2Cmaster
  this is the hal_data for ATCA HAL for ASF SERCOM

Macros

- #define **MAX_I2C_BUSES** 3

Typedefs

- typedef struct atcaI2Cmaster **ATCAI2CMaster_t**
  this is the hal_data for ATCA HAL for ASF SERCOM

Functions

- ATCA_STATUS change_i2c_speed (ATCAIface iface, uint32_t speed)
  method to change the bus speec of I2C

23.156.1 Detailed Description

ATCA Hardware abstraction layer for SAMV71 I2C over ASF drivers.

Prerequisite: add SERCOM I2C Master Polled support to application in Atmel Studio

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23.157 hal_uc3_timer_asf.c File Reference

ATCA Hardware abstraction layer for SAM4S I2C over ASF drivers.

```
#include <asf.h>
#include <delay.h>
#include "atca_hal.h"
```

Functions

- void atca_delay_us (uint32_t delay)

    This function delays for a number of microseconds.
- void atca_delay_10us (uint32_t delay)

    This function delays for a number of tens of microseconds.
- void atca_delay_ms (uint32_t ms)

    Timer API for legacy implementations.

23.157.1 Detailed Description

ATCA Hardware abstraction layer for SAM4S I2C over ASF drivers.

Prerequisite: add "Delay routines (service)" module to application in Atmel Studio

Copyright

23.158 hal_windows.c File Reference

ATCA Hardware abstraction layer for windows timer functions.

```
#include "atca_hal.h"
#include <windows.h>
#include <math.h>
```

Functions

- void hal_delay_us (uint32_t delay)

    This function delays for a number of microseconds.
- void hal_delay_ms (uint32_t delay)

    Timer API implemented at the HAL level.
- ATCA_STATUS hal_create_mutex (void **ppMutex, const char *pName)

    Optional hal interfaces.
- ATCA_STATUS **hal_destroy_mutex** (void *pMutex)
- ATCA_STATUS **hal_lock_mutex** (void *pMutex)
- ATCA_STATUS **hal_unlock_mutex** (void *pMutex)
- ATCA_STATUS **hal_check_pid** (hal_pid_t pid)

    Check if the pid exists in the system.

23.158.1 Detailed Description

ATCA Hardware abstraction layer for windows timer functions.

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23.159 hal_windows_kit_uart.c File Reference

ATCA Hardware abstraction layer for Windows using UART.

```
#include "cryptoauthlib.h"
#include "atca_hal.h"
#include <windows.h>
#include <stdio.h>
#include <conio.h>
#include <math.h>
#include <string.h>
```

Data Structures

- struct atca_uart_host_s

Typedefs

- typedef struct atca_uart_host_s **atca_uart_host_t**

Functions

- ATCA_STATUS hal_uart_init (ATCAIface iface, ATCAIfaceCfg ∗cfg)

  HAL implementation of UART init.
- ATCA_STATUS hal_uart_post_init (ATCAIface iface)

  HAL implementation of UART post init.
- ATCA_STATUS hal_uart_send (ATCAIface iface, uint8_t word_address, uint8_t ∗txdata, int txlength)

  HAL implementation of UART send.
- ATCA_STATUS hal_uart_receive (ATCAIface iface, uint8_t word_address, uint8_t ∗rxdata, uint16_t ∗rxlength)

  HAL implementation of UART receive function.
- ATCA_STATUS hal_uart_control (ATCAIface iface, uint8_t option, void ∗param, size_t paramlen)

  Perform control operations for the UART.
- ATCA_STATUS hal_uart_release (void ∗hal_data)

  manages reference count on given bus and releases resource if no more refences exist

23.159.1 Detailed Description

ATCA Hardware abstraction layer for Windows using UART.

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23.159.2 Function Documentation

23.159.2.1 hal_uart_control()

```
ATCA_STATUS hal_uart_control (
            ATCAIface iface,
            uint8_t option,
            void * param,
            size_t paramlen )
```

Perform control operations for the UART.

Parameters

in	*iface*	Interface to interact with.
in	*option*	Control parameter identifier
in	*param*	Optional pointer to parameter value
in	*paramlen*	Length of the parameter

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.159.2.2 hal_uart_init()

```
ATCA_STATUS hal_uart_init (
            ATCAIface iface,
            ATCAIfaceCfg * cfg )
```

HAL implementation of UART init.

this implementation assumes UART SERIAL PORT peripheral has been enabled by user . It only initialize an UART interface using given config.

Parameters

in	*hal*	pointer to HAL specific data that is maintained by this HAL
in	*cfg*	pointer to HAL specific configuration data that is used to initialize this HAL

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.159.2.3 hal_uart_post_init()

```
ATCA_STATUS hal_uart_post_init (
            ATCAIface iface )
```

HAL implementation of UART post init.

Parameters

in	*iface*	instance

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.159.2.4 hal_uart_receive()

```
ATCA_STATUS hal_uart_receive (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * rxdata,
            uint16_t * rxlength )
```

HAL implementation of UART receive function.

Parameters

in	*iface*	Device to interact with.
in	*word_address*	device transaction type
out	*rxdata*	Data received will be returned here.
in,out	*rxlength*	As input, the size of the rxdata buffer. As output, the number of bytes received.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.159.2.5 hal_uart_release()

```
ATCA_STATUS hal_uart_release (
            void * hal_data )
```

manages reference count on given bus and releases resource if no more refences exist

Parameters

in	*hal_data*	- opaque pointer to hal data structure - known only to the HAL implementation

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.159.2.6 hal_uart_send()

```
ATCA_STATUS hal_uart_send (
            ATCAIface iface,
            uint8_t word_address,
            uint8_t * txdata,
            int txlength )
```

HAL implementation of UART send.

Parameters

in	*iface*	instance
in	*word_address*	transaction type
in	*txdata*	data to be send to device
in	*txdata*	pointer to space to bytes to send
in	*len*	number of bytes to send

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.160 kit_protocol.c File Reference

Microchip Crypto Auth hardware interface object.

```
#include <stdlib.h>
#include <stdio.h>
#include <limits.h>
#include "atca_compiler.h"
#include "kit_protocol.h"
#include "atca_helpers.h"
```

Macros

- #define **KIT_MAX_SCAN_COUNT** 8
- #define **KIT_MAX_TX_BUF** 32

Functions

- const char * kit_id_from_devtype (ATCADeviceType devtype)
- const char * kit_interface_from_kittype (ATCAKitType kittype)
- const char * kit_interface (ATCAKitType kittype)

23.160.1 Detailed Description

Microchip Crypto Auth hardware interface object.

Copyright

23.161 kit_protocol.h File Reference

```
#include "cryptoauthlib.h"
```

Macros

- #define **KIT_TX_WRAP_SIZE** (10)
- #define **KIT_MSG_SIZE** (32u)
- #define **KIT_RX_WRAP_SIZE** (KIT_MSG_SIZE + 6u)

Functions

- ATCA_STATUS **kit_init** (ATCAIface iface, ATCAIfaceCfg *cfg)
- ATCA_STATUS **kit_post_init** (ATCAIface iface)
- ATCA_STATUS **kit_send** (ATCAIface iface, uint8_t word_address, uint8_t *txdata, int txlength)
- ATCA_STATUS **kit_receive** (ATCAIface iface, uint8_t word_address, uint8_t *rxdata, uint16_t *rxsize)
- ATCA_STATUS **kit_control** (ATCAIface iface, uint8_t option, void *param, size_t paramlen)
- ATCA_STATUS **kit_release** (void *hal_data)
- ATCA_STATUS **kit_wrap_cmd** (ATCAIface iface, uint8_t word_address, const uint8_t *txdata, int txlen, char *pkitcmd, int *nkitcmd)
- ATCA_STATUS **kit_parse_rsp** (const char *pkitbuf, int nkitbuf, uint8_t *kitstatus, uint8_t *rxdata, int *datasize)
- ATCA_STATUS **kit_wake** (ATCAIface iface)
- ATCA_STATUS **kit_idle** (ATCAIface iface)
- ATCA_STATUS **kit_sleep** (ATCAIface iface)
- ATCA_STATUS **kit_phy_send** (ATCAIface iface, uint8_t *txdata, int txlength)
- ATCA_STATUS **kit_phy_receive** (ATCAIface iface, uint8_t *rxdata, int *rxsize)
- const char * kit_id_from_devtype (ATCADeviceType devtype)
- const char * kit_interface_from_kittype (ATCAKitType kittype)
- const char * kit_interface (ATCAKitType kittype)

23.161.1 Detailed Description

Copyright

23.162 swi_uart_samd21_asf.c File Reference

ATXMEGA's ATCA Hardware abstraction layer for SWI interface over UART drivers.

```
#include <stdlib.h>
#include <stdio.h>
#include "swi_uart_samd21_asf.h"
#include "atca_helpers.h"
```

Functions

- ATCA_STATUS swi_uart_init (ATCASWIMaster_t ∗instance)

  Implementation of SWI UART init.
- ATCA_STATUS swi_uart_deinit (ATCASWIMaster_t ∗instance)

  Implementation of SWI UART deinit.
- void swi_uart_setbaud (ATCASWIMaster_t ∗instance, uint32_t baudrate)

  implementation of SWI UART change baudrate.
- void swi_uart_mode (ATCASWIMaster_t ∗instance, uint8_t mode)

  implementation of SWI UART change mode.
- void swi_uart_discover_buses (int swi_uart_buses[ ], int max_buses)

  discover UART buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge
- ATCA_STATUS swi_uart_send_byte (ATCASWIMaster_t ∗instance, uint8_t data)

  HAL implementation of SWI UART send byte over ASF. This function send one byte over UART.
- ATCA_STATUS swi_uart_receive_byte (ATCASWIMaster_t ∗instance, uint8_t ∗data)

  HAL implementation of SWI UART receive bytes over ASF. This function receive one byte over UART.

Variables

- struct port_config **pin_conf**

23.162.1 Detailed Description

ATXMEGA's ATCA Hardware abstraction layer for SWI interface over UART drivers.

Prerequisite: add UART Polled support to application in Atmel Studio

Copyright

23.163 swi_uart_samd21_asf.h File Reference

ATXMEGA's ATCA Hardware abstraction layer for SWI interface over UART drivers.

```
#include <asf.h>
#include "cryptoauthlib.h"
```

Data Structures

- struct atcaSWImaster

  this is the hal_data for ATCA HAL for ASF SERCOM

Macros

- #define MAX_SWI_BUSES 6
- #define **RECEIVE_MODE** 0
- #define **TRANSMIT_MODE** 1
- #define **RX_DELAY** 10
- #define **TX_DELAY** 90
- #define **DEBUG_PIN_1** EXT2_PIN_5
- #define **DEBUG_PIN_2** EXT2_PIN_6

Typedefs

- typedef struct atcaSWImaster **ATCASWIMaster_t**

  this is the hal_data for ATCA HAL for ASF SERCOM

Functions

- ATCA_STATUS swi_uart_init (ATCASWIMaster_t ∗instance)

  Implementation of SWI UART init.
- ATCA_STATUS swi_uart_deinit (ATCASWIMaster_t ∗instance)

  Implementation of SWI UART deinit.
- void swi_uart_setbaud (ATCASWIMaster_t ∗instance, uint32_t baudrate)

  implementation of SWI UART change baudrate.
- void swi_uart_mode (ATCASWIMaster_t ∗instance, uint8_t mode)

  implementation of SWI UART change mode.
- void swi_uart_discover_buses (int swi_uart_buses[ ], int max_buses)

  discover UART buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge
- ATCA_STATUS swi_uart_send_byte (ATCASWIMaster_t ∗instance, uint8_t data)

  HAL implementation of SWI UART send byte over ASF. This function send one byte over UART.
- ATCA_STATUS swi_uart_receive_byte (ATCASWIMaster_t ∗instance, uint8_t ∗data)

  HAL implementation of SWI UART receive bytes over ASF. This function receive one byte over UART.

23.163.1 Detailed Description

ATXMEGA's ATCA Hardware abstraction layer for SWI interface over UART drivers.

Prerequisite: add UART Polled support to application in Atmel Studio

Copyright

23.164 swi_uart_start.c File Reference

```
#include <stdlib.h>
#include <stdio.h>
#include <peripheral_clk_config.h>
#include "swi_uart_start.h"
#include "atca_helpers.h"
```

Macros

- #define **USART_BAUD_RATE**(baud, sercom_freq) (65536 - ((65536 * 16.0F * baud) / sercom_freq))

Functions

- ATCA_STATUS swi_uart_init (ATCASWIMaster_t *instance)

  Implementation of SWI UART init.
- ATCA_STATUS swi_uart_deinit (ATCASWIMaster_t *instance)

  Implementation of SWI UART deinit.
- void swi_uart_setbaud (ATCASWIMaster_t *instance, uint32_t baudrate)

  implementation of SWI UART change baudrate.
- void swi_uart_mode (ATCASWIMaster_t *instance, uint8_t mode)

  implementation of SWI UART change mode.
- void swi_uart_discover_buses (int swi_uart_buses[ ], int max_buses)

  discover UART buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge
- ATCA_STATUS swi_uart_send_byte (ATCASWIMaster_t *instance, uint8_t data)

  HAL implementation of SWI UART send byte over ASF. This function send one byte over UART.
- ATCA_STATUS swi_uart_receive_byte (ATCASWIMaster_t *instance, uint8_t *data)

  HAL implementation of SWI UART receive bytes over ASF. This function receive one byte over UART.

23.164.1 Detailed Description

Copyright

23.165 swi_uart_start.h File Reference

```
#include <stdlib.h>
#include "atmel_start.h"
#include "cryptoauthlib.h"
```

Data Structures

- struct atcaSWImaster

    this is the hal_data for ATCA HAL for ASF SERCOM

Macros

- #define MAX_SWI_BUSES 6
- #define **RECEIVE_MODE** 0
- #define **TRANSMIT_MODE** 1
- #define **RX_DELAY** 10
- #define **TX_DELAY** 93

Typedefs

- typedef struct atcaSWImaster **ATCASWIMaster_t**

    this is the hal_data for ATCA HAL for ASF SERCOM

Functions

- ATCA_STATUS swi_uart_init (ATCASWIMaster_t ∗instance)

    Implementation of SWI UART init.
- ATCA_STATUS swi_uart_deinit (ATCASWIMaster_t ∗instance)

    Implementation of SWI UART deinit.
- void swi_uart_setbaud (ATCASWIMaster_t ∗instance, uint32_t baudrate)

    implementation of SWI UART change baudrate.
- void swi_uart_mode (ATCASWIMaster_t ∗instance, uint8_t mode)

    implementation of SWI UART change mode.
- void swi_uart_discover_buses (int swi_uart_buses[ ], int max_buses)

    discover UART buses available for this hardware this maintains a list of logical to physical bus mappings freeing the application of the a-priori knowledge
- ATCA_STATUS swi_uart_send_byte (ATCASWIMaster_t ∗instance, uint8_t data)

    HAL implementation of SWI UART send byte over ASF. This function send one byte over UART.
- ATCA_STATUS swi_uart_receive_byte (ATCASWIMaster_t ∗instance, uint8_t ∗data)

    HAL implementation of SWI UART receive bytes over ASF. This function receive one byte over UART.

23.165.1 Detailed Description

Copyright

23.166 atca_host.c File Reference

Host side methods to support CryptoAuth computations.

```
#include "atca_host.h"
#include "crypto/atca_crypto_sw_sha2.h"
#include "cal_internal.h"
```

23.166.1 Detailed Description

Host side methods to support CryptoAuth computations.

Copyright

23.167 atca_host.h File Reference

Definitions and Prototypes for ATCA Utility Functions.

```
#include <stdint.h>
#include "cryptoauthlib.h"
#include "calib/calib_basic.h"
#include "atca_host_config_check.h"
```

Data Structures

- struct atca_temp_key

  Structure to hold TempKey fields.
- struct atca_include_data_in_out

  Input / output parameters for function atca_include_data().
- struct atca_nonce_in_out

  Input/output parameters for function atca_nonce().
- struct atca_io_decrypt_in_out
- struct atca_verify_mac
- struct atca_secureboot_enc_in_out
- struct atca_secureboot_mac_in_out
- struct atca_mac_in_out

  Input/output parameters for function atca_mac().
- struct atca_hmac_in_out

  Input/output parameters for function atca_hmac().
- struct atca_gen_dig_in_out

  Input/output parameters for function atcah_gen_dig().
- struct atca_diversified_key_in_out

  Input/output parameters for function atcah_gendivkey().
- struct atca_write_mac_in_out

  Input/output parameters for function atcah_write_auth_mac() and atcah_privwrite_auth_mac().

- struct atca_derive_key_in_out

  Input/output parameters for function atcah_derive_key().
- struct atca_derive_key_mac_in_out

  Input/output parameters for function atcah_derive_key_mac().
- struct atca_decrypt_in_out

  Input/output parameters for function atca_decrypt().
- struct atca_check_mac_in_out

  Input/output parameters for function atcah_check_mac().
- struct atca_resp_mac_in_out

  Input/Output parameters for calculating the output response mac in SHA105 device. Used with the atcah_gen_↩ output_resp_mac() function.
- struct atca_verify_in_out

  Input/output parameters for function atcah_verify().
- struct atca_gen_key_in_out

  Input/output parameters for calculating the PubKey digest put into TempKey by the GenKey command with the atcah↩ _gen_key_msg() function.
- struct atca_sign_internal_in_out

  Input/output parameters for calculating the message and digest used by the Sign(internal) command. Used with the atcah_sign_internal_msg() function.
- struct atca_session_key_in_out

  Input/Output paramters for calculating the session key by the nonce command. Used with the atcah_gen_session↩ _key() function.
- struct atca_delete_in_out

  Input/Output paramters for calculating the mac.Used with Delete command.

Macros

Definitions for ATECC Message Sizes to Calculate a SHA256 Hash

"||" is the concatenation operator. The number in braces is the length of the hash input value in bytes.

- #define **ATCA_MSG_SIZE_NONCE** (55)

  RandOut{32} || NumIn{20} || OpCode{1} || Mode{1} || LSB of Param2{1}.
- #define **ATCA_MSG_SIZE_MAC** (88)

  (Key or TempKey){32} || (Challenge or TempKey){32} || OpCode{1} || Mode{1} || Param2{2} || (OTP0_7 or 0){8} || (OTP8_10 or 0){3} || SN8{1} || (SN4_7 or 0){4} || SN0_1{2} || (SN2_3 or 0){2}
- #define **ATCA_MSG_SIZE_HMAC** (88u)
- #define **ATCA_MSG_SIZE_GEN_DIG** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2} || 0{25} || TempKey{32}.
- #define **ATCA_MSG_SIZE_DIVERSIFIED_KEY** (96)

  ParentKey{32} || OtherData{4} || SN8{1} || SN0_1{2} || 0{25} || InputData{32}.
- #define **ATCA_MSG_SIZE_DERIVE_KEY** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2} || 0{25} || TempKey{32}.
- #define **ATCA_MSG_SIZE_DERIVE_KEY_MAC** (39)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2}.
- #define **ATCA_MSG_SIZE_ENCRYPT_MAC** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2}|| SN8{1} || SN0_1{2} || 0{25} || TempKey{32}.
- #define **ATCA_MSG_SIZE_SESSION_KEY** (96)

  TransportKey{32} || 0x15{1} || 0x00{1} || KeyId{2} || SN8{1} || SN0_1{2} || 0{25} || Nonce{32}.
- #define **ATCA_MSG_SIZE_DELETE_MAC** (96)

  Hmac/SecretKey{32} || 0x13{1} || 0x00{1} || 0x0000{2} || SN8{1} || SN0_1{2} || 0{25} || Nonce{32}.
- #define **ATCA_MSG_SIZE_RESPONSE_MAC** (97)

  SlotKey{32} || Opcode{1} || Param1{1} || Param2{2} || SN8{1} || SN0_1{2} || 0{25} || client_Resp{32} || checkmac_result{1}.
- #define **ATCA_MSG_SIZE_PRIVWRITE_MAC** (96)

  KeyId{32} || OpCode{1} || Param1{1} || Param2{2}|| SN8{1} || SN0_1{2} || 0{21} || PlainText{36}.

- #define **ATCA_COMMAND_HEADER_SIZE** (4)
- #define **ATCA_GENDIG_ZEROS_SIZE** (25)
- #define **ATCA_GENDIVKEY_ZEROS_SIZE** (25)
- #define **ATCA_WRITE_MAC_ZEROS_SIZE** (25)
- #define **ATCA_DELETE_MAC_ZEROS_SIZE** (25)
- #define **ATCA_RESP_MAC_ZEROS_SIZE** (25)
- #define **ATCA_PRIVWRITE_MAC_ZEROS_SIZE** (21)
- #define **ATCA_PRIVWRITE_PLAIN_TEXT_SIZE** (36)
- #define **ATCA_DERIVE_KEY_ZEROS_SIZE** (25)
- #define **ATCA_HMAC_BLOCK_SIZE** (64u)
- #define **ATCA_ENCRYPTION_KEY_SIZE** (64)

Definition for TempKey Mode

- #define **MAC_MODE_USE_TEMPKEY_MASK** ((uint8_t)0x03)

  mode mask for MAC command when using TempKey

Typedefs

- typedef struct atca_temp_key **atca_temp_key_t**

  Structure to hold TempKey fields.
- typedef struct atca_nonce_in_out **atca_nonce_in_out_t**
- typedef struct atca_io_decrypt_in_out **atca_io_decrypt_in_out_t**
- typedef struct atca_verify_mac **atca_verify_mac_in_out_t**
- typedef struct atca_secureboot_enc_in_out **atca_secureboot_enc_in_out_t**
- typedef struct atca_secureboot_mac_in_out **atca_secureboot_mac_in_out_t**
- typedef struct atca_mac_in_out **atca_mac_in_out_t**
- typedef struct atca_gen_dig_in_out **atca_gen_dig_in_out_t**

  Input/output parameters for function atcah_gen_dig().
- typedef struct atca_diversified_key_in_out **atca_diversified_key_in_out_t**

  Input/output parameters for function atcah_gendivkey().
- typedef struct atca_write_mac_in_out **atca_write_mac_in_out_t**

  Input/output parameters for function atcah_write_auth_mac() and atcah_privwrite_auth_mac().
- typedef struct atca_check_mac_in_out **atca_check_mac_in_out_t**

  Input/output parameters for function atcah_check_mac().
- typedef struct atca_resp_mac_in_out **atca_resp_mac_in_out_t**

  Input/Output parameters for calculating the output response mac in SHA105 device. Used with the atcah_gen_←output_resp_mac() function.
- typedef struct atca_verify_in_out **atca_verify_in_out_t**
- typedef struct atca_gen_key_in_out **atca_gen_key_in_out_t**

  Input/output parameters for calculating the PubKey digest put into TempKey by the GenKey command with the atcah←_gen_key_msg() function.
- typedef struct atca_sign_internal_in_out **atca_sign_internal_in_out_t**

  Input/output parameters for calculating the message and digest used by the Sign(internal) command. Used with the atcah_sign_internal_msg() function.
- typedef struct atca_session_key_in_out **atca_session_key_in_out_t**

  Input/Output paramters for calculating the session key by the nonce command. Used with the atcah_gen_session←_key() function.
- typedef struct atca_delete_in_out **atca_delete_in_out_t**

  Input/Output paramters for calculating the mac.Used with Delete command.

Functions

- ATCA_STATUS **atcah_nonce** (struct atca_nonce_in_out *param)
- ATCA_STATUS **atcah_mac** (struct atca_mac_in_out *param)
- ATCA_STATUS **atcah_check_mac** (struct atca_check_mac_in_out *param)
- ATCA_STATUS **atcah_hmac** (struct atca_hmac_in_out *param)
- ATCA_STATUS **atcah_gen_dig** (struct atca_gen_dig_in_out *param)
- ATCA_STATUS **atcah_gendivkey** (struct atca_diversified_key_in_out *param)
- ATCA_STATUS **atcah_gen_mac** (struct atca_gen_dig_in_out *param)
- ATCA_STATUS **atcah_write_auth_mac** (struct atca_write_mac_in_out *param)
- ATCA_STATUS **atcah_privwrite_auth_mac** (struct atca_write_mac_in_out *param)
- ATCA_STATUS **atcah_derive_key** (struct atca_derive_key_in_out *param)
- ATCA_STATUS **atcah_derive_key_mac** (struct atca_derive_key_mac_in_out *param)
- ATCA_STATUS **atcah_decrypt** (struct atca_decrypt_in_out *param)
- ATCA_STATUS **atcah_sha256** (uint32_t len, const uint8_t *message, uint8_t *digest)
- uint8_t * **atcah_include_data** (struct atca_include_data_in_out *param)
- ATCA_STATUS **atcah_gen_key_msg** (struct atca_gen_key_in_out *param)
- ATCA_STATUS **atcah_config_to_sign_internal** (ATCADeviceType device_type, struct atca_sign_internal_in_out *param, const uint8_t *config)
- ATCA_STATUS **atcah_sign_internal_msg** (ATCADeviceType device_type, struct atca_sign_internal_in_out *param)
- ATCA_STATUS **atcah_verify_mac** (atca_verify_mac_in_out_t *param)
- ATCA_STATUS **atcah_secureboot_enc** (atca_secureboot_enc_in_out_t *param)
- ATCA_STATUS **atcah_secureboot_mac** (atca_secureboot_mac_in_out_t *param)
- ATCA_STATUS **atcah_encode_counter_match** (uint32_t counter_value, uint8_t *counter_match_value)
- ATCA_STATUS **atcah_io_decrypt** (struct atca_io_decrypt_in_out *param)
- ATCA_STATUS **atcah_ecc204_write_auth_mac** (struct atca_write_mac_in_out *param)
- ATCA_STATUS **atcah_gen_session_key** (atca_session_key_in_out_t *param)
- ATCA_STATUS **atcah_gen_output_resp_mac** (struct atca_resp_mac_in_out *param)

23.167.1 Detailed Description

Definitions and Prototypes for ATCA Utility Functions.

Copyright

23.168 atca_host_config_check.h File Reference

Consistency checks for configuration options.

Macros

- #define ATCAH_INCLUDE_DATA (DEFAULT_ENABLED)
- #define ATCAH_NONCE (DEFAULT_ENABLED)
- #define ATCAH_IO_DECRYPT (DEFAULT_ENABLED)
- #define ATCAH_VERIFY_MAC (DEFAULT_ENABLED)
- #define ATCAH_SECUREBOOT_ENC (DEFAULT_ENABLED)
- #define ATCAH_SECUREBOOT_MAC (DEFAULT_ENABLED)
- #define ATCAH_MAC (DEFAULT_ENABLED)
- #define ATCAH_CHECK_MAC (DEFAULT_ENABLED)
- #define ATCAH_GEN_OUTPUT_RESP_MAC (DEFAULT_ENABLED)
- #define ATCAH_HMAC (DEFAULT_ENABLED)
- #define ATCAH_GENDIG (DEFAULT_ENABLED)
- #define ATCAH_GENDIVKEY (DEFAULT_ENABLED)
- #define ATCAH_GEN_MAC (DEFAULT_ENABLED)
- #define ATCAH_WRITE_AUTH_MAC (DEFAULT_ENABLED)
- #define ATCAH_PRIVWRITE_AUTH_MAC (DEFAULT_ENABLED)
- #define ATCAH_DERIVE_KEY (DEFAULT_ENABLED)
- #define ATCAH_DERIVE_KEY_MAC (DEFAULT_ENABLED)
- #define ATCAH_DECRYPT (DEFAULT_ENABLED)
- #define ATCAH_SHA256 (DEFAULT_ENABLED)
- #define ATCAH_GEN_KEY_MSG (DEFAULT_ENABLED)
- #define ATCAH_CONFIG_TO_SIGN_INTERNAL (DEFAULT_ENABLED)
- #define ATCAH_SIGN_INTERNAL_MSG (DEFAULT_ENABLED)
- #define ATCAH_ENCODE_COUNTER_MATCH (DEFAULT_ENABLED)
- #define ATCAH_GEN_SESSION_KEY (DEFAULT_ENABLED)
- #define ATCAH_DELETE_MAC (CALIB_DELETE_EN)
- #define **ATCAC_SW_SHA2_256** (DEFAULT_ENABLED)

23.168.1 Detailed Description

Consistency checks for configuration options.

Copyright

23.168.2 Macro Definition Documentation

23.168.2.1 ATCAH_CHECK_MAC

```
#define ATCAH_CHECK_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_CHECK_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_check_mac

Enable ATCAH_CHECK_MAC to perform the checkmac operation to generate client response on the host side

23.168.2.2 ATCAH_CONFIG_TO_SIGN_INTERNAL

```
#define ATCAH_CONFIG_TO_SIGN_INTERNAL (DEFAULT_ENABLED)
```

Requires: ATCAH_CONFIG_TO_SIGN_INTERNAL

Supported API's: atcah_config_to_sign_internal

Enable ATCAH_CONFIG_TO_SIGN_INTERNAL to populate the slot_config, key_config, and is_slot_locked fields in the atca_sign_internal_in_out structure from the provided config zone

23.168.2.3 ATCAH_DECRYPT

```
#define ATCAH_DECRYPT (DEFAULT_ENABLED)
```

Requires: ATCAH_DECRYPT

Supported API's: atcah_decrypt

Enable ATCAH_DECRYPT to decrypt 32-byte encrypted data received with the Read command

23.168.2.4 ATCAH_DELETE_MAC

```
#define ATCAH_DELETE_MAC (CALIB_DELETE_EN)
```

Requires: ATCAH_DELETE_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_delete_mac

Enable ATCAH_DELETE_MAC to calculate the mac

23.168.2.5 ATCAH_DERIVE_KEY

```
#define ATCAH_DERIVE_KEY (DEFAULT_ENABLED)
```

Requires: ATCAH_DERIVE_KEY ATCAC_SW_SHA2_256

Supported API's: atcah_derive_key

Enable ATCAH_DERIVE_KEY to derive a key with a key and TempKey

23.168.2.6 ATCAH_DERIVE_KEY_MAC

```
#define ATCAH_DERIVE_KEY_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_DERIVE_KEY_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_derive_key_mac

Enable ATCAH_DERIVE_KEY_MAC to calculate the input MAC for a DeriveKey command

23.168.2.7 ATCAH_ENCODE_COUNTER_MATCH

```
#define ATCAH_ENCODE_COUNTER_MATCH (DEFAULT_ENABLED)
```

Requires: ATCAH_ENCODE_COUNTER_MATCH

Supported API's: atcah_encode_counter_match

Enable ATCAH_ENCODE_COUNTER_MATCH to build the counter match value that needs to be stored in a slot

23.168.2.8 ATCAH_GEN_KEY_MSG

```
#define ATCAH_GEN_KEY_MSG (DEFAULT_ENABLED)
```

Requires: ATCAH_SHA256 ATCAC_SW_SHA2_256

Supported API's: atcah_gen_key_msg

Enable ATCAH_GEN_KEY_MSG to calculate the PubKey digest created by GenKey and saved to TempKey

23.168.2.9 ATCAH_GEN_MAC

```
#define ATCAH_GEN_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_GEN_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_gen_mac

Enable ATCAH_GEN_MAC to generate mac with session key with a plain text

23.168.2.10 ATCAH_GEN_OUTPUT_RESP_MAC

```
#define ATCAH_GEN_OUTPUT_RESP_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_GEN_OUTPUT_RESP_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_gen_output_resp_mac

Enable ATCAH_GEN_OUTPUT_RESP_MAC to generate output response mac

23.168.2.11 ATCAH_GEN_SESSION_KEY

```
#define ATCAH_GEN_SESSION_KEY (DEFAULT_ENABLED)
```

Requires: ATCAH_GEN_SESSION_KEY ATCAC_SW_SHA2_256

Supported API's: atcah_gen_Session_key

Enable ATCAH_GEN_SESSION_KEY to calculate the session key for the ECC204

23.168.2.12 ATCAH_GENDIG

```
#define ATCAH_GENDIG (DEFAULT_ENABLED)
```

Requires: ATCAH_GENDIG ATCAC_SW_SHA2_256

Supported API's: atcah_gen_dig

Enable ATCAH_GENDIG to combine the current TempKey with a stored value

23.168.2.13 ATCAH_GENDIVKEY

```
#define ATCAH_GENDIVKEY (DEFAULT_ENABLED)
```

Requires: ATCAH_GENDIVKEY ATCAC_SW_SHA2_256

Supported API's: atcah_gendivkey

Enable ATCAH_GENDIVKEY to generate the diversified key

23.168.2.14 ATCAH_HMAC

```
#define ATCAH_HMAC (DEFAULT_ENABLED)
```

Requires: ATCAH_HMAC ATCAC_SW_SHA2_256 ATCAH_INCLUDE_DATA

Supported API's: atcah_hmac

Enable ATCAH_HMAC to generate an HMAC / SHA-256 hash of a key and other information

23.168.2.15 ATCAH_INCLUDE_DATA

```
#define ATCAH_INCLUDE_DATA (DEFAULT_ENABLED)
```

Requires: ATCAH_INCLUDE_DATA

Supported API's: atcah_include_data

Enable ATCAH_INCLUDE_DATA to copy otp and sn data into a command buffer

23.168.2.16 ATCAH_IO_DECRYPT

```
#define ATCAH_IO_DECRYPT (DEFAULT_ENABLED)
```

Requires: ATCAH_IO_DECRYPT ATCAC_SW_SHA2_256

Supported API's: atcah_io_decrypt

Enable ATCAH_IO_DECRYPT to decrypt data that's been encrypted by the IO protection key.The ECDH and KDF commands on the ATECC608 are the only ones that support this operation

23.168.2.17 ATCAH_MAC

```
#define ATCAH_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_MAC ATCAC_SW_SHA2_256 ATCAH_INCLUDE_DATA

Supported API's: atcah_mac

Enable ATCAH_MAC to generate an SHA-256 digest (MAC) of a key, challenge, and other information

23.168.2.18 ATCAH_NONCE

```
#define ATCAH_NONCE (DEFAULT_ENABLED)
```

Requires: ATCAH_NONCE ATCAC_SW_SHA2_256

Supported API's: atcah_nonce

Enable ATCAH_NONCE to calculate host side nonce with the parameters passed

23.168.2.19 ATCAH_PRIVWRITE_AUTH_MAC

```
#define ATCAH_PRIVWRITE_AUTH_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_PRIVWRITE_AUTH_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_privwrite_auth_mac

Enable ATCAH_PRIVWRITE_AUTH_MAC to calculate the input MAC for the PrivWrite command

23.168.2.20 ATCAH_SECUREBOOT_ENC

```
#define ATCAH_SECUREBOOT_ENC (DEFAULT_ENABLED)
```

Requires: ATCAH_SECUREBOOT_ENC ATCAC_SW_SHA2_256

Supported API's: atcah_secureboot_enc

Enable ATCAH_SECUREBOOT_ENC to encrypt the digest for the SecureBoot command when using the encrypted digest / validating mac option

23.168.2.21 ATCAH_SECUREBOOT_MAC

```
#define ATCAH_SECUREBOOT_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_SECUREBOOT_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_secureboot_mac

Enable ATCAH_SECUREBOOT_MAC to calculates the expected MAC returned from the SecureBoot command when verification is a success

23.168.2.22 ATCAH_SHA256

```
#define ATCAH_SHA256 (DEFAULT_ENABLED)
```

Requires: ATCAH_SHA256 ATCAC_SW_SHA2_256

Supported API's: atcah_sha256

Enable ATCAH_SHA256 to create a SHA256 digest on a little-endian system

23.168.2.23 ATCAH_SIGN_INTERNAL_MSG

```
#define ATCAH_SIGN_INTERNAL_MSG (DEFAULT_ENABLED)
```

Requires: ATCAH_SIGN_INTERNAL_MSG ATCAC_SW_SHA2_256

Supported API's: atcah_sign_internal_msg

Enable ATCAH_SIGN_INTERNAL_MSG to build the full message that would be signed by the Sign(Internal) command

23.168.2.24 ATCAH_VERIFY_MAC

```
#define ATCAH_VERIFY_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_VERIFY_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_verify_mac

Enable ATCAH_VERIFY_MAC to calculate the expected MAC on the host side for the Verify command

23.168.2.25 ATCAH_WRITE_AUTH_MAC

```
#define ATCAH_WRITE_AUTH_MAC (DEFAULT_ENABLED)
```

Requires: ATCAH_WRITE_AUTH_MAC ATCAC_SW_SHA2_256

Supported API's: atcah_write_auth_mac ECC204 specific API's: atcah_ecc204_write_auth_mac

Enable ATCAH_WRITE_AUTH_MAC to calculate the input MAC for the Write command

23.169 atca_jwt.c File Reference

Utilities to create and verify a JSON Web Token (JWT)

```
#include "cryptoauthlib.h"
#include "atca_helpers.h"
#include "crypto/atca_crypto_sw_sha2.h"
#include "jwt/atca_jwt.h"
#include <stdio.h>
```

23.169.1 Detailed Description

Utilities to create and verify a JSON Web Token (JWT)

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23.170 atca_jwt.h File Reference

Utilities to create and verify a JSON Web Token (JWT)

```
#include "cryptoauthlib.h"
```

23.170.1 Detailed Description

Utilities to create and verify a JSON Web Token (JWT)

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23.171 atca_mbedtls_interface.h File Reference

Configuration Check for MbedTLS Integration Support.

```
#include "atca_config_check.h"
```

Data Structures

- struct atcac_x509_ctx

Macros

- #define ATCAC_SHA1_EN (DEFAULT_ENABLED)
- #define ATCAC_SHA256_EN (FEATURE_ENABLED)
- #define ATCAC_SHA384_EN (FEATURE_DISABLED)
- #define ATCAC_SHA512_EN (FEATURE_DISABLED)
- #define ATCAC_AES_CMAC_EN (DEFAULT_ENABLED)
- #define ATCAC_AES_GCM_EN (DEFAULT_ENABLED)
- #define ATCAC_PKEY_EN (DEFAULT_ENABLED)
- #define HOSTLIB_CERT_EN (DEFAULT_ENABLED)

Typedefs

- typedef struct atcac_x509_ctx **atcac_x509_ctx_t**

23.171.1 Detailed Description

Configuration Check for MbedTLS Integration Support.

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23.171.2 Macro Definition Documentation

23.171.2.1 ATCAC_AES_CMAC_EN

```
#define ATCAC_AES_CMAC_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of an AES-CMAC implementation

23.171.2.2 ATCAC_AES_GCM_EN

```
#define ATCAC_AES_GCM_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of an AES-GCM implementation

23.171.2.3 ATCAC_PKEY_EN

```
#define ATCAC_PKEY_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of a generic asymmetric cryptography implementation

23.171.2.4 ATCAC_SHA1_EN

```
#define ATCAC_SHA1_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of a SHA1 implementation

23.171.2.5 ATCAC_SHA256_EN

```
#define ATCAC_SHA256_EN (FEATURE_ENABLED)
```

Indicates if this module is a provider of a SHA256 implementation

23.171.2.6 ATCAC_SHA384_EN

```
#define ATCAC_SHA384_EN (FEATURE_DISABLED)
```

Indicates if this module is a provider of a SHA384 implementation

Disabled by default. Use FEATURE_ENABLED to use SHA384

23.171.2.7 ATCAC_SHA512_EN

```
#define ATCAC_SHA512_EN (FEATURE_DISABLED)
```

Indicates if this module is a provider of a SHA512 implementation

Disabled by default. Use FEATURE_ENABLED to use SHA512

23.171.2.8 HOSTLIB_CERT_EN

```
#define HOSTLIB_CERT_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of x509 certificate handling

23.172 atca_mbedtls_wrap.c File Reference

Wrapper functions to replace cryptoauthlib software crypto functions with the mbedTLS equivalent.

```
#include "atca_config_check.h"
#include "mbedtls/config.h"
#include <stdlib.h>
#include "mbedtls/cmac.h"
#include "mbedtls/ctr_drbg.h"
#include "mbedtls/pk.h"
#include "mbedtls/ecdh.h"
#include "mbedtls/ecp.h"
#include "mbedtls/entropy.h"
#include "mbedtls/x509_crt.h"
#include "mbedtls/oid.h"
#include "cryptoauthlib.h"
#include "atca_mbedtls_wrap.h"
#include "atca_mbedtls_patch.h"
#include "crypto/atca_crypto_sw.h"
#include "atcacert/atcacert_client.h"
#include "atcacert/atcacert_def.h"
#include "mbedtls/pk_internal.h"
#include "atcacert/atcacert_der.h"
```

Macros

- #define **mbedtls_calloc** calloc
- #define **mbedtls_free** free

Functions

- ATCA_STATUS atcac_sw_random (uint8_t *data, size_t data_size)

    Return Random Bytes.
- ATCA_STATUS atcac_aes_gcm_aad_update (struct atcac_aes_gcm_ctx *ctx, const uint8_t *aad, const size_t aad_len)

    Update the GCM context with additional authentication data (AAD)
- ATCA_STATUS atcac_aes_gcm_encrypt_start (struct atcac_aes_gcm_ctx *ctx, const uint8_t *key, const uint8_t key_len, const uint8_t *iv, const uint8_t iv_len)

    Initialize an AES-GCM context.
- ATCA_STATUS atcac_aes_gcm_encrypt_update (struct atcac_aes_gcm_ctx *ctx, const uint8_t *plaintext, const size_t pt_len, uint8_t *ciphertext, size_t *ct_len)

    Encrypt a data using the initialized context.
- ATCA_STATUS atcac_aes_gcm_encrypt_finish (struct atcac_aes_gcm_ctx *ctx, uint8_t *tag, size_t tag_len)

    Get the AES-GCM tag and free the context.
- ATCA_STATUS atcac_aes_gcm_decrypt_start (struct atcac_aes_gcm_ctx *ctx, const uint8_t *key, const uint8_t key_len, const uint8_t *iv, const uint8_t iv_len)

    Initialize an AES-GCM context for decryption.
- ATCA_STATUS atcac_aes_gcm_decrypt_update (struct atcac_aes_gcm_ctx *ctx, const uint8_t *ciphertext, const size_t ct_len, uint8_t *plaintext, size_t *pt_len)

    Decrypt ciphertext using the initialized context.
- ATCA_STATUS atcac_aes_gcm_decrypt_finish (struct atcac_aes_gcm_ctx *ctx, const uint8_t *tag, size_t tag_len, bool *is_verified)

    Compare the AES-GCM tag and free the context.
- ATCA_STATUS atcac_sw_sha1_init (struct atcac_sha1_ctx *ctx)

    Initialize context for performing SHA1 hash in software.
- ATCA_STATUS atcac_sw_sha1_update (struct atcac_sha1_ctx *ctx, const uint8_t *data, size_t data_size)

    Add data to a SHA1 hash.
- ATCA_STATUS atcac_sw_sha1_finish (struct atcac_sha1_ctx *ctx, uint8_t digest[ATCA_SHA1_DIGEST_↩ SIZE])

    Complete the SHA1 hash in software and return the digest.
- ATCA_STATUS atcac_aes_cmac_init (struct atcac_aes_cmac_ctx *ctx, const uint8_t *key, const uint8_↩ t key_len)

    Initialize context for performing CMAC in software.
- ATCA_STATUS atcac_aes_cmac_update (struct atcac_aes_cmac_ctx *ctx, const uint8_t *data, const size↩ _t data_size)

    Update CMAC context with input data.
- ATCA_STATUS atcac_aes_cmac_finish (struct atcac_aes_cmac_ctx *ctx, uint8_t *cmac, size_t *cmac_size)

    Finish CMAC calculation and clear the CMAC context.
- ATCA_STATUS atcac_sha256_hmac_init (struct atcac_hmac_ctx *ctx, struct atcac_sha2_256_ctx *sha256_ctx, const uint8_t *key, const uint8_t key_len)

    Initialize context for performing HMAC (sha256) in software.
- ATCA_STATUS atcac_sha256_hmac_update (struct atcac_hmac_ctx *ctx, const uint8_t *data, size_t data↩ _size)

    Update HMAC context with input data.
- ATCA_STATUS atcac_sha256_hmac_finish (struct atcac_hmac_ctx *ctx, uint8_t *digest, size_t *digest_len)

    Finish CMAC calculation and clear the HMAC context.
- ATCA_STATUS atcac_pk_init (struct atcac_pk_ctx *ctx, const uint8_t *buf, size_t buflen, uint8_t key_type, bool pubkey)

    Set up a public/private key structure for use in asymmetric cryptographic functions.
- ATCA_STATUS atcac_pk_init_pem (struct atcac_pk_ctx *ctx, const uint8_t *buf, size_t buflen, bool pubkey)

    Set up a public/private key structure for use in asymmetric cryptographic functions.

- ATCA_STATUS atcac_pk_free (struct atcac_pk_ctx *ctx)

  Free a public/private key structure.
- ATCA_STATUS atcac_pk_public (struct atcac_pk_ctx *ctx, uint8_t *buf, size_t *buflen)

  Get the public key from the context.
- ATCA_STATUS atcac_pk_sign (struct atcac_pk_ctx *ctx, const uint8_t *digest, size_t dig_len, uint8_↩ t *signature, size_t *sig_len)

  Perform a signature with the private key in the context.
- ATCA_STATUS atcac_pk_verify (struct atcac_pk_ctx *ctx, const uint8_t *digest, size_t dig_len, const uint8↩ _t *signature, size_t sig_len)

  Perform a verify using the public key in the provided context.
- ATCA_STATUS atcac_pk_derive (struct atcac_pk_ctx *private_ctx, struct atcac_pk_ctx *public_ctx, uint8_t *buf, size_t *buflen)

  Execute the key agreement protocol for the provided keys (if they can)
- int atca_mbedtls_pk_init_ext (ATCADevice device, mbedtls_pk_context *pkey, const uint16_t slotid)

  Initializes an mbedtls pk context for use with EC operations.
- int atca_mbedtls_pk_init (mbedtls_pk_context *pkey, const uint16_t slotid)

  Initializes an mbedtls pk context for use with EC operations.
- ATCA_STATUS **atcac_parse_der** (struct atcac_x509_ctx **cert, cal_buffer *der)
- ATCA_STATUS **atcac_get_subject** (const struct atcac_x509_ctx *cert, cal_buffer *cert_subject)
- ATCA_STATUS **atcac_get_subj_public_key** (const struct atcac_x509_ctx *cert, cal_buffer *subj_public↩ _key)
- ATCA_STATUS **atcac_get_subj_key_id** (const struct atcac_x509_ctx *cert, cal_buffer *subj_public_key_id)
- ATCA_STATUS **atcac_get_issue_date** (const struct atcac_x509_ctx *cert, cal_buffer *not_before, uint8_t *fmt)
- ATCA_STATUS **atcac_get_expire_date** (const struct atcac_x509_ctx *cert, cal_buffer *not_after, uint8_t *fmt)
- ATCA_STATUS **atcac_get_issuer** (const struct atcac_x509_ctx *cert, cal_buffer *issuer_buf)
- ATCA_STATUS **atcac_get_cert_sn** (const struct atcac_x509_ctx *cert, cal_buffer *cert_sn)
- ATCA_STATUS **atcac_get_auth_key_id** (const struct atcac_x509_ctx *cert, cal_buffer *auth_key_id)
- void **atcac_x509_free** (void *cert)

Variables

- const mbedtls_pk_info_t atca_mbedtls_eckey_info

23.172.1 Detailed Description

Wrapper functions to replace cryptoauthlib software crypto functions with the mbedTLS equivalent.

Copyright

23.172.2 Function Documentation

23.172.2.1 atcac_aes_cmac_finish()

```
ATCA_STATUS atcac_aes_cmac_finish (
            struct atcac_aes_cmac_ctx * ctx,
            uint8_t * cmac,
            size_t * cmac_size )
```

Finish CMAC calculation and clear the CMAC context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a aes-cmac context
out	*cmac*	cmac value
in,out	*cmac_size*	length of cmac

23.172.2.2 atcac_aes_cmac_init()

```
ATCA_STATUS atcac_aes_cmac_init (
            struct atcac_aes_cmac_ctx * ctx,
            const uint8_t * key,
            const uint8_t key_len )
```

Initialize context for performing CMAC in software.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a aes-cmac context
in	*key*	key value to use
in	*key_len*	length of the key

23.172.2.3 atcac_aes_cmac_update()

```
ATCA_STATUS atcac_aes_cmac_update (
            struct atcac_aes_cmac_ctx * ctx,
            const uint8_t * data,
            const size_t data_size )
```

Update CMAC context with input data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a aes-cmac context
in	*data*	input data
in	*data_size*	length of input data

23.172.2.4 atcac_aes_gcm_aad_update()

```
ATCA_STATUS atcac_aes_gcm_aad_update (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * aad,
            const size_t aad_len )
```

Update the GCM context with additional authentication data (AAD)

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*aad*	Additional Authentication Data
in	*aad_len*	Length of AAD

23.172.2.5 atcac_aes_gcm_decrypt_finish()

```
ATCA_STATUS atcac_aes_gcm_decrypt_finish (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * tag,
            size_t tag_len,
            bool * is_verified )
```

Compare the AES-GCM tag and free the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*tag*	GCM Tag to Verify
in	*tag_len*	Length of the GCM tag
out	*is_verified*	Tag verified as matching

23.172.2.6 atcac_aes_gcm_decrypt_start()

```
ATCA_STATUS atcac_aes_gcm_decrypt_start (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * key,
            const uint8_t key_len,
            const uint8_t * iv,
            const uint8_t iv_len )
```

Initialize an AES-GCM context for decryption.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*key*	AES Key
in	*key_len*	Length of the AES key - should be 16 or 32
in	*iv*	Initialization vector input
in	*iv_len*	Length of the initialization vector

23.172.2.7 atcac_aes_gcm_decrypt_update()

```
ATCA_STATUS atcac_aes_gcm_decrypt_update (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * ciphertext,
            const size_t ct_len,
            uint8_t * plaintext,
            size_t * pt_len )
```

Decrypt ciphertext using the initialized context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*ciphertext*	Ciphertext to decrypt
in	*ct_len*	Length of the ciphertext
out	*plaintext*	Resulting decrypted plaintext
in,out	*pt_len*	Length of the plaintext buffer

23.172.2.8 atcac_aes_gcm_encrypt_finish()

```
ATCA_STATUS atcac_aes_gcm_encrypt_finish (
            struct atcac_aes_gcm_ctx * ctx,
            uint8_t * tag,
            size_t tag_len )
```

Get the AES-GCM tag and free the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
out	*tag*	GCM Tag Result
in	*tag_len*	Length of the GCM tag

23.172.2.9 atcac_aes_gcm_encrypt_start()

```
ATCA_STATUS atcac_aes_gcm_encrypt_start (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * key,
            const uint8_t key_len,
            const uint8_t * iv,
            const uint8_t iv_len )
```

Initialize an AES-GCM context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*key*	AES Key
in	*key_len*	Length of the AES key - should be 16 or 32
in	*iv*	Initialization vector input
in	*iv_len*	Length of the initialization vector

23.172.2.10 atcac_aes_gcm_encrypt_update()

```
ATCA_STATUS atcac_aes_gcm_encrypt_update (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * plaintext,
            const size_t pt_len,
            uint8_t * ciphertext,
            size_t * ct_len )
```

Encrypt a data using the initialized context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*plaintext*	Input buffer to encrypt
in	*pt_len*	Length of the input
out	*ciphertext*	Output buffer
in,out	*ct_len*	Length of the ciphertext buffer

23.172.2.11 atcac_pk_derive()

```
ATCA_STATUS atcac_pk_derive (
            struct atcac_pk_ctx * private_ctx,
            struct atcac_pk_ctx * public_ctx,
            uint8_t * buf,
            size_t * buflen )
```

Execute the key agreement protocol for the provided keys (if they can)

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.172.2.12 atcac_pk_free()

```
ATCA_STATUS atcac_pk_free (
            struct atcac_pk_ctx * ctx )
```

Free a public/private key structure.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a pk context

23.172.2.13 atcac_pk_init()

```
ATCA_STATUS atcac_pk_init (
            struct atcac_pk_ctx * ctx,
            const uint8_t * buf,
            size_t buflen,
            uint8_t key_type,
            bool pubkey )
```

Set up a public/private key structure for use in asymmetric cryptographic functions.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a pk context
in	*buf*	buffer containing a pem encoded key
in	*buflen*	length of the input buffer
in	*pubkey*	buffer is a public key

23.172.2.14 atcac_pk_init_pem()

```
ATCA_STATUS atcac_pk_init_pem (
            struct atcac_pk_ctx * ctx,
            const uint8_t * buf,
            size_t buflen,
            bool pubkey )
```

Set up a public/private key structure for use in asymmetric cryptographic functions.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a pk context
in	*buf*	buffer containing a pem encoded key
in	*buflen*	length of the input buffer
in	*pubkey*	buffer is a public key

23.172.2.15 atcac_pk_public()

```
ATCA_STATUS atcac_pk_public (
            struct atcac_pk_ctx * ctx,
            uint8_t * buf,
            size_t * buflen )
```

Get the public key from the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.172.2.16 atcac_pk_sign()

```
ATCA_STATUS atcac_pk_sign (
            struct atcac_pk_ctx * ctx,
            const uint8_t * digest,
            size_t dig_len,
            uint8_t * signature,
            size_t * sig_len )
```

Perform a signature with the private key in the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.172.2.17 atcac_pk_verify()

```
ATCA_STATUS atcac_pk_verify (
            struct atcac_pk_ctx * ctx,
            const uint8_t * digest,
            size_t dig_len,
            const uint8_t * signature,
            size_t sig_len )
```

Perform a verify using the public key in the provided context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.172.2.18 atcac_sha256_hmac_finish()

```
ATCA_STATUS atcac_sha256_hmac_finish (
            struct atcac_hmac_ctx * ctx,
            uint8_t * digest,
            size_t * digest_len )
```

Finish CMAC calculation and clear the HMAC context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a sha256-hmac context
out	*digest*	hmac value
in,out	*digest_len*	length of hmac

23.172.2.19 atcac_sha256_hmac_init()

```
ATCA_STATUS atcac_sha256_hmac_init (
            struct atcac_hmac_ctx * ctx,
            struct atcac_sha2_256_ctx * sha256_ctx,
            const uint8_t * key,
            const uint8_t key_len )
```

Initialize context for performing HMAC (sha256) in software.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a sha256-hmac context
in	*sha256_ctx*	pointer to a sha256 context
in	*key*	key value to use
in	*key_len*	length of the key

23.172.2.20 atcac_sha256_hmac_update()

```
ATCA_STATUS atcac_sha256_hmac_update (
            struct atcac_hmac_ctx * ctx,
```

```
            const uint8_t * data,
            size_t data_size )
```

Update HMAC context with input data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a sha256-hmac context
in	*data*	input data
in	*data_size*	length of input data

23.172.2.21 atcac_sw_random()

```
ATCA_STATUS atcac_sw_random (
            uint8_t * data,
            size_t data_size )
```

Return Random Bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.172.2.22 atcac_sw_sha1_finish()

```
ATCA_STATUS atcac_sw_sha1_finish (
            struct atcac_sha1_ctx * ctx,
            uint8_t digest[ATCA_SHA1_DIGEST_SIZE] )
```

Complete the SHA1 hash in software and return the digest.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a hash context
out	*digest*	output buffer (20 bytes)

23.172.2.23 atcac_sw_sha1_init()

```
ATCA_STATUS atcac_sw_sha1_init (
            struct atcac_sha1_ctx * ctx )
```

Initialize context for performing SHA1 hash in software.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a hash context

23.172.2.24 atcac_sw_sha1_update()

```
ATCA_STATUS atcac_sw_sha1_update (
            struct atcac_sha1_ctx * ctx,
            const uint8_t * data,
            size_t data_size )
```

Add data to a SHA1 hash.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a hash context
in	*data*	input data buffer
in	*data_size*	input data length

23.172.3 Variable Documentation

23.172.3.1 atca_mbedtls_eckey_info

```
const mbedtls_pk_info_t atca_mbedtls_eckey_info
```

Initial value:
```
= {
    MBEDTLS_PK_ECKEY,
    "EC",
    atca_mbedtls_eckey_get_bitlen,
    atca_mbedtls_eckey_can_do,
    atca_mbedtls_eckey_verify,
    atca_mbedtls_eckey_sign,
    NULL,
    NULL,
    atca_mbedtls_eckey_check_pair,
    atca_mbedtls_eckey_alloc,
    atca_mbedtls_eckey_free,
    atca_mbedtls_eckey_debug,
}
```

23.173 atca_openssl_interface.c File Reference

Crypto abstraction functions for external host side cryptography.

```
#include "cryptoauthlib.h"
#include "crypto/atca_crypto_sw.h"
#include <openssl/bn.h>
#include <openssl/bio.h>
#include <openssl/cmac.h>
#include <openssl/ec.h>
#include <openssl/evp.h>
#include <openssl/hmac.h>
#include <openssl/pem.h>
#include <openssl/rand.h>
#include <openssl/x509.h>
#include <openssl/x509v3.h>
```

Data Structures

- struct atca_evp_ctx

Functions

- ATCA_STATUS atcac_sw_random (uint8_t ∗data, size_t data_size)

  Return Random Bytes.
- ATCA_STATUS atcac_aes_gcm_aad_update (struct atcac_aes_gcm_ctx ∗ctx, const uint8_t ∗aad, const size_t aad_len)

  Update the GCM context with additional authentication data (AAD)
- ATCA_STATUS atcac_aes_gcm_encrypt_start (struct atcac_aes_gcm_ctx ∗ctx, const uint8_t ∗key, const uint8_t key_len, const uint8_t ∗iv, const uint8_t iv_len)

  Initialize an AES-GCM context.
- ATCA_STATUS atcac_aes_gcm_encrypt_update (struct atcac_aes_gcm_ctx ∗ctx, const uint8_t ∗plaintext, const size_t pt_len, uint8_t ∗ciphertext, size_t ∗ct_len)

  Encrypt a data using the initialized context.
- ATCA_STATUS atcac_aes_gcm_encrypt_finish (struct atcac_aes_gcm_ctx ∗ctx, uint8_t ∗tag, size_t tag_len)

  Get the AES-GCM tag and free the context.
- ATCA_STATUS atcac_aes_gcm_decrypt_start (struct atcac_aes_gcm_ctx ∗ctx, const uint8_t ∗key, const uint8_t key_len, const uint8_t ∗iv, const uint8_t iv_len)

  Initialize an AES-GCM context for decryption.

- ATCA_STATUS atcac_aes_gcm_decrypt_update (struct atcac_aes_gcm_ctx *ctx, const uint8_t *ciphertext, const size_t ct_len, uint8_t *plaintext, size_t *pt_len)

    Decrypt ciphertext using the initialized context.
- ATCA_STATUS atcac_aes_gcm_decrypt_finish (struct atcac_aes_gcm_ctx *ctx, const uint8_t *tag, size_t tag_len, bool *is_verified)

    Compare the AES-GCM tag and free the context.
- ATCA_STATUS atcac_sw_sha1_init (struct atcac_sha1_ctx *ctx)

    Initialize context for performing SHA1 hash in software.
- ATCA_STATUS atcac_sw_sha1_update (struct atcac_sha1_ctx *ctx, const uint8_t *data, size_t data_size)

    Add data to a SHA1 hash.
- ATCA_STATUS atcac_sw_sha1_finish (struct atcac_sha1_ctx *ctx, uint8_t digest[ATCA_SHA1_DIGEST_↩ SIZE])

    Complete the SHA1 hash in software and return the digest.
- ATCA_STATUS atcac_aes_cmac_init (struct atcac_aes_cmac_ctx *ctx, const uint8_t *key, const uint8_↩ t key_len)

    Initialize context for performing CMAC in software.
- ATCA_STATUS atcac_aes_cmac_update (struct atcac_aes_cmac_ctx *ctx, const uint8_t *data, const size↩ _t data_size)

    Update CMAC context with input data.
- ATCA_STATUS atcac_aes_cmac_finish (struct atcac_aes_cmac_ctx *ctx, uint8_t *cmac, size_t *cmac_size)

    Finish CMAC calculation and clear the CMAC context.
- ATCA_STATUS atcac_sha256_hmac_init (struct atcac_hmac_ctx *ctx, struct atcac_sha2_256_ctx *sha256_ctx, const uint8_t *key, const uint8_t key_len)

    Initialize context for performing HMAC (sha256) in software.
- ATCA_STATUS atcac_sha256_hmac_update (struct atcac_hmac_ctx *ctx, const uint8_t *data, size_t data↩ _size)

    Update HMAC context with input data.
- ATCA_STATUS atcac_sha256_hmac_finish (struct atcac_hmac_ctx *ctx, uint8_t *digest, size_t *digest_len)

    Finish CMAC calculation and clear the HMAC context.
- ATCA_STATUS atcac_pk_init (struct atcac_pk_ctx *ctx, const uint8_t *buf, size_t buflen, uint8_t key_type, bool pubkey)

    Set up a public/private key structure for use in asymmetric cryptographic functions.
- ATCA_STATUS atcac_pk_init_pem (struct atcac_pk_ctx *ctx, const uint8_t *buf, size_t buflen, bool pubkey)

    Set up a public/private key structure for use in asymmetric cryptographic functions.
- ATCA_STATUS atcac_pk_free (struct atcac_pk_ctx *ctx)

    Free a public/private key structure.
- ATCA_STATUS atcac_pk_public (struct atcac_pk_ctx *ctx, uint8_t *buf, size_t *buflen)

    Get the public key from the context.
- ATCA_STATUS atcac_pk_sign (struct atcac_pk_ctx *ctx, const uint8_t *digest, size_t dig_len, uint8_↩ t *signature, size_t *sig_len)

    Perform a signature with the private key in the context.
- ATCA_STATUS atcac_pk_verify (struct atcac_pk_ctx *ctx, const uint8_t *digest, size_t dig_len, const uint8↩ _t *signature, size_t sig_len)

    Perform a verify using the public key in the provided context.
- ATCA_STATUS atcac_pk_derive (struct atcac_pk_ctx *private_ctx, struct atcac_pk_ctx *public_ctx, uint8_t *buf, size_t *buflen)

    Execute the key agreement protocol for the provided keys (if they can)
- ATCA_STATUS **atcac_parse_der** (struct atcac_x509_ctx **cert, cal_buffer *der)
- ATCA_STATUS **atcac_get_subject** (const struct atcac_x509_ctx *cert, cal_buffer *cert_subject)
- ATCA_STATUS **atcac_get_subj_public_key** (const struct atcac_x509_ctx *cert, cal_buffer *subj_public↩ _key)
- ATCA_STATUS **atcac_get_subj_key_id** (const struct atcac_x509_ctx *cert, cal_buffer *subj_public_key_id)

- ATCA_STATUS **atcac_get_issuer** (const struct atcac_x509_ctx ∗cert, cal_buffer ∗issuer_buf)
- ATCA_STATUS **atcac_get_auth_key_id** (const struct atcac_x509_ctx ∗cert, cal_buffer ∗auth_key_id)
- ATCA_STATUS **atcac_get_issue_date** (const struct atcac_x509_ctx ∗cert, cal_buffer ∗not_before, uint8_t ∗fmt)
- ATCA_STATUS **atcac_get_expire_date** (const struct atcac_x509_ctx ∗cert, cal_buffer ∗not_after, uint8_t ∗fmt)
- ATCA_STATUS **atcac_get_cert_sn** (const struct atcac_x509_ctx ∗cert, cal_buffer ∗cert_sn)
- void **atcac_x509_free** (void ∗cert)

23.173.1 Detailed Description

Crypto abstraction functions for external host side cryptography.

Copyright

23.173.2 Function Documentation

23.173.2.1 atcac_aes_cmac_finish()

```
ATCA_STATUS atcac_aes_cmac_finish (
            struct atcac_aes_cmac_ctx * ctx,
            uint8_t * cmac,
            size_t * cmac_size )
```

Finish CMAC calculation and clear the CMAC context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a aes-cmac context
out	*cmac*	cmac value
in,out	*cmac_size*	length of cmac

23.173.2.2 atcac_aes_cmac_init()

```
ATCA_STATUS atcac_aes_cmac_init (
            struct atcac_aes_cmac_ctx * ctx,
```

```
            const uint8_t * key,
            const uint8_t key_len )
```

Initialize context for performing CMAC in software.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a aes-cmac context
in	*key*	key value to use
in	*key_len*	length of the key

23.173.2.3 atcac_aes_cmac_update()

```
ATCA_STATUS atcac_aes_cmac_update (
            struct atcac_aes_cmac_ctx * ctx,
            const uint8_t * data,
            const size_t data_size )
```

Update CMAC context with input data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a aes-cmac context
in	*data*	input data
in	*data_size*	length of input data

23.173.2.4 atcac_aes_gcm_aad_update()

```
ATCA_STATUS atcac_aes_gcm_aad_update (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * aad,
            const size_t aad_len )
```

Update the GCM context with additional authentication data (AAD)

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*aad*	Additional Authentication Data
in	*aad_len*	Length of AAD

23.173.2.5 atcac_aes_gcm_decrypt_finish()

```
ATCA_STATUS atcac_aes_gcm_decrypt_finish (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * tag,
            size_t tag_len,
            bool * is_verified )
```

Compare the AES-GCM tag and free the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*tag*	GCM Tag to Verify
in	*tag_len*	Length of the GCM tag
out	*is_verified*	Tag verified as matching

23.173.2.6 atcac_aes_gcm_decrypt_start()

```
ATCA_STATUS atcac_aes_gcm_decrypt_start (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * key,
            const uint8_t key_len,
            const uint8_t * iv,
            const uint8_t iv_len )
```

Initialize an AES-GCM context for decryption.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*key*	AES Key
in	*key_len*	Length of the AES key - should be 16 or 32
in	*iv*	Initialization vector input
in	*iv_len*	Length of the initialization vector

23.173.2.7 atcac_aes_gcm_decrypt_update()

```
ATCA_STATUS atcac_aes_gcm_decrypt_update (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * ciphertext,
            const size_t ct_len,
            uint8_t * plaintext,
            size_t * pt_len )
```

Decrypt ciphertext using the initialized context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*ciphertext*	Ciphertext to decrypt
in	*ct_len*	Length of the ciphertext
out	*plaintext*	Resulting decrypted plaintext
in,out	*pt_len*	Length of the plaintext buffer

23.173.2.8 atcac_aes_gcm_encrypt_finish()

```
ATCA_STATUS atcac_aes_gcm_encrypt_finish (
            struct atcac_aes_gcm_ctx * ctx,
            uint8_t * tag,
            size_t tag_len )
```

Get the AES-GCM tag and free the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
out	*tag*	GCM Tag Result
in	*tag_len*	Length of the GCM tag

23.173.2.9 atcac_aes_gcm_encrypt_start()

```
ATCA_STATUS atcac_aes_gcm_encrypt_start (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * key,
            const uint8_t key_len,
            const uint8_t * iv,
            const uint8_t iv_len )
```

Initialize an AES-GCM context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*key*	AES Key
in	*key_len*	Length of the AES key - should be 16 or 32
in	*iv*	Initialization vector input
in	*iv_len*	Length of the initialization vector

23.173.2.10 atcac_aes_gcm_encrypt_update()

```
ATCA_STATUS atcac_aes_gcm_encrypt_update (
            struct atcac_aes_gcm_ctx * ctx,
            const uint8_t * plaintext,
            const size_t pt_len,
            uint8_t * ciphertext,
            size_t * ct_len )
```

Encrypt a data using the initialized context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	AES-GCM Context
in	*plaintext*	Input buffer to encrypt
in	*pt_len*	Length of the input
out	*ciphertext*	Output buffer
in,out	*ct_len*	Length of the ciphertext buffer

23.173.2.11 atcac_pk_derive()

```
ATCA_STATUS atcac_pk_derive (
            struct atcac_pk_ctx * private_ctx,
            struct atcac_pk_ctx * public_ctx,
            uint8_t * buf,
            size_t * buflen )
```

Execute the key agreement protocol for the provided keys (if they can)

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.173.2.12 atcac_pk_free()

```
ATCA_STATUS atcac_pk_free (
            struct atcac_pk_ctx * ctx )
```

Free a public/private key structure.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a pk context

23.173.2.13 atcac_pk_init()

```
ATCA_STATUS atcac_pk_init (
            struct atcac_pk_ctx * ctx,
            const uint8_t * buf,
            size_t buflen,
            uint8_t key_type,
            bool pubkey )
```

Set up a public/private key structure for use in asymmetric cryptographic functions.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a pk context
in	*buf*	buffer containing a pem encoded key
in	*buflen*	length of the input buffer
in	*pubkey*	buffer is a public key

23.173.2.14 atcac_pk_init_pem()

```
ATCA_STATUS atcac_pk_init_pem (
            struct atcac_pk_ctx * ctx,
            const uint8_t * buf,
            size_t buflen,
            bool pubkey )
```

Set up a public/private key structure for use in asymmetric cryptographic functions.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a pk context
in	*buf*	buffer containing a pem encoded key
in	*buflen*	length of the input buffer
in	*pubkey*	buffer is a public key

23.173.2.15 atcac_pk_public()

```
ATCA_STATUS atcac_pk_public (
            struct atcac_pk_ctx * ctx,
            uint8_t * buf,
            size_t * buflen )
```

Get the public key from the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.173.2.16 atcac_pk_sign()

```
ATCA_STATUS atcac_pk_sign (
            struct atcac_pk_ctx * ctx,
            const uint8_t * digest,
            size_t dig_len,
            uint8_t * signature,
            size_t * sig_len )
```

Perform a signature with the private key in the context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.173.2.17 atcac_pk_verify()

```
ATCA_STATUS atcac_pk_verify (
            struct atcac_pk_ctx * ctx,
            const uint8_t * digest,
            size_t dig_len,
            const uint8_t * signature,
            size_t sig_len )
```

Perform a verify using the public key in the provided context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.173.2.18 atcac_sha256_hmac_finish()

```
ATCA_STATUS atcac_sha256_hmac_finish (
            struct atcac_hmac_ctx * ctx,
            uint8_t * digest,
            size_t * digest_len )
```

Finish CMAC calculation and clear the HMAC context.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a sha256-hmac context
out	*digest*	hmac value
in,out	*digest_len*	length of hmac

23.173.2.19 atcac_sha256_hmac_init()

```
ATCA_STATUS atcac_sha256_hmac_init (
            struct atcac_hmac_ctx * ctx,
            struct atcac_sha2_256_ctx * sha256_ctx,
            const uint8_t * key,
            const uint8_t key_len )
```

Initialize context for performing HMAC (sha256) in software.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a sha256-hmac context
in	*sha256_ctx*	pointer to a sha256 context
in	*key*	key value to use
in	*key_len*	length of the key

23.173.2.20 atcac_sha256_hmac_update()

```
ATCA_STATUS atcac_sha256_hmac_update (
            struct atcac_hmac_ctx * ctx,
            const uint8_t * data,
            size_t data_size )
```

Update HMAC context with input data.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a sha256-hmac context
in	*data*	input data
in	*data_size*	length of input data

23.173.2.21 atcac_sw_random()

```
ATCA_STATUS atcac_sw_random (
```

```
uint8_t * data,
size_t data_size )
```

Return Random Bytes.

Returns

ATCA_SUCCESS on success, otherwise an error code.

23.173.2.22 atcac_sw_sha1_finish()

```
ATCA_STATUS atcac_sw_sha1_finish (
            struct atcac_sha1_ctx * ctx,
            uint8_t digest[ATCA_SHA1_DIGEST_SIZE] )
```

Complete the SHA1 hash in software and return the digest.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a hash context
out	*digest*	output buffer (20 bytes)

23.173.2.23 atcac_sw_sha1_init()

```
ATCA_STATUS atcac_sw_sha1_init (
            struct atcac_sha1_ctx * ctx )
```

Initialize context for performing SHA1 hash in software.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a hash context

23.173.2.24 atcac_sw_sha1_update()

```
ATCA_STATUS atcac_sw_sha1_update (
            struct atcac_sha1_ctx * ctx,
            const uint8_t * data,
            size_t data_size )
```

Add data to a SHA1 hash.

Returns

ATCA_SUCCESS on success, otherwise an error code.

Parameters

in	*ctx*	pointer to a hash context
in	*data*	input data buffer
in	*data_size*	input data length

23.174 atca_openssl_interface.h File Reference

OpenSSL Integration Support.

```
#include "atca_config_check.h"
```

Data Structures

- struct atcac_sha1_ctx
- struct atcac_sha2_256_ctx
- struct atcac_sha2_384_ctx
- struct atcac_sha2_512_ctx
- struct atcac_aes_cmac_ctx
- struct atcac_hmac_ctx
- struct atcac_pk_ctx
- struct atcac_x509_ctx

Macros

- #define ATCAC_SHA1_EN (DEFAULT_ENABLED)
- #define ATCAC_SHA256_EN (FEATURE_ENABLED)
- #define ATCAC_SHA384_EN (FEATURE_DISABLED)
- #define ATCAC_SHA512_EN (FEATURE_DISABLED)
- #define ATCAC_AES_CMAC_EN (DEFAULT_ENABLED)
- #define ATCAC_AES_GCM_EN (DEFAULT_ENABLED)
- #define ATCAC_PKEY_EN (DEFAULT_ENABLED)
- #define HOSTLIB_CERT_EN (DEFAULT_ENABLED)

Typedefs

- typedef struct atcac_sha1_ctx **atcac_sha1_ctx_t**
- typedef struct atcac_sha2_256_ctx **atcac_sha2_256_ctx_t**
- typedef struct atcac_sha2_384_ctx **atcac_sha2_384_ctx_t**
- typedef struct atcac_sha2_512_ctx **atcac_sha2_512_ctx_t**
- typedef struct atcac_aes_cmac_ctx **atcac_aes_cmac_ctx_t**
- typedef struct atcac_hmac_ctx **atcac_hmac_ctx_t**
- typedef struct atcac_pk_ctx **atcac_pk_ctx_t**
- typedef struct atcac_x509_ctx **atcac_x509_ctx_t**

23.174.1 Detailed Description

OpenSSL Integration Support.

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23.174.2 Macro Definition Documentation

23.174.2.1 ATCAC_AES_CMAC_EN

```
#define ATCAC_AES_CMAC_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of an AES-CMAC implementation

23.174.2.2 ATCAC_AES_GCM_EN

```
#define ATCAC_AES_GCM_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of an AES-GCM implementation

23.174.2.3 ATCAC_PKEY_EN

```
#define ATCAC_PKEY_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of a generic asymmetric cryptography implementation

23.174.2.4 ATCAC_SHA1_EN

```
#define ATCAC_SHA1_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of a SHA1 implementation

23.174.2.5 ATCAC_SHA256_EN

```
#define ATCAC_SHA256_EN (FEATURE_ENABLED)
```

Indicates if this module is a provider of a SHA256 implementation

23.174.2.6 ATCAC_SHA384_EN

```
#define ATCAC_SHA384_EN (FEATURE_DISABLED)
```

Indicates if this module is a provider of a SHA384 implementation

Disabled by default. Use FEATURE_ENABLED to use SHA384

23.174.2.7 ATCAC_SHA512_EN

```
#define ATCAC_SHA512_EN (FEATURE_DISABLED)
```

Indicates if this module is a provider of a SHA512 implementation

Disabled by default. Use FEATURE_ENABLED to use SHA512

23.174.2.8 HOSTLIB_CERT_EN

```
#define HOSTLIB_CERT_EN (DEFAULT_ENABLED)
```

Indicates if this module is a provider of x509 certificate handling

23.175 pkcs11_attrib.c File Reference

PKCS11 Library Object Attributes Handling.

```
#include "pkcs11_config.h"
#include "pkcs11_attrib.h"
#include "cryptoauthlib.h"
#include "pkcs11_session.h"
```

Functions

- CK_RV pkcs11_attrib_fill (CK_ATTRIBUTE_PTR pAttribute, const void *pData, const CK_ULONG ulSize)

    Perform the nessasary checks and copy data into an attribute structure.
- CK_RV **pkcs11_attrib_value** (CK_ATTRIBUTE_PTR pAttribute, const CK_ULONG ulValue, const CK_ULONG ulSize)

    Helper function to write a numerical value to an attribute buffer.
- CK_RV **pkcs11_attrib_false** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_attrib_true** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_attrib_empty** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)

23.175.1 Detailed Description

PKCS11 Library Object Attributes Handling.

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23.176 pkcs11_attrib.h File Reference

PKCS11 Library Object Attribute Handling.

```
#include "cryptoauthlib.h"
#include "cryptoki.h"
#include "pkcs11_session.h"
```

Data Structures

- struct pkcs11_attrib_model_s

Typedefs

- typedef CK_RV(∗ attrib_f) (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- typedef struct pkcs11_attrib_model_s **pkcs11_attrib_model**
- typedef struct pkcs11_attrib_model_s ∗ **pkcs11_attrib_model_ptr**

Functions

- CK_RV pkcs11_attrib_fill (CK_ATTRIBUTE_PTR pAttribute, const void ∗pData, const CK_ULONG ulSize)

  Perform the nessasary checks and copy data into an attribute structure.
- CK_RV **pkcs11_attrib_value** (CK_ATTRIBUTE_PTR pAttribute, const CK_ULONG ulValue, const CK_↩ ULONG ulSize)

  Helper function to write a numerical value to an attribute buffer.
- CK_RV **pkcs11_attrib_false** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_attrib_true** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_attrib_empty** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)

23.176.1 Detailed Description

PKCS11 Library Object Attribute Handling.

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23.176.2 Typedef Documentation

23.176.2.1 attrib_f

```
typedef CK_RV(* attrib_f) (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr
pSession)
```

Populate an attribute based on the "object"

23.177 pkcs11_cert.c File Reference

PKCS11 Library Certificate Handling.

```
#include "cryptoauthlib.h"
#include "atcacert/atcacert_def.h"
#include "atcacert/atcacert_client.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_token.h"
#include "pkcs11_cert.h"
#include "pkcs11_os.h"
#include "pkcs11_util.h"
#include "pkcs11_slot.h"
```

Functions

- CK_RV **pkcs11_cert_load** (pkcs11_object_ptr pObject, CK_ATTRIBUTE_PTR pAttribute, ATCADevice device)
- CK_RV **pkcs11_cert_x509_write** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_cert_clear_session_cache** (pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_cert_clear_object_cache** (pkcs11_object_ptr pObject)

Variables

- const pkcs11_attrib_model pkcs11_cert_x509public_attributes [ ]
- const CK_ULONG **pkcs11_cert_x509public_attributes_count** = (CK_ULONG)(sizeof(pkcs11_cert_x509public_attributes) / sizeof(pkcs11_cert_x509public_attributes [0]))
- const pkcs11_attrib_model pkcs11_cert_wtlspublic_attributes [ ]
- const CK_ULONG **pkcs11_cert_wtlspublic_attributes_count** = (CK_ULONG)(sizeof(pkcs11_cert_wtlspublic_attributes) / sizeof(pkcs11_cert_wtlspublic_attributes [0]))
- const pkcs11_attrib_model pkcs11_cert_x509_attributes [ ]
- const CK_ULONG **pkcs11_cert_x509_attributes_count** = (CK_ULONG)(sizeof(pkcs11_cert_x509_attributes) / sizeof(pkcs11_cert_x509_attributes [0]))

23.177.1 Detailed Description

PKCS11 Library Certificate Handling.

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23.178 pkcs11_cert.h File Reference

PKCS11 Library Certificate Handling.

```
#include "pkcs11_object.h"
```

Functions

- CK_RV **pkcs11_cert_x509_write** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_cert_load** (pkcs11_object_ptr pObject, CK_ATTRIBUTE_PTR pAttribute, ATCADevice device)
- CK_RV **pkcs11_cert_clear_session_cache** (pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_cert_clear_object_cache** (pkcs11_object_ptr pObject)

Variables

- const pkcs11_attrib_model pkcs11_cert_x509public_attributes [ ]
- const CK_ULONG **pkcs11_cert_x509public_attributes_count**
- const pkcs11_attrib_model pkcs11_cert_wtlspublic_attributes [ ]
- const CK_ULONG **pkcs11_cert_wtlspublic_attributes_count**
- const pkcs11_attrib_model pkcs11_cert_x509_attributes [ ]
- const CK_ULONG **pkcs11_cert_x509_attributes_count**

23.178.1 Detailed Description

PKCS11 Library Certificate Handling.

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23.179 pkcs11_config.c File Reference

PKCS11 Library Configuration.

```
#include <stdbool.h>
#include "cryptoauthlib.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_slot.h"
#include "pkcs11_object.h"
#include "pkcs11_key.h"
#include "pkcs11_cert.h"
#include "pkcs11_os.h"
#include "pkcs11_util.h"
#include <limits.h>
#include <stdio.h>
#include <ctype.h>
#include <stdlib.h>
#include <errno.h>
#include <fcntl.h>
#include <dirent.h>
```

Data Structures

- struct pkcs11_conf_filedata_s

Macros

- #define **PKCS11_CONFIG_U8_MAX** 0xFFL
- #define **PKCS11_CONFIG_U16_MAX** 0xFFFFL
- #define **PKCS11_CONFIG_U32_MAX** 0xFFFFFFFFL

Typedefs

- typedef struct pkcs11_conf_filedata_s **pkcs11_conf_filedata**
- typedef struct pkcs11_conf_filedata_s ∗ **pkcs11_conf_filedata_ptr**

Functions

- void **pkcs11_config_set_key_size** (pkcs11_object_ptr pObject)
- void **pkcs11_config_init_private** (pkcs11_object_ptr pObject, const char ∗label, size_t len)
- void **pkcs11_config_init_public** (pkcs11_object_ptr pObject, const char ∗label, size_t len)
- void **pkcs11_config_init_secret** (pkcs11_object_ptr pObject, const char ∗label, size_t len, size_t keylen)
- void **pkcs11_config_init_cert** (pkcs11_object_ptr pObject, const char ∗label, size_t len)
- void **pkcs11_config_split_string** (char ∗s, char splitter, int ∗argc, char ∗argv[ ])
- CK_RV **pkcs11_config_cert** (pkcs11_lib_ctx_ptr pLibCtx, pkcs11_slot_ctx_ptr pSlot, pkcs11_object_ptr pObject, CK_ATTRIBUTE_PTR pLabel)
- CK_RV **pkcs11_config_key** (pkcs11_lib_ctx_ptr pLibCtx, pkcs11_slot_ctx_ptr pSlot, pkcs11_object_ptr pObject, CK_ATTRIBUTE_PTR pLabel)
- CK_RV **pkcs11_config_remove_object** (pkcs11_lib_ctx_ptr pLibCtx, pkcs11_slot_ctx_ptr pSlot, pkcs11_object_ptr pObject)
- CK_RV **pkcs11_config_load_objects** (pkcs11_slot_ctx_ptr slot_ctx)
- CK_RV **pkcs11_config_load** (pkcs11_slot_ctx_ptr slot_ctx)

23.179.1 Detailed Description

PKCS11 Library Configuration.

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23.180 pkcs11_debug.c File Reference

PKCS11 Library Debugging.

```
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_os.h"
#include "atca_helpers.h"
```

23.180.1 Detailed Description

PKCS11 Library Debugging.

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23.181 pkcs11_debug.h File Reference

PKCS11 Library Debugging.

```
#include "pkcs11_config.h"
```

Macros

- #define **PKCS11_DEBUG_NOFILE**(...)
- #define **PKCS11_DEBUG**(...)
- #define **PKCS11_DEBUG_RETURN**(x) { return x; }
- #define **pkcs11_debug_attributes**(x, y)

23.181.1 Detailed Description

PKCS11 Library Debugging.

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23.182 pkcs11_digest.h File Reference

PKCS11 Library Digest (SHA256) Handling.

```
#include "cryptoki.h"
```

Functions

- CK_RV **pkcs11_digest_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism)
  Initializes a message-digesting operation using the specified mechanism in the specified session.
- CK_RV **pkcs11_digest** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pDigest, CK_ULONG_PTR pulDigestLen)
  Digest the specified data in a one-pass operation and return the resulting digest.
- CK_RV **pkcs11_digest_update** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)
  Continues a multiple-part digesting operation.
- CK_RV **pkcs11_digest_final** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pDigest, CK_ULONG_PTR pulDigestLen)
  Finishes a multiple-part digesting operation.

23.182.1 Detailed Description

PKCS11 Library Digest (SHA256) Handling.

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23.183 pkcs11_encrypt.c File Reference

PKCS11 Library Encrypt Support.

```
#include "cryptoauthlib.h"
#include <limits.h>
#include "pkcs11_config.h"
#include "pkcs11_encrypt.h"
#include "pkcs11_debug.h"
#include "pkcs11_init.h"
#include "pkcs11_object.h"
#include "pkcs11_session.h"
#include "pkcs11_util.h"
#include "pkcs11_slot.h"
#include "pkcs11_key.h"
```

Functions

- CK_RV **pkcs11_encrypt_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_encrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)
- CK_RV **pkcs11_encrypt_update** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)
- CK_RV **pkcs11_encrypt_final** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)

  Finishes a multiple-part encryption operation.
- CK_RV **pkcs11_decrypt_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_decrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG ulEncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)
- CK_RV **pkcs11_decrypt_update** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG ulEncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)
- CK_RV **pkcs11_decrypt_final** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)

  Finishes a multiple-part decryption operation.

23.183.1 Detailed Description

PKCS11 Library Encrypt Support.

Copyright

23.184 pkcs11_encrypt.h File Reference

PKCS11 Library AES Support.

`#include "cryptoki.h"`

Functions

- CK_RV **pkcs11_encrypt_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_encrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)
- CK_RV **pkcs11_encrypt_update** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)
- CK_RV **pkcs11_encrypt_final** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)

  Finishes a multiple-part encryption operation.
- CK_RV **pkcs11_decrypt_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_decrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG ulEncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)
- CK_RV **pkcs11_decrypt_update** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG ulEncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)
- CK_RV **pkcs11_decrypt_final** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)

  Finishes a multiple-part decryption operation.

23.184.1 Detailed Description

PKCS11 Library AES Support.

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23.185 pkcs11_find.c File Reference

PKCS11 Library Object Find/Searching.

```
#include "cryptoauthlib.h"
#include "atcacert/atcacert_def.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_init.h"
#include "pkcs11_os.h"
#include "pkcs11_slot.h"
#include "pkcs11_session.h"
#include "pkcs11_find.h"
#include "pkcs11_util.h"
#include "pkcs11_cert.h"
```

Functions

- CK_RV **pkcs11_find_init** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)
- CK_RV **pkcs11_find_continue** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE_PTR phObject, CK_ULONG ulMaxObjectCount, CK_ULONG_PTR pulObjectCount)
- CK_RV **pkcs11_find_finish** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_find_get_attribute** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)

23.185.1 Detailed Description

PKCS11 Library Object Find/Searching.

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23.186 pkcs11_find.h File Reference

PKCS11 Library Object Find/Searching.

```
#include "cryptoki.h"
#include "pkcs11_object.h"
```

Functions

- CK_RV **pkcs11_find_init** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_↩ ULONG ulCount)
- CK_RV **pkcs11_find_continue** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE_PTR ph↩ Object, CK_ULONG ulMaxObjectCount, CK_ULONG_PTR pulObjectCount)
- CK_RV **pkcs11_find_finish** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_find_get_attribute** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)

23.186.1 Detailed Description

PKCS11 Library Object Find/Searching.

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23.187 pkcs11_info.c File Reference

PKCS11 Library Information Functions.

```
#include "cryptoauthlib.h"
#include "pkcs11_config.h"
#include "pkcs11_init.h"
#include "pkcs11_slot.h"
#include "pkcs11_session.h"
#include "pkcs11_util.h"
#include "pkcs11_info.h"
#include <stdio.h>
```

Functions

- CK_RV **pkcs11_get_lib_info** (CK_INFO_PTR pInfo)
  Obtains general information about Cryptoki.

Variables

- const char **pkcs11_lib_manufacturer_id** [ ] = "Microchip Technology Inc"
- const char **pkcs11_lib_description** [ ] = "Cryptoauthlib PKCS11 Interface"

23.187.1 Detailed Description

PKCS11 Library Information Functions.

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23.188 pkcs11_info.h File Reference

PKCS11 Library Information Functions.

```
#include "cryptoki.h"
```

Functions

- CK_RV **pkcs11_get_lib_info** (CK_INFO_PTR pInfo)

  Obtains general information about Cryptoki.

Variables

- const char **pkcs11_lib_manufacturer_id** [ ]
- const char **pkcs11_lib_description** [ ]

23.188.1 Detailed Description

PKCS11 Library Information Functions.

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23.189 pkcs11_init.c File Reference

PKCS11 Library Init/Deinit.

```
#include "atca_device.h"
#include "hal/atca_hal.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_init.h"
#include "pkcs11_os.h"
#include "pkcs11_slot.h"
#include "pkcs11_object.h"
#include "pkcs11_session.h"
#include "cryptoauthlib.h"
```

Functions

- pkcs11_lib_ctx_ptr **pkcs11_get_context** (void)

    Retrieve the current library context.
- CK_RV **pkcs11_lock_context** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_context** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_lock_device** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_device** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_lock_both** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_both** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_init_check** (pkcs11_lib_ctx_ptr *ppContext, CK_BBOOL lock)

    Check if the library is initialized properly.
- CK_RV pkcs11_init (CK_C_INITIALIZE_ARGS const *pInitArgs)

    Initializes the PKCS11 API Library for Cryptoauthlib.
- CK_RV pkcs11_deinit (CK_VOID_PTR pReserved)

23.189.1 Detailed Description

PKCS11 Library Init/Deinit.

23.190 pkcs11_init.h File Reference

PKCS11 Library Initialization & Context.

```
#include "atca_compiler.h"
#include "pkcs11_config.h"
#include "pkcs11_os.h"
#include "cryptoauthlib.h"
```

Data Structures

- struct pkcs11_dev_ctx
- struct pkcs11_dev_res
- struct pkcs11_dev_state
- struct pkcs11_lib_ctx_s

Macros

- #define **PKCS11_AES_OP** (0x0u)
- #define **PKCS11_DIGEST_OP_0** (0x1u)
- #define **PKCS11_DIGEST_OP_1** (0x2u)
- #define **PKCS11_AUTH_OP_0** (0x3u)
- #define **PKCS11_AUTH_OP_1** (0x4u)
- #define **PKCS11_MAX_DEV_CTX** (5u)
- #define **MAX_DIGEST_SESSIONS** (2u)
- #define **MAX_AUTH_SESSIONS** (2u)

Typedefs

- typedef struct pkcs11_lib_ctx_s pkcs11_lib_ctx

Functions

- CK_RV pkcs11_init (CK_C_INITIALIZE_ARGS const *pInitArgs)
  Initializes the PKCS11 API Library for Cryptoauthlib.
- CK_RV pkcs11_deinit (CK_VOID_PTR pReserved)
- CK_RV **pkcs11_init_check** (pkcs11_lib_ctx_ptr *ppContext, CK_BBOOL lock)
  Check if the library is initialized properly.
- pkcs11_lib_ctx_ptr **pkcs11_get_context** (void)
  Retrieve the current library context.
- CK_RV **pkcs11_lock_context** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_context** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_lock_device** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_device** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_lock_both** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_unlock_both** (pkcs11_lib_ctx_ptr pContext)

23.190.1 Detailed Description

PKCS11 Library Initialization & Context.

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23.190.2 Typedef Documentation

23.190.2.1 pkcs11_lib_ctx

```
typedef struct pkcs11_lib_ctx_s pkcs11_lib_ctx
```

Library Context

23.191 pkcs11_key.c File Reference

PKCS11 Library Key Object Handling.

```
#include "cryptoauthlib.h"
#include "crypto/atca_crypto_sw_sha1.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_token.h"
#include "pkcs11_attrib.h"
#include "pkcs11_key.h"
#include "pkcs11_session.h"
#include "pkcs11_slot.h"
#include "pkcs11_util.h"
#include "pkcs11_os.h"
```

Functions

- const pkcs11_key_info_t * **pkcs11_get_object_key_type** (ATCADevice device_ctx, pkcs11_object_ptr obj↵_ptr)
- CK_RV **pkcs11_ta_get_pubkey** (CK_VOID_PTR pObject, cal_buffer *key_buffer, pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_key_write** (CK_VOID_PTR pSession, CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR p↵Attribute)
- CK_RV **pkcs11_key_generate** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phKey)
- CK_RV **pkcs11_key_generate_pair** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↵Mechanism, CK_ATTRIBUTE_PTR pPublicKeyTemplate, CK_ULONG ulPublicKeyAttributeCount, CK_↵ATTRIBUTE_PTR pPrivateKeyTemplate, CK_ULONG ulPrivateKeyAttributeCount, CK_OBJECT_HANDLE↵_PTR phPublicKey, CK_OBJECT_HANDLE_PTR phPrivateKey)
- CK_RV **pkcs11_key_derive** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hBaseKey, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT↵_HANDLE_PTR phKey)
- CK_RV **pkcs11_key_clear_session_cache** (pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_key_clear_object_cache** (pkcs11_object_ptr pObject)

Variables

- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p256 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec256 [ ]
- CK_BYTE **pkcs11_key_ec_params_p256** [ ] = { 0x06, 0x08, 0x2a, 0x86, 0x48, 0xce, 0x3d, 0x03, 0x01, 0x07 }
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p224 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec224 [ ]
- CK_BYTE **pkcs11_key_ec_params_p224** [ ] = { 0x06, 0x05, 0x2B, 0x81, 0x04, 0x00, 0x21 }
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p384 [ ]
- CK_BYTE **pkcs11_key_ec_params_p384** [ ] = { 0x06, 0x05, 0x2B, 0x81, 0x04, 0x00, 0x22 }
- CK_BYTE pkcs11_x962_asn1_hdr_ec384 [ ]
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p521 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec521 [ ]
- CK_BYTE **pkcs11_key_ec_params_p521** [ ] = { 0x06, 0x05, 0x2B, 0x81, 0x04, 0x00, 0x23 }
- const pkcs11_ecc_key_info_t ec_key_data_table [4]
- const pkcs11_rsa_key_info_t rsa_key_data_table [4]
- const pkcs11_key_info_t key_data_table [ ]
- const pkcs11_attrib_model pkcs11_key_public_attributes [ ]
- const CK_ULONG **pkcs11_key_public_attributes_count** = (CK_ULONG)(sizeof(pkcs11_key_public_attributes) / sizeof(pkcs11_key_public_attributes [0]))
- const pkcs11_attrib_model pkcs11_key_private_attributes [ ]
- const CK_ULONG **pkcs11_key_private_attributes_count** = (CK_ULONG)(sizeof(pkcs11_key_private_attributes) / sizeof(pkcs11_key_private_attributes [0]))
- const pkcs11_attrib_model pkcs11_key_secret_attributes [ ]
- const CK_ULONG **pkcs11_key_secret_attributes_count** = (CK_ULONG)(sizeof(pkcs11_key_secret_attributes) / sizeof(pkcs11_key_secret_attributes [0]))

23.191.1 Detailed Description

PKCS11 Library Key Object Handling.

Copyright

23.192 pkcs11_key.h File Reference

PKCS11 Library Object Handling.

```
#include "pkcs11_object.h"
```

Data Structures

- struct pkcs11_ecc_key_info_s
- struct pkcs11_rsa_key_info_s
- struct pkcs11_key_info_s

Macros

- #define **PKCS11_X962_ASN1_HEADER_SZ** 3u
- #define **PKCS11_MAX_ECC_ASN1_HDR_SIZE** ATCA_ECCP256_ASN1_HDR_SIZE
- #define **PKCS11_MAX_ECC_RSA_ASN1_HDR_SIZE** ATCA_RSA4K_ASN1_HDR_SIZE
- #define **PKCS11_MAX_ECC_RSA_PB_KEY_SIZE** ATCA_MAX_ECC_RSA_PB_KEY_SIZE
- #define **PKCS11_MAX_ECC_PB_KEY_SIZE** TA_ECC521_PUB_KEY_SIZE
- #define **PKCS11_MAX_RSA_PB_KEY_SIZE** TA_KEY_TYPE_RSA4096_SIZE

Typedefs

- typedef struct pkcs11_ecc_key_info_s **pkcs11_ecc_key_info_t**
- typedef struct pkcs11_rsa_key_info_s **pkcs11_rsa_key_info_t**
- typedef struct pkcs11_key_info_s **pkcs11_key_info_t**

Functions

- CK_RV **pkcs11_key_write** (CK_VOID_PTR pSession, CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR p↩ Attribute)
- CK_RV **pkcs11_key_generate** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phKey)
- CK_RV **pkcs11_key_generate_pair** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↩ Mechanism, CK_ATTRIBUTE_PTR pPublicKeyTemplate, CK_ULONG ulPublicKeyAttributeCount, CK_↩ ATTRIBUTE_PTR pPrivateKeyTemplate, CK_ULONG ulPrivateKeyAttributeCount, CK_OBJECT_HANDLE↩ _PTR phPublicKey, CK_OBJECT_HANDLE_PTR phPrivateKey)
- CK_RV **pkcs11_key_derive** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hBaseKey, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT↩ _HANDLE_PTR phKey)
- CK_RV **pkcs11_key_clear_session_cache** (pkcs11_session_ctx_ptr session_ctx)
- CK_RV **pkcs11_key_clear_object_cache** (pkcs11_object_ptr pObject)
- const pkcs11_key_info_t * **pkcs11_get_object_key_type** (ATCADevice device_ctx, pkcs11_object_ptr obj↩ _ptr)
- CK_RV **pkcs11_ta_get_pubkey** (CK_VOID_PTR pObject, cal_buffer *key_buffer, pkcs11_session_ctx_ptr session_ctx)

Variables

- const pkcs11_ecc_key_info_t **ec_key_data_table** [4]
- const pkcs11_rsa_key_info_t **rsa_key_data_table** [4]
- const pkcs11_key_info_t **key_data_table** [ ]
- const pkcs11_attrib_model pkcs11_key_public_attributes [ ]
- const CK_ULONG **pkcs11_key_public_attributes_count**
- const pkcs11_attrib_model pkcs11_key_private_attributes [ ]
- const CK_ULONG **pkcs11_key_private_attributes_count**
- const pkcs11_attrib_model pkcs11_key_secret_attributes [ ]
- const CK_ULONG **pkcs11_key_secret_attributes_count**
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p256 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec256 [ ]
- CK_BYTE **pkcs11_key_ec_params_p256** [ ]
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p224 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec224 [ ]
- CK_BYTE **pkcs11_key_ec_params_p224** [ ]
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p384 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec384 [ ]
- CK_BYTE **pkcs11_key_ec_params_p384** [ ]
- CK_BYTE pkcs11_ec_pbkey_asn1_hdr_p521 [ ]
- CK_BYTE pkcs11_x962_asn1_hdr_ec521 [ ]
- CK_BYTE **pkcs11_key_ec_params_p521** [ ]

23.192.1 Detailed Description

PKCS11 Library Object Handling.

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23.193 pkcs11_main.c File Reference

PKCS11 Basic library redirects based on the 2.40 specification docs.oasis-open.org/pkcs11/pkcs11-base/v2.40/os/pkcs11-base-v2.40-os.html.

```
#include "cryptoki.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_encrypt.h"
#include "pkcs11_init.h"
#include "pkcs11_info.h"
#include "pkcs11_slot.h"
#include "pkcs11_mech.h"
#include "pkcs11_session.h"
#include "pkcs11_token.h"
#include "pkcs11_find.h"
#include "pkcs11_object.h"
#include "pkcs11_signature.h"
#include "pkcs11_digest.h"
#include "pkcs11_key.h"
```

Functions

- CK_RV **C_Initialize** (CK_VOID_PTR pInitArgs)

  Initializes Cryptoki library NOTES: If pInitArgs is a non-NULL_PTR is must dereference to a CK_C_INITIALIZE_ARGS structure.
- CK_RV **C_Finalize** (CK_VOID_PTR pReserved)

  Clean up miscellaneous Cryptoki-associated resources.
- CK_RV **C_GetInfo** (CK_INFO_PTR pInfo)

  Obtains general information about Cryptoki.
- CK_RV **C_GetFunctionList** (CK_FUNCTION_LIST_PTR_PTR ppFunctionList)

  Obtains entry points of Cryptoki library functions.
- CK_RV **C_GetSlotList** (CK_BBOOL tokenPresent, CK_SLOT_ID_PTR pSlotList, CK_ULONG_PTR pul↩ Count)

  Obtains a list of slots in the system.
- CK_RV **C_GetSlotInfo** (CK_SLOT_ID slotID, CK_SLOT_INFO_PTR pInfo)

  Obtains information about a particular slot.
- CK_RV **C_GetTokenInfo** (CK_SLOT_ID slotID, CK_TOKEN_INFO_PTR pInfo)

  Obtains information about a particular token.
- CK_RV **C_GetMechanismList** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE_PTR pMechanismList, CK↩ _ULONG_PTR pulCount)

  Obtains a list of mechanisms supported by a token (in a slot)
- CK_RV **C_GetMechanismInfo** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE type, CK_MECHANISM_↩ INFO_PTR pInfo)

  Obtains information about a particular mechanism of a token (in a slot)
- CK_RV **C_InitToken** (CK_SLOT_ID slotID, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen, CK_UTF8↩ CHAR_PTR pLabel)

  Initializes a token (in a slot)
- CK_RV **C_InitPIN** (CK_SESSION_HANDLE hSession, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen)

  Initializes the normal user's PIN.
- CK_RV **C_SetPIN** (CK_SESSION_HANDLE hSession, CK_UTF8CHAR_PTR pOldPin, CK_ULONG ulOld↩ Len, CK_UTF8CHAR_PTR pNewPin, CK_ULONG ulNewLen)

  Modifies the PIN of the current user.
- CK_RV **C_OpenSession** (CK_SLOT_ID slotID, CK_FLAGS flags, CK_VOID_PTR pApplication, CK_NOTIFY Notify, CK_SESSION_HANDLE_PTR phSession)

  Opens a connection between an application and a particular token or sets up an application callback for token insertion.
- CK_RV **C_CloseSession** (CK_SESSION_HANDLE hSession)

  Close the given session.
- CK_RV **C_CloseAllSessions** (CK_SLOT_ID slotID)

  Close all open sessions.
- CK_RV **C_GetSessionInfo** (CK_SESSION_HANDLE hSession, CK_SESSION_INFO_PTR pInfo)

  Retrieve information about the specified session.
- CK_RV **C_GetOperationState** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pOperationState, CK↩ _ULONG_PTR pulOperationStateLen)

  Obtains the cryptographic operations state of a session.
- CK_RV **C_SetOperationState** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pOperationState, CK_ULONG ulOperationStateLen, CK_OBJECT_HANDLE hEncryptionKey, CK_OBJECT_HANDLE h↩ AuthenticationKey)

  Sets the cryptographic operations state of a session.
- CK_RV **C_Login** (CK_SESSION_HANDLE hSession, CK_USER_TYPE userType, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen)

  Login on the token in the specified session.
- CK_RV **C_Logout** (CK_SESSION_HANDLE hSession)

Log out of the token in the specified session.

- CK_RV **C_CreateObject** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_↩ ULONG ulCount, CK_OBJECT_HANDLE_PTR phObject)

  Create a new object on the token in the specified session using the given attribute template.
- CK_RV **C_CopyObject** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_↩ ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phNewObject)

  Create a copy of the object with the specified handle.
- CK_RV **C_DestroyObject** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject)

  Destroy the specified object.
- CK_RV **C_GetObjectSize** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_↩ ULONG_PTR pulSize)

  Obtains the size of an object in bytes.
- CK_RV **C_GetAttributeValue** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_↩ ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)

  Obtains an attribute value of an object.
- CK_RV **C_SetAttributeValue** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_↩ ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount)

  Change or set the value of the specified attributes on the specified object.
- CK_RV **C_FindObjectsInit** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_↩ ULONG ulCount)

  Initializes an object search in the specified session using the specified attribute template as search parameters.
- CK_RV **C_FindObjects** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE_PTR phObject, CK↩ _ULONG ulMaxObjectCount, CK_ULONG_PTR pulObjectCount)

  Continue the search for objects in the specified session.
- CK_RV **C_FindObjectsFinal** (CK_SESSION_HANDLE hSession)

  Finishes an object search operation (and cleans up)
- CK_RV **C_EncryptInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ OBJECT_HANDLE hKey)

  Initializes an encryption operation using the specified mechanism and session.
- CK_RV **C_Encrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pEncryptedData, CK_ULONG_PTR pulEncryptedDataLen)

  Perform a single operation encryption operation in the specified session.
- CK_RV **C_EncryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ul↩ PartLen, CK_BYTE_PTR pEncryptedPart, CK_ULONG_PTR pulEncryptedPartLen)

  Continues a multiple-part encryption operation.
- CK_RV **C_EncryptFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pLastEncryptedPart, CK_↩ ULONG_PTR pulLastEncryptedPartLen)

  Finishes a multiple-part encryption operation.
- CK_RV **C_DecryptInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ OBJECT_HANDLE hKey)

  Initialize decryption using the specified object.
- CK_RV **C_Decrypt** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedData, CK_ULONG ul↩ EncryptedDataLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)

  Perform a single operation decryption in the given session.
- CK_RV **C_DecryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedPart, CK_↩ ULONG ulEncryptedPartLen, CK_BYTE_PTR pPart, CK_ULONG_PTR pulPartLen)

  Continues a multiple-part decryption operation.
- CK_RV **C_DecryptFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pLastPart, CK_ULONG_PTR pulLastPartLen)

  Finishes a multiple-part decryption operation.
- CK_RV **C_DigestInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism)

  Initializes a message-digesting operation using the specified mechanism in the specified session.

- CK_RV **C_Digest** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pDigest, CK_ULONG_PTR pulDigestLen)

  Digest the specified data in a one-pass operation and return the resulting digest.
- CK_RV **C_DigestUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPart←Len)

  Continues a multiple-part digesting operation.
- CK_RV **C_DigestKey** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hKey)

  Update a running digest operation by digesting a secret key with the specified handle.
- CK_RV **C_DigestFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pDigest, CK_ULONG_PTR pulDigestLen)

  Finishes a multiple-part digesting operation.
- CK_RV **C_SignInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_←OBJECT_HANDLE hKey)

  Initialize a signing operation using the specified key and mechanism.
- CK_RV **C_Sign** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK←_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Sign the data in a single pass operation.
- CK_RV **C_SignUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part signature operation.
- CK_RV **C_SignFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Finishes a multiple-part signature operation.
- CK_RV **C_SignRecoverInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hKey)

  Initializes a signature operation, where the data can be recovered from the signature.
- CK_RV **C_SignRecover** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulData←Len, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Signs single-part data, where the data can be recovered from the signature.
- CK_RV **C_VerifyInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_←OBJECT_HANDLE hKey)

  Initializes a verification operation using the specified key and mechanism.
- CK_RV **C_Verify** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK←_BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Verifies a signature on single-part data.
- CK_RV **C_VerifyUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPart←Len)

  Continues a multiple-part verification operation.
- CK_RV **C_VerifyFinal** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG ul←SignatureLen)

  Finishes a multiple-part verification operation.
- CK_RV **C_VerifyRecoverInit** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_OBJECT_HANDLE hKey)

  Initializes a verification operation where the data is recovered from the signature.
- CK_RV **C_VerifyRecover** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen, CK_BYTE_PTR pData, CK_ULONG_PTR pulDataLen)

  Verifies a signature on single-part data, where the data is recovered from the signature.
- CK_RV **C_DigestEncryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen, CK_BYTE_PTR pEncryptedPart, CK_ULONG_PTR pulEncryptedPartLen)

  Continues simultaneous multiple-part digesting and encryption operations.
- CK_RV **C_DecryptDigestUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedPart, CK_ULONG ulEncryptedPartLen, CK_BYTE_PTR pPart, CK_ULONG_PTR pulPartLen)

  Continues simultaneous multiple-part decryption and digesting operations.

- CK_RV **C_SignEncryptUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen, CK_BYTE_PTR pEncryptedPart, CK_ULONG_PTR pulEncryptedPartLen)

    Continues simultaneous multiple-part signature and encryption operations.
- CK_RV **C_DecryptVerifyUpdate** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pEncryptedPart, CK_ULONG ulEncryptedPartLen, CK_BYTE_PTR pPart, CK_ULONG_PTR pulPartLen)

    Continues simultaneous multiple-part decryption and verification operations.
- CK_RV **C_GenerateKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phKey)

    Generates a secret key using the specified mechanism.
- CK_RV **C_GenerateKeyPair** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_ATTRIBUTE_PTR pPublicKeyTemplate, CK_ULONG ulPublicKeyAttributeCount, CK_ATTRIBUTE_PTR pPrivateKeyTemplate, CK_ULONG ulPrivateKeyAttributeCount, CK_OBJECT_HANDLE_PTR phPublicKey, CK_OBJECT_HANDLE_PTR phPrivateKey)

    Generates a public-key/private-key pair using the specified mechanism.
- CK_RV **C_WrapKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ OBJECT_HANDLE hWrappingKey, CK_OBJECT_HANDLE hKey, CK_BYTE_PTR pWrappedKey, CK_↩ ULONG_PTR pulWrappedKeyLen)

    Wraps (encrypts) the specified key using the specified wrapping key and mechanism.
- CK_RV **C_UnwrapKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK_↩ OBJECT_HANDLE hUnwrappingKey, CK_BYTE_PTR pWrappedKey, CK_ULONG ulWrappedKeyLen, CK↩ _ATTRIBUTE_PTR pTemplate, CK_ULONG ulAttributeCount, CK_OBJECT_HANDLE_PTR phKey)

    Unwraps (decrypts) the specified key using the specified unwrapping key.
- CK_RV **C_DeriveKey** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR pMechanism, CK↩ _OBJECT_HANDLE hBaseKey, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulAttributeCount, CK_↩ OBJECT_HANDLE_PTR phKey)

    Derive a key from the specified base key.
- CK_RV **C_SeedRandom** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSeed, CK_ULONG ul↩ SeedLen)

    Mixes in additional seed material to the random number generator.
- CK_RV **C_GenerateRandom** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR RandomData, CK_↩ ULONG ulRandomLen)

    Generate the specified amount of random data.
- CK_RV **C_GetFunctionStatus** (CK_SESSION_HANDLE hSession)

    Legacy function - see PKCS#11 v2.40.
- CK_RV **C_CancelFunction** (CK_SESSION_HANDLE hSession)

    Legacy function.
- CK_RV **C_WaitForSlotEvent** (CK_FLAGS flags, CK_SLOT_ID_PTR pSlot, CK_VOID_PTR pRserved)

    Wait for a slot event (token insertion, removal, etc) on the specified slot to occur.

23.193.1 Detailed Description

PKCS11 Basic library redirects based on the 2.40 specification docs.oasis-open.org/pkcs11/pkcs11-base/v2.40/os/pkcs11-base-v2.40-os.html.

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23.194 pkcs11_mech.c File Reference

PKCS11 Library Mechanism Handling.

```
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_init.h"
#include "pkcs11_mech.h"
#include "pkcs11_slot.h"
#include "cryptoauthlib.h"
```

Data Structures

- struct pcks11_mech_table_e

Macros

- #define **PCKS11_MECH_ECC508_EC_CAPABILITY** (CKF_EC_F_P | CKF_EC_NAMEDCURVE | CKF_↩ EC_UNCOMPRESS)
- #define **TABLE_SIZE**(x) sizeof(x) / sizeof(x[0])

Typedefs

- typedef struct pcks11_mech_table_e **pcks11_mech_table_e**
- typedef struct pcks11_mech_table_e * **pcks11_mech_table_ptr**

Functions

- CK_RV **pkcs11_mech_get_list** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE_PTR pMechanismList, CK_ULONG_PTR pulCount)
- CK_RV **pkcs_mech_get_info** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE type, CK_MECHANISM_↩ INFO_PTR pInfo)

23.194.1 Detailed Description

PKCS11 Library Mechanism Handling.

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23.195 pkcs11_mech.h File Reference

PKCS11 Library Mechanism Handling.

```
#include "cryptoki.h"
```

Functions

- CK_RV **pkcs11_mech_get_list** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE_PTR pMechanismList, CK_ULONG_PTR pulCount)
- CK_RV **pkcs_mech_get_info** (CK_SLOT_ID slotID, CK_MECHANISM_TYPE type, CK_MECHANISM_↩ INFO_PTR pInfo)

23.195.1 Detailed Description

PKCS11 Library Mechanism Handling.

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23.196 pkcs11_object.c File Reference

PKCS11 Library Object Handling Base.

```
#include "cryptoauthlib.h"
#include "atcacert/atcacert_def.h"
#include "cryptoki.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_init.h"
#include "pkcs11_slot.h"
#include "pkcs11_session.h"
#include "pkcs11_util.h"
#include "pkcs11_object.h"
#include "pkcs11_os.h"
#include "pkcs11_find.h"
#include "pkcs11_key.h"
#include "pkcs11_cert.h"
```

Functions

- CK_RV **pkcs11_object_alloc** (CK_SLOT_ID slotId, pkcs11_object_ptr ∗ppObject)
- CK_RV **pkcs11_object_free** (pkcs11_object_ptr pObject)
- CK_RV **pkcs11_object_check** (pkcs11_object_ptr ∗ppObject, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_object_get_handle** (pkcs11_object_ptr pObject, CK_OBJECT_HANDLE_PTR phObject)
- CK_RV **pkcs11_object_get_owner** (pkcs11_object_ptr pObject, CK_SLOT_ID_PTR pSlotId)
- CK_RV **pkcs11_object_get_name** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_class** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_type** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_destroyable** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_size** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ULONG_PTR pulSize)

- CK_RV **pkcs11_object_find** (CK_SLOT_ID slotId, pkcs11_object_ptr ∗ppObject, CK_ATTRIBUTE_PTR p↩ Template, CK_ULONG ulCount)
- CK_RV **pkcs11_object_create** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phObject)

  Create a new object on the token in the specified session using the given attribute template.
- CK_RV **pkcs11_object_destroy** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject)

  Destroy the specified object.
- CK_RV **pkcs11_object_deinit** (pkcs11_lib_ctx_ptr pContext)
- ATCA_STATUS **pkcs11_object_load_handle_info** (ATCADevice device, pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_object_is_private** (pkcs11_object_ptr pObject, CK_BBOOL ∗is_private, pkcs11_session_ctx_ptr pSession)

  Checks the attributes of the underlying cryptographic asset to determine if it is a private key - this changes the way the associated public key is referenced.

Variables

- pkcs11_object_cache_t **pkcs11_object_cache** [PKCS11_MAX_OBJECTS_ALLOWED]
- const pkcs11_attrib_model pkcs11_object_monotonic_attributes [ ]
- const CK_ULONG **pkcs11_object_monotonic_attributes_count** = (CK_ULONG)(sizeof(pkcs11_object_monotonic_attributes) / sizeof(pkcs11_object_monotonic_attributes [0]))

23.196.1 Detailed Description

PKCS11 Library Object Handling Base.

Copyright

23.197 pkcs11_object.h File Reference

PKCS11 Library Object Handling.

```
#include "cryptoauthlib.h"
#include "cryptoki.h"
#include "pkcs11_config.h"
#include "pkcs11_attrib.h"
```

Data Structures

- struct pkcs11_object_s
- struct pkcs11_object_cache_s

Macros

- #define **PKCS11_OBJECT_FLAG_DESTROYABLE** (0x01U)
- #define **PKCS11_OBJECT_FLAG_MODIFIABLE** (0x02U)
- #define **PKCS11_OBJECT_FLAG_DYNAMIC** (0x04U)
- #define **PKCS11_OBJECT_FLAG_SENSITIVE** (0x08U)
- #define **PKCS11_OBJECT_FLAG_TA_TYPE** (0x10U)
- #define **PKCS11_OBJECT_FLAG_TRUST_TYPE** (0x20U)
- #define **PKCS11_OBJECT_FLAG_CERT_CACHE** (0x40U)
- #define **PKCS11_OBJECT_FLAG_KEY_CACHE** (0x80U)
- #define **PKCS11_OBJECT_FLAG_KEY_CACHE_COMPLEMENT** ∼(PKCS11_OBJECT_FLAG_KEY_←CACHE & 0xffu)
- #define **PKCS11_OBJECT_FLAG_CERT_CACHE_COMPLEMENT** ∼(PKCS11_OBJECT_FLAG_CERT←_CACHE & 0xffu)

Typedefs

- typedef struct pkcs11_object_s **pkcs11_object**
- typedef struct pkcs11_object_cache_s **pkcs11_object_cache_t**

Functions

- CK_RV **pkcs11_object_alloc** (CK_SLOT_ID slotId, pkcs11_object_ptr ∗ppObject)
- CK_RV **pkcs11_object_free** (pkcs11_object_ptr pObject)
- CK_RV **pkcs11_object_check** (pkcs11_object_ptr ∗ppObject, CK_OBJECT_HANDLE hObject)
- CK_RV **pkcs11_object_find** (CK_SLOT_ID slotId, pkcs11_object_ptr ∗ppObject, CK_ATTRIBUTE_PTR p←Template, CK_ULONG ulCount)
- CK_RV **pkcs11_object_is_private** (pkcs11_object_ptr pObject, CK_BBOOL ∗is_private, pkcs11_session_ctx_ptr pSession)

  Checks the attributes of the underlying cryptographic asset to determine if it is a private key - this changes the way the associated public key is referenced.
- CK_RV **pkcs11_object_deinit** (pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_object_get_owner** (pkcs11_object_ptr pObject, CK_SLOT_ID_PTR pSlotId)
- ATCA_STATUS **pkcs11_object_load_handle_info** (ATCADevice device, pkcs11_lib_ctx_ptr pContext)
- CK_RV **pkcs11_object_get_class** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_name** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_type** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_destroyable** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_object_get_size** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject, CK_ULONG_PTR pulSize)
- CK_RV **pkcs11_object_get_handle** (pkcs11_object_ptr pObject, CK_OBJECT_HANDLE_PTR phObject)
- CK_RV **pkcs11_object_create** (CK_SESSION_HANDLE hSession, CK_ATTRIBUTE_PTR pTemplate, CK_ULONG ulCount, CK_OBJECT_HANDLE_PTR phObject)

  Create a new object on the token in the specified session using the given attribute template.
- CK_RV **pkcs11_object_destroy** (CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hObject)

  Destroy the specified object.

Variables

- pkcs11_object_cache_t **pkcs11_object_cache** [ ]
- const pkcs11_attrib_model pkcs11_object_monotonic_attributes [ ]
- const CK_ULONG **pkcs11_object_monotonic_attributes_count**

23.197.1 Detailed Description

PKCS11 Library Object Handling.

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23.198 pkcs11_os.c File Reference

PKCS11 Library Operating System Abstraction Functions.

```
#include "pkcs11_os.h"
#include "pkcs11_util.h"
#include "pkcs11_init.h"
```

Functions

- CK_RV pkcs11_os_create_mutex (CK_VOID_PTR_PTR ppMutex)
  Application callback for creating a mutex object.
- CK_RV **pkcs11_os_destroy_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_lock_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_unlock_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_alloc_shared_ctx** (void **ppShared, size_t size)
- CK_RV **pkcs11_os_free_shared_ctx** (void *pShared, size_t size)

23.198.1 Detailed Description

PKCS11 Library Operating System Abstraction Functions.

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23.199 pkcs11_os.h File Reference

PKCS11 Library Operating System Abstraction.

```
#include "cryptoki.h"
#include "cryptoauthlib.h"
```

Macros

- #define **pkcs11_os_malloc** hal_malloc
- #define **pkcs11_os_free** hal_free

Functions

- CK_RV pkcs11_os_create_mutex (CK_VOID_PTR_PTR ppMutex)

  Application callback for creating a mutex object.
- CK_RV **pkcs11_os_destroy_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_lock_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_unlock_mutex** (CK_VOID_PTR pMutex)
- CK_RV **pkcs11_os_alloc_shared_ctx** (void **ppShared, size_t size)
- CK_RV **pkcs11_os_free_shared_ctx** (void *pShared, size_t size)

23.199.1 Detailed Description

PKCS11 Library Operating System Abstraction.

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23.200 pkcs11_session.c File Reference

PKCS11 Library Session Handling.

```
#include "cryptoauthlib.h"
#include "host/atca_host.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_session.h"
#include "pkcs11_token.h"
#include "pkcs11_init.h"
#include "pkcs11_slot.h"
#include "pkcs11_object.h"
#include "pkcs11_os.h"
#include "pkcs11_util.h"
#include "pkcs11_key.h"
#include "pkcs11_cert.h"
```

Functions

- pkcs11_session_ctx_ptr **pkcs11_get_session_context** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_session_check** (pkcs11_session_ctx_ptr ∗pSession, CK_SESSION_HANDLE hSession)

    Check if the session is initialized properly.
- CK_RV **pkcs11_reserve_resource** (pkcs11_lib_ctx_ptr pContext, pkcs11_session_ctx_ptr pSession, uint8_t resource)
- CK_RV **pkcs11_release_resource** (pkcs11_lib_ctx_ptr pContext, pkcs11_session_ctx_ptr pSession, uint8_t resource)
- CK_RV **pkcs11_session_open** (CK_SLOT_ID slotID, CK_FLAGS flags, CK_VOID_PTR pApplication, CK←_NOTIFY notify, CK_SESSION_HANDLE_PTR phSession)
- CK_RV **pkcs11_session_close** (CK_SESSION_HANDLE hSession)
- CK_RV pkcs11_session_closeall (CK_SLOT_ID slotID)

    Close all sessions for a given slot - not actually all open sessions.
- CK_RV **pkcs11_session_get_info** (CK_SESSION_HANDLE hSession, CK_SESSION_INFO_PTR pInfo)

    Obtains information about a particular session.
- CK_RV pkcs11_session_login (CK_SESSION_HANDLE hSession, CK_USER_TYPE userType, CK_UTF8←CHAR_PTR pPin, CK_ULONG ulPinLen)
- CK_RV **pkcs11_session_logout** (CK_SESSION_HANDLE hSession)

23.200.1 Detailed Description

PKCS11 Library Session Handling.

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23.201 pkcs11_session.h File Reference

PKCS11 Library Session Management & Context.

```
#include "cryptoki.h"
#include "pkcs11_config.h"
#include "cal_internal.h"
```

Data Structures

- struct pkcs11_session_mech_ctx_s
- struct pkcs11_session_ctx_s

Typedefs

- typedef struct pkcs11_session_mech_ctx_s **pkcs11_session_mech_ctx**
- typedef struct pkcs11_session_mech_ctx_s ∗ **pkcs11_session_mech_ctx_ptr**
- typedef struct pkcs11_session_ctx_s pkcs11_session_ctx
- typedef struct pkcs11_session_ctx_s ∗ **pkcs11_session_ctx_ptr**

Functions

- pkcs11_session_ctx_ptr **pkcs11_get_session_context** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_session_check** (pkcs11_session_ctx_ptr *pSession, CK_SESSION_HANDLE hSession)
  Check if the session is initialized properly.
- CK_RV **pkcs11_session_get_info** (CK_SESSION_HANDLE hSession, CK_SESSION_INFO_PTR pInfo)
  Obtains information about a particular session.
- CK_RV **pkcs11_session_open** (CK_SLOT_ID slotID, CK_FLAGS flags, CK_VOID_PTR pApplication, CK↩_NOTIFY notify, CK_SESSION_HANDLE_PTR phSession)
- CK_RV **pkcs11_session_close** (CK_SESSION_HANDLE hSession)
- CK_RV pkcs11_session_closeall (CK_SLOT_ID slotID)
  Close all sessions for a given slot - not actually all open sessions.
- CK_RV pkcs11_session_login (CK_SESSION_HANDLE hSession, CK_USER_TYPE userType, CK_UTF8↩CHAR_PTR pPin, CK_ULONG ulPinLen)
- CK_RV **pkcs11_session_logout** (CK_SESSION_HANDLE hSession)
- CK_RV **pkcs11_reserve_resource** (pkcs11_lib_ctx_ptr pContext, pkcs11_session_ctx_ptr pSession, uint8_t resource)
- CK_RV **pkcs11_release_resource** (pkcs11_lib_ctx_ptr pContext, pkcs11_session_ctx_ptr pSession, uint8_t resource)

23.201.1 Detailed Description

PKCS11 Library Session Management & Context.

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23.201.2 Typedef Documentation

23.201.2.1 pkcs11_session_ctx

```
typedef struct pkcs11_session_ctx_s pkcs11_session_ctx
```

Session Context

23.202 pkcs11_signature.c File Reference

PKCS11 Library Sign/Verify Handling.

```
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_init.h"
#include "pkcs11_signature.h"
#include "pkcs11_object.h"
#include "pkcs11_session.h"
#include "pkcs11_util.h"
#include "cryptoauthlib.h"
#include "pkcs11_slot.h"
#include "pkcs11_key.h"
#include "atcacert/atcacert_der.h"
```

Functions

- CK_RV **pkcs11_signature_sign_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↩ Mechanism, CK_OBJECT_HANDLE hKey)

  Initialize a signing operation using the specified key and mechanism.
- CK_RV **pkcs11_signature_sign** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Sign the data in a single pass operation.
- CK_RV **pkcs11_signature_sign_continue** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part signature operation.
- CK_RV **pkcs11_signature_sign_finish** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Finishes a multiple-part signature operation.
- CK_RV **pkcs11_signature_verify_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↩ Mechanism, CK_OBJECT_HANDLE hKey)

  Initializes a verification operation using the specified key and mechanism.
- CK_RV **pkcs11_signature_verify** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Verifies a signature on single-part data.
- CK_RV **pkcs11_signature_verify_continue** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part verification operation.
- CK_RV **pkcs11_signature_verify_finish** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Finishes a multiple-part verification operation.

23.202.1 Detailed Description

PKCS11 Library Sign/Verify Handling.

Copyright

23.203 pkcs11_signature.h File Reference

PKCS11 Library Sign/Verify Handling.

```
#include "cryptoki.h"
```

Functions

- CK_RV **pkcs11_signature_sign_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↩ Mechanism, CK_OBJECT_HANDLE hKey)

  Initialize a signing operation using the specified key and mechanism.
- CK_RV **pkcs11_signature_sign** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Sign the data in a single pass operation.
- CK_RV **pkcs11_signature_sign_continue** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part signature operation.
- CK_RV **pkcs11_signature_sign_finish** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG_PTR pulSignatureLen)

  Finishes a multiple-part signature operation.
- CK_RV **pkcs11_signature_verify_init** (CK_SESSION_HANDLE hSession, CK_MECHANISM_PTR p↩ Mechanism, CK_OBJECT_HANDLE hKey)

  Initializes a verification operation using the specified key and mechanism.
- CK_RV **pkcs11_signature_verify** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pData, CK_ULONG ulDataLen, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Verifies a signature on single-part data.
- CK_RV **pkcs11_signature_verify_continue** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pPart, CK_ULONG ulPartLen)

  Continues a multiple-part verification operation.
- CK_RV **pkcs11_signature_verify_finish** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pSignature, CK_ULONG ulSignatureLen)

  Finishes a multiple-part verification operation.

23.203.1 Detailed Description

PKCS11 Library Sign/Verify Handling.

Copyright

23.204 pkcs11_slot.c File Reference

PKCS11 Library Slot Handling.

```
#include "cryptoauthlib.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_init.h"
#include "pkcs11_slot.h"
#include "pkcs11_info.h"
#include "pkcs11_util.h"
#include "pkcs11_object.h"
#include "pkcs11_os.h"
#include <stdio.h>
```

Functions

- pkcs11_slot_ctx_ptr **pkcs11_slot_get_context** (pkcs11_lib_ctx_ptr lib_ctx, CK_SLOT_ID slotID)

    Retrieve the current slot context.
- pkcs11_slot_ctx_ptr **pkcs11_slot_get_new_context** (pkcs11_lib_ctx_ptr lib_ctx)
- CK_VOID_PTR **pkcs11_slot_initslots** (CK_ULONG pulCount)
- CK_RV **pkcs11_slot_deinitslots** (pkcs11_lib_ctx_ptr lib_ctx)
- CK_RV **pkcs11_slot_config** (CK_SLOT_ID slotID)
- CK_RV **pkcs11_slot_init** (CK_SLOT_ID slotID)

    This is an internal function that initializes a pkcs11 slot - it must already have the locks in place before being called.
- CK_RV **pkcs11_slot_get_list** (CK_BBOOL tokenPresent, CK_SLOT_ID_PTR pSlotList, CK_ULONG_PTR pulCount)
- CK_RV **pkcs11_slot_get_info** (CK_SLOT_ID slotID, CK_SLOT_INFO_PTR pInfo)

    Obtains information about a particular slot.

23.204.1 Detailed Description

PKCS11 Library Slot Handling.

The nomenclature here can lead to some confusion - the pkcs11 slot is not the same as a device slot. So for example each slot defined here is a specific device (most systems would have only one). The "slots" as defined by the device specification would be enumerated seperately as related to specific supported mechanisms as cryptographic "objects".

Copyright

23.205 pkcs11_slot.h File Reference

PKCS11 Library Slot Handling & Context.

```
#include "pkcs11_init.h"
#include "cryptoauthlib.h"
```

Data Structures

- struct pkcs11_slot_ctx_s

Macros

- #define **SLOT_STATE_UNINITIALIZED** (0U)
- #define **SLOT_STATE_CONFIGURED** (1U)
- #define **SLOT_STATE_READY** (2U)

Typedefs

- typedef struct pkcs11_slot_ctx_s pkcs11_slot_ctx

Functions

- CK_RV **pkcs11_slot_init** (CK_SLOT_ID slotID)

    This is an internal function that initializes a pkcs11 slot - it must already have the locks in place before being called.
- CK_RV **pkcs11_slot_config** (CK_SLOT_ID slotID)
- CK_VOID_PTR **pkcs11_slot_initslots** (CK_ULONG pulCount)
- CK_RV **pkcs11_slot_deinitslots** (pkcs11_lib_ctx_ptr lib_ctx)
- pkcs11_slot_ctx_ptr **pkcs11_slot_get_context** (pkcs11_lib_ctx_ptr lib_ctx, CK_SLOT_ID slotID)

    Retrieve the current slot context.
- pkcs11_slot_ctx_ptr **pkcs11_slot_get_new_context** (pkcs11_lib_ctx_ptr lib_ctx)
- CK_RV **pkcs11_slot_get_list** (CK_BBOOL tokenPresent, CK_SLOT_ID_PTR pSlotList, CK_ULONG_PTR pulCount)
- CK_RV **pkcs11_slot_get_info** (CK_SLOT_ID slotID, CK_SLOT_INFO_PTR pInfo)

    Obtains information about a particular slot.

23.205.1 Detailed Description

PKCS11 Library Slot Handling & Context.

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23.205.2 Typedef Documentation

23.205.2.1 pkcs11_slot_ctx

```
typedef struct pkcs11_slot_ctx_s pkcs11_slot_ctx
```

Slot Context

23.206 pkcs11_token.c File Reference

PKCS11 Library Token Handling.

```
#include "cryptoauthlib.h"
#include "pkcs11_config.h"
#include "pkcs11_debug.h"
#include "pkcs11_token.h"
#include "pkcs11_slot.h"
#include "pkcs11_info.h"
#include "pkcs11_util.h"
#include "pkcs11_object.h"
#include "pkcs11_key.h"
#include "pkcs11_cert.h"
#include "pkcs11_session.h"
```

Functions

- CK_RV pkcs11_token_init (CK_SLOT_ID slotID, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen, CK_UTF8CHAR_PTR pLabel)
- CK_RV **pkcs11_token_get_access_type** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_writable** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_storage** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_info** (CK_SLOT_ID slotID, CK_TOKEN_INFO_PTR pInfo)

  Obtains information about a particular token.
- CK_RV **pkcs11_token_random** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pRandomData, CK_ULONG ulRandomLen)

  Generate the specified amount of random data.
- CK_RV **pkcs11_token_convert_pin_to_key** (const CK_UTF8CHAR_PTR pPin, const CK_ULONG ulPinLen, const CK_UTF8CHAR_PTR pSalt, const CK_ULONG ulSaltLen, CK_BYTE_PTR pKey, CK_ULONG ulKeyLen, pkcs11_slot_ctx_ptr slot_ctx)
- CK_RV **pkcs11_token_set_pin** (CK_SESSION_HANDLE hSession, CK_UTF8CHAR_PTR pOldPin, CK_ULONG ulOldLen, CK_UTF8CHAR_PTR pNewPin, CK_ULONG ulNewLen)

23.206.1 Detailed Description

PKCS11 Library Token Handling.

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23.207 pkcs11_token.h File Reference

PKCS11 Library Token Management & Context.

```
#include "pkcs11_init.h"
#include "pkcs11_session.h"
```

Macros

- #define **ATCA_SERIAL_NUM_SIZE** (9)

Functions

- CK_RV pkcs11_token_init (CK_SLOT_ID slotID, CK_UTF8CHAR_PTR pPin, CK_ULONG ulPinLen, CK_↩
UTF8CHAR_PTR pLabel)
- CK_RV **pkcs11_token_get_access_type** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_writable** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_storage** (CK_VOID_PTR pObject, CK_ATTRIBUTE_PTR pAttribute, pkcs11_session_ctx_ptr pSession)
- CK_RV **pkcs11_token_get_info** (CK_SLOT_ID slotID, CK_TOKEN_INFO_PTR pInfo)

    Obtains information about a particular token.
- CK_RV **pkcs11_token_convert_pin_to_key** (const CK_UTF8CHAR_PTR pPin, const CK_ULONG ulPin↩
Len, const CK_UTF8CHAR_PTR pSalt, const CK_ULONG ulSaltLen, CK_BYTE_PTR pKey, CK_ULONG ulKeyLen, pkcs11_slot_ctx_ptr slot_ctx)
- CK_RV **pkcs11_token_random** (CK_SESSION_HANDLE hSession, CK_BYTE_PTR pRandomData, CK↩
_ULONG ulRandomLen)

    Generate the specified amount of random data.
- CK_RV **pkcs11_token_set_pin** (CK_SESSION_HANDLE hSession, CK_UTF8CHAR_PTR pOldPin, CK↩
_ULONG ulOldLen, CK_UTF8CHAR_PTR pNewPin, CK_ULONG ulNewLen)

23.207.1 Detailed Description

PKCS11 Library Token Management & Context.

Copyright

23.208 pkcs11_util.c File Reference

PKCS11 Library Utility Functions.

```
#include "pkcs11_util.h"
```

Functions

- void **pkcs11_util_escape_string** (CK_UTF8CHAR_PTR buf, CK_ULONG buf_len)
- CK_RV **pkcs11_util_convert_rv** (ATCA_STATUS status)
- int **pkcs11_util_memset** (void ∗dest, size_t destsz, int ch, size_t count)

23.208.1 Detailed Description

PKCS11 Library Utility Functions.

Copyright

23.209 pkcs11_util.h File Reference

PKCS11 Library Utilities.

```
#include "pkcs11_config.h"
#include "cryptoki.h"
#include "cryptoauthlib.h"
```

Macros

- #define **PKCS11_UTIL_ARRAY_SIZE**(x) sizeof(x) / sizeof(x[0])

Functions

- void **pkcs11_util_escape_string** (CK_UTF8CHAR_PTR buf, CK_ULONG buf_len)
- CK_RV **pkcs11_util_convert_rv** (ATCA_STATUS status)
- int **pkcs11_util_memset** (void *dest, size_t destsz, int ch, size_t count)

23.209.1 Detailed Description

PKCS11 Library Utilities.

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23.210 atca_wolfssl_interface.c File Reference

Crypto abstraction functions for external host side cryptography.

```
#include "cryptoauthlib.h"
```

23.210.1 Detailed Description

Crypto abstraction functions for external host side cryptography.

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23.211 atca_wolfssl_interface.h File Reference

Configuration Check for WolfSSL Integration Support.

```
#include "atca_config_check.h"
```

23.211.1 Detailed Description

Configuration Check for WolfSSL Integration Support.

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23.212 atca_wolfssl_internal.h File Reference

WolfSSL Integration Support.

23.212.1 Detailed Description

WolfSSL Integration Support.

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