RM00284

EdgeLock Enclave Hardware Security Module API

Rev. 4.1 — 25 September 2025 **Reference manual**

Document information

Information	Content
Keywords	i.MX, Linux, EdgeLock Enclave, Hardware Security Module, API, RM00284, LF6.12.34_2.1.0
Abstract	This document is a software reference description of the API provided by the i.MX 8ULP, i.MX 91, i.MX 93, i.MX 95, and i.MX 943 Hardware Security Module (HSM) solutions for the EdgeLock Enclave (ELE) Platform.

1 Overview

This document is a software reference description of the API provided by the i.MX 8ULP, i.MX 91, i.MX 93, i.MX 95, and i.MX 943 Hardware Security Module (HSM) solutions for the EdgeLock Enclave (ELE) Platform.

Note: *A reference implementation of this API is available at https://github.com/nxp-imx/imx-secure-enclave. All code examples in this document use this implementation.*

2 General Concepts Related to the API

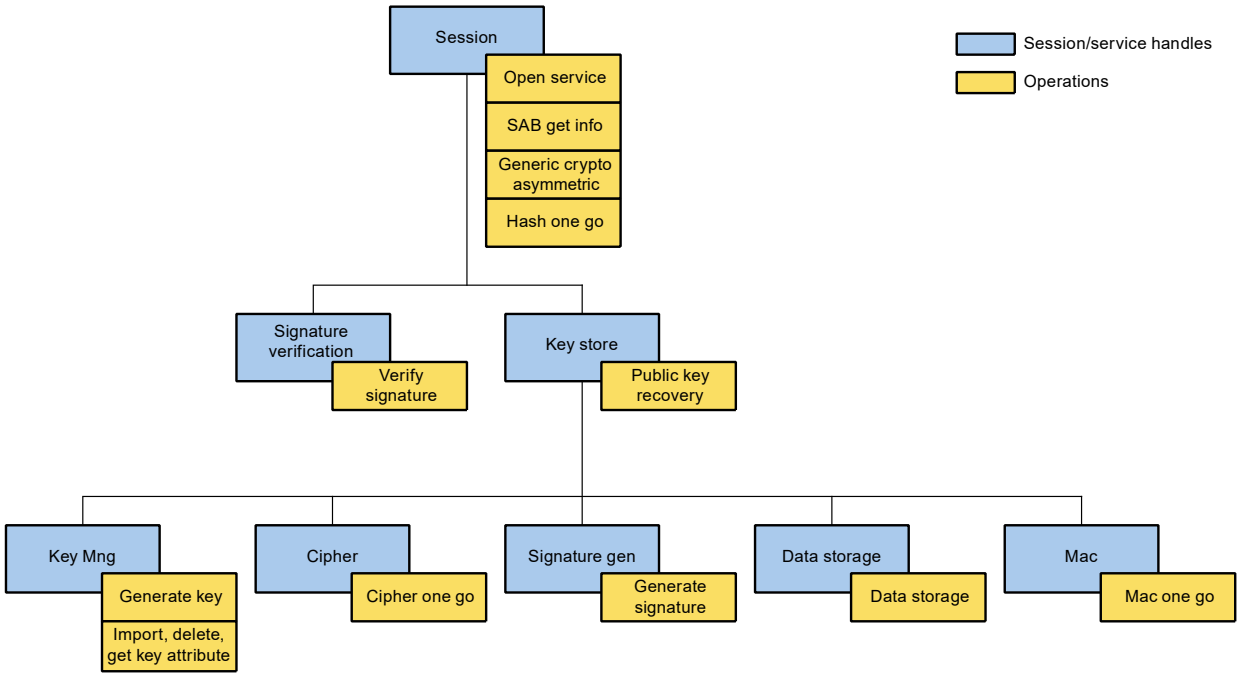

Figure 1. General Concepts Related to the API

2.1 Session

The API must be initialized by a potential requestor by opening a session.

The session establishes a route (MU, DomainID...) between the requester and the HSM. When a session is opened, the HSM returns a handle identifying the session to the requester.

2.2 Service flow

For a given category of services that require service handle, the requestor is expected to open a service flow by invoking the appropriate HSM API.

The session handle, as well as the control data needed for the service flow, are provided as parameters of the call.

Upon reception of the open request, the HSM allocates a context in which the session handle, as well as the provided control parameters are stored and return a handle identifying the service flow.

The context is preserved until the service flow, or the session, are closed by the user and it is used by the HSM to proceed with the sub-sequent operations requested by the user on the service flow.

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2.3 Example

```
/* Open a session: create a route between the user and the HSM */
hsm_open_session(&open_session_args, &session_hdl):

/* Open a key store user is authenticated */
hsm_open_key_store_service(session_hdl, open_svc_key_store args,
 &key_store_hdl);

/* Open cipher service it grants access to ciphering operations */
hsm_open_cipher_service(key_store_hdl, &open_svc_cipher_args, &cipher_hdl):

/* Perform ECB, CCB … */
hsm_cipher_one_go (cipher_hdl, &op_cipher_one_go_args);
/* Perform authenticate and encryption algos: e.g GCM */
hsm_auth_enc(cipher_hdl, &op_auth_enc_args);

/* Perform hashing operations: e.g SHA */
hsm_hash_one_go(hash_hdl, &op_hash_one_go args);

/* Close the session and all the related services */
hsm_close_session(session_hdl);
```

2.4 Key store

A key store can be created by specifying the CREATE flag in the `hsm_open_key_store_service` API. The created key store is not stored in the NVM until a key is generated or imported specifying the "STRICT OPERATION" flag.

Only symmetric and private keys are stored into the key store. Public keys can be exported during the key pair generation operation or recalculated through the `hsm_pub_key_recovery` API.

Secret keys cannot be exported under any circumstances, while they can be imported in encrypted form.

2.4.1 Key management

Keys are divided in groups. Keys belonging to the same group are written/read from the NVM as a monolithic block.

Up to 2 key groups can be handled in the HSM local memory (those immediately available to perform crypto operations), while up to 100 key groups can be handled in the external NVM and imported in the local memory as needed.

If the local memory is full (2 key groups already reside in the HSM local memory) and a new key group is needed by an incoming user request, the HSM swaps one of the local key group with the one needed by the user request.

The user can control which key group to be kept in the local memory (cached) through the `manage_key_group` API lock/unlock mechanism.

As general concept, frequently used keys should be kept, when possible, in the same key group and locked in the local memory for performance optimization.

2.4.2 NVM writing

All the APIs creating a key store (open key store API) or modifying its content (key generation, key management, key derivation functions) provide a "STRICT OPERATION" flag. If the flag is set, the HSM exports

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the relevant key store blocks into the external NVM. In case of key generation/derivation/update, the "STRICT OPERATION" has effect only on the target key group.

Any update to the key store must be considered as effective only after an operation specifying flag "STRICT OPERATION" is acknowledged by the HSM. All the operations not specifying the "STRICT OPERATION" flags impact the HSM local memory only and will be lost in case of system reset.

Due to the limited monotonic counter size, the user should, when possible, perform multiple update before setting the "STRICT OPERATION" flag (i.e., keys to be updated should be kept in the same key group).

When the monotonic counter is completely blown, a warning is returned on each key store export to the NVM to inform the user that the new updates are not roll-back protected.

2.5 Cyber-Resilient Recovery Module (CRRM)

It enables early detection of attacks and adds the capability to recover to a trusted state without human intervention.

2.6 Implementation specificities

HSM API with common features are supported on i.MX 8ULP, i.MX 91, i.MX 93, i.MX 95, and i.MX 943. The details of the supported features per chip are listed in the platform specificities.

3 Module Documentation

3.1 Session

The API must be initialized by a potential requestor by opening a session.

Once a session is closed, all the associated service flows are closed by the HSM.

Data structures

- struct hsm_session_hdl_s
- struct hsm_service_hdl_s
- struct open_session_args_t

Macros

- #define HSM_MAX_SESSIONS (8u)
  Maximum sessions supported.
- #define HSM_MAX_SERVICES (32u)
  Maximum services supported.
- #define HSM_OPEN_SESSION_PRIORITY_LOW (0x00U)
  Low priority. Default setting on platforms that does not support session priorities.
- #define HSM_OPEN_SESSION_PRIORITY_HIGH (0x01U)
  High Priority session.
- #define HSM_OPEN_SESSION_FIPS_MODE_MASK (1u << 0)
  Only FIPS certified operations authorized in this session.
- #define HSM_OPEN_SESSION_EXCLUSIVE_MASK (1u << 1)
  No other HSM sessions are authorized on the same security enclave.
- #define HSM_OPEN_SESSION_LOW_LATENCY_MASK (1u << 3)
  Use a low latency HSM implementation.
- #define HSM_OPEN_SESSION_NO_KEY_STORE_MASK (1u << 4)

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No key store is attached to this session. May provide better performances on some operations depending on the implementation. Usage of the session is restricted to the operations that do not involve secret keys (e.g., hash, signature verification, and random generation).

- #define HSM_OPEN_SESSION_RESERVED_MASK ((1u << 2) | (1u << 5) | (1u << 6) | (1u << 7))
  Bits reserved for future use. Should be set to **0**.
- #define HSM1 (0x0u)
  HSM1 channel on SE, best effort high priority.
- #define HSM2 (0x1u)
  HSM2 channel on SE, best effort high priority.
- #define HSM_NVM (0x80u)
  HSM NVM channel on SE.

Typedefs

- typedef uint32_t hsm_hdl_t

Functions

- hsm_err_t hsm_open_session (open_session_args_t *args, hsm_hdl_t *session_hdl)
- hsm_err_t hsm_close_session (hsm_hdl_t session_hdl)
- struct hsm_session_hdl_s * session_hdl_to_ptr (uint32_t hdl)
- struct hsm_service_hdl_s * service_hdl_to_ptr (uint32_t hdl)
- void delete_session (struct hsm_session_hdl_s *s_ptr)
- void delete_service (struct hsm_service_hdl_s *s_ptr)
- struct hsm_session_hdl_s * add_session (void)
- struct hsm_service_hdl_s * add_service (struct hsm_session_hdl_s *session)

3.1.1 Detailed description

The API must be initialized by a potential requestor by opening a session.

When a session is closed, all the associated service flows are closed by the HSM.

3.1.2 Data structure documentation

3.1.2.1 struct hsm_session_hdl_s

Structure describing the session handle members.

Data Fields

struct plat_os_abs_hdl *	phdl	Pointer to the OS device node.
uint32_t	session_hdl	Session handle.
uint32_t	mu_type	Session MU type.

3.1.2.2 struct hsm_service_hdl_s

Structure describing the service handle members.

Data Fields

struct hsm_session_hdl_s *	session	Pointer to session handle.
uint32_t	service_hdl	Service handle.

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3.1.2.3 struct open_session_args_t

Structure detailing the open session operation member arguments.

Data Fields

uint32_t	session_hdl	Session handle.
uint8_t	mu_type	MU with associated functionality on which the session is opened.
uint8_t	interrupt_idx	Interrupt number of the MU used to indicate data availability.

3.1.3 Typedef documentation

3.1.3.1 hsm_hdl_t

```
typedef uint32_t hsm_hdl_t
```

Define the HSM handle type.

3.1.4 Function documentation

3.1.4.1 hsm_open_session()

```
hsm_err_t hsm_open_session (
open_session_args_t * args,
hsm_hdl_t * session_hdl)
```

Parameters

args	Pointer to the structure containing the function arguments.
session_hdl	Pointer to where the session handle must be written.

Returns

Error code.

3.1.4.2 hsm_close_session()

```
hsm_err_t hsm_close_session (hsm_hdl_t session_hdl)
```

Terminate a previously opened session. All the services opened under this session are closed as well.

Parameters

session_hdl	Pointer to the handle identifying the session to be closed.

Returns

Error code.

3.1.4.3 session_hdl_to_ptr()

```
struct hsm_session_hdl_s* session_hdl_to_ptr (uint32_t hdl)
```


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Return pointer to the session handle.

Parameters

hdl	Identifying the session handle.

Returns

Pointer to the session handle.

3.1.4.4 service_hdl_to_ptr()

```
struct hsm_service_hdl_s* service_hdl_to_ptr (uint32_t hdl)
```

Return pointer to the service handle.

Parameters

hdl	Identifying the session handle.

Returns

Pointer to the service handle.

3.1.4.5 delete_session()

```
void delete_session (struct hsm_session_hdl_s * s_ptr)
```

Delete the session.

Parameters

s_ptr	Pointer identifying the session.

3.1.4.6 delete_service()

```
void delete_service (struct hsm_service_hdl_s * s_ptr)
```

Delete the service.

Parameters

s_ptr	Pointer identifying the service.

3.1.4.7 add_session()

```
struct hsm_session_hdl_s* add_session (void )
```

Add the session.

Returns

Pointer to the session.

3.1.4.8 add_service()

```
struct hsm_service_hdl_s* add_service (
```


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```
struct hsm_session_hdl_s * session)
```

Add the service.

Returns

Pointer to the service.

3.2 Key management

Data Structures

- struct op_delete_key_args_t
- struct op_get_key_attr_args_t
- struct op_import_key_args_t
- struct kek_enc_key_hdr_t
- struct op_generate_key_args_t
- struct open_svc_key_management_args_t
- struct op_manage_key_group_args_t

Macros

- #define HSM_OP_DEL_KEY_FLAGS_STRICT_OPERATION ((hsm_op_delete_key_flags_t)(1u << 7))
- #define HSM_OP_IMPORT_KEY_INPUT_E2GO_TLV ((hsm_op_import_key_flags_t)(1u << 0))
  Bit 0: set 1 means input is E2GO_TLV.
- #define HSM_OP_IMPORT_KEY_INPUT_SIGNED_MSG ((hsm_op_import_key_flags_t)(0u << 0))
  Bit 0: set 0 means input is signed message.
- #define HSM_OP_IMPORT_KEY_FLAGS_AUTOMATIC_GROUP ((hsm_op_import_key_flags_t)(0u << 2))
  Bit 2: set 0 means ELE automatically chooses key group.
- #define HSM_OP_IMPORT_KEY_FLAGS_GROUP_FIELD ((hsm_op_import_key_flags_t)(1u << 2))
  Bit 2: set 1 means ELE stores key in the key group set by the key group field.
- #define HSM_OP_IMPORT_KEY_FLAGS_STRICT_OPERATION ((hsm_op_import_key_flags_t) (1u << 7))
  Bit 7: Strict: Request completed - New key written to NVM with updated MC.
- #define HSM_KEY_USAGE_ENCRYPT ((hsm_key_usage_t) (1u << 8))
- #define HSM_KEY_USAGE_DECRYPT ((hsm_key_usage_t) (1u << 9))
- #define HSM_KEY_USAGE_SIGN_MSG ((hsm_key_usage_t) (1u << 10))
- #define HSM_KEY_USAGE_VERIFY_MSG ((hsm_key_usage_t) (1u << 11))
- #define HSM_KEY_USAGE_SIGN_HASH ((hsm_key_usage_t) (1u << 12))
- #define HSM_KEY_USAGE_VERIFY_HASH ((hsm_key_usage_t) (1u << 13))
- #define HSM_KEY_USAGE_DERIVE ((hsm_key_usage_t) (1u << 14))
- #define HSM_OP_KEY_GENERATION_FLAGS_STRICT_OPERATION ((hsm_op_key_gen_flags_t)(1u << 7))
- #define HSM_OP_KEY_GENERATION_FLAGS_PLAINTEXT_KEY ((hsm_op_key_gen_flags_t)(1u << 3))
- #define HSM_OP_KEY_GENERATION_FLAGS_MONOTONIC_COUNTER ((hsm_op_key_gen_flags_t)(1u << 5))
- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_LOCKDOWN ((hsm_op_manage_key_group_flags_t) (1u << 0))
- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_UNLOCK ((hsm_op_manage_key_group_flags_t) (1u << 1))
  Import the key group.
- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_IMPORT ((hsm_op_manage_key_group_flags_t) (1u << 2))

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Export the key group.

- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_EXPORT ((hsm_op_manage_key_group_flags_t) (1u << 3))
- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_MONOTONIC
- ((hsm_op_manage_key_group_flags_t) (1u << 5))
- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_SYNC_KEYSTORE ((hsm_op_manage_key_group_flags_t) (1u << 6))
- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_STRICT_OPERATION ((hsm_op_manage_key_group_flags_t) (1u << 7))

Typedefs

- typedef uint8_t hsm_op_delete_key_flags_t
- typedef uint8_t hsm_op_import_key_flags_t
- typedef uint32_t hsm_key_usage_t
- typedef uint16_t hsm_key_group_t
- typedef uint16_t hsm_key_info_t
- typedef uint8_t hsm_op_key_gen_flags_t
  Reserverd Bits 0 - 6.
- typedef uint8_t hsm_svc_key_management_flags_t
- typedef uint8_t hsm_op_manage_key_group_flags_t

Enumerations

- enum hsm_storage_loc_t {
  HSM_SE_KEY_STORAGE = 0x00000000 }
- enum hsm_storage_persist_lvl_t {
  HSM_VOLATILE_STORAGE = 0x0,
  HSM_PERSISTENT_STORAGE = 0x1,
  HSM_PERMANENT_STORAGE = 0xFF }
- enum hsm_key_lifetime_t {
  HSM_SE_KEY_STORAGE_VOLATILE = HSM_SE_KEY_STORAGE | HSM_VOLATILE_STORAGE,
  HSM_SE_KEY_STORAGE_PERSISTENT = HSM_SE_KEY_STORAGE | HSM_PERSISTENT_STORAGE,
  HSM_SE_KEY_STORAGE_PERS_PERM = HSM_SE_KEY_STORAGE | HSM_PERMANENT_STORAGE }
- enum hsm_pubkey_type_t {
  HSM_PUBKEY_TYPE_RSA = 0x4001,
  HSM_PUBKEY_TYPE_ECC_BP_R1 = 0x4130,
  HSM_PUBKEY_TYPE_ECC_NIST = 0x4112,
  HSM_PUBKEY_TYPE_ECC_MONTGOMERY = 0x4141,
  HSM_PUBKEY_TYPE_ECC_TWISTED_EDWARDS = 0x4142,
  HSM_PUBKEY_TYPE_ECC_BP_T1 = 0xC180 }
- enum hsm_key_type_t {
  HSM_KEY_TYPE_DERIVE = 0x1200,
  HSM_KEY_TYPE_HMAC = 0x1100,
  HSM_KEY_TYPE_CHACHA20_POLY1305 = 0x2004,
  HSM_KEY_TYPE_AES = 0x2400,
  HSM_KEY_TYPE_SM4 = 0x2405,
  HSM_KEY_TYPE_RSA = 0x7001,
  HSM_KEY_TYPE_ECC_BP_R1 = 0x7130,
  HSM_KEY_TYPE_ECC_NIST = 0x7112,
  HSM_KEY_TYPE_ECC_MONTGOMERY = 0x7141,
  HSM_KEY_TYPE_ECC_TWISTED_EDWARDS = 0x7142,
  HSM_KEY_TYPE_OEM_IMPORT_MK_SK = 0x9200 }

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- enum hsm_bit_key_sz_t {
  HSM_KEY_SIZE_DERIVE_256 = 256,
  HSM_KEY_SIZE_DERIVE_384 = 384,
  HSM_KEY_SIZE_HMAC_224 = 224,
  HSM_KEY_SIZE_HMAC_256 = 256,
  HSM_KEY_SIZE_HMAC_384 = 384,
  HSM_KEY_SIZE_HMAC_512 = 512,
  HSM_KEY_SIZE_AES_128 = 128,
  HSM_KEY_SIZE_AES_192 = 192,
  HSM_KEY_SIZE_AES_256 = 256,
  HSM_KEY_SIZE_CHACHA20_POLY1305_256 = 256,
  HSM_KEY_SIZE_SM4_128 = 128,
  HSM_KEY_SIZE_RSA_2048 = 2048,
  HSM_KEY_SIZE_RSA_3072 = 3072,
  HSM_KEY_SIZE_RSA_4096 = 4096,
  HSM_KEY_SIZE_ECC_BP_R1_224 = 224,
  HSM_KEY_SIZE_ECC_BP_R1_256 = 256,
  HSM_KEY_SIZE_ECC_BP_R1_320 = 320,
  HSM_KEY_SIZE_ECC_BP_R1_384 = 384,
  HSM_KEY_SIZE_ECC_BP_R1_512 = 512,
  HSM_KEY_SIZE_ECC_NIST_224 = 224,
  HSM_KEY_SIZE_ECC_NIST_256 = 256,
  HSM_KEY_SIZE_ECC_NIST_384 = 384,
  HSM_KEY_SIZE_ECC_NIST_521 = 521,
  HSM_KEY_SIZE_ECC_MONTGOMERY_255 = 255,
  HSM_KEY_SIZE_ECC_MONTGOMERY_448 = 448,
  HSM_KEY_SIZE_ECC_TWISTED_EDWARDS_255 = 255,
  HSM_KEY_SIZE_ECC_TWISTED_EDWARDS_448 = 448,
  HSM_KEY_SIZE_ECC_BP_T1_224 = 224,
  HSM_KEY_SIZE_ECC_BP_T1_256 = 256,
  HSM_KEY_SIZE_ECC_BP_T1_320 = 320,
  HSM_KEY_SIZE_ECC_BP_T1_384 = 384,
  HSM_KEY_SIZE_OEM_IMPORT_MK_SK_128 = 128,
  HSM_KEY_SIZE_OEM_IMPORT_MK_SK_192 = 192,
  HSM_KEY_SIZE_OEM_IMPORT_MK_SK_256 = 256 }
- enum hsm_permitted_algo_t {
  PERMITTED_ALGO_SHA224 = ALGO_HASH_SHA224,
  PERMITTED_ALGO_SHA256 = ALGO_HASH_SHA256,
  PERMITTED_ALGO_SHA384 = ALGO_HASH_SHA384,
  PERMITTED_ALGO_SHA512 = ALGO_HASH_SHA512,
  PERMITTED_ALGO_SM3 = ALGO_HASH_SM3,
  PERMITTED_ALGO_HMAC_SHA256 = ALGO_HMAC_SHA256,
  PERMITTED_ALGO_HMAC_SHA384 = ALGO_HMAC_SHA384,
  PERMITTED_ALGO_CMAC = ALGO_CMAC,
  PERMITTED_ALGO_CTR = ALGO_CIPHER_CTR,
  PERMITTED_ALGO_CFB = ALGO_CIPHER_CFB,
  PERMITTED_ALGO_OFB = ALGO_CIPHER_OFB,
  PERMITTED_ALGO_ECB_NO_PADDING = ALGO_CIPHER_ECB_NO_PAD,
  PERMITTED_ALGO_CBC_NO_PADDING = ALGO_CIPHER_CBC_NO_PAD,
  PERMITTED_ALGO_CCM = ALGO_CCM,
  PERMITTED_ALGO_GCM = ALGO_GCM,
  PERMITTED_ALGO_CHACHA20_POLY1305 = ALGO_CHACHA20_POLY1305,

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PERMITTED_ALGO_RSA_PKCS1_V15_SHA_ANY = ALGO_RSA_PKCS1_V15_SHA_ANY,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA_ANY = ALGO_RSA_PKCS1_PSS_MGF1_SHA_ANY,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA224 = ALGO_RSA_PKCS1_V15_SHA224,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA256 = ALGO_RSA_PKCS1_V15_SHA256,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA384 = ALGO_RSA_PKCS1_V15_SHA384,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA512 = ALGO_RSA_PKCS1_V15_SHA512,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA224 = ALGO_RSA_PKCS1_PSS_MGF1_SHA224,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA256 = ALGO_RSA_PKCS1_PSS_MGF1_SHA256,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA384 = ALGO_RSA_PKCS1_PSS_MGF1_SHA384,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA512 = ALGO_RSA_PKCS1_PSS_MGF1_SHA512,
PERMITTED_ALGO_RSA_SIGNATURE_ALL = ALGO_RSA_SIGNATURE_ALL,
PERMITTED_ALGO_ECDSA_SHA224 = ALGO_ECDSA_SHA224,
PERMITTED_ALGO_ECDSA_SHA256 = ALGO_ECDSA_SHA256,
PERMITTED_ALGO_ECDSA_SHA384 = ALGO_ECDSA_SHA384,
PERMITTED_ALGO_ECDSA_SHA512 = ALGO_ECDSA_SHA512,
PERMITTED_ALGO_ED25519PH = ALGO_ED25519PH,
PERMITTED_ALGO_ED448PH = ALGO_ED448PH,
PERMITTED_ALGO_PURE_EDDSA = ALGO_PURE_EDDSA,
PERMITTED_ALGO_EDDSA_ALL = ALGO_EDDSA_ALL,
PERMITTED_ALGO_HMAC_KDF_SHA256 = ALGO_HMAC_KDF_SHA256,
PERMITTED_ALGO_ALL_CIPHER = ALGO_CIPHER_ALL,
PERMITTED_ALGO_ALL_AEAD = ALGO_ALL_AEAD,
PERMITTED_ALGO_OTH_KEK_CBC = ALGO_CIPHER_KEK_CBC,
PERMITTED_ALGO_KEY_EX_ECDH_HKDF_SHA256_KEY_IMPORT =
ALGO_ECDH_HKDF_SHA256_KEY_IMPORT,
PERMITTED_ALGO_KEY_EX_ECDH_HKDF_SHA384_KEY_IMPORT =
ALGO_ECDH_HKDF_SHA384_KEY_IMPORT,
PERMITTED_ALGO_KEY_EX_ECDH_HKDF_SHA_ANY_KEY_IMPORT =
ALGO_ECDH_HKDF_SHA_ANY_KEY_IMPORT,
PERMITTED_ALGO_KEY_EX_ECDH_HKDF_SHA256 = ALGO_ECDH_HKDF_SHA256,
PERMITTED_ALGO_KEY_EX_ECDH_HKDF_SHA384 = ALGO_ECDH_HKDF_SHA384,
PERMITTED_ALGO_KEY_EX_ECDH_HKDF_SHA_ANY = ALGO_ECDH_HKDF_SHA_ANY,
PERMITTED_ALGO_ECDH_HKDF_SHA256 = ALGO_ECDH_HKDF_SHA256_KEY_IMPORT,
PERMITTED_ALGO_ECDH_HKDF_SHA384 = ALGO_ECDH_HKDF_SHA384_KEY_IMPORT,
PERMITTED_ALGO_HKDF_EXTRACT_SHA256 = ALGO_HKDF_EXTRACT_SHA256,
PERMITTED_ALGO_HKDF_EXTRACT_SHA384 = ALGO_HKDF_EXTRACT_SHA384,
PERMITTED_ALGO_HKDF_EXTRACT_SHA_ANY = ALGO_HKDF_EXTRACT_SHA_ANY,
PERMITTED_ALGO_HKDF_EXPAND_SHA256 = ALGO_HKDF_EXPAND_SHA256,
PERMITTED_ALGO_HKDF_EXPAND_SHA384 = ALGO_HKDF_EXPAND_SHA384,
PERMITTED_ALGO_TLS1_2_MASTER_SECRET_SHA256 = ALGO_TLS1_2_MASTER_SECRET_SHA256,
PERMITTED_ALGO_TLS1_2_MASTER_SECRET_SHA384 = ALGO_TLS1_2_MASTER_SECRET_SHA384,
PERMITTED_ALGO_TLS1_2_MASTER_SECRET_SHA_ANY =
ALGO_TLS1_2_MASTER_SECRET_SHA_ANY,
PERMITTED_ALGO_TLS1_3_MASTER_SECRET_SHA256 = ALGO_TLS1_3_MS_SHA256,
PERMITTED_ALGO_TLS1_3_MASTER_SECRET_SHA384 = ALGO_TLS1_3_MS_SHA384,
PERMITTED_ALGO_TLS1_3_MASTER_SECRET_SHA_ANY = ALGO_TLS1_3_MS_SHA_ANY,
PERMITTED_ALGO_ATTEST_CMAC = ALGO_ATTEST_CMAC,
PERMITTED_ALGO_ATTEST_ECDSA_SHA224 = ALGO_ATTEST_ECDSA_SHA224,
PERMITTED_ALGO_ATTEST_ECDSA_SHA256 = ALGO_ATTEST_ECDSA_SHA256,
PERMITTED_ALGO_ATTEST_ECDSA_SHA384 = ALGO_ATTEST_ECDSA_SHA384,
PERMITTED_ALGO_ATTEST_ECDSA_SHA512 = ALGO_ATTEST_ECDSA_SHA512 }

- enum hsm_key_lifecycle_t {

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HSM_KEY_LIFECYCLE_OPEN = 0x1,
HSM_KEY_LIFECYCLE_CLOSED = 0x2,
HSM_KEY_LIFECYCLE_CLOSED_LOCKED = 0x4,
HSM_KEY_LIFECYCLE_INVALID = 0xFF }

Functions

- hsm_err_t hsm_delete_key (hsm_hdl_t key_management_hdl, op_delete_key_args_t *args)
- hsm_err_t hsm_get_key_attr (hsm_hdl_t key_management_hdl, op_get_key_attr_args_t *args)
- hsm_err_t hsm_import_key (hsm_hdl_t key_management_hdl, op_import_key_args_t *args)
- hsm_err_t hsm_generate_key (hsm_hdl_t key_management_hdl, op_generate_key_args_t *args)
- hsm_err_t hsm_open_key_management_service (hsm_hdl_t key_store_hdl, open_svc_key_management_args_t *args, hsm_hdl_t *key_management_hdl)
- hsm_err_t hsm_close_key_management_service (hsm_hdl_t key_management_hdl)
- hsm_err_t hsm_manage_key_group (hsm_hdl_t key_management_hdl, op_manage_key_group_args_t *args)

The entire key group is cached in the HSM local memory.

3.2.1 Detailed description

3.2.2 Data structure documentation

3.2.2.1 struct op_delete_key_args_t

Structure detailing the delete key operation member arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
hsm_op_delete_key_flags_t	flags	Bitmap specifying the operation properties.

3.2.2.2 struct op_get_key_attr_args_t

Structure describing the get key attribute operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
hsm_key_type_t	key_type	Indicates which type of key must be generated.
hsm_bit_key_sz_t	bit_key_sz	Indicates key security size in bits.
hsm_key_lifetime_t	key_lifetime	This attribute comprises of two indicaters-key persistence level and location where the key is stored.
hsm_key_usage_t	key_usage	Indicates the cryptographic operations that key can execute.
hsm_permitted_algo_t	permitted_algo	Indicates the key permitted algorithm.
hsm_key_lifecycle_t	lifecycle	Indicates the device lifecycle in which key is usable.

3.2.2.3 struct op_import_key_args_t

Structure detailing the import key operation member arguments.

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Data Fields

uint32_t	key_identifier	Identifier of the KEK used to encrypt the key to be imported (Ignored if KEK is not used as set as part of the "flags" field).
uint8_t *	input_lsb_addr	Address in the requester space where: • EdgeLock 2GO TLV can be found. • Ignore this field if not `E2GO_TLV`.
uint32_t	input_size	Size in bytes of: • EdgeLock 2GO TLV can be found. • Ignore this field if not `E2GO_TLV`.
hsm_op_import_key_flags_t	flags	Bitmap specifying the operation properties.
uint16_t	key_group	In case of import key ELE option: • The imported key group. • Ignore this field if it is not the ELE option.

3.2.2.4 struct kek_enc_key_hdr_t

Structure describing the encryption key header.

Data Fields

uint8_t	iv[IV_LENGTH]	-
uint8_t *	key	-
uint32_t	tag	-

3.2.2.5 struct op_generate_key_args_t

Structure describing the generate key operation member arguments.

Data Fields

uint32_t *	key_identifier	Pointer to the identifier of the key to be used for the operation. In case of create operation, the new key identifier is stored in this location. To use the key identifier (for example, opaque key), ensure that the flag for the PLAINTEXT key is not set.
uint16_t	out_size	Length of the generated public key in bytes. It must be **0** in case of symmetric keys.
hsm_op_key_gen_flags_t	flags	Bitmap specifying the operation properties.
hsm_key_type_t	key_type	Indicates which type of key must be generated.
hsm_key_group_t	key_group	Key group of the generated key. It must be a value in the range of 0-99. The keys belonging to the same group can be cached in the HSM local memory through the `hsm_manage_key_group` API. Reserved in case of PLAINTEXT flag usage.
uint8_t *	out_key	Pointer to the output area where the generated public key must be written.
uint16_t	exp_out_size	Expected public key output buffer size, valid in case of `HSM_OUT_TOO_SMALL (0x1D)` error code.
hsm_bit_key_sz_t	bit_key_sz	Indicates the key security size in bits.
hsm_key_lifecycle_t	key_lifecycle	Defines the key lifecycle in which the key is usable. If it is set to **0**, the current key lifecycle is used.

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Data Fields...*continued*

		Reserved in case of PLAINTEXT flag usage.
hsm_key_lifetime_t	key_lifetime	This attribute includes two indicaters: key persistence level and location where the key is stored. Reserved in case of PLAINTEXT flag usage.
hsm_key_usage_t	key_usage	Indicates the cryptographic operations that the key can execute. Reserved in case of PLAINTEXT flag usage.
hsm_permitted_algo_t	permitted_algo	Indicates the key permitted algorithm. Reserved in case of PLAINTEXT flag usage.
uint16_t	priv_out_key_sz	Length of the generated private key in bytes. Only valid with the PLAINTEXT flag.
uint8_t *	priv_out_key	Pointer to the output area where the generated private key must be written. Only valid with the PLAINTEXT flag.
uint16_t	exp_priv_out_key_sz	Expected private key output buffer size, valid in case of `HSM_OUT_TOO_SMALL (0x1D)` error code. Only valid with the PLAINTEXT flag.

3.2.2.6 struct open_svc_key_management_args_t

Structure detailing the key management open service member arguments.

Data Fields

hsm_hdl_t	key_management_hdl	Handle identifying the key management service flow.
hsm_svc_key_management_flags_t	flags	Bitmap specifying the services properties.

3.2.2.7 struct op_manage_key_group_args_t

Data Fields

hsm_key_group_t	key_group	It must be a value in the range of 0-99. Keys belonging to the same group can be cached in the HSM local memory through the `hsm_manage_key_group` API.
hsm_op_manage_key_group_flags_t	flags	Bitmap specifying the operation properties.
uint8_t	reserved	-

3.2.3 Macro definition documentation

3.2.3.1 HSM_OP_DEL_KEY_FLAGS_STRICT_OPERATION

```
#define HSM_OP_DEL_KEY_FLAGS_STRICT_OPERATION ((hsm_op_delete_key_flags_t)(1u <<
 7))
```

Bitmap detailing the delete key operation properties.

- Bits 0-4: Reserved.
- Bit 5: Monotonic counter increment.
- Bit 6: Reserved.
- Bit 7: Strict: Request completed - New key written to NVM with updated MC.

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3.2.3.2 HSM_KEY_USAGE_ENCRYPT

```
#define HSM_KEY_USAGE_ENCRYPT ((hsm_key_usage_t) (1u << 8))
```

Bit indicating the permission to encrypt a message with the key.

3.2.3.3 HSM_KEY_USAGE_DECRYPT

```
#define HSM_KEY_USAGE_DECRYPT ((hsm_key_usage_t) (1u << 9))
```

Bit indicating the permission to decrypt a message with the key.

3.2.3.4 HSM_KEY_USAGE_SIGN_MSG

```
#define HSM_KEY_USAGE_SIGN_MSG ((hsm_key_usage_t) (1u << 10))
```

Bit indicating the permission to sign a message with the key.

3.2.3.5 HSM_KEY_USAGE_VERIFY_MSG

```
#define HSM_KEY_USAGE_VERIFY_MSG ((hsm_key_usage_t) (1u << 11))
```

Bit indicating the permission to verify a message signature with the key.

3.2.3.6 HSM_KEY_USAGE_SIGN_HASH

```
#define HSM_KEY_USAGE_SIGN_HASH ((hsm_key_usage_t) (1u << 12))
```

Bit indicating the permission to sign a hashed message with the key.

3.2.3.7 HSM_KEY_USAGE_VERIFY_HASH

```
#define HSM_KEY_USAGE_VERIFY_HASH ((hsm_key_usage_t) (1u << 13))
```

Bit indicating the permission to verify a hashed message signature with the key.

3.2.3.8 HSM_KEY_USAGE_DERIVE

```
#define HSM_KEY_USAGE_DERIVE  ((hsm_key_usage_t) (1u << 14))
```

Bit indicating the permission to derive other keys from this key.

3.2.3.9 HSM_OP_KEY_GENERATION_FLAGS_PLAINTEXT_KEY

```
#define HSM_OP_KEY_GENERATION_FLAGS_PLAINTEXT_KEY ((hsm_op_key_gen_flags_t)(1u
 << 3))
```

Plaintext key. The key is generated and exported to user's memory.

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3.2.3.10 HSM_OP_KEY_GENERATION_FLAGS_MONOTONIC_COUNTER

```
#define HSM_OP_KEY_GENERATION_FLAGS_MONOTONIC_COUNTER ((hsm_op_key_gen_flags_t)
(1u << 5))
```

Monotonic counter increment used in conjunction with SYNC. The request is completed only when the monotonic counter has been updated.

3.2.3.11 HSM_OP_KEY_GENERATION_FLAGS_STRICT_OPERATION

```
#define HSM_OP_KEY_GENERATION_FLAGS_STRICT_OPERATION ((hsm_op_key_gen_flags_t)
 (1u << 7))
```

The request is completed only when the new key is written in the NVM. This is applicable for the persistent and permanent keys.

3.2.3.12 HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_LOCKDOWN

```
#define
 HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_LOCKDOWN ((hsm_op_manage_key_group_flags_t)
 (1u << 0))
```

The entire key group is cached in the HSM local memory.

3.2.3.13 HSM_OP_MANAGE_KEY_GROUP_FLAGS_EXPORT

```
#define HSM_OP_MANAGE_KEY_GROUP_FLAGS_EXPORT ((hsm_op_manage_key_group_flags_t)
 (1u << 3))
```

Export the key group.

3.2.3.14 HSM_OP_MANAGE_KEY_GROUP_FLAGS_MONOTONIC

```
#define
 HSM_OP_MANAGE_KEY_GROUP_FLAGS_MONOTONIC ((hsm_op_manage_key_group_flags_t) (1u
 << 5))
```

When used in conjunction with the SYNC key group or SYNC key store and storage only, the request is completed only when the monotonic counter is updated.

3.2.3.15 HSM_OP_MANAGE_KEY_GROUP_FLAGS_SYNC_KEYSTORE

```
#define
 HSM_OP_MANAGE_KEY_GROUP_FLAGS_SYNC_KEYSTORE ((hsm_op_manage_key_group_flags_t)
 (1u << 6))
```

The request is completed only when the update is written in the NVM. Not applicable for cache lockdown/ unlock.

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3.2.4 Typedef documentation

3.2.4.1 hsm_op_delete_key_flags_t

```
typedef uint8_t hsm_op_delete_key_flags_t
```

Bitmap describing the delete key operation properties.

3.2.4.2 hsm_op_import_key_flags_t

```
typedef uint8_t hsm_op_import_key_flags_t
```

Bitmap specifying the import key operation supported properties.

- Bit 0: Defines input configuration.
- Bits 1-4: Reserved.
- Bit 5: Monotonic counter increment.
- Bit 6: Reserved.
- Bit 7: Strict.

3.2.4.3 hsm_key_usage_t

```
typedef uint32_t hsm_key_usage_t
```

Bitmap indicating the cryptographic operations that the key can execute.

3.2.4.4 hsm_key_group_t

```
typedef uint16_t hsm_key_group_t
```

Bit field indicating the key group.

3.2.4.5 hsm_key_info_t

```
typedef uint16_t hsm_key_info_t
```

Bit field indicating the key information.

3.2.4.6 hsm_op_key_gen_flags_t

```
typedef uint8_t hsm_op_key_gen_flags_t
```

Reserved Bits 0 - 6.

Bitmap specifying the key generate operation supported properties.

3.2.4.7 hsm_svc_key_management_flags_t

```
typedef uint8_t hsm_svc_key_management_flags_t
```


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Bitmap specifying the key management service supported properties.

3.2.5 Enumeration type documentation

3.2.5.1 hsm_storage_loc_t

```
enum hsm_storage_loc_t
```

Enum indicating the key location indicator.

3.2.5.2 hsm_storage_persist_lvl_t

```
enum hsm_storage_persist_lvl_t
```

Enum indicating the key persistent level indicator.

3.2.5.3 hsm_key_lifetime_t

```
enum hsm_key_lifetime_t
```

Enum indicating the key lifetime.

3.2.5.4 hsm_pubkey_type_t

```
enum hsm_pubkey_type_t
```

Enum indicating the public key type.

3.2.5.5 hsm_key_type_t

```
enum hsm_key_type_t
```

Enum indicating the key type.

3.2.5.6 hsm_bit_key_sz_t

```
enum hsm_bit_key_sz_t
```

Enum indicating the key security size in bits.

3.2.5.7 hsm_permitted_algo_t

```
enum hsm_permitted_algo_t
```

Enum describing the permitted algorithm.

Permitted algorithm attribute.

- MAC default algorithms supported
- HMAC truncated permitted algorithm encoding, CMAC truncated permitted algorithm encoding, and Cipher algorithms supported

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- AEAD algorithms supported
- Signature algorithms supported

Note: *Only one of the previous algorithms could be set.*

3.2.5.8 hsm_key_lifecycle_t

```
enum hsm_key_lifecycle_t
```

Enum detailing the permitted key lifecycle.

3.2.6 Function documentation

3.2.6.1 hsm_delete_key()

```
hsm_err_t hsm_delete_key (
hsm_hdl_t key_management_hdl,
op_delete_key_args_t * args)
```

This command is designed to perform the following operation:

- Delete an existing key.

Parameters

key_management_hdl	Handle identifying the key management service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.2.6.2 hsm_get_key_attr()

```
hsm_err_t hsm_get_key_attr(
hsm_hdl_t key_management_hdl,
op_get_key_attr_args_t * args)
```

This command is designed to perform the following operation:

- Get attributes of an existing key.

Parameters

key_management_hdl	Handle identifying the key management service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.2.6.3 hsm_import_key()

```
hsm_err_t hsm_import_key (
hsm_hdl_t key_management_hdl,
```


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```
op_import_key_args_t * args)
```

This API is used to import the key.

Parameters

key_management_hdl	Handle identifying the key management service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.2.6.4 hsm_generate_key()

```
hsm_err_t hsm_generate_key (
hsm_hdl_t key_management_hdl,
op_generate_key_args_t * args)
```

Generate a key or a key pair. Only the confidential keys (symmetric and private keys) are stored in the internal key store, while the non-confidential keys (public key) are exported.

The generated key can be stored using a new or existing key identifier with the restriction that an existing key can be replaced only by a key of the same type.

Parameters

key_management_hdl	Handle identifying the key management service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.2.6.5 hsm_open_key_management_service()

```
hsm_err_t hsm_open_key_management_service (
hsm_hdl_t key_store_hdl,
open_svc_key_management_args_t * args,
hsm_hdl_t * key_management_hdl )
```

Open a key management service flow.

Users must open this service flow to perform operation on the key store keys (generate, update, delete).

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.
key_management_hdl	Pointer to where the key management service flow handle must be written.

Returns

Error code.

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3.2.6.6 hsm_close_key_management_service()

```
hsm_err_t hsm_close_key_management_service (hsm_hdl_t key_management_hdl)
```

Terminate a previously opened key management service flow.

Parameters

key_management_hdl	Handle identifying the key management service flow.

Returns

Error code

3.2.6.7 hsm_manage_key_group()

```
hsm_err_t hsm_manage_key_group (
hsm_hdl_t key_management_hdl,
op_manage_key_group_args_t * args)
```

The entire key group is cached in the HSM local memory.

This command is designed to perform the following operations:

- Lock/Unlock down a key group in the HSM local memory so that the keys are available to the HSM without additional latency.
- Un-lock a key group. HSM may export the key group into the external NVM to free up the local memory as needed.
- Delete an existing key group.

Users can call this function only after having opened a key management service flow.

Parameters

key_management_hdl	Handle identifying the key management service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.3 Ciphering

Modules

- i.MX 8ULP

Data Structures

- struct op_auth_enc_args_t
- struct open_svc_cipher_args_t
- struct op_auth_enc_new_args_t
- struct op_cipher_args_t

Macros

- #define HSM_AUTH_ENC_FLAGS_DECRYPT ((hsm_op_auth_enc_flags_t)(0u << 0))
- #define HSM_AUTH_ENC_FLAGS_ENCRYPT ((hsm_op_auth_enc_flags_t)(1u << 0))

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- #define HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV ((hsm_op_auth_enc_flags_t)(1u << 1))
- #define HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV ((hsm_op_auth_enc_flags_t)(1u << 2))
- #define HSM_AUTH_ENC_FLAGS_PLAINTEXT_KEY ((hsm_op_auth_enc_new_flags_t)(1u << 3))
- #define HSM_AUTH_ENC_FLAGS_ONE_SHOT ((hsm_op_auth_enc_new_flags_t)(1u << 4))
- #define HSM_AUTH_ENC_FLAGS_INIT ((hsm_op_auth_enc_new_flags_t)(1u << 8))
- #define HSM_AUTH_ENC_FLAGS_UPDATE_AAD ((hsm_op_auth_enc_new_flags_t)(1u << 9))
- #define HSM_AUTH_ENC_FLAGS_UPDATE_DATA ((hsm_op_auth_enc_new_flags_t)(1u << 10))
- #define HSM_AUTH_ENC_FLAGS_FINALIZE ((hsm_op_auth_enc_new_flags_t)(1u << 11))
- #define HSM_AUTH_ENC_FLAGS_FINALIZE_VERIFY ((hsm_op_auth_enc_new_flags_t)(1u << 12))
- #define HSM_AUTH_ENC_FLAGS_ABORT ((hsm_op_auth_enc_new_flags_t)(1u << 13))
- #define HSM_AUTH_ENC_FLAGS_GET_CTX_SIZE ((hsm_op_auth_enc_new_flags_t)(1u << 15))
- #define HSM_AEAD_VERIFICATION_STATUS_SUCCESS ((hsm_aead_verification_status_t)(0x5A3CC3 A5u))
- #define HSM_AEAD_VERIFICATION_STATUS_FAILURE ((hsm_aead_verification_status_t)(0x2B4DD4B2u))
- #define HSM_AUTH_ENC_IV_OUT_SIZE (12)
- #define HSM_CIPHER_ONE_GO_FLAGS_DECRYPT ((hsm_op_cipher_one_go_flags_t)(0u << 0))
- #define HSM_CIPHER_ONE_GO_FLAGS_ENCRYPT ((hsm_op_cipher_one_go_flags_t)(1u << 0))
- #define HSM_CIPHER_FLAGS_DECRYPT ((hsm_op_cipher_flags_t)(0u << 0))
- #define HSM_CIPHER_FLAGS_ENCRYPT ((hsm_op_cipher_flags_t)(1u << 0))
- #define HSM_CIPHER_FLAGS_PLAINTEXT_KEY ((hsm_op_cipher_flags_t)(1u << 3))
- #define HSM_CIPHER_FLAGS_INIT ((hsm_op_cipher_flags_t)(1u << 8))
- #define HSM_CIPHER_FLAGS_UPDATE_DATA ((hsm_op_cipher_flags_t)(1u << 10))
- #define HSM_CIPHER_FLAGS_FINALIZE ((hsm_op_cipher_flags_t)(1u << 11))
- #define HSM_CIPHER_FLAGS_ABORT ((hsm_op_cipher_flags_t)(1u << 13))
- #define HSM_CIPHER_FLAGS_GET_CTX_SIZE ((hsm_op_cipher_flags_t)(1u << 15))

Typedefs

- typedef uint8_t hsm_op_auth_enc_flags_t
- typedef uint8_t hsm_svc_cipher_flags_t
- typedef uint16_t hsm_op_auth_enc_new_flags_t
- typedef uint16_t hsm_op_cipher_one_go_flags_t
- typedef uint32_t hsm_aead_verification_status_t
- typedef hsm_op_cipher_one_go_flags_t hsm_op_cipher_flags_t
- typedef op_cipher_args_t op_cipher_one_go_args_t

Enumerations

- enum hsm_op_auth_enc_algo_t {
  HSM_AEAD_ALGO_CCM = ALGO_CCM,
  HSM_AEAD_ALGO_GCM = ALGO_GCM,
  HSM_AEAD_ALGO_CHACHA20_POLY1305 = ALGO_CHACHA20_POLY1305,
  HSM_AEAD_ALGO_ALL_AEAD = ALGO_ALL_AEAD }
- enum hsm_op_cipher_one_go_algo_t {
  HSM_CIPHER_ONE_GO_ALGO_CTR = ALGO_CIPHER_CTR,
  HSM_CIPHER_ONE_GO_ALGO_CFB = ALGO_CIPHER_CFB,
  HSM_CIPHER_ONE_GO_ALGO_OFB = ALGO_CIPHER_OFB,
  HSM_CIPHER_ONE_GO_ALGO_ECB = ALGO_CIPHER_ECB_NO_PAD,
  HSM_CIPHER_ONE_GO_ALGO_CBC = ALGO_CIPHER_CBC_NO_PAD }
- enum hsm_op_cipher_algo_t {
  HSM_CIPHER_ALGO_CTR = ALGO_CIPHER_CTR,

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HSM_CIPHER_ALGO_CFB = ALGO_CIPHER_CFB,
HSM_CIPHER_ALGO_OFB = ALGO_CIPHER_OFB,
HSM_CIPHER_ALGO_ECB = ALGO_CIPHER_ECB_NO_PAD,
HSM_CIPHER_ALGO_CBC = ALGO_CIPHER_CBC_NO_PAD,
}

Functions

- hsm_err_t hsm_do_cipher (hsm_hdl_t cipher_hdl, op_cipher_args_t *args)
- hsm_err_t hsm_auth_enc (hsm_hdl_t cipher_hdl, op_auth_enc_args_t *args)
- hsm_err_t hsm_auth_enc_new(hsm_hdl_t cipher_hdl, op_auth_enc_new_args_t *args);
- hsm_err_t hsm_open_cipher_service (hsm_hdl_t key_store_hdl, open_svc_cipher_args_t *args, hsm_hdl_t *cipher_hdl)
- hsm_err_t hsm_cipher_one_go (hsm_hdl_t cipher_hdl, op_cipher_one_go_args_t *args)
- hsm_err_t hsm_cipher (hsm_hdl_t cipher_hdl, op_cipher_args_t *args)
- hsm_err_t hsm_close_cipher_service (hsm_hdl_t cipher_hdl)

3.3.1 Detailed description

3.3.2 Data structure documentation

3.3.2.1 struct op_auth_enc_args_t

Structure describing the authenticated encryption operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
uint8_t *	iv	Pointer to the user supplied part of initialization vector or nonce, when applicable, otherwise **0**.
uint16_t	iv_size	Size of the fixed part of the initialization vector. For GCM algorithm, it can be: • **0** when the full IV is internally generated (RBG-based construction, Bit 1 of “Flags” field). • **4** when the counter IV generation option is used (deterministic construction, Bit 2 of “Flags” field). • **12** when the IV is entirely generated by the user (Bit 1 and Bit 2 of “Flags” field must be set to 0). For CCM algorithm IV size, it must be 12 bytes.
uint8_t *	aad	Pointer to the additional authentication data.
uint16_t	aad_size	Length in bytes of the additional authentication data.
hsm_op_auth_enc_algo_t	ae_algo	Algorithm to be used for the operation.
hsm_op_auth_enc_flags_t	flags	Bitmap specifying the operation attributes.
uint8_t *	input	Pointer to the input area. • Plaintext for encryption • Ciphertext + Tag (16 bytes) for decryption
uint8_t *	output	Pointer to the output area. Ciphertext + Tag (16 bytes) • IV for encryption • Plaintext for decryption if the Tag is verified

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Data Fields...*continued*

uint32_t	input_size	Length in bytes of the input.
uint32_t	output_size	Length in bytes of the output.
uint32_t	exp_output_size	Expected output buffer size in bytes, valid in case of `HSM_OUT_TOO_SMALL (0x1D)` error code.

3.3.2.2 struct op_auth_enc_new_args_t

Structure describing the authenticated encryption (new) operation arguments.

Data Fields

hsm_op_auth_enc_algo_t	ae_algo	Algorithm to be used for the operation.
hsm_op_auth_enc_new_flags_t	flags	Bitmap specifying the operation attributes.
uint32_t	key_id	Identifier of the key. Only valid with `INIT` or `ONE SHOT`. `PLAINTEXT` key flag must not be set.
uint8_t *	key	`PLAINTEXT` key to be used for operation. Only valid with `INIT` or `ONE SHOT` and `PLAINTEXT` key flag.
uint16_t	key_size	Size in Bytes of Key. Only needed for `ONE SHOT` or `INIT` with `PLAINTEXT`.
uint16_t	key_type	Key Type attribute. Only needed for `ONE SHOT` or `INIT` with `PLAINTEXT`.
uint16_t	iv_size	IV size in bytes. CCM: Must be 12 bytes. GCM: The following are the possible input sizes: • **0** when the Full IV is internally generated (Bit 1 flag) • **4** when the Counter IV generation option is used (Bit 2 flag) • **12** when the IV is entirely generated by the user
uint8_t *	iv_in	Pointer to the user input IV (or nonce) when applicable, otherwise **0**. Only valid with `INIT` or `ONE SHOT`.
uint8_t *	iv_out	IV (or nonce) output if generated randomly by ELE, depends on flags. Only valid with `INIT` or `ONE SHOT` and IV generated by ELE (Bit 1 or Bit 2 flag). 12 bytes in size. User responsible to free the buffer after usage.
uint8_t *	tag	Depending on the operation, usage is different: • Encrypt: Output buffer for the tag. • Decrypt: `ONE SHOT` or `FINALIZE VERIFY`: Input tag buffer to be verified. • Decrypt: `FINALIZE`: output buffer where the tag is outputted. Only valid with `FINALIZE` (output), `FINALIZE VERIFY` (input), or `ONE SHOT`.
uint16_t	tag_size	Size in Bytes of Tag buffer. Must be at least 16 bytes, if applicable. Only valid with `FINALIZE`, `FINALIZE VERIFY`, or `ONE SHOT`.
uint8_t *	aad	Pointer to the additional authentication data, if applicable. Only valid with `ONE SHOT` or `UPDATE AAD`.

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Data Fields...*continued*

uint32_t	aad_size	Size in Bytes of AAD. Must be set to valid value during init phase for AES CCM algo. Must be set to **0** for other algorithm init phase. Only valid with `ONE SHOT` or `UPDATE AAD`.
uint8_t *	input	Pointer to the input area. Depending on the operation, signification is different: • Encrypt: Plaintext to encrypt • Decrypt: Ciphertext to decrypt This field is valid with `ONE SHOT` or `UPDATE DATA`.
uint32_t	input_size	Size in Bytes of Input data. Must be set to a valid value during the initialization phase for AES CCM algo. Must be set to **0** for other algorithm init phase. Only valid with `ONE SHOT` or `UPDATE DATA`.
uint8_t *	output	Pointer to the output area. Depending on the operation, signification is different: • Encrypt: Ciphertext • Decrypt: Plaintext Only valid with `ONE SHOT`, `UPDATE DATA`, `FINALIZE`, or `FINALIZE VERIFY`.
uint32_t	output_size	Length in bytes of the output. Only valid with `ONE SHOT`, `UPDATE DATA`, `FINALIZE`, or `FINALIZE VERIFY`.
uint8_t *	context	Input context buffer. Only valid with `PLAINTEXT` key.
uint16_t	context_size	Size in Bytes of context buffer. Only valid with `PLAINTEXT` key.
uint32_t	exp_output_size	Expected output buffer size in bytes, valid in case of `HSM_OUT_TOO_SMALL (0x1D)` error code. In case of streaming operation, expected context size in bytes if operation failed with 0x1E.
hsm_aead_verification_status_t	verify_status	Verification status.

3.3.2.3 struct op_cipher_args_t

Structure describing the cipher operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation. The flag for `PLAINTEXT` key must not be set.
uint8_t *	key	Pointer to the plaintext key buffer. The flag for `PLAINTEXT` key must be set. Only valid for `INIT` and `ONE SHOT` operations.
uint8_t *	iv	Pointer to the initialization vector (nonce in case of AES CCM). Only valid for `INIT` and `ONE SHOT` operations.
uint16_t	iv_size	Length in bytes of the initialization vector. It must be **0** for algorithms not using the initialization vector. CBC, CTR, OFB, CFB size is fixed to 16 bytes.

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Data Fields...*continued*

		Only valid for `INIT` and `ONE SHOT` operations.
uint8_t	svc_flags	Bitmap specifying the services properties.
uint16_t	flags	Bitmap specifying the operation attributes. One-Shot operation configured, if none of bits 8, 10, 11, 15 are set.
uint32_t	cipher_algo	Algorithm to be used for the operation
uint8_t *	input	Pointer to the input area: • Plaintext for encryption • Ciphertext for decryption – Only valid with `ONE SHOT` or `UPDATE DATA`.
uint8_t *	output	Pointer to the output area: • Ciphertext for encryption • Plaintext for decryption – Only valid with `ONE SHOT`, `UPDATE DATA`, or `FINALIZE`.
uint32_t	input_size	Length in bytes of the input. In case of CBC and ECB, the input size should be multiple of a block cipher size (16 bytes). • Only valid with valid with `ONE SHOT` or `UPDATE DATA`.
uint32_t	output_size	Length in bytes of the output. Only valid with `ONE SHOT` or `UPDATE DATA`.
uint16_t	key_size	Key size in bytes. Only valid with the `PLAINTEXT` flag. Only valid with `ONE SHOT` or `INIT` operations.
uint16_t	key_type	Key type. Only valid with `PLAINTEXT` flag. Only valid with `ONE SHOT` or `INIT` operations.
uint8_t *	context	Context buffer. Only valid with `PLAINTEXT` flag.
uint16_t	context_size	Size in Bytes of context buffer. Only valid with `PLAINTEXT` flag.
uint32_t	exp_output_size	Expected output buffer size in bytes, valid in case of (0x1D) error code. Expected context buffer size in bytes, valid in case of (0x1E) error code.

3.3.2.4 struct open_svc_cipher_args_t

Structure describing the open cipher service members.

Data Fields

uint32_t	cipher_hdl	Handle identifying the cipher service flow.
uint8_t	flags	Bitmap specifying the services properties.
uint8_t	reserved[3]	Reserverd bits.

3.3.3 Macro definition documentation

3.3.3.1 HSM_AUTH_ENC_FLAGS_DECRYPT

```
#define HSM_AUTH_ENC_FLAGS_DECRYPT ((hsm_op_auth_enc_flags_t)(0u << 0))
```


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Bit indicating the decryption operation.

3.3.3.2 HSM_AUTH_ENC_FLAGS_ENCRYPT

```
#define HSM_AUTH_ENC_FLAGS_ENCRYPT ((hsm_op_auth_enc_flags_t)(1u << 0))
```

Bit indicating the encryption operation.

3.3.3.3 HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV

```
#define HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV ((hsm_op_auth_enc_flags_t) (1u <<
 1))
```

Bit indicating the Full IV is internally generated (only relevant for encryption).

3.3.3.4 HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV

```
#define HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV ((hsm_op_auth_enc_flags_t)(1u <<
 2))
```

Bit indicating 4 bytes supplied other bytes internally generated (only relevant for encryption).

3.3.3.5 HSM_AUTH_ENC_FLAGS_PLAINTEXT_KEY

```
#define HSM_AUTH_ENC_FLAGS_PLAINTEXT_KEY ((hsm_op_auth_enc_new_flags_t)(1u <<
 3))
```

Bit indicating the plaintext key user input.

3.3.3.6 HSM_AUTH_ENC_FLAGS_ONE_SHOT

```
#define HSM_AUTH_ENC_FLAGS_ONE_SHOT ((hsm_op_auth_enc_new_flags_t)(1u << 4))
```

Bit indicating the ONE SHOT operation.

3.3.3.7 HSM_AUTH_ENC_FLAGS_INIT

```
#define HSM_AUTH_ENC_FLAGS_INIT ((hsm_op_auth_enc_new_flags_t)(1u << 8))
```

Bit indicating the initialization operation. To initialize a multipart context.

3.3.3.8 HSM_AUTH_ENC_FLAGS_UPDATE_AAD

```
#define HSM_AUTH_ENC_FLAGS_UPDATE_AAD ((hsm_op_auth_enc_new_flags_t)(1u << 9))
```

Bit indicating the UPDATE AAD operation. To update the additional authenticated data.

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3.3.3.9 HSM_AUTH_ENC_FLAGS_UPDATE_DATA

```
#define HSM_AUTH_ENC_FLAGS_UPDATE_DATA ((hsm_op_auth_enc_new_flags_t)(1u << 10))
```

Bit indicating the UPDATE DATA operation. To update the data to be encrypted/decrypted.

3.3.3.10 HSM_AUTH_ENC_FLAGS_FINALIZE

```
#define HSM_AUTH_ENC_FLAGS_FINALIZE ((hsm_op_auth_enc_new_flags_t)(1u << 11))
```

Bit indicating the FINALIZE operation. The tag is output in the buffer.

3.3.3.11 HSM_AUTH_ENC_FLAGS_FINALIZE_VERIFY

```
#define HSM_AUTH_ENC_FLAGS_FINALIZE_VERIFY ((hsm_op_auth_enc_new_flags_t)(1u <<
 12))
```

Bit indicating the FINALIZE VERIFY operation. The tag is compared internally with the one provided in the Tag buffer. Valid only for decryption.

3.3.3.12 HSM_AUTH_ENC_FLAGS_ABORT

```
#define HSM_AUTH_ENC_FLAGS_ABORT ((hsm_op_auth_enc_new_flags_t)(1u << 13))
```

Bit indicating the ABORT operation. To abort a multipart operation and clean the context.

3.3.3.13 HSM_AUTH_ENC_FLAGS_GET_CTX_SIZE

```
#define HSM_AUTH_ENC_FLAGS_GET_CTX_SIZE ((hsm_op_auth_enc_new_flags_t)(1u <<
 15))
```

Bit indicating the GET CTX SIZE operation. Size of the needed allocated context, returned in the output size response field.

3.3.3.14 HSM_AEAD_VERIFICATION_STATUS_SUCCESS

```
#define HSM_AEAD_VERIFICATION_STATUS_SUCCESS ((hsm_aead_verification_status_t)
(0x5A3CC3A5u))
```

Authenticated Encryption response verification status success.

3.3.3.15 HSM_AEAD_VERIFICATION_STATUS_FAILURE

```
#define HSM_AEAD_VERIFICATION_STATUS_FAILURE ((hsm_aead_verification_status_t)
(0x2B4DD4B2u))
```

Authenticated Encryption response verification status failure.

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3.3.3.16 HSM_AUTH_ENC_IV_OUT_SIZE

```
#define HSM_AUTH_ENC_IV_OUT_SIZE (12)
```

It indicates the size (in bytes) of the IV output buffer, received with the response of the Authenticated Encryption operation. Valid only if the flag is set for:

- HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV
- HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV

3.3.3.17 HSM_CIPHER_ONE_GO_FLAGS_DECRYPT

```
#define HSM_CIPHER_ONE_GO_FLAGS_DECRYPT ((hsm_op_cipher_one_go_flags_t) (0u <<
 0))
```

Bit indicating the decrypt operation.

3.3.3.18 HSM_CIPHER_ONE_GO_FLAGS_ENCRYPT

```
#define HSM_CIPHER_ONE_GO_FLAGS_ENCRYPT ((hsm_op_cipher_one_go_flags_t) (1u <<
 0))
```

Bit indicating the encrypt operation.

3.3.3.19 HSM_CIPHER_FLAGS_DECRYPT

```
#define HSM_CIPHER_FLAGS_DECRYPT ((hsm_op_cipher_flags_t)(0u << 0))
```

Bit indicating the decrypt operation.

3.3.3.20 HSM_CIPHER_FLAGS_ENCRYPT

```
#define HSM_CIPHER_FLAGS_ENCRYPT ((hsm_op_cipher_flags_t)(1u << 0))
```

Bit indicating the encrypt operation.

3.3.3.21 HSM_CIPHER_FLAGS_PLAINTEXT_KEY

```
#define HSM_CIPHER_FLAGS_PLAINTEXT_KEY ((hsm_op_cipher_flags_t)(1u << 3))
```

Bit indicating the plaintext key user input.

3.3.3.22 HSM_CIPHER_FLAGS_INIT

```
#define HSM_CIPHER_FLAGS_INIT ((hsm_op_cipher_flags_t)(1u << 8))
```

Bit indicating the initialization for a multipart context.

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3.3.3.23 HSM_CIPHER_FLAGS_UPDATE_DATA

```
#define HSM_CIPHER_FLAGS_UPDATE_DATA ((hsm_op_cipher_flags_t)(1u << 10))
```

Bit indicating UPDATE DATA to be encrypted/decrypted.

3.3.3.24 HSM_CIPHER_FLAGS_FINALIZE

```
#define HSM_CIPHER_FLAGS_FINALIZE ((hsm_op_cipher_flags_t)(1u << 11))
```

Bit indicating to finalize the multipart operation.

3.3.3.25 HSM_CIPHER_FLAGS_ABORT

```
#define HSM_CIPHER_FLAGS_ABORT ((hsm_op_cipher_flags_t)(1u << 13))
```

Bit indicating to abort a multipart operation and to clean the context.

3.3.3.26 HSM_CIPHER_FLAGS_GET_CTX_SIZE

```
#define HSM_CIPHER_FLAGS_GET_CTX_SIZE ((hsm_op_cipher_flags_t)(1u << 15))
```

Bit indicating to get the context size. Size of the needed allocated context is returned in the output size response field.

3.3.4 Typedef documentation

3.3.4.1 hsm_op_auth_enc_flags_t

```
typedef uint8_t hsm_op_auth_enc_flags_t
```

Bit field indicating the authenticated encryption operations.

3.3.4.2 hsm_op_auth_enc_new_flags_t

```
typedef uint16_t hsm_op_auth_enc_new_flags_t
```

Bit field indicating the authenticated encryption operations.

3.3.4.3 hsm_aead_verification_status_t

```
typedef uint32_t hsm_aead_verification_status_t
```

Bit indicating the Authenticated Encryption (New) response verification status.

3.3.4.4 hsm_svc_cipher_flags_t

```
typedef uint8_t hsm_svc_cipher_flags_t
```

Bit field describing the open cipher service requested operation.

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3.3.4.5 hsm_op_cipher_one_go_flags_t

```
typedef uint16_t hsm_op_cipher_one_go_flags_t
```

Bit field indicating the requested operations.

3.3.4.6 hsm_op_cipher_flags_t

```
typedef hsm_op_cipher_one_go_flags_t hsm_op_cipher_flags_t
```

Bit field indicating the requested operations.

3.3.4.7 op_cipher_one_go_args_t

```
typedef op_cipher_args_t op_cipher_one_go_args_t
```

Structure describing the cipher one go operation arguments.

3.3.5 Enumeration type documentation

3.3.5.1 hsm_op_auth_enc_algo_t

```
enum hsm_op_auth_enc_algo_t
```

Bit field indicating the supported algorithm.

Enumerator

HSM_AEAD_ALGO_CCM	CCM (AES CCM)
HSM_AEAD_ALGO_GCM	GCM (AES GCM)
HSM_AEAD_ALGO_CHACHA20_POLY1305	CHACHA20_POLY1305
HSM_AEAD_ALGO_ALL_AEAD	ALL AEAD (ALL AEAD)

3.3.5.2 hsm_op_cipher_one_go_algo_t

```
enum hsm_op_cipher_one_go_algo_t
```

Enum describing the cipher one go operation algorithm.

Enumerator

HSM_CIPHER_ONE_GO_ALGO_CTR	CTR (AES supported).
HSM_CIPHER_ONE_GO_ALGO_CFB	CFB (AES supported).
HSM_CIPHER_ONE_GO_ALGO_OFB	OFB (AES supported).
HSM_CIPHER_ONE_GO_ALGO_ECB	ECB no padding (AES supported).
HSM_CIPHER_ONE_GO_ALGO_CBC	CBC no padding (AES supported).

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3.3.5.3 hsm_op_cipher_algo_t

```
enum hsm_op_cipher_algo_t
```

Enum describing the cipher operation algorithm.

Enumerator

HSM_CIPHER_ALGO_CTR	CTR (AES supported).
HSM_CIPHER_ALGO_CFB	CFB (AES supported).
HSM_CIPHER_ALGO_OFB	OFB (AES supported).
HSM_CIPHER_ALGO_ECB	ECB no padding (AES supported).
HSM_CIPHER_ALGO_CBC	CBC no padding (AES supported).

3.3.6 Function documentation

3.3.6.1 hsm_do_cipher()

```
hsm_err_t hsm_do_cipher (
hsm_hdl_t cipher_hdl,
op_cipher_args_t *args)
```

Secondary API to perform ciphering operation.

This API does the following operations:

- Opens an Cipher service flow.
- Performs the Ciphering operation.
- Terminates a previously opened Cipher service flow.

Users can call this function only after having opened a cipher service flow.

Parameters

cipher_hdl	Handle identifying the cipher service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.2 hsm_auth_enc()

```
hsm_err_t hsm_auth_enc (
hsm_hdl_t cipher_hdl,
op_auth_enc_args_t * args)
```

Perform authenticated encryption operation.

Users can call this function only after having opened a Cipher service flow.

For decryption operations, the full IV is supplied by the caller through the `iv` and `iv_size` parameters. `HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV` and `HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV` flags are ignored.

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For encryption operations, either HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV or HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV must be set when calling this function:

- When HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV is set, the full IV is internally generated, iv and iv_size must be set to **0**.
- When HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV is set, the user supplies a 4 byte fixed part of the IV. The other IV bytes are internally generated.

Note: *The API is deprecated now.*

Parameters

cipher_hdl	Handle identifying the cipher service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.3 hsm_auth_enc_new()

```
hsm_err_t hsm_auth_enc_new(
hsm_hdl_t cipher_hdl,
op_auth_enc_new_args_t *args)
```

Perform the authenticated encryption operation (NEW).

- One-Shot AEAD operation using an opaque or plaintext key.
- Streaming AEAD operation using an opaque or plaintext key.

Users can call this function only after having opened a cipher service flow.

Parameters

cipher_hdl	Handle identifying the cipher service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.4 hsm_open_cipher_service()

```
hsm_err_t hsm_open_cipher_service (
hsm_hdl_t key_store_hdl,
open_svc_cipher_args_t * args,
hsm_hdl_t * cipher_hdl)
```

- Open a Cipher service flow.
- Users can call this function only after having opened a key-store service flow.
- Users must open this service to perform Ciphering operation.

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.
cipher_hdl	Pointer to where the cipher service flow handle must be written.

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Returns

Error code

3.3.6.5 hsm_cipher_one_go()

```
hsm_err_t hsm_cipher_one_go (
hsm_hdl_t cipher_hdl,
op_cipher_args_t * args)
```

Perform Ciphering operation.

Users can call this function only after having opened a cipher service flow.

Note: *This API will be deprecated soon.*

Parameters

cipher_hdl	Handle identifying the cipher service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.6 hsm_cipher()

```
hsm_err_t hsm_cipher(
hsm_hdl_t cipher_hdl,
op_cipher_args_t *args)
```

Perform the ciphering operation:

- One-Shot cipher operation using an opaque or plaintext key.
- Streaming cipher operation using an opaque or plaintext key.

Users can call this function only after having opened a cipher service flow.

Parameters

cipher_hdl	Handle identifying the cipher service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.7 hsm_close_cipher_service()

```
hsm_err_t hsm_close_cipher_service (hsm_hdl_t cipher_hdl)
```

Terminate a previously opened Cipher service flow.

Parameters

cipher_hdl	Pointer to handle identifying the Cipher service flow to be closed.

Returns

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Error code

3.4 Signature generation

Data Structures

- struct op_pub_key_attest_args_t
- struct open_svc_sign_gen_args_t
- struct op_generate_sign_args_t
- struct op_prepare_sign_args_t

Macros

- #define HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST ((hsm_op_generate_sign_flags_t) (0u << 0))
- #define HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE ((hsm_op_generate_sign_flags_t)(1u << 0))
- #define HSM_OP_GENERATE_SIGN_FLAGS_PLAINTEXT_KEY ((hsm_op_generate_sign_flags_t)(1u << 3))
- #define HSM_OP_PREPARE_SIGN_INPUT_DIGEST ((hsm_op_prepare_signature_flags_t)(0u << 0))
  Bit indicating input digest.
- #define HSM_OP_PREPARE_SIGN_INPUT_MESSAGE ((hsm_op_prepare_signature_flags_t) (1u << 0))
  Bit indicating input message.
- #define HSM_OP_PREPARE_SIGN_COMPRESSED_POINT ((hsm_op_prepare_signature_flags_t) (1u << 1))
  Bit indicating compressed point.

Typedefs

- typedef uint8_t hsm_op_generate_sign_flags_t
- typedef uint8_t hsm_op_prepare_signature_flags_t

Enumerations

- enum hsm_op_pub_key_attest_algo_t {
  HSM_PKEY_ATTEST_ALGO_CMAC = ALGO_ATTEST_CMAC,
  HSM_PKEY_ATTEST_ALGO_ECDSA_SHA224 = ALGO_ATTEST_ECDSA_SHA224,
  HSM_PKEY_ATTEST_ALGO_ECDSA_SHA256 = ALGO_ATTEST_ECDSA_SHA256,
  HSM_PKEY_ATTEST_ALGO_ECDSA_SHA384 = ALGO_ATTEST_ECDSA_SHA384,
  HSM_PKEY_ATTEST_ALGO_ECDSA_SHA512 = ALGO_ATTEST_ECDSA_SHA512 }
- enum hsm_signature_scheme_id_t {
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA224 = 0x06000208,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA256 = 0x06000209,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA384 = 0x0600020A,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA512 = 0x0600020B,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_ANY_HASH = 0x060002FF,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA224 = 0x06000308,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA256 = 0x06000309,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA384 = 0x0600030A,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA512 = 0x0600030B,
  HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_ANY_HASH = 0x060003FF,
  HSM_SIGNATURE_SCHEME_ECDSA_ANY = 0x06000600,
  HSM_SIGNATURE_SCHEME_ECDSA_SHA224 = 0x06000608,
  HSM_SIGNATURE_SCHEME_ECDSA_SHA256 = 0x06000609,
  HSM_SIGNATURE_SCHEME_ECDSA_SHA384 = 0x0600060A,
  HSM_SIGNATURE_SCHEME_ED25519PH = 0x0600090B,

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HSM_SIGNATURE_SCHEME_ED448PH = 0x06000915,
HSM_SIGNATURE_SCHEME_PURE_EDDSA = 0x06000800,
HSM_SIGNATURE_SCHEME_EDDSA_ALL = 0x86000800,
HSM_SIGNATURE_SCHEME_ECDSA_SHA512 = 0x0600060B }

Functions

- hsm_err_t hsm_do_sign (hsm_hdl_t key_store_hdl, op_generate_sign_args_t *args)
- hsm_err_t hsm_open_signature_generation_service (hsm_hdl_t key_store_hdl, open_svc_sign_gen_args_t *args, hsm_hdl_t *signature_gen_hdl)
- hsm_err_t hsm_pub_key_attest (hsm_hdl_t signature_gen_hdl, op_pub_key_attest_args_t args)
- hsm_err_t hsm_close_signature_generation_service (hsm_hdl_t signature_gen_hdl)
- hsm_err_t hsm_generate_signature (hsm_hdl_t signature_gen_hdl, op_generate_sign_args_t *args)
- hsm_err_t hsm_prepare_signature (hsm_hdl_t signature_gen_hdl, op_prepare_sign_args_t *args)

3.4.1 Detailed description

3.4.2 Data structure documentation

3.4.2.1 struct op_pub_key_attest_args_t

Structure to represent the generate sign operation arguments.

Table 1. Data Fields

uint32_t	key_identifier	Identifier of the key to be attested.
uint32_t	key_attestation_id	Identifier of the key to be used for the attestation.
hsm_op_pub_key_attest_algo_t	attest_algo	Algorithm to be used for the attestation.
uint8_t *	auth_challenge	Pointer to the authentication challenge.
uint32_t	auth_challenge_size	Authentication challenge size in bytes.
uint8_t *	certificate	Pointer to the output certificate encoded as signed TLV buffer.
uint32_t	certificate_size	Certificate size in bytes.
uint32_t	exp_certificate_size	Expected certificate size for output, returned by FW in case of HSM_OUT_TOO_SMALL (0x1D) error.

3.4.2.2 struct open_svc_sign_gen_args_t

Structure to represent the generate sign open service arguments.

Data Fields

hsm_hdl_t	signature_gen_hdl	-

3.4.2.3 struct op_generate_sign_args_t

Structure to represent the generate sign operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation. To the key identifier (for example, opaque key), ensure that the flag for the PLAINTEXT key is not set.

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Data Fields...*continued*

uint8_t *	Message	Pointer to the input (message or message digest) to be signed.
uint8_t *	Signature	Pointer to the output area where the signature must be stored. The signature `S=(r,s)` is stored in the format `r||s||Ry`, where: `Ry` is an additional byte containing the lsb of `y`. `Ry` should be considered valid only if `HSM_OP_GENERATE_SIGN_FLAGS_COMPRESSED_POINT` is set.
uint16_t	signature_size	Length in bytes of the output. After the signature generation operation, this field contains the expected signature buffer size, if the operation fails due to the provided output buffer size being too short.
uint32_t	message_size	Length of the input in bytes.
hsm_signature_scheme_id_t	scheme_id	Identifier of the digital signature scheme to be used for the operation.
uint16_t	salt_len	Salt length in bytes.
uint16_t	key_type	Key Type. Only valid with the PLAINTEXT flag.
uint16_t	priv_key_size	Size of the private key input buffer in bytes. Only valid with the PLAINTEXT flag.
uint8_t *	priv_key	Pointer to the private key input buffer, to be used to generate the signature. Only valid with the PLAINTEXT flag.
uint16_t	key_security_size	Keypair security size in bits. Only valid with the PLAINTEXT flag.
uint16_t	exp_signature_size	Expected signature buffer size for output, returned by FW if the input signature size provided is less than the required size.
hsm_op_generate_sign_flags_t	flags	Bitmap specifying the operation attributes.

3.4.2.4 struct op_prepare_sign_args_t

Structure detailing the prepare signature operation member arguments.

Data Fields

hsm_signature_scheme_id_t	scheme_id	Identifier of the digital signature scheme to be used for the operation.
hsm_op_prepare_signature_flags_t	flags	Bitmap specifying the operation attributes.

3.4.3 Macro definition documentation

3.4.3.1 HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST

```
#define HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST ((hsm_op_generate_sign_flags_t)
 (0u << 0))
```

Bit field indicating the input is the message digest.

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3.4.3.2 HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE

```
#define HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE ((hsm_op_generate_sign_flags_t)
(1u << 0))
```

Bit field indicating the input is the actual message.

3.4.3.3 HSM_OP_GENERATE_SIGN_FLAGS_PLAINTEXT_KEY

```
#define HSM_OP_GENERATE_SIGN_FLAGS_PLAINTEXT_KEY ((hsm_op_generate_sign_flags_t)
(1u << 3))
```

Bit field indicating the private key input from the user.

3.4.4 Typedef documentation

3.4.4.1 hsm_op_generate_sign_flags_t

```
typedef uint8_t hsm_op_generate_sign_flags_t
```

Bit field indicating the requested operation.

3.4.4.2 hsm_op_prepare_signature_flags_t

```
typedef uint8_t hsm_op_prepare_signature_flags_t
```

Bitmap specifying the prepare signature operation supported attributes.

3.4.5 Enumeration type documentation

3.4.5.1 hsm_op_pub_key_attest_algo_t

Enum containing the Signature Algorithms for Public Key Attestation.

Table 2. Enumerator

HSM_PKEY_ATTEST_ALGO_CMAC	CMAC Attestation
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA224	ECDSA SHA224 Attestation.
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA256	ECDSA SHA256 Attestation.
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA384	ECDSA SHA384 Attestation.
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA512	ECDSA SHA512 Attestation.

3.4.5.2 hsm_signature_scheme_id_t

```
enum hsm_signature_scheme_id_t
```

Bit field indicating the PSA compliant requested operations:

Bits 2-7: Reserved.

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3.4.6 Function documentation

3.4.6.1 hsm_do_sign()

```
hsm_err_t hsm_do_sign (
hsm_hdl_t key_store_hdl,
op_generate_sign_args_t * args)
```

Secondary API to generate the signature on the given message.

This API does the following:

- Open a service flow for signature generation.
- Based on the flag to identify the type of message: Digest or actual message, generate the signature using the key corresponding to the key ID.
- Post performing the operation, terminate the previously opened signature-generation service flow.

Users can call this function only after having opened a key-store.

Parameters

key_store_hdl	Handle identifying the current key-store.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.2 hsm_do_pub_key_attest()

```
hsm_err_t hsm_do_pub_key_attest (
hsm_hdl_t key_store_hdl,
op_pub_key_attest_args_t *  args)
```

Secondary API to attest the public key of an asymmetric key present in the ELE FW key storage (generated or imported).

This API does the following:

- Open a service flow for signature generation.
- Perform the operation to attest the public key of required asymmetric key present in the ELE FW key storage.
- Post performing the operation, and terminate the previously opened signature-generation service flow.

Users can call this function only after opening a key store service flow.

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.3 hsm_pub_key_attest()

```
hsm_err_t hsm_pub_key_attest (
```


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```
hsm_hdl_t signature_gen_hdl,
op_pub_key_attest_args_t *  args)
```

Attest the public key of an asymmetric key present in the ELE FW key storage. Users can call this function only after having opened a signature generation service flow.

Parameters

signature_gen_hdl	Handle identifying the signature generation service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.4 hsm_open_signature_generation_service()

```
hsm_err_t hsm_open_signature_generation_service (
hsm_hdl_t key_store_hdl,
open_svc_sign_gen_args_t * args,
hsm_hdl_t * signature_gen_hdl)
```

- Open a signature generation service flow.
- Users can call this function only after having opened a key store service flow.
- Users must open this service to perform signature generation operations.

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.
signature_gen_hdl	Pointer to where the signature generation service flow handle must be written.

Returns

Error code

3.4.6.5 hsm_close_signature_generation_service()

```
hsm_err_t hsm_close_signature_generation_service (hsm_hdl_t signature_gen_hdl)
```

Terminate a previously opened signature generation service flow.

Parameters

signature_gen_hdl	Handle identifying the signature generation service flow to be closed.

Returns

Error code

3.4.6.6 hsm_generate_signature()

```
hsm_err_t hsm_generate_signature (
hsm_hdl_t signature_gen_hdl,
op_generate_sign_args_t * args)
```


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Generate a digital signature according to the signature scheme.

Users can call this function only after having opened a signature generation service flow.

The signature S=(r,s) is stored in the format `r||s||Ry` where:

- Ry is an additional byte containing the lsb of y. Ry has to be considered valid only if the `HSM_OP_GENERATE_SIGN_FLAGS_COMPRESSED_POINT` is set.

Parameters

signature_gen_hdl	Handle identifying the signature generation service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.7 hsm_prepare_signature()

```
hsm_err_t hsm_prepare_signature (
hsm_hdl_t signature_gen_hdl,
op_prepare_sign_args_t * args)
```

Prepare the creation of a signature by pre-calculating the operations having no dependencies on the input message.

The pre-calculated value is stored internally and used once `hsm_generate_signature` is called. Up to 20 pre-calculated values can be stored, and additional preparation operations have no effects.

Users can call this function only after having opened a signature generation service flow.

The signature S=(r,s) is stored in the format `r||s||Ry` where:

- Ry is an additional byte containing the lsb of y. Ry has to be considered valid only if the `HSM_OP_PREPARE_SIGN_COMPRESSED_POINT` is set.

Parameters

signature_gen_hdl	Handle identifying the signature generation service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.5 Signature verification

Data Structures

- struct open_svc_sign_ver_args_t
- struct op_verify_sign_args_t

Macros

- #define HSM_OP_VERIFY_SIGN_FLAGS_INPUT_DIGEST ((hsm_op_verify_sign_flags_t)(0u << 0))
- #define HSM_OP_VERIFY_SIGN_FLAGS_INPUT_MESSAGE ((hsm_op_verify_sign_flags_t) (1u << 0))
- #define HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT ((hsm_op_verify_sign_flags_t) (1u << 1))
- #define HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL ((hsm_op_verify_sign_flags_t) (1u << 2))

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- #define HSM_OP_VERIFY_SIGN_FLAGS_PLAINTEXT_KEY ((hsm_op_verify_sign_flags_t)(0u << 3))
- #define HSM_OP_VERIFY_SIGN_FLAGS_OPAQUE_KEY ((hsm_op_verify_sign_flags_t)(1u << 3))
- #define HSM_VERIFICATION_STATUS_SUCCESS ((hsm_verification_status_t) (0x5A3CC3A5u))
- #define HSM_VERIFICATION_STATUS_FAILURE ((hsm_verification_status_t) (0x2B4DD4B2u))

Typedefs

- typedef uint32_t hsm_verification_status_t
- typedef uint8_t hsm_op_verify_sign_flags_t

Functions

- hsm_err_t hsm_verify_sign (hsm_hdl_t session_hdl, op_verify_sign_args_t *args, hsm_verification_status_t *verification_status)
- hsm_err_t hsm_open_signature_verification_service (hsm_hdl_t session_hdl, open_svc_sign_ver_args_t *args, hsm_hdl_t *signature_ver_hdl)
- hsm_err_t hsm_close_signature_verification_service (hsm_hdl_t signature_ver_hdl)
- hsm_err_t hsm_verify_signature (hsm_hdl_t signature_ver_hdl, op_verify_sign_args_t *args, hsm_verification_status_t *status)

3.5.1 Detailed description

3.5.2 Data structure documentation

3.5.2.1 struct open_svc_sign_ver_args_t

Structure to represent verify sign open service arguments.

Data Fields

hsm_hdl_t	sig_ver_hdl	-

3.5.2.2 struct op_verify_sign_args_t

Structure to represent verify signature operation arguments.

Data Fields

uint8_t *	key	Pointer to the public key to be used for the verification. If `HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL` is set, it must point to the key reference returned by the `hsm_import_public_key` API. Only valid with the `PLAINTEXT` flag.
uint32_t	key_identifier	Identifier of the key to be used for the operation. In case of using key identifier (for example, opaque key), it must be ensured that the flag for the `PLAINTEXT` key is not set. Supported platforms: i.MX 95 and i.MX 943.
uint8_t *	message	Pointer to the input (message or message digest).
uint8_t *	signature	Pointer to the input signature. The signature S=(r,s) is expected to be in the format `r||s||Ry`, where Ry is an additional byte containing the lsb of y. Ry is considered as valid only if the `HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT` is set.
uint16_t	key_size	Length in bytes of the input key. Only valid with the `PLAINTEXT` flag.

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Data Fields...*continued*

uint16_t	signature_size	Length in bytes of the output. It must contain one additional byte where to store the Ry.
uint32_t	message_size	Length in bytes of the input message.
hsm_verification_status_t	verification_status	Verification status.
hsm_signature_scheme_id_t	scheme_id	Identifier of the digital signature scheme to be used for the operation.
uint16_t	salt_len	Salt length in bytes.
hsm_bit_key_sz_t	key_sz	Indicates key security size in bits. Only valid with the `PLAINTEXT` flag.
hsm_pubkey_type_t	pkey_type	Indicates the public key type. Only valid with the `PLAINTEXT` flag.
hsm_op_verify_sign_flags_t	flags	Bitmap specifying the operation attributes.

3.5.3 Macro Definition Documentation

3.5.3.1 HSM_OP_VERIFY_SIGN_FLAGS_INPUT_DIGEST

```
#define HSM_OP_VERIFY_SIGN_FLAGS_INPUT_DIGEST ((hsm_op_verify_sign_flags_t) (0u
 << 0))
```

Verify signature bit indicating input is message digest.

3.5.3.2 HSM_OP_VERIFY_SIGN_FLAGS_INPUT_MESSAGE

```
#define HSM_OP_VERIFY_SIGN_FLAGS_INPUT_MESSAGE ((hsm_op_verify_sign_flags_t) (1u
 << 0))
```

Verify signature bit indicating input is actual message.

3.5.3.3 HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT

```
#define HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT ((hsm_op_verify_sign_flags_t)
 (1u << 1))
```

Verify signature bit indicating input based on signature format.

3.5.3.4 HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL

```
#define HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL ((hsm_op_verify_sign_flags_t) (1u
 << 2))
```

Verify signature bit indicating input is key argument.

3.5.3.5 HSM_OP_VERIFY_SIGN_FLAGS_PLAINTEXT_KEY

```
#define HSM_OP_VERIFY_SIGN_FLAGS_PLAINTEXT_KEY ((hsm_op_verify_sign_flags_t)(0u
 << 3))
```


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Verify signature bit indicating input public key is in plaintext. For example, the public key comes from the user memory.

3.5.3.6 HSM_OP_VERIFY_SIGN_FLAGS_OPAQUE_KEY

```
#define HSM_OP_VERIFY_SIGN_FLAGS_OPAQUE_KEY ((hsm_op_verify_sign_flags_t)(1u <<
 3))
```

Verify signature bit indicating the input public key is opaque. For example, the public key comes from the Secure Enclave keystore.

3.5.3.7 HSM_VERIFICATION_STATUS_SUCCESS

```
#define HSM_VERIFICATION_STATUS_SUCCESS ((hsm_verification_status_t)
 (0x5A3CC3A5u))
```

Verify signature response success status.

3.5.3.8 HSM_VERIFICATION_STATUS_FAILURE

```
#define HSM_VERIFICATION_STATUS_FAILURE ((hsm_verification_status_t)
 (0x2B4DD4B2u))
```

Verify signature response failure status.

3.5.4 Typedef documentation

3.5.4.1 hsm_verification_status_t

```
typedef uint32_t hsm_verification_status_t
```

Bit indicating the response verification status.

3.5.4.2 hsm_op_verify_sign_flags_t

```
typedef uint8_t hsm_op_verify_sign_flags_t
```

Bit indicating the requested operations.

3.5.5 Function documentation

3.5.5.1 hsm_verify_sign()

```
hsm_err_t hsm_verify_sign (
hsm_hdl_t op_hdl,
op_verify_sign_args_t * args,
hsm_verification_status_t * verification_status)
```

Secondary API to verify a message signature.

This API does the following:

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- Open a flow for verification of the signature.
- Based on the flag to identify the type of message: Digest or actual message, verification of the signature is done using the public key.
- Post performing the operation, terminate the previously opened signature-verification service flow.

Users can call this function only after having opened a session or keystore, depending on the type of the operation (plaintext or opaque key) and platform.

Parameters

op_hdl	Handle identifying the current session or keystore, depending on the type of the operation (plaintext or opaque key) and platform.
args	Pointer to the structure containing the function arguments.
verification_status	Pointer for storing the verification status.

Returns

Error code

3.5.5.2 hsm_open_signature_verification_service()

```
hsm_err_t hsm_open_signature_verification_service(
hsm_hdl_t op_hdl,
open_svc_sign_ver_args_t * args,
hsm_hdl_t * signature_ver_hdl)
```

Users must open this service to perform signature verification operations. Users can call this function only after having opened a session or keystore, depending on the type of the operation (plaintext or opaque key) and platform.

Parameters

op_hdl	Handle identifying the current session or the key store, depending on the type of the operation (plaintext or opaque key) and platform.
args	Pointer to the structure containing the function arguments.
signature_ver_hdl	Pointer to where the signature verification service flow handle must be written.

Returns

Error code

3.5.5.3 hsm_close_signature_verification_service()

```
hsm_err_t hsm_close_signature_verification_service (hsm_hdl_t signature_ver_hdl)
```

Terminate a previously opened signature verification service flow.

Parameters

signature_ver_hdl	Handle identifying the signature verification service flow to be closed.

Returns

Error code

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3.5.5.4 hsm_verify_signature()

```
hsm_err_t hsm_verify_signature (
hsm_hdl_t signature_ver_hdl,
op_verify_sign_args_t * args,
hsm_verification_status_t * status)
```

Verify a digital signature according to the signature scheme. Users can call this function only after opening a signature verification service flow.

The signature S=(r,s) is expected to be in format `r||s||Ry`, where:

- Ry is an additional byte containing the lsb of y. Ry is considered as valid only if the `HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT` is set.

Only not-compressed keys (x,y) can be used by this command. Compressed keys can be decompressed by using the dedicated API.

Parameters

signature_ver_hdl	Handle identifying the signature verification service flow.
args	Pointer to the structure containing the function arguments.
status	Pointer to where the verification status must be stored. If the verification succeed, the value `HSM_VERIFICATION_STATUS_SUCCESS` is returned.

Returns

Error code

3.6 Random number generation

Data Structures

- struct op_get_random_args_t

Functions

- hsm_err_t hsm_do_rng (hsm_hdl_t session_hdl, op_get_random_args_t *args)
- hsm_err_t hsm_get_random (hsm_hdl_t rng_hdl, op_get_random_args_t *args)

3.6.1 Detailed description

3.6.2 Data structure documentation

3.6.2.1 struct op_get_random_args_t

Structure detailing the get random number operation member arguments.

Data Fields

uint8_t *	output	Pointer to the output area where the random number must be written.
uint32_t	random_size	Length in bytes of the random number to be provided.

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3.6.3 Function documentation

3.6.3.1 hsm_do_rng()

```
hsm_err_t hsm_do_rng (
hsm_hdl_t session_hdl,
op_get_random_args_t * args)
```

Secondary API to fetch the Random Number.

This API does the following:

Get a freshly generated random number.

Parameters

session_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.6.3.2 hsm_get_random()

```
hsm_err_t hsm_get_random (
hsm_hdl_t rng_hdl,
op_get_random_args_t * args)
```

Get a freshly generated random number.

Users can call this function only after opening an RNG service flow.

Parameters

rng_hdl	Handle identifying the rng service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.7 Hashing

Data Structures

- struct op_hash_one_go_args_t

Macros

- #define HSM_HASH_FLAG_ALLOWED

Enumerations

- enum hsm_hash_algo_t {
  HSM_HASH_ALGO_MD5 = 0x02000003,
  HSM_HASH_ALGO_SHA_1 = 0x02000005,
  HSM_HASH_ALGO_SHA_224 = 0x02000008,
  HSM_HASH_ALGO_SHA_256 = 0x02000009,

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HSM_HASH_ALGO_SHA_384 = 0x0200000A,
HSM_HASH_ALGO_SHA_512 = 0x0200000B,
HSM_HASH_ALGO_SHA3_224 = 0x02000010,
HSM_HASH_ALGO_SHA3_256 = 0x02000011,
HSM_HASH_ALGO_SHA3_384 = 0x02000012,
HSM_HASH_ALGO_SHA3_512 = 0x02000013,
HSM_HASH_ALGO_SHAKE_256 = 0x02000015 }

- enum hsm_hash_svc_flags_t {
  HSM_HASH_FLAG_ONE_SHOT = 0x1,
  HSM_HASH_FLAG_INIT = 0x2,
  HSM_HASH_FLAG_UPDATE = 0x4,
  HSM_HASH_FLAG_FINAL = 0x8,
  HSM_HASH_FLAG_DESTROY = 0x10,
  HSM_HASH_FLAG_GET_CONTEXT = 0x80 }

Functions

- hsm_err_t hsm_do_hash (hsm_hdl_t session_hdl, op_hash_one_go_args_t *args)
- hsm_err_t hsm_hash_one_go (hsm_hdl_t hash_hdl, op_hash_one_go_args_t *args)

3.7.1 Detailed description

3.7.2 Data structure documentation

3.7.2.1 struct op_hash_one_go_args_t

Structure describing the hash one go operation arguments.

Data Fields

uint8_t *	msb	Pointer to the MSB of address in the requester space where buffers can be found, must be **0** until supported.
uint8_t *	ctx	Pointer to the context.
uint8_t *	input	Pointer to the input data to be hashed.
uint8_t *	output	Pointer to the output area where the resulting digest must be written.
uint32_t	input_size	Length in bytes of the input.
uint32_t	output_size	Length in bytes of the output.
hsm_hash_algo_t	algo	Hash algorithm to be used for the operation.
hsm_hash_svc_flags_t	svc_flags	Flags identifying the operation `init()` `update()`, `final()`, or one shot operation.
uint16_t	ctx_size	Size of context buffer in bytes, ignored in case of one shot operation.
uint32_t	exp_output_size	Expected output digest buffer size, returned by FW in case the provided output size is incorrect.
uint16_t	context_size	Expected context size to allocate in bytes, if flag Get context size is set or provided context size is incorrect.

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3.7.3 Macro definition documentation

3.7.3.1 HSM_HASH_FLAG_ALLOWED

```
#define HSM_HASH_FLAG_ALLOWED
```

```
Value:              (HSM_HASH_FLAG_ONE_SHOT | HSM_HASH_FLAG_INIT \
                  | HSM_HASH_FLAG_UPDATE | HSM_HASH_FLAG_FINAL \
                  | HSM_HASH_FLAG_DESTROY | HSM_HASH_FLAG_GET_CONTEXT)
```

Bitmap indicating the allowed hash service operations.

3.7.4 Enumeration type documentation

3.7.4.1 hsm_hash_algo_t

```
enum hsm_hash_algo_t
```

Bitmap indicating the supported hash algorithm.

3.7.4.2 hsm_hash_svc_flags_t

```
enum hsm_hash_svc_flags_t
```

Bit field indicating the hash service operations (only one can be set):

Table 3. Data Fields

HSM_HASH_FLAG_ONE_SHOT	One-Shot operation (Context is not used).
HSM_HASH_FLAG_INIT	Initialization.
HSM_HASH_FLAG_UPDATE	Update. For SHAKE algo, all data needs to be processed by update.
HSM_HASH_FLAG_FINAL	Final (Final can be used multiple times if algo is SHAKE).
HSM_HASH_FLAG_DESTROY	Destroy (valid for SHAKE algo only).
HSM_HASH_FLAG_GET_CONTEXT	Get context size. Return context size to allocate (depends on Algorithm).

3.7.5 Function documentation

3.7.5.1 hsm_do_hash()

```
hsm_err_t hsm_do_hash (
hsm_hdl_t session_hdl,
op_hash_one_go_args_t * args)
```

Secondary API to digest a message.

This API performs hash.

Parameters

session_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

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Returns

Error code

3.7.5.2 hsm_hash_one_go()

```
hsm_err_t hsm_hash_one_go (
hsm_hdl_t hash_hdl,
op_hash_one_go_args_t * args)
```

Perform the hash operation on a given input.

Users can call this function only after opening a hash service flow.

Parameters

hash_hdl	Handle identifying the hash service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.8 Data storage

Data Structures

- struct open_svc_data_storage_args_t
- struct op_data_storage_args_t
- struct op_enc_data_storage_args_t
- struct op_data_storage_delete_args_t

Macros

- #define HSM_OP_DATA_STORAGE_FLAGS_EL2GO ((hsm_op_data_storage_flags_t) (1u << 0))
- #define HSM_OP_DATA_STORAGE_FLAGS_DEFAULT ((hsm_op_data_storage_flags_t) (0u << 0))

Store data.

- #define HSM_OP_DATA_STORAGE_FLAGS_STORE ((hsm_op_data_storage_flags_t) (1u << 1))

Retrieve data.

- #define HSM_OP_DATA_STORAGE_FLAGS_RETRIEVE ((hsm_op_data_storage_flags_t) (0u << 1))
- #define ENC_DATA_TLV_DEV_UUID_TAG 0x41u
- #define ENC_DATA_TLV_IV_TAG 0x45u
- #define ENC_DATA_TLV_ENC_DATA_TAG 0x46u
- #define ENC_DATA_TLV_SIGN_TAG 0x5Eu
- #define ENC_DATA_TLV_DEV_UUID_TAG_LEN 0x01u
- #define ENC_DATA_TLV_IV_TAG_LEN 0x01u
- #define ENC_DATA_TLV_ENC_DATA_TAG_LEN 0x01u
- #define ENC_DATA_TLV_SIGN_TAG_LEN 0x01u
- #define HSM_OP_ENC_DATA_STORAGE_FLAGS_RANDOM_IV ((hsm_op_enc_data_storage_flags_t) (1u << 0))
  Internally generate random IV, if needed for operation.

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- #define HSM_OP_ENC_DATA_STORAGE_FLAGS_READ_ONCE ((hsm_op_enc_data_storage_flags_t) (1u << 1))
  Read once, and delete data from NVM after retrieve.

Typedefs

- typedef uint8_t hsm_svc_data_storage_flags_t
- typedef uint8_t hsm_op_data_storage_flags_t
- typedef uint16_t hsm_op_enc_data_storage_flags_t

Functions

- hsm_err_t hsm_data_ops (hsm_hdl_t key_store_hdl, op_data_storage_args_t *args)
- hsm_err_t hsm_data_delete_ops (hsm_hdl_t key_store_hdl, op_data_storage_delete_args_t *args)
- hsm_err_t hsm_enc_data_ops (hsm_hdl_t key_store_hdl, op_enc_data_storage_args_t *args)
- hsm_err_t hsm_open_data_storage_service (hsm_hdl_t key_store_hdl, open_svc_data_storage_args_t *args, hsm_hdl_t *data_storage_hdl)
- hsm_err_t hsm_data_storage (hsm_hdl_t data_storage_hdl, op_data_storage_args_t *args)
- hsm_err_t hsm_data_storage_delete (hsm_hdl_t data_storage_hdl, op_data_storage_delete_args_t *args)
- hsm_err_t hsm_enc_data_storage (hsm_hdl_t data_storage_hdl, op_enc_data_storage_args_t *args)
- uint8_t decode_enc_data_tlv (op_data_storage_args_t *args)
- hsm_err_t hsm_close_data_storage_service (hsm_hdl_t data_storage_hdl)

3.8.1 Detailed description

3.8.2 Data structure documentation

3.8.2.1 struct open_svc_data_storage_args_t

Structure specifying the data storage open service member arguments.

Data Fields

hsm_hdl_t	data_storage_handle	Data storage handle.
hsm_svc_data_storage_flags_t	flags	Bitmap specifying the services properties.
uint8_t	reserved[3]	-

3.8.2.2 struct op_data_storage_args_t

Structure detailing the data storage operation member arguments.

Data Fields

uint8_t *	data	Pointer to the data. In case of store request, it is the input data to store. In case of retrieve, it is the pointer where to load data.
uint32_t	data_size	Length in bytes of the data.
uint32_t	data_id	ID of the data.
hsm_op_data_storage_flags_t	flags	Flags bitmap specifying the operation attributes.
hsm_svc_data_storage_flags_t	svc_flags	Bitmap specifying the services properties.
uint16_t	uuid_len	Device UUID length in bytes. In case of retrieve, if the data retrieved is in the TLV format, which was stored by Encrypted Data Storage API, the TLV format data is decoded to fill the following fields.

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Data Fields...*continued*

		Memory for storing uuid/iv/ciphertext/payload/signature is allocated by the HSM library. Caller of the function decode_enc_data_tlv(), needs to ensure freeing up memory.
uint8_t *	uuid	Device UUID.
uint16_t	iv_len	IV length in bytes if needed, otherwise **0**.
uint8_t *	iv	IV buffer, if needed.
uint32_t	ciphertext_len	Encrypted text length in bytes.
uint8_t *	ciphertext	Encrypted text buffer.
uint32_t	payload_len	Payload length in bytes.
uint8_t *	payload	Payload data buffer to verify signature.
uint16_t	signature_len	Signature length in bytes.
uint8_t *	signature	Signature buffer.
uint32_t	exp_output_size	Expected output buffer size in bytes, valid in case of `HSM_OUT_TOO_SMALL (0x1D)` error code.

3.8.2.3 struct op_enc_data_storage_args_t

Data Fields

uint32_t	data_id	ID of the data.
uint8_t *	data	Pointer to the data, to be encrypted and signed.
uint32_t	data_size	Length in bytes of the data.
uint32_t	enc_algo	Cipher algorithm to be used for encryption of data.
uint32_t	enc_key_id	Identifier of the key to be used for encryption.
uint32_t	sign_algo	Signature algorithm to be used for signing the data.
uint32_t	sign_key_id	Identifier of the key to be used for signing.
uint8_t *	iv	Pointer to the IV buffer.
uint16_t	iv_size	IV size in bytes.
hsm_op_enc_data_storage_flags_t	flags	Bitmap specifying the operation attributes.
hsm_svc_data_storage_flags_t	svc_flags	Bitmap specifying the service attributes.
uint16_t	lifecycle	Bitmask of device lifecycle, in which the data can be retrieved.
uint32_t	out_data_size	Size (bytes) of the signed TLV stored, received with API resp.

3.8.2.4 struct op_data_storage_delete_args_t

Structure detailing the data storage delete operation member arguments.

Data Fields

hsm_svc_data_storage_flags_t	svc_flags	bitmap specifying the services properties.
uint32_t	data_id	ID of the data.

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3.8.3 Macro definition documentation

3.8.3.1 ENC_DATA_TLV_DEV_UUID_TAG

```
#define ENC_DATA_TLV_DEV_UUID_TAG  0x41u
```

Encrypted Data TLV Tags.

3.8.3.2 ENC_DATA_TLV_DEV_UUID_TAG_LEN

```
#define ENC_DATA_TLV_DEV_UUID_TAG_LEN 0x01u
```

Encrypted Data TLV Tags lengths.

3.8.4 Typedef documentation

3.8.4.1 hsm_svc_data_storage_flags_t

```
typedef uint8_t hsm_svc_data_storage_flags_t
```

Bitmap specifying the data storage open service supported properties.

3.8.4.2 hsm_op_data_storage_flags_t

```
typedef uint8_t hsm_op_data_storage_flags_t
```

Bitmap specifying the data storage operation supported attributes.

3.8.4.3 hsm_op_enc_data_storage_flags_t

```
typedef uint16_t hsm_op_enc_data_storage_flags_t
```

Bitmap specifying the encrypted data storage operation supported attributes.

3.8.5 Function Documentation

3.8.5.1 hsm_data_ops()

```
hsm_err_t hsm_data_ops (
hsm_hdl_t key_store_hdl,
op_data_storage_args_t * args)
```

Secondary API to store and retrieve data from the Linux filesystem managed by EdgeLock Enclave Firmware.

This API does the following:

- Open a data storage service flow.
- Based on the flag for operation attribute: Store or Retrieve
  - Store the data.
  - Retrieve the data, from the non-volatile storage.
- Post performing the operation, and terminate the previously opened data-storage service flow.

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Users can call this function only after opening a key-store.

Parameters

key_store_hdl	Handle identifying the current key-store.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.2 hsm_data_delete_ops()

```
hsm_err_t hsm_data_delete_ops(
hsm_hdl_t key_store_hdl,
op_data_storage_delete_args_t *args)
```

Secondary API to delete data from the Linux filesystem managed by EdgeLock Enclave Firmware.

This API does the following:

- Open a data storage service flow.
- Delete the data identified by input Data ID, and from the non-volatile storage.
- Post performing the operation, and terminate the previously opened data-storage service flow.

Users can call this function only after opening a key-store.

Parameters

key_store_hdl	Handle identifying the current key-store.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.3 hsm_enc_data_ops()

```
hsm_err_t hsm_enc_data_ops (
hsm_hdl_t key_store_hdl,
op_enc_data_storage_args_t * args)
```

Secondary API to store the encrypted and signed data in NVM.

This API does the following:

- Open a data storage service Flow.
- Store the encryted and signed data in NVM. The stored data can be retrieved through Data Storage API.
- Post performing the operation, terminate the previously opened data-storage service flow.

Users can call this function only after having opened a key-store.

Parameters

key_store_hdl	Handle identifying the current key-store.
args	Pointer to the structure containing the function arguments.

Returns

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Error code

3.8.5.4 hsm_open_data_storage_service()

```
hsm_err_t hsm_open_data_storage_service(
hsm_hdl_t key_store_hdl,
open_svc_data_storage_args_t * args,
hsm_hdl_t * data_storage_hdl)
```

Open a data storage service flow.

Users must open this service flow to store/retrieve generic data in/from the HSM.

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.
data_storage_hdl	Pointer to where the data storage service flow handle must be written.

Returns

Error code.

3.8.5.5 hsm_data_storage()

```
hsm_err_t hsm_data_storage (
hsm_hdl_t data_storage_hdl,
op_data_storage_args_t * args)
```

Store or retrieve generic data identified by a `data_id`.

Parameters

data_storage_hdl	Handle identifying the data storage service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.6 hsm_data_storage_delete()

```
hsm_err_t hsm_data_storage_delete(
hsm_hdl_t data_storage_hdl,
op_data_storage_delete_args_t *args);
```

Delete the data object identified by `data_id`.

Parameters

data_storage_hdl	Handle identifying the data storage service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

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3.8.5.7 hsm_enc_data_storage()

```
hsm_err_t hsm_enc_data_storage (
hsm_hdl_t data_storage_hdl,
op_enc_data_storage_args_t * args)
```

Store encrypted and signed data in the NVM.

Parameters

data_storage_hdl	Handle identifying the data storage service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.8 decode_enc_data_tlv()

```
uint8_t decode_enc_data_tlv (op_data_storage_args_t * args)
```

Decode and populate the data storage op args for Encrypted Data TLV fields.

Parameters

args	Pointer to the structure containing Retrieved Encrypted Data TLV buffer and to be populated with decoded data from TLV.

Returns

Error code **0** for success

3.8.5.9 hsm_close_data_storage_service()

```
hsm_err_t hsm_close_data_storage_service(
hsm_hdl_t data_storage_hdl)
```

Terminate a previously opened data storage service flow

Parameters

data_storage_hdl	Handle identifying the data storage service flow.

Returns

Error code

3.9 Authenticated encryption

Functions

- hsm_err_t hsm_do_auth_enc (hsm_hdl_t key_store_hdl, op_auth_enc_args_t *auth_enc_args)
- hsm_err_t hsm_do_auth_enc_new (hsm_hdl_t key_store_hdl, op_auth_enc_new_args_t *args)

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3.9.1 Detailed description

3.9.2 Function documentation

3.9.2.1 hsm_do_auth_enc()

```
hsm_err_t hsm_do_auth_enc (
hsm_hdl_t key_store_hdl,
op_auth_enc_args_t * auth_enc_args)
```

Secondary API to perform Authenticated Encryption.

This API does the following:

- Opens Cipher service flow.
- Perform authenticated encryption operation.
- Terminates the previously opened Cipher service flow.

Users can call this function only after opening a key store service flow.

Note: *The API is deprecated now.*

Parameters

key_store_hdl	Handle identifying the key store service flow.
auth_enc_args	Pointer to the structure containing the function arguments.

Returns

Error code

3.9.2.2 hsm_do_auth_enc_new()

```
hsm_err_t hsm_do_auth_enc_new(
hsm_hdl_t key_store_hdl,
op_auth_enc_new_args_t *args)
```

Secondary API to perform Authenticated Encryption (New).

This API does the following:

- Opens Cipher service flow.
- Perform authenticated encryption operation.
  - One-Shot AEAD operation using an opaque or plaintext key.
  - Streaming AEAD operation using an opaque or plaintext key.
- Terminates the previously opened Cipher service flow.

Users can call this function only after opening a key store service flow.

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

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3.10 MAC

Data Structures

- struct open_svc_mac_args_t
- struct op_mac_args_t

Macros

- #define HSM_OP_MAC_FLAGS_MAC_VERIFICATION ((hsm_op_mac_flags_t)(0u << 0))
- #define HSM_OP_MAC_FLAGS_MAC_GENERATION ((hsm_op_mac_flags_t)(1u << 0))
- #define HSM_OP_MAC_FLAGS_PLAINTEXT_KEY ((hsm_op_mac_flags_t)(1u << 3))
- #define HSM_OP_MAC_FLAGS_INIT ((hsm_op_mac_flags_t)(1u << 8))
- #define HSM_OP_MAC_FLAGS_UPDATE_DATA ((hsm_op_mac_flags_t)(1u << 10))
- #define HSM_OP_MAC_FLAGS_FINALIZE ((hsm_op_mac_flags_t)(1u << 11))
- #define HSM_OP_MAC_FLAGS_FINALIZE_VERIFY ((hsm_op_mac_flags_t)(1u << 12))
- #define HSM_OP_MAC_FLAGS_ABORT ((hsm_op_mac_flags_t)(1u << 13))
- #define HSM_OP_MAC_FLAGS_GET_CTX_SIZE ((hsm_op_mac_flags_t)(1u << 15))
- #define HSM_MAC_VERIFICATION_STATUS_FAILURE ((hsm_mac_verification_status_t)(0x0u))
- #define HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION (HSM_OP_MAC_FLAGS_MAC_VERIFICATION)
- #define HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION (HSM_OP_MAC_FLAGS_MAC_GENERATION)
- #define HSM_MAC_VERIFICATION_STATUS_SUCCESS ((hsm_mac_verification_status_t) (0x6C1AA1C6u))

Typedefs

- typedef uint16_t hsm_op_mac_flags_t
- typedef hsm_op_mac_flags_t hsm_op_mac_one_go_flags_t
- typedef uint32_t hsm_mac_verification_status_t
- typedef hsm_permitted_algo_t hsm_op_mac_algo_t
- typedef hsm_op_mac_algo_t hsm_op_mac_one_go_algo_t
- typedef op_mac_args_t op_mac_one_go_args_t

Functions

- hsm_err_t hsm_do_mac (hsm_hdl_t key_store_hdl, op_mac_args_t *args)
- hsm_err_t hsm_open_mac_service (hsm_hdl_t key_store_hdl, open_svc_mac_args_t *args, hsm_hdl_t *mac_hdl)
- hsm_err_t hsm_mac_one_go (hsm_hdl_t mac_hdl, op_mac_one_go_args_t *args, hsm_mac_verification_status_t *status)
- hsm_err_t hsm_mac (hsm_hdl_t mac_hdl, op_mac_args_t *args, hsm_mac_verification_status_t *status)
- hsm_err_t hsm_close_mac_service (hsm_hdl_t mac_hdl)

3.10.1 Detailed description

3.10.2 Data structure documentation

3.10.2.1 struct open_svc_mac_args_t

Structure describing the MAC open service member arguments.

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Data Fields

hsm_hdl_t	mac_serv_hdl	Indicates the MAC handle.

3.10.2.2 struct op_mac_args_t

Structure describing the MAC operation member arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation. The flag for plaintext key must not be set.
uint8_t *	key	Pointer to the plaintext key buffer. The flag for plaintext key must be set. Only valid for `INIT` and `ONE SHOT` operations.
hsm_op_mac_algo_t	algorithm	Algorithm to be used for the operation.
hsm_op_mac_flags_t	flags	Bitmap specifying the operation attributes.
uint8_t *	payload	Pointer to the payload area. Only valid for `UPDATE DATA` and `ONE SHOT` operations.
uint8_t *	mac	Pointer to the MAC area. • MAC generation: Output MAC value • MAC verification: Input MAC value to verify – Only valid for `FINALIZE`, `FINALIZE VERIFY`, and `ONE SHOT` operations.
uint32_t	payload_size	Length in bytes of the payload. Only valid for `UPDATE DATA` and `ONE SHOT` operations.
uint16_t	mac_size	Length of the MAC. Only valid for `FINALIZE`, `FINALIZE VERIFY`, and `ONE SHOT` operations.
uint16_t	key_type	Key type. Only valid with `PLAINTEXT` flag. Only valid with `ONE SHOT` or `INIT` operations.
uint16_t	key_size	Key size in bytes. Only valid with `PLAINTEXT` flag. Only valid with `ONE SHOT` or `INIT` operations.
uint8_t *	context	Context buffer. Only valid with `PLAINTEXT` flag.
uint16_t	context_size	Size in Bytes of context buffer. Only valid with `PLAINTEXT` flag.
hsm_mac_verification_status_t	verification_status	MAC verification status.
uint16_t	exp_mac_size	Expected MAC size for output, returned by FW if the MAC size provided is less than the expected MAC size calculated from the MAC algorithm. ***Note:*** *This field will be deprecated soon.* `exp_output_size` *to be be used instead.*
uint16_t	exp_output_size	Expected output buffer size in bytes, valid in case of `HSM_OUT_TOO_SMALL (0x1D)` error code. In case of streaming operation, expected context size in bytes if operation failed with 0x1E.

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3.10.3 Macro definition documentation

3.10.3.1 HSM_OP_MAC_FLAGS_MAC_VERIFICATION

```
#define HSM_OP_MAC_FLAGS_MAC_VERIFICATION ((hsm_op_mac_flags_t)(0u << 0))
```

Bit indicating the MAC Verify operation.

3.10.3.2 HSM_OP_MAC_FLAGS_MAC_GENERATION

```
#define HSM_OP_MAC_FLAGS_MAC_GENERATION ((hsm_op_mac_flags_t)(1u << 0))
```

Bit indicating the MAC Generate operation.

3.10.3.3 HSM_OP_MAC_FLAGS_PLAINTEXT_KEY

```
#define HSM_OP_MAC_FLAGS_PLAINTEXT_KEY ((hsm_op_mac_flags_t)(1u << 3))
```

Bit indicating the PLAINTEXT key user input.

3.10.3.4 HSM_OP_MAC_FLAGS_INIT

```
#define HSM_OP_MAC_FLAGS_INIT ((hsm_op_mac_flags_t)(1u << 8))
```

Bit indicating the initialization of a multipart context.

3.10.3.5 HSM_OP_MAC_FLAGS_UPDATE_DATA

```
#define HSM_OP_MAC_FLAGS_UPDATE_DATA ((hsm_op_mac_flags_t)(1u << 10))
```

Bit indicating the UPDATE DATA to be processed for the multipart operation.

3.10.3.6 HSM_OP_MAC_FLAGS_FINALIZE

```
#define HSM_OP_MAC_FLAGS_FINALIZE ((hsm_op_mac_flags_t)(1u << 11))
```

Bit indicating the FINALIZE multipart operation, for example, MAC Generation.

3.10.3.7 HSM_OP_MAC_FLAGS_FINALIZE_VERIFY

```
#define HSM_OP_MAC_FLAGS_FINALIZE_VERIFY ((hsm_op_mac_flags_t)(1u << 12))
```

Bit indicating the FINALIZE VERIFY multipart operation, for example, finalize the operation and internal MAC verification.

3.10.3.8 HSM_OP_MAC_FLAGS_ABORT

```
#define HSM_OP_MAC_FLAGS_ABORT ((hsm_op_mac_flags_t)(1u << 13))
```

Bit indicating to ABORT the multipart operation and clean the context.

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3.10.3.9 HSM_OP_MAC_FLAGS_GET_CTX_SIZE

```
#define HSM_OP_MAC_FLAGS_GET_CTX_SIZE ((hsm_op_mac_flags_t)(1u << 15))
```

Bit indicating to get the context size for multipart operation. Size of the needed allocated context, returned in the output size response field.

3.10.3.10 HSM_MAC_VERIFICATION_STATUS_FAILURE

```
#define HSM_MAC_VERIFICATION_STATUS_FAILURE ((hsm_mac_verification_status_t)
(0x0u))
```

Bit indicating the MAC verification failure status.

3.10.3.11 HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION

```
#define HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION
 (HSM_OP_MAC_FLAGS_MAC_VERIFICATION)
```

Bit indicating MAC one go verification operation.

3.10.3.12 HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION

```
#define HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION (HSM_OP_MAC_FLAGS_MAC_GENERATION)
```

Bit indicating MAC one go generate operation.

3.10.3.13 HSM_MAC_VERIFICATION_STATUS_SUCCESS

```
#define HSM_MAC_VERIFICATION_STATUS_SUCCESS ((hsm_mac_verification_status_t)
 (0x6C1AA1C6u))
```

Bit indicating MAC verification success status.

3.10.4 Typedef documentation

3.10.4.1 hsm_op_mac_flags_t

```
typedef uint16_t hsm_op_mac_flags_t
```

Bitmap describing the MAC operation.

3.10.4.2 hsm_op_mac_one_go_flags_t

```
typedef hsm_op_mac_flags_t hsm_op_mac_one_go_flags_t
```

Bitmap describing the MAC one go operation.

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3.10.4.3 hsm_mac_verification_status_t

```
typedef uint32_t hsm_mac_verification_status_t
```

Bitmap describing the MAC verification status.

3.10.4.4 hsm_op_mac_algo_t

```
typedef hsm_permitted_algo_t hsm_op_mac_algo_t
```

Bitmap describing the MAC operation permitted algorithm.

The following three permitted algos are allowed:

- PERMITTED_ALGO_HMAC_SHA256 = 0x03800009
- PERMITTED_ALGO_HMAC_SHA384 = 0x0380000A
- PERMITTED_ALGO_CMAC = 0x03C00200

3.10.4.5 hsm_op_mac_one_go_algo_t

```
typedef hsm_op_mac_algo_t hsm_op_mac_one_go_algo_t
```

Bitmap describing the MAC one go operation permitted algorithm.

3.10.4.6 op_mac_one_go_args_t

```
typedef op_mac_args_t op_mac_one_go_args_t
```

Structure describing the MAC one go operation member agruments.

3.10.5 Function documentation

3.10.5.1 hsm_do_mac()

```
hsm_err_t hsm_do_mac (
hsm_hdl_t key_store_hdl,
op_mac_args_t *args)
```

Secondary API to perform MAC operation.

This API does the following:

- Open an MAC Service Flow.
- Perform MAC operation.
- Terminate a previously opened MAC service flow.

Users can call this function only after opening a key store service flow.

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.

Returns

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Error code

3.10.5.2 hsm_open_mac_service()

```
hsm_err_t hsm_open_mac_service (
hsm_hdl_t key_store_hdl,
open_svc_mac_args_t * args,
hsm_hdl_t * mac_hdl)
```

Open a MAC service flow.

Users can call this function only after opening a key store service flow.

Users must open this service to perform MAC operation.

Parameters

key_store_hdl	Handle identifying the key store service flow.
args	Pointer to the structure containing the function arguments.
mac_hdl	Pointer to where the MAC service flow handle must be written.

Returns

Error code

3.10.5.3 hsm_mac_one_go()

```
hsm_err_t hsm_mac_one_go (
hsm_hdl_t mac_hdl,
op_mac_args_t * args,
hsm_mac_verification_status_t * status)
```

Perform MAC operation.

Users can call this function only after opening a MAC service flow.

Note: *This API will be deprecated soon.*

Parameters

mac_hdl	Handle identifying the MAC service flow.
args	Pointer to the structure containing the function arguments.
status	Pointer for storing the verification status.

Returns

Error code

3.10.5.4 hsm_mac()

```
hsm_err_t hsm_mac (
hsm_hdl_t mac_hdl,
op_mac_args_t *args,
hsm_mac_verification_status_t *status)
```

Perform MAC operation.

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- One-Shot MAC generation or verification operation using opaque or plaintext key.
- Streaming MAC generation or verification operation using opaque or plaintext key.

Users can call this function only after opening a MAC service flow.

Parameters

mac_hdl	Handle identifying the MAC service flow.
args	Pointer to the structure containing the function arguments.
status	Pointer for storing the verification status.

Returns

Error code

3.10.5.5 hsm_close_mac_service()

```
hsm_err_t hsm_close_mac_service (hsm_hdl_t mac_hdl)
```

Terminate a previously opened MAC service flow.

Parameters

mac_hdl	Pointer to handle identifying the MAC service flow to be closed.

Returns

Error code

3.11 Dump firmware log

Data Structures

- struct op_debug_dump_args_t

Functions

- hsm_err_t dump_firmware_log (hsm_hdl_t session_hdl)

3.11.1 Detailed description

3.11.2 Data structure documentation

3.11.2.1 struct op_debug_dump_args_t

Structure detailing the debug dump operation member arguments.

Data Fields

bool	is_dump_pending	-
uint32_t	dump_buf_len	-
uint32_t	dump_buf[MAC_BUFF_LEN]	-

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3.11.3 Function documentation

3.11.3.1 dump_firmware_log()

```
hsm_err_t dump_firmware_log (hsm_hdl_t session_hdl)
```

This command is designed to dump the firmware logs.

Parameters

session_hdl	Handle identifying the session handle.

Returns

Error code

3.12 Dev attest

Data Structures

- struct op_dev_attest_args_t

Macros

- #define DEV_ATTEST_NOUNCE_SIZE_V1 (4)
- #define DEV_ATTEST_NOUNCE_SIZE_V2 (16)

Functions

- hsm_err_t hsm_dev_attest (hsm_hdl_t sess_hdl, op_dev_attest_args_t *args)

3.12.1 Detailed description

3.12.2 Data structure documentation

3.12.2.1 struct op_dev_attest_args_t

Structure describing the device attestation operation member arguments. Memory for storing uid/ sha_rom_patch/sha_fw/signature is allocated by the HSM library. Caller of the function hsm_dev_attest() needs to ensure freeing up memory.

Data Fields

uint16_t	soc_id	SoC ID.
uint16_t	soc_rev	SoC Revision.
uint16_t	lmda_val	Lmda Lifecycle value.
uint8_t	ssm_state	Security Subsystem State Machine state.
uint8_t	uid_sz	Buffer size in bytes for Chip Unique Identifier.
uint8_t *	uid	Pointer to the Chip Unique Identifier buffer.
uint16_t	rom_patch_sha_sz	Buffer size in bytes for SHA256 of Sentinel ROM patch fuses.
uint16_t	sha_fw_sz	Buffer size in bytes for the first 256 bits of installed FW SHA.
uint8_t *	sha_rom_patch	Pointer to the buffer containing SHA256 of Sentinel ROM patch fuses.
uint8_t *	sha_fw	Pointer to the buffer containing first 256 bits of installed FW SHA.

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Data Fields...*continued*

uint16_t	nounce_sz	Buffer size in bytes for request nounce value.
uint8_t *	nounce	Pointer to the input/request nounce value buffer.
uint16_t	rsp_nounce_sz	Size in bytes for FW nounce buffer, returned with FW resp.
uint8_t *	rsp_nounce	Pointer to the FW nounce buffer, returned with FW resp.
uint16_t	oem_srkh_sz	Buffer size in bytes for OEM SRKH (version 2).
uint8_t *	oem_srkh	Pointer to the buffer of OEM SRKH (version 2).
uint8_t	imem_state	IMEM state (version 2).
uint8_t	csal_state	CSAL state (version 2).
uint8_t	trng_state	TRNG state (version 2).
uint16_t	oem_pqc_srkh_sz	Buffer size in bytes for OEM PQC SRKH (version 3).
uint8_t*	oem_pqc_srkh	Pointer to the buffer of OEM PQC SRKH (version 3).
uint16_t	info_buf_sz	Size in bytes for info buffer.
uint8_t *	info_buf	Pointer to the info buffer, for verification of the signature.
uint16_t	sign_sz	Buffer size in bytes for signature.
uint8_t *	signature	Pointer to the signature buffer.

3.12.3 Macro definition documentation

3.12.3.1 DEV_ATTEST_NOUNCE_SIZE_V1

```
#define DEV_ATTEST_NOUNCE_SIZE_V1  (4)
```

Device Attestation Nounce sizes.

3.12.4 Function documentation

3.12.4.1 hsm_dev_attest()

```
hsm_err_t hsm_dev_attest (
hsm_hdl_t sess_hdl,
op_dev_attest_args_t * args)
```

Perform device attestation operation.

Users can call this function only after opening the session.

Parameters

sess_hdl	Handle identifying the active session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

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3.13 Dev Info

Data Structures

- struct op_dev_getinfo_args_t

Enumerations

- enum hsm_lmda_val_t {
  HSM_LMDA_OEM_OPEN = 0x10,
  HSM_LMDA_OEM_CLOSED = 0x40,
  HSM_LMDA_OEM_LOCKED = 0x200 }

Functions

- hsm_err_t hsm_dev_getinfo (hsm_hdl_t sess_hdl, op_dev_getinfo_args_t *args)
- hsm_key_lifecycle_t hsm_get_lc_from_lmda (hsm_lmda_val_t lmda_val)

3.13.1 Detailed description

3.13.2 Data structure documentation

3.13.2.1 struct op_dev_getinfo_args_t

Structure detailing the device getinfo operation member arguments. Memory for storing uid/sha_rom_patch/sha_fw/signature is allocated by the HSM library. Caller of the function hsm_dev_getinfo() needs to ensure freeing up memory.

Data Fields

uint16_t	soc_id	SoC ID.
uint16_t	soc_rev	SoC revision number.
uint16_t	lmda_val	Indicates the lmda lifecycle value.
uint8_t	ssm_state	Security subsystem state machine.
uint8_t	uid_sz	Chip unique identifier size.
uint8_t *	uid	Pointer to the chip unique identifier.
uint16_t	rom_patch_sha_sz	Indicates the size of SHA256 of sentinel ROM patch fuses.
uint16_t	sha_fw_sz	Indicates the size of first 256 bits of installed FW SHA.
uint8_t *	sha_rom_patch	Pointer to the SHA256 of sentinel ROM patch fuses digest.
uint8_t *	sha_fw	Pointer to the first 256 bits of installed FW SHA digest.
uint16_t	oem_srkh_sz	Indicates the size of FW OEM SRKH.
uint8_t *	oem_srkh	Pointer to the FW OEM SRKH.
uint8_t	imem_state	Indicates the IMEM state.
uint8_t	csal_state	Crypto Lib random context initialization state.
uint8_t	trng_state	Indicates TRNG state.
uint16_t	oem_pqc_srkh_sz	Indicates the size of FW OEM PQC SRKH.
uint8_t*	oem_pqc_srkh	Pointer to the FW OEM PQC SRKH.

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3.13.2.2 hsm_lmda_val_t

```
hsm_lmda_val_t enum hsm_lmda_val_t
```

LMDA values.

Enumerator

HSM_LMDA_OEM_OPEN	LMDA value for OEM Open state LMDA value for OEM Closed state.
HSM_LMDA_OEM_CLOSED	LMDA value for OEM Locked state.

3.13.3 Function documentation

3.13.3.1 hsm_dev_getinfo()

```
hsm_err_t hsm_dev_getinfo (
hsm_hdl_t sess_hdl,
op_dev_getinfo_args_t * args)
```

Perform the device attestation operation.

Users can call this function only after opening the session.

Parameters

sess_hdl	Handle identifying the active session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.13.3.2 hsm_get_lc_from_lmda()

```
hsm_key_lifecycle_t hsm_get_lc_from_lmda (hsm_lmda_val_t  lmda_val)
```

Returns the lifecycle value corresponding to the given LMDA value.

Parameters

lmda_val	LMDA value.

Returns

LC Lifecycle value

3.14 Write Fuse

Data Structures

- struct op_dev_write_fuse_args_t

Functions

- hsm_err_t hsm_dev_write_fuse (hsm_hdl_t sess_hdl, op_dev_write_fuse_args_t a *rgs)

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3.14.1 Detailed description

3.14.2 Data structure documentation

3.14.2.1 struct op_dev_write_fuse_args_t

Structure detailing the device write fuse operation member arguments.

Data Fields

uint16_t	processed_idx	Last processed fuse. Value is `valid if != 0xffff`. In case of failure, it can indicate which fuse triggered the error. In case of success, it provide the last fused word index.
uint16_t	word_pos	Fuse identifier expressed as its position in word in the fuse map.
uint16_t	bit_pos	Fuse identifier expressed as its position in bit in the fuse map.
uint16_t	bit_len	Contains bit length.
uint32_t	payload[ ]	Payload.

3.14.3 Function documentation

3.14.3.1 hsm_dev_write_fuse()

```
hsm_err_t hsm_dev_write_fuse (
hsm_hdl_t sess_hdl, op_dev_write_fuse_args_t * args )
```

Perform the write fuse operation.

Users can call this function only after having opened the session.

Parameters

sess_hdl	Handle identifying the active session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.15 Generic Crypto: Asymmetric Crypto

Data Structures

- struct op_gc_acrypto_args_t

Macros

- #define HSM_OP_GC_ACRYPTO_FLAGS_INPUT_DIGEST ((hsm_op_gc_acrypto_flags_t) (0u << 0))
- #define HSM_OP_GC_ACRYPTO_FLAGS_INPUT_MESSAGE ((hsm_op_gc_acrypto_flags_t) (1u << 0))
- #define HSM_GC_ACRYPTO_VERIFICATION_SUCCESS ((hsm_gc_acrypto_verification_status_t) (0x5A3CC3A5u))
- #define HSM_GC_ACRYPTO_VERIFICATION_FAILURE ((hsm_gc_acrypto_verification_status_t) (0x2B4DD4B2u))

Typedefs

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- typedef uint8_t hsm_op_gc_acrypto_flags_t
- typedef uint32_t hsm_gc_acrypto_verification_status_t

Enumerations

- enum hsm_op_gc_acrypto_algo_t {
  HSM_GC_ACRYPTO_ALGO_ECDSA_SHA224 = ALGO_ECDSA_SHA224,
  HSM_GC_ACRYPTO_ALGO_ECDSA_SHA256 = ALGO_ECDSA_SHA256,
  HSM_GC_ACRYPTO_ALGO_ECDSA_SHA384 = ALGO_ECDSA_SHA384,
  HSM_GC_ACRYPTO_ALGO_ECDSA_SHA512 = ALGO_ECDSA_SHA512,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA224 = ALGO_RSA_PKCS1_V15_SHA224,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA256 = ALGO_RSA_PKCS1_V15_SHA256,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA384 = ALGO_RSA_PKCS1_V15_SHA384,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA512 = ALGO_RSA_PKCS1_V15_SHA512,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA224 =
  ALGO_RSA_PKCS1_PSS_MGF1_SHA224,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA256 =
  ALGO_RSA_PKCS1_PSS_MGF1_SHA256,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA384 =
  ALGO_RSA_PKCS1_PSS_MGF1_SHA384,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA512 =
  ALGO_RSA_PKCS1_PSS_MGF1_SHA512,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_CRYPT = ALGO_RSA_PKCS1_V15_CRYPT,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA1 = ALGO_RSA_PKCS1_OAEP_SHA1,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA224 = ALGO_RSA_PKCS1_OAEP_SHA224,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA256 = ALGO_RSA_PKCS1_OAEP_SHA256,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA384 = ALGO_RSA_PKCS1_OAEP_SHA384,
  HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA512 = ALGO_RSA_PKCS1_OAEP_SHA512 }
- enum hsm_gc_acrypto_op_mode_t {
  HSM_GC_ACRYPTO_OP_MODE_ENCRYPT = 0x01,
  HSM_GC_ACRYPTO_OP_MODE_DECRYPT = 0x02,
  HSM_GC_ACRYPTO_OP_MODE_SIGN_GEN = 0x03,
  HSM_GC_ACRYPTO_OP_MODE_SIGN_VER = 0x04 }

Functions

- hsm_err_t hsm_gc_acrypto (hsm_hdl_t session_hdl, op_gc_acrypto_args_t *args)

3.15.1 Detailed description

3.15.2 Data structure documentation

3.15.2.1 struct op_gc_acrypto_args_t

Structure describing the generic asymmetric crypto member arguments.

Data Fields

hsm_op_gc_acrypto_algo_t	algorithm	Algorithm to use for the operation.
hsm_gc_acrypto_op_mode_t	op_mode	Indicates the operation mode.
hsm_op_gc_acrypto_flags_t	flags	Indicates operation flags.
hsm_bit_key_sz_t	bit_key_sz	Key size in bits.
uint8_t *	data_buff1	Pointer to the data buffer 1:

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Data Fields...*continued*

		• Plaintext in case of encryption/decryption operation. • Digest or message in case of signature generation/verification operation.
uint8_t *	data_buff2	Pointer to the data buffer 2: • Ciphertext in case of encryption/decryption operation. • Signature in case of signature generation/verification operation.
uint32_t	data_buff1_size	Size in bytes of data buffer 1.
uint32_t	data_buff2_size	Size in bytes of data buffer 2.
uint8_t *	key_buff1	Pointer to the key modulus buffer.
uint8_t *	key_buff2	Pointer the key exponent, either private or public. • Encryption mode, public exponent • Decryption mode, private exponent • Signature Generation mode, private exponent • Signature Verification mode, public exponent
uint16_t	key_buff1_size	Size in bytes of the key buffer 1.
uint16_t	key_buff2_size	Size in bytes of the key buffer 2.
uint8_t *	rsa_label	RSA label address. Only used for OAEP encryption/decryption operation mode and optional.
uint16_t	rsa_label_size	RSA label size in bytes. Only used for OAEP encryption/decryption operation mode.
uint16_t	rsa_salt_len	RSA salt length in bytes. Only used for PSS signature algorithm scheme.
uint32_t	exp_plaintext_len	Expected plaintext length in bytes, returned by FW in case of DECRYPT operation mode.
hsm_gc_acrypto_verification_status_t	verification_status	Signature verification status.

3.15.3 Macro definition documentation

3.15.3.1 HSM_OP_GC_ACRYPTO_FLAGS_INPUT_DIGEST

```
#define HSM_OP_GC_ACRYPTO_FLAGS_INPUT_DIGEST ((hsm_op_gc_acrypto_flags_t)(0u <<
 0))
```

Bit indicating the generic asymmetric crypto input message digest operation. Only valid for signature modes.

3.15.3.2 HSM_OP_GC_ACRYPTO_FLAGS_INPUT_MESSAGE

```
#define HSM_OP_GC_ACRYPTO_FLAGS_INPUT_MESSAGE ((hsm_op_gc_acrypto_flags_t) (1u
 << 0))
```

Bit indicating the generic asymmetric crypto input message operation. Only valid for signature modes.

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3.15.3.3 HSM_GC_ACRYPTO_VERIFICATION_SUCCESS

```
#define HSM_GC_ACRYPTO_VERIFICATION_SUCCESS
 ((hsm_gc_acrypto_verification_status_t) (0x5A3CC3A5u))
```

Bit indicating the generic asymmetric crypto success verification status.

3.15.3.4 HSM_GC_ACRYPTO_VERIFICATION_FAILURE

```
#define HSM_GC_ACRYPTO_VERIFICATION_FAILURE
 ((hsm_gc_acrypto_verification_status_t) (0x2B4DD4B2u))
```

Bit indicating the generic asymmetric crypto failure verification status.

3.15.4 Typedef documentation

3.15.4.1 hsm_op_gc_acrypto_flags_t

```
typedef uint8_t hsm_op_gc_acrypto_flags_t
```

Bitmap describing the generic asymmetric crypto supported operation.

3.15.4.2 hsm_gc_acrypto_verification_status_t

```
typedef uint32_t hsm_gc_acrypto_verification_status_t
```

Bitmap describing the generic asymmetric crypto verification status.

3.15.5 Enumeration type documentation

3.15.5.1 hsm_op_gc_acrypto_algo_t

```
enum hsm_op_gc_acrypto_algo_t
```

Enum detailing the generic asymmetric crypto supported algorithms.

3.15.5.2 hsm_gc_acrypto_op_mode_t

```
enum hsm_gc_acrypto_op_mode_t
```

Enum describing the generic asymmetric crypto supported operating modes.

3.15.6 Function documentation

3.15.6.1 hsm_gc_acrypto()

```
hsm_err_t hsm_gc_acrypto (
hsm_hdl_t session_hdl,
op_gc_acrypto_args_t * args)
```


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This command is designed to perform the following operations:

- Asymmetric crypto
- Encryption/decryption
- Signature generation/verification

Parameters

session_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.16 Generic Crypto Asymmetric Key Generate

Data Structures

- struct op_gc_akey_gen_args_t

Functions

- hsm_err_t hsm_gc_akey_gen (hsm_hdl_t session_hdl, op_gc_akey_gen_args_t *args)

3.16.1 Detailed description

3.16.2 Data structure documentation

3.16.2.1 struct op_gc_akey_gen_args_t

Structure detailing the generic crypto asymmetric key generate operation members.

Table 4. Data Fields

uint8_t *	modulus	Pointer to the output buffer of key modulus.
uint8_t *	priv_buff	Pointer to the output buffer of key private exponent.
uint8_t *	pub_buff	Pointer to the input buffer containing key public exponent.
uint16_t	modulus_size	Size in bytes of the modulus buffer.
uint16_t	priv_buff_size	Size in bytes of the private exponent buffer.
uint16_t	pub_buff_size	Size in bytes of the public exponent buffer.
hsm_key_type_t	key_type	Indicates which type of keypair must be generated.
hsm_bit_key_sz_t	bit_key_sz	Size in bits of the keypair to be generated.

3.16.3 Function documentation

3.16.3.1 hsm_gc_akey_gen()

```
hsm_err_t hsm_gc_akey_gen (
hsm_hdl_t session_hdl,
op_gc_akey_gen_args_t * args)
```

This command is designed to perform the following operation:

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Generate asymmetric keys, without using FW keystore.

Parameters

session_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.17 Generic Crypto: Cipher

Data Structures

- struct op_gc_cipher_args_t

Enumerations

- enum hsm_op_gc_cipher_algo_t {
  HSM_GC_CIPHER_ALGO_AES_ECB_NOPAD = 0x2,
  HSM_GC_CIPHER_ALGO_AES_CBC_NOPAD = 0x3 }
- enum hsm_gc_cipher_op_mode_t {
  HSM_GC_CIPHER_OP_MODE_ENCRYPT = 0x41,
  HSM_GC_CIPHER_OP_MODE_DECRYPT = 0x42 }

Functions

- hsm_err_t hsm_gc_cipher (hsm_hdl_t session_hdl, op_gc_cipher_args_t *args)

3.17.1 Detailed description

3.17.2 Data structure documentation

3.17.2.1 struct op_gc_cipher_args_t

Structure describing member arguments of generic crypto for cipher ops.

Data Fields

hsm_op_gc_cipher_algo_t	algorithm	Algorithm to use for the operation.
hsm_gc_cipher_op_mode_t	op_mode	Indicates the operation mode.
uint16_t	byte_key_sz	Key size in bytes.
uint8_t *	in_data_buff	Pointer to the input data buffer.
uint8_t *	out_data_buff	Pointer to the out data buffer.
uint32_t	in_data_buff_sz	Size in bytes of input data buffer.
uint8_t *	plain_key_buff	Pointer to the data buffer 1.
uint32_t	plain_key_buff_sz	Size in bytes of input data buffer.
uint8_t *	iv_buff	Pointer to the data buffer 1.
uint32_t	iv_buff_sz	Size in bytes of input data buffer.

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3.17.3 Enumeration type documentation

3.17.3.1 hsm_op_gc_cipher_algo_t

```
enum hsm_op_gc_cipher_algo_t
```

Enum detailing the generic crypto supported cipher algorithms.

3.17.3.2 hsm_gc_cipher_op_mode_t

```
enum hsm_gc_cipher_op_mode_t
```

Enum describing the generic cipher crypto supported operating modes.

3.17.4 Function documentation

3.17.4.1 hsm_gc_cipher ()

```
hsm_err_t hsm_gc_cipher (
hsm_hdl_t  session_hdl,
op_gc_cipher_args_t *  args)
```

This command is designed to perform the following operations:

- Cipher Opertions:
  - AES ECB encryption/decryption
  - AES CBC encryption/decryption

Parameters

session_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.18 Generic Crypto: AEAD

Data Structures

- struct op_gc_aead_args_t

Enumerations

- enum hsm_op_gc_aead_algo_t {
  HSM_GC_AEAD_ALGO_AES_GCM = 0x05,
  HSM_GC_AEAD_ALGO_AES_CCM = 0x06,
  HSM_GC_AEAD_ALGO_CHACHA20_POLY1305 = 0x07 }
- enum hsm_gc_aead_op_mode_t {
  HSM_GC_AEAD_OP_MODE_ENCRYPT = 0x41,
  HSM_GC_AEAD_OP_MODE_DECRYPT = 0x42 }

Functions

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- hsm_err_t hsm_gc_aead (hsm_hdl_t session_hdl, op_gc_aead_args_t *args)

3.18.1 Detailed description

3.18.2 Data structure documentation

3.18.2.1 struct op_gc_aead_args_t

Structure describing the member arguments for generic crypto for AEAD Ops.

Data Fields

hsm_op_gc_aead_algo_t	algorithm	Algorithm to use for the operation.
hsm_gc_aead_op_mode_t	op_mode	Indicates the operation mode.
uint8_t *	in_data_buff	Pointer to the input data buffer.
uint8_t *	out_data_buff	Pointer to the out data buffer.
uint32_t	in_data_buff_sz	Size in bytes of input data buffer.
uint8_t *	plain_key_buff	Pointer to the plain-text key buffer.
uint32_t	plain_key_buff_sz	Size in bytes of plain-text key buffer.
uint8_t *	nonce_buff	Pointer to the nonce buffer.
uint32_t	nonce_sz	Size in bytes of the nonce buffer.
uint8_t *	aad_buff	Pointer to the authenticated associated data buffer.
uint32_t	aad_sz	Size in bytes of aad buffer.
uint8_t *	tag_buff	Pointer to the tag buffer.
uint32_t	tag_sz	Size in bytes of input data buffer.

3.18.3 Enumeration type documentation

3.18.3.1 hsm_op_gc_aead_algo_t

```
enum hsm_op_gc_aead_algo_t
```

Enum detailing the generic aead crypto supported algorithms.

3.18.3.2 hsm_gc_aead_op_mode_t

```
enum hsm_gc_aead_op_mode_t
```

Enum describing the generic AEAD crypto supported operating modes.

3.18.4 Function documentation

3.18.4.1 hsm_gc_aead ()

```
hsm_err_t hsm_gc_aead (
hsm_hdl_t  session_hdl,
op_gc_aead_args_t *  args)
```


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This command is designed to perform the following operations:

- AEAD Cipher generic crypto operations:
  - Encryption/Decryption

Parameters

session_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.19 Get Info

Data Structures

- struct op_get_info_args_t

Functions

- hsm_err_t hsm_get_info (hsm_hdl_t sess_hdl, op_get_info_args_t *args)

3.19.1 Detailed description

3.19.2 Data structure documentation

3.19.2.1 struct op_get_info_args_t

Structure describing the get info operation member arguments.

Data Fields

uint32_t	user_sab_id	Stores User identifier (32 bits).
uint8_t *	chip_unique_id	Stores the chip unique identifier.
uint16_t	chip_unq_id_sz	Size of the chip unique identifier in bytes.
uint16_t	chip_monotonic_ counter	Stores the chip monotonic counter value (16 bits).
uint16_t	chip_life_cycle	Stores the chip current life cycle bitfield (16 bits).
uint32_t	version	Stores the module version (32 bits).
uint32_t	version_ext	Stores the module extended version (32 bits).
uint8_t	fips_mode	Stores the FIPS mode bitfield (8 bits). Bitmask definition: bit0: FIPS mode of operation: • Value 0: part is running in FIPS non-approved mode. • Value 1: part is running in FIPS approved mode. • Bit 1: FIPS certified part: • Value 0: part is not FIPS certified. • Value 1: part is FIPS certified. • Bit 2-7: reserved • Value 0.

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3.19.3 Function documentation

3.19.3.1 hsm_get_info()

```
hsm_err_t hsm_get_info (
hsm_hdl_t sess_hdl,
op_get_info_args_t * args)
```

Perform device attestation operation.

Users can call this function only after opening the session.

Parameters

sess_hdl	Handle identifying the active session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.20 Key exchange

Data Structures

- struct op_key_exchange_args_t

Macros

- #define HSM_OP_KEY_EXCHANGE_FLAGS_INPUT_SIGNED_CONTENT ((hsm_op_key_exchange_flags_t)(0u << 0))
- #define HSM_OP_KEY_EXCHANGE_FLAGS_INPUT_PLAINTEXT_CONTENT ((hsm_op_key_exchange_flags_t)(1u << 0))
- #define HSM_OP_KEY_EXCHANGE_FLAGS_RETURN_KEY_IDS ((hsm_op_key_exchange_flags_t)(1u << 1))
- #define HSM_OP_KEY_EXCHANGE_FLAGS_RETURN_OUTPUT ((hsm_op_key_exchange_flags_t)(1u << 2))
- #define HSM_OP_KEY_EXCHANGE_FLAGS_SALT_ZERO ((hsm_op_key_exchange_flags_t)(0u << 0))
- #define HSM_OP_KEY_EXCHANGE_FLAGS_SALT_PEER_PUBKEY_HASH ((hsm_op_key_exchange_flags_t)(1u << 0))
- #define HSM_OP_KEY_EXCHANGE_FLAGS_MONOTONIC ((hsm_op_key_exchange_flags_t)(1u << 5))
- #define HSM_OP_KEY_EXCHANGE_FLAGS_STRICT_OPERATION ((hsm_op_key_exchange_flags_t)(1u << 7))

Typedefs

typedef uint16_t hsm_op_key_exchange_flags_t

Enumerations

- enum hsm_op_key_exchange_algo_t {
  HSM_KEY_EX_ECDH_HKDF_SHA256_KEY_IMPORT = 0x09020109,
  HSM_KEY_EX_ECDH_HKDF_SHA384_KEY_IMPORT = 0x0902010A,
  HSM_KEY_EX_ECDH_HKDF_SHA256 = 0x89020109,
  HSM_KEY_EX_ECDH_HKDF_SHA384 = 0x8902010A,
  HSM_KEY_EXCHANGE_ECDH_HKDF_SHA256 = 0x09020109,
  HSM_KEY_EXCHANGE_ECDH_HKDF_SHA384 = 0x0902010A}

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- enum hsm_op_key_derivation_algo_t {
  HSM_KEY_DERIVATION_HKDF_SHA256 = 0x08000109,
  HSM_KEY_DERIVATION_HKDF_SHA384 = 0x0800010A,
  HSM_KEY_DERIVATION_HKDF_EXTRACT_SHA256 = 0x08000409,
  HSM_KEY_DERIVATION_HKDF_EXTRACT_SHA384 = 0x0800040A,
  HSM_KEY_DERIVATION_HKDF_EXPAND_SHA256 = 0x08000509,
  HSM_KEY_DERIVATION_HKDF_EXPAND_SHA384 = 0x0800050A }
- enum hsm_op_key_derivation_tls1_3_algo_t {
  HSM_KEY_DERIVATION_TLS1_3_EARLY_SECRET_SHA256 = 0x8800D009,
  HSM_KEY_DERIVATION_TLS1_3_EARLY_SECRET_SHA384 = 0x8800D00A,
  HSM_KEY_DERIVATION_TLS1_3_HANDSHAKE_SECRET_SHA256 = 0x8800D109,
  HSM_KEY_DERIVATION_TLS1_3_HANDSHAKE_SECRET_SHA384 = 0x8800D10A,
  HSM_KEY_DERIVATION_TLS1_3_KEYING_MATERIAL_SHA256 = 0x8800D309,
  HSM_KEY_DERIVATION_TLS1_3_KEYING_MATERIAL_SHA384 = 0x8800D30A,
  HSM_KEY_DERIVATION_TLS1_3_IV_SHA256 = 0x8800D409,
  HSM_KEY_DERIVATION_TLS1_3_IV_SHA384 = 0x8800D40A,
  HSM_KEY_DERIVATION_TLS1_3_MASTER_SECRET_SHA256 = 0x8800D209,
  HSM_KEY_DERIVATION_TLS1_3_MASTER_SECRET_SHA384 = 0x8800D20A }
- enum hsm_op_key_derivation_tls1_2_algo_t {
  HSM_KEY_DERIVATION_TLS1_2_MASTER_SECRET_SHA256 = 0x8800E009,
  HSM_KEY_DERIVATION_TLS1_2_MASTER_SECRET_SHA384 = 0x8800E00A,
  HSM_KEY_DERIVATION_TLS1_2_KEY_BLOCK_SHA256 = 0x8800E109,
  HSM_KEY_DERIVATION_TLS1_2_KEY_BLOCK_SHA384 = 0x8800E10A,
  HSM_KEY_DERIVATION_TLS1_2_VERIFY_DATA_SHA256 = 0x8800E409,
  HSM_KEY_DERIVATION_TLS1_2_VERIFY_DATA_SHA384 = 0x8800E40A,
  HSM_KEY_DERIVATION_TLS1_2_IV_SHA256 = 0x8800E209,
  HSM_KEY_DERIVATION_TLS1_2_IV_SHA384 = 0x8800E20A}

Functions

hsm_err_t hsm_key_exchange (hsm_hdl_t key_management_hdl, op_key_exchange_args_t *args)

3.20.1 Detailed description

3.20.2 Data structure documentation

3.20.2.1 struct op_key_exchange_args_t

Structure describing the key exchange operation member arguments.

Table 5. Data Fields

uint32_t	in_content_sz	Input content buffer size in bytes.
uint8_t *	in_content	Input content buffer.
uint32_t	in_pub_buffer_sz	Input public buffer size in bytes.
uint8_t *	in_pub_buffer	Input public buffer.
uint32_t	user_fixed_info_sz	Input user fixed information size in bytes.
uint8_t *	user_fixed_info	Input user fixed information buffer. Optional, i.e., can be NULL, depending on the key derivation process.
uint32_t	output_sz	Output buffer size in bytes.

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Table 5. Data Fields*...continued*

uint8_t *	output	Operation output returned as Output buffer. Optional ,i.e., can be NULL, depending on Flags.
uint32_t	out_derived_key_id	Identifier of the derived key, with FW Resp.
uint32_t	out_salt_sz	Salt size in bytes, from FW Resp. It is equal to the hash (in bytes) of hash algorithm used in the key exchange algorithm.
uint32_t	exp_output_sz	Size in bytes of the exported derived key buffer, or Expected output derived key size (bytes), in case of `HSM_OUT_TOO_SMALL` error code.
hsm_op_key_exchange_flags_t	flags	Bit field indicating the requested operations: • Bit 0: Input content type. – - 0: Input signed content – - 1: Input unsigned content • Bit 1: When multiple keys are derived (TLS 1.2), IDs are returned as buffer. • Bit 2: Operation output is returned as buffer (in plain text) and not stored in EdgeLock secure enclave storage. • Bit 3 to 4: Reserved. • Bit 5: Monotonic counter increment (SYNC operation). When used in conjunction with SYNC key group or SYNC key store and storage master, the request is completed only when the monotonic counter has been updated. • Bit 6: Reserved when the modified key store and storage master have been written in the NVM. • Bit 7: SYNC operation. The request is completed only when the new key has been written in NVM.

3.20.2.2 Field description - Input Content buffer

This API can be used for several operations, by choosing the Input Content buffer accordingly.

The following sections provide the tables having representations and description of required Input Content formats, for each possible operation. The supported operations are as follows:

- Combined key agreement and key derivation operation
- TLS 1.2
  - Master Secret
  - Key Block
  - IV
- TLS 1.3
  - Early Secrets, Handshake Secrets, and Master Secrets
- HMAC-based Key Derivation Function
  - HKDF
  - HKDF Extract
  - HKDF Expand

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3.20.2.2.1 Combined key agreement and key derivation operation

Table 6. Key exchange input signed content payload description

Field	Size (in bits)	Description
TAG	8	Signed content TAG, must be set to **0x47**.
Version	8	Signed content version, must be set to **0x07**.
Reserved	16	Reserved bits.
Key store ID	32	Key store ID where to store the derived key. It must be the key store ID related to the key management handle set in the command API.
Key exchange algorithm	32	Algorithm used by the key exchange process.
Derived key group	16	Indicates the derived key group ID. 100 groups are available per key store. It must be a value in the range [0; 99].
Salt flags	16	Bit field indicating the requested salt flags: **Bit 0**: Salt in step #1 (HKDF-extract) of HMAC based two-step key derivation process. • 0: Use zeros salt. • 1: Use peer public key digest as salt. **Bit 1**: In case of OEM Master Key generation for Key Import purpose, salt used to derive `OEM_IMPORT_WRAP_SK and OEM_IMPORT_CMAC_SK`. • 0: Zeros string. • 1: Device SRKH. **Bit 2 to 15**: Reserved.
Derived key type	16	Derived key type attribute (Symmetric). **Reminder**: In case of OEM Master Key generation for Key Import purpose, the value must be set to `OEM_IMPORT_MK_SK`.
Derived key security size bits	16	Derived key security size in bits attribute (Symmetric). **Reminder**: In case of OEM Master Key generation for Key Import purpose, the value must be set to **256**.
Derived key lifetime	32	Derived key lifetime attribute.
Derived key usage	32	Derived key usage attribute. **Reminder**: In case of OEM Master Key generation for Key Import purpose, the value must be set to **Derive**.
Derived key permitted algorithm	32	Derived key permitted algorithm attribute. **Reminder**: In case of OEM Master Key generation for Key Import purpose, the value must be set to **HKDF SHA256**.
Derived key lifecycle	32	Derived key lifecycle attribute. The current device lifecycle could be used by setting this field to **0x0**.
Derived key ID	32	Derived key ID attribute. • **0x0** to let EdgeLock secure enclave Firmware choose the key identifier (supported by all Persistence level indicator). • Wanted key identifier of the derived key (only supported by Persistent and Permanent Persistence level indicator). In both cases, the key identifier value must respect the range defined.

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Table 6. Key exchange input signed content payload description*...continued*

Field	Size (in bits)	Description
Private key ID	32	Identifier in the EdgeLock secure enclave Firmware key storage of the private key to use with the peer public key during the key agreement process.
Input peer public key digest word #0	32	First 32-bits word (in little endian) of the input peer public key digest buffer. The algorithm used to generate the digest must be **SHA256**.
…	32	Intermediate 32-bits words (in little endian) of the input peer public key digest buffer. The algorithm used to generate the digest must be **SHA256**.
Input peer public key digest word #7	32	Last 32-bits word (in little endian) of the input peer public key digest buffer. The algorithm used to generate the digest must be **SHA256**.
Input user fixed info digest word #0	32	First 32-bits word (in little endian) of the input user fixed info digest buffer. The algorithm used to generate the digest must be **SHA256**. ***Note:*** *If the input user fixed info is not used (set to NULL in command API), this digest value is ignored.*
…	32	Intermediate 32-bits words (in little endian) of the input user fixed info digest buffer. The algorithm used to generate the digest must be **SHA256**. Note: If the input user fixed info is not used (set to NULL in command API), this digest value is ignored.
Input user fixed info digest word #7	32	Last 32-bits word (in little endian) of the input user fixed info digest buffer. The algorithm used to generate the digest must be **SHA256**. ***Note:*** *If the input user fixed info is not used (set to NULL in command API), this digest value is ignored.*

3.20.2.2.2 TLS 1.2

Table 7. Key exchange input unsigned content TLS 1.2 Master Secret

Field	Size (in bits)	Description
Version	16	This structure version, only **0x1** is supported.
Reserved	16	Reserved bits.
Key store ID	32	Key store ID where to store the Master Secret. It must be the key store ID related to the key management handle set in the command API. This is not used and ignored when Master Secret is exported and not stored in the EdgeLock secure enclave storage.
TLS 1.2 algorithm	32	Algorithm used by the key exchange process, **Master Secret** values.
Private key ID	32	Identifier in the EdgeLock secure enclave Firmware key storage of the private key to use with the peer public key during the premaster secret generation.
Derived key type	16	Ignored by the EdgeLock secure enclave Firmware, any value can be set.

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Table 7. Key exchange input unsigned content TLS 1.2 Master Secret*...continued*

Field	Size (in bits)	Description
		When Master Secret is stored in the EdgeLock secure enclave key storage, it is set to **DERIVE** by the EdgeLock secure enclave Firmware.
Derived key security size bits	16	Ignored by the EdgeLock secure enclave Firmware as hardcoded to **384**.
Derived key lifetime	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When Master Secret is stored in EdgeLock secure enclave key storage, it is set to **VOLATILE** by the EdgeLock secure enclave Firmware.
Derived key usage	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When Master Secret is stored in the EdgeLock secure enclave key storage. it is set to **DERIVE** by the EdgeLock secure enclave Firmware.
Derived key permitted algorithm	32	Ignored by EdgeLock secure enclave Firmware, any value can be set. When Master Secret is stored in the EdgeLock secure enclave key storage, it is set by the EdgeLock secure enclave Firmware to an internal algorithm value that allows the Master Secret to derive the TLS 1.2 key block and IVs. The hash algorithm is the same as the one set in the `TLS 1.2 algorithm` field.
Derived key lifecycle	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When Master Secret is stored in the EdgeLock secure enclave key storage, it is set to **current device lifeycle** by the EdgeLock secure enclave Firmware.
Derived key ID	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
Reserved	32	Reserved bits.

Table 8. Key exchange input unsigned content TLS 1.2 Key Block

Field	Size (in bits)	Description
Version	16	This structure version, only **0x1** is supported.
Reserved	16	Reserved bits.
Key store ID	32	Key store ID where to store the derived keys. It must be the key store ID related to the key management handle set in the command API. This is not used and ignored when derived keys are exported and not stored in the EdgeLock secure enclave storage.
TLS 1.2 algorithm	32	Algorithm used by the key exchange process, **Key Block** values.
Private key ID	32	Identifier in the EdgeLock secure enclave Firmware key storage of the Master Secret to use to derive the keys. Could be set to **0x0** if Master Secret is used as input plaintext buffer.

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Table 8. Key exchange input unsigned content TLS 1.2 Key Block*...continued*

Field	Size (in bits)	Description
Derived key type	16	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
Ciphersuite key security size bits	16	The client/server write key security size in bits.
Derived key lifetime	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When keys are stored in the EdgeLock secure enclave key storage, it is set to **VOLATILE** by the EdgeLock secure enclave Firmware.
Derived key usage	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
Ciphersuite algorithm	32	The permitted algorithm assigned to client/server write key that defined the ciphersuite.
Derived key lifecycle	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When keys are stored in the EdgeLock secure enclave key storage, it is set to **current device lifeycle** by the EdgeLock secure enclave Firmware.
Derived key ID	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
Master Secret length	32	Master Secret size (in bytes) if used as input plaintext buffer. Must be set to **48** in that case. Must be set to **0** if used as stored secret.
Master Secret buffer	384	(Optional) Master Secret value, in big endian format, if Master Secret length is set.

Table 9. Key exchange input unsigned content TLS 1.2 IV

Field	Size (in bits)	Description
Version	16	This structure version, only **0x1** is supported.
Reserved	16	Reserved bits.
Key store ID	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
TLS 1.2 algorithm	32	Algorithm used by the key exchange process, **IV** values.
Private key ID	32	Identifier in the EdgeLock secure enclave Firmware key storage of the Master Secret to use to derive the IVs. Could be set to **0x0** if Master Secret is used as input plaintext buffer.
Derived key type	16	Ignored by the EdgeLock secure enclave Firmware, any value can be set
Ciphersuite key security size bits	16	The client/server write key security size in bits.
Derived key lifetime	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.

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Table 9. Key exchange input unsigned content TLS 1.2 IV*...continued*

Field	Size (in bits)	Description
Derived key usage	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
Ciphersuite algorithm	32	The permitted algorithm assigned to the client/server write key that defined the ciphersuite.
Derived key lifecycle	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
Derived key ID	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.
Master Secret length	32	Master Secret size (in bytes) if used as input plaintext buffer. Must be set to EdgeLock® secure enclave Firmware in that case. Must be set to **0** if used as stored secret.
Master Secret buffer	384	(Optional) Master Secret value, in big endian format, if Master Secret length is set.

3.20.2.2.3 TLS 1.3

Table 10. Key exchange input unsigned content TLS 1.3

Field	Size (in bits)	Description
Version	16	This structure version, only **0x1** is supported.
Reserved	16	Reserved bits.
Key store ID	32	Key store ID where to store the derived key. It must be the key store ID related to the key management handle set in the command API. This is not used and ignored when derived key is exported and not stored in EdgeLock secure enclave storage.
TLS 1.3 algorithm	32	Algorithm used by the key exchange process.
Private key ID	32	Identifier in the EdgeLock secure enclave Firmware key storage of the private key to use with the peer public key during the key agreement process. Not used and ignored for **Early Secret** algorithm.
Derived key type	16	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When key is stored in the EdgeLock secure enclave key storage, it is set to **DERIVE** by the EdgeLock secure enclave Firmware.
Derived key security size bits	16	Derived key security size in bits attribute.
Derived key lifetime	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When key is stored in EdgeLock secure enclave key storage, it is set to **VOLATILE** by the EdgeLock secure enclave Firmware.
Derived key usage	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When key is stored in EdgeLock secure enclave key storage, it is set to **DERIVE** by the EdgeLock secure enclave Firmware.
Derived key permitted algorithm	32	Derived key permitted algorithm attribute. Must be a “HKDF Expand SHAxxx” value.

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Table 10. Key exchange input unsigned content TLS 1.3*...continued*

Field	Size (in bits)	Description
		Not used and ignored if the derived key is exported.
Derived key lifecycle	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When key is stored in EdgeLock secure enclave key storage, it is set to **current device lifeycle** by the EdgeLock secure enclave Firmware.
Derived key ID	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set
PSK length	32	(Optional) PSK length in **bytes**. Can be set to **0** if not used.
PSK buffer	PSK length * 8	(Optional) PSK value if PSK length is set.

3.20.2.2.4 HMAC-based Key Derivation function

Table 11. Key exchange input unsigned content HKDF Extract

Field	Size (in bits)	Description
Version	16	This structure version, only **0x1** is supported.
Reserved	16	Reserved bits.
Key store ID	32	Key store ID where to store the derived key. It must be the key store ID related to the key management handle set in the command API. This is not used and ignored when derived key is exported and not stored in the EdgeLock secure enclave storage.
HKDF Extract algorithm	32	Algorithm used by the key exchange process, **HKDF Extract**.
Private key ID	32	Identifier in the EdgeLock secure enclave Firmware key storage of the private key to use during the key derivation process. It is used as private key for ECDH operation. The ECDH result is used as IKM for the HKDF Extract operation. Could be set to **0x0** if IKM is used as the input plaintext buffer.
Derived key type	16	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When key is stored in EdgeLock secure enclave key storage, it is set to **DERIVE** by the EdgeLock secure enclave Firmware.
Derived key security size bits	16	Ignored by the EdgeLock secure enclave Firmware, any value can be set. it is set, by the EdgeLock secure enclave Firmware, to **hash algorithm length** used by this operation.
Derived key lifetime	32	Derived key lifetime attribute. Not used and ignored if derived key is exported.
Derived key usage	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set. When key is stored in EdgeLock secure enclave key storage, it is set to **DERIVE** by the EdgeLock secure enclave Firmware.
Derived key permitted algorithm	32	Ignored by the EdgeLock secure enclave Firmware, any value can be set.

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Table 11. Key exchange input unsigned content HKDF Extract*...continued*

Field	Size (in bits)	Description
		When key is stored in EdgeLock secure enclave key storage, it is set to **HKDF_Expand** (Hash algorithm used in current Extract operation) by the EdgeLock secure enclave Firmware.
Derived key lifecycle	32	Derived key lifecycle attribute. Current device lifecycle could be used by setting this field to **0x0**. Not used and ignored if the derived key is exporte.
Derived key ID	32	Derived key ID attribute: • **0x0** to let the EdgeLock secure enclave Firmware choose the key identifier (supported by all Persistence level indicator). • Wanted key identifier of the derived key (only supported by Persistent and Permanent Persistence level indicator). In both cases, the key identifier value must respect the range defined. Not used and ignored if derived key is exported.
Salt length	32	Salt length in **bytes**. It can be set to **0x0**. In that case a zero's string of hash algorithm (used by this operation) length is used.
Salt buffer	Salt length * 8	Salt value if the Salt length is set.

Table 12. Key exchange input unsigned content HKDF Expand

Field	Size (in bits)	Description
Version	16	This structure version, only **0x1** is supported.
Reserved	16	Reserved bits.
Key store ID	32	Key store ID where to store the derived key. It must be the key store ID related to the key management handle set in the command API. This is not used and ignored when the derived key is exported and not stored in EdgeLock secure enclave storage.
HKDF Expand algorithm	32	Algorithm used by the key exchange process, **HKDF Expand**.
PRK ID	32	Identifier in the EdgeLock secure enclave Firmware key storage of the PRK to use during the key derivation process. Could be set to **0x0** if PRK is used as input plaintext buffer.
Derived key type	16	Derived key type attribute (Symmetric). Not used and ignored if the derived key is exported.
Derived key security size bits	16	Derived key security size in bits attribute, (Symmetric).
Derived key lifetime	32	Derived key lifetime attribute. Not used and ignored if derived key is exported.
Derived key usage	32	Derived key usage attribute. Not used and ignored if derived key is exported.
Derived key permitted algorithm	32	Derived key permitted algorithm attribute. Not used and ignored if derived key is exported.

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Table 12. Key exchange input unsigned content HKDF Expand*...continued*

Field	Size (in bits)	Description
Derived key lifecycle	32	Derived key lifecycle attribute. Current device lifecycle could be used by setting this field to **0x0**. Not used and ignored if derived key is exported.
Derived key ID	32	Derived key ID attribute: • **0x0** to let EdgeLock secure enclave Firmware choose the key identifier (supported by all Persistence level indicators). • Wanted key identifier of the derived key (only supported by Persistent and Permanent Persistence level indicators). In both cases, the key identifier value must respect the range defined. Not used and ignored if derived key is exported.
Plaintext PRK length	32	PRK length in bytes. Must be set to **0x0** if a PRK ID is used.
Plaintext PRK buffer	Plaintext PRK length * 8	Plaintext PRK value if the Plaintext PRK length is set.

Table 13. Key exchange input unsigned content HKDF

Field	Size (in bits)	Description
Version	16	This structure version, only **0x1** is supported.
Reserved	16	Reserved bits.
Key store ID	32	Key store ID where to store the derived key. It must be the key store ID related to the key management handle set in the command API. This is not used and ignored when derived key is exported and not stored in EdgeLock secure enclave storage.
HKDF algorithm	32	HKDF Algorithm used by the key exchange process.
Private key ID	32	Identifier, in the EdgeLock secure enclave Firmware key storage, of the private key to use during the key derivation process. It is used as private key for ECDH operation. ECDH result is used as IKM for HKDF Extract operation. Could be set to **0x0** if IKM is used as the input plaintext buffer.
Derived key type	16	Derived key type attribute. Not used and ignored if derived key is exported.
Derived key security size bits	16	Derived key security size in bits attribute.
Derived key lifetime	32	Derived key lifetime attribute. Not used and ignored if derived key is exported.
Derived key usage	32	Derived key usage attribute. Not used and ignored if derived key is exported.
Derived key permitted algorithm	32	Derived key permitted algorithm attribute. Not used and ignored if derived key is exported.
Derived key lifecycle	32	Derived key lifecycle attribute. Current device lifecycle could be used by setting this field to **0x0**. Not used and ignored if derived key is exported.
Derived key ID	32	Derived key ID attribute: • **0x0** to let EdgeLock secure enclave Firmware choose the key identifier

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Table 13. Key exchange input unsigned content HKDF*...continued*

Field	Size (in bits)	Description
		• Wanted key identifier of the derived key (only supported by Persistent and Permanent Persistence level indicators). In both cases, the key identifier value must respect the range defined. Not used and ignored if derived key is exported.
Salt length	32	Salt length in **bytes**. It can be set to 0x0. In that case a zero's string of hash algorithm (used by this operation) length is used.
Salt buffer	Salt length * 8	Salt value if Salt length is set.

3.20.3 Macro definition documentation

3.20.3.1 HSM_OP_KEY_EXCHANGE_FLAGS_INPUT_SIGNED_CONTENT

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_INPUT_SIGNED_CONTENT
 ((hsm_op_key_exchange_flags_t)(0u << 0))
```

Input signed content.

3.20.3.2 HSM_OP_KEY_EXCHANGE_FLAGS_INPUT_PLAINTEXT_CONTENT

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_INPUT_PLAINTEXT_CONTENT
 ((hsm_op_key_exchange_flags_t)(1u << 0))
```

Input plaintext content.

3.20.3.3 HSM_OP_KEY_EXCHANGE_FLAGS_RETURN_KEY_IDS

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_RETURN_KEY_IDS ((hsm_op_key_exchange_flags_t)
(1u << 1))
```

Return the multiple derived key IDs as output buffer. Flag only available for TLS 1.2 Key Block operation.

3.20.3.4 HSM_OP_KEY_EXCHANGE_FLAGS_RETURN_OUTPUT

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_RETURN_OUTPUT ((hsm_op_key_exchange_flags_t)
(1u << 2))
```

Return the operation's output as buffer (in plaintext).

3.20.3.5 HSM_OP_KEY_EXCHANGE_FLAGS_SALT_ZERO

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_SALT_ZERO  ((hsm_op_key_exchange_flags_t)(0u
 << 0))
```

Use zeros salt.

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3.20.3.6 HSM_OP_KEY_EXCHANGE_FLAGS_SALT_PEER_PUBKEY_HASH

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_SALT_PEER_PUBKEY_HASH
 ((hsm_op_key_exchange_flags_t)(1u << 0))
```

Use peer public key hash salt.

3.20.3.7 HSM_OP_KEY_EXCHANGE_FLAGS_MONOTONIC

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_MONOTONIC  ((hsm_op_key_exchange_flags_t)(1u
 << 5))
```

When used in conjunction with the STRICT flag, the request is completed only when the monotonic counter has been updated.

3.20.3.8 HSM_OP_KEY_EXCHANGE_FLAGS_STRICT_OPERATION

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_STRICT_OPERATION
 ((hsm_op_key_exchange_flags_t)(1u << 7))
```

The request is completed only when the new key has been written in the NVM. This is applicable for the persistent key only.

Note: *In the latest ELE FW API guide, "STRICT" has been replaced with "SYNC".*

3.20.4 Typedef documentation

3.20.4.1 hsm_op_key_exchange_flags_t

```
typedef uint16_t hsm_op_key_exchange_flags_t
```

Bitmap specifying the key exchange operation properties.

3.20.5 Enumeration type documentation

3.20.5.1 hsm_op_key_exchange_algo_t

```
enum hsm_op_key_exchange_algo_t
```

Enum describing Key Exchange algorithms supported.

Table 14. Enumerators

HSM_KEY_EX_ECDH_HKDF_SHA256_KEY_IMPORT	ECDH HKDF SHA256 KEY IMPORT.
HSM_KEY_EX_ECDH_HKDF_SHA384_KEY_IMPORT	ECDH HKDF SHA384 KEY IMPORT.
HSM_KEY_EX_ECDH_HKDF_SHA256	ECDH HKDF SHA256.
HSM_KEY_EX_ECDH_HKDF_SHA384	ECDH HKDF SHA384.
HSM_KEY_EXCHANGE_ECDH_HKDF_SHA256	ECDH HKDF SHA256. This will be deprecated soon.
HSM_KEY_EXCHANGE_ECDH_HKDF_SHA384	ECDH HKDF SHA384. This will be deprecated soon.

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3.20.5.2 hsm_op_key_derivation_algo_t

```
enum hsm_op_key_derivation_algo_t
```

Enum describing the Key Derivation algorithms supported.

Table 15. Enumerators

HSM_KEY_DERIVATION_HKDF_SHA256	HKDF SHA256 (HMAC two-step)
HSM_KEY_DERIVATION_HKDF_SHA384	HKDF SHA384 (HMAC two-step)
HSM_KEY_DERIVATION_HKDF_EXTRACT_SHA256	HKDF Extract SHA256
HSM_KEY_DERIVATION_HKDF_EXTRACT_SHA384	HKDF Extract SHA384
HSM_KEY_DERIVATION_HKDF_EXPAND_SHA256	HKDF Expand SHA256
HSM_KEY_DERIVATION_HKDF_EXPAND_SHA384	HKDF Expand SHA384

3.20.5.3 hsm_op_key_derivation_tls1_3_algo_t

```
enum hsm_op_key_derivation_tls1_3_algo_t
```

Enum describing the TLS 1.3 Key Derivation algorithms supported.

Table 16. Enumerators

HSM_KEY_DERIVATION_TLS1_3_EARLY_SECRET_SHA256	TLS 1.3 Early Secret SHA256
HSM_KEY_DERIVATION_TLS1_3_EARLY_SECRET_SHA384	TLS 1.3 Early Secret SHA384
HSM_KEY_DERIVATION_TLS1_3_HANDSHAKE_SECRET_SHA256	TLS 1.3 Handshake Secret SHA256
HSM_KEY_DERIVATION_TLS1_3_HANDSHAKE_SECRET_SHA384	TLS 1.3 Handshake Secret SHA384
HSM_KEY_DERIVATION_TLS1_3_MASTER_SECRET_SHA256	TLS 1.3 Master Secret SHA256
HSM_KEY_DERIVATION_TLS1_3_MASTER_SECRET_SHA384	TLS 1.3 Master Secret SHA384
HSM_KEY_DERIVATION_TLS1_3_KEYING_MATERIAL_SHA256	TLS 1.3 Keying Material SHA256
HSM_KEY_DERIVATION_TLS1_3_KEYING_MATERIAL_SHA384	TLS 1.3 Keying Material SHA384
HSM_KEY_DERIVATION_TLS1_3_IV_SHA256	TLS 1.3 IV SHA256
HSM_KEY_DERIVATION_TLS1_3_IV_SHA384	TLS 1.3 IV SHA384

3.20.5.4 hsm_op_key_derivation_tls1_2_algo_t

```
enum hsm_op_key_derivation_tls1_2_algo_t
```

Enum describing TLS 1.2 Key Derivation algorithms supported.

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Table 17. Enumerators

HSM_KEY_DERIVATION_TLS1_2_MASTER_SECRET_SHA256	TLS 1.2 Master Secret SHA256
HSM_KEY_DERIVATION_TLS1_2_MASTER_SECRET_SHA384	TLS 1.2 Master Secret SHA384
HSM_KEY_DERIVATION_TLS1_2_KEY_BLOCK_SHA256	TLS 1.2 Key Block SHA256
HSM_KEY_DERIVATION_TLS1_2_KEY_BLOCK_SHA384	TLS 1.2 Key Block SHA384
HSM_KEY_DERIVATION_TLS1_2_VERIFY_DATA_SHA256	TLS 1.2 VERIFY DATA SHA256
HSM_KEY_DERIVATION_TLS1_2_VERIFY_DATA_SHA384	TLS 1.2 VERIFY DATA SHA384
HSM_KEY_DERIVATION_TLS1_2_IV_SHA256	TLS 1.2 IV SHA256
HSM_KEY_DERIVATION_TLS1_2_IV_SHA384	TLS 1.2 IV SHA384

3.20.6 Function documentation

3.20.6.1 hsm_key_exchange

```
hsm_err_t hsm_key_exchange (
hsm_hdl_t key_management_hdl,
op_key_exchange_args_t *  args)
```

This command is designed to compute secret keys through a key exchange protocol and the use of a key derivation function.

This API supports the following use cases:

- Combined key agreement and key derivation operation
  - This option is used to perform combined key agreement and key derivation op.
  - Only symmetric keys can be created with this operation.
- TLS 1.2
  This option is used to derive TLS 1.2 secrets and IVs:
  - Master Secret
  - Client/Server write MAC keys
  - Client/Server write keys
  - Client/Server IVs
- TLS 1.3
  This option is used to derive:
  - Early Secrets
  - Handshake Secrets
  - Master Secrets
- HMAC-based Key Derivation Function
  This option is used to derive key using HKDF algorithm. It can be either the entire process or one specific step.
  1. Extract
  2. Expand

Users can call this function only after having opened a key management service flow.

Table 18. Parameters

key_management_hdl	Handle identifying the key store management service flow.

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Table 18. Parameters...*continued*

args	Pointer to the structure containing the function arguments.

Returns

Error code

3.21 Public key recovery

Public Key Recovery is also known as Public Key Exportation, in PSA compliant APIs. The naming here has been kept unchanged, for backward compatibility and Non-PSA compliant APIs.

Data Structures

- struct op_pub_key_recovery_args_t

Functions

- hsm_err_t hsm_pub_key_recovery (hsm_hdl_t key_store_hdl, op_pub_key_recovery_args_t *args)

3.21.1 Detailed description

Public Key Recovery is now known as Public Key Exportation, in PSA compliant APIs. The naming here has been kept unchanged, for backward compatibility and Non-PSA compliant APIs.

3.21.2 Data structure documentation

3.21.2.1 struct op_pub_key_recovery_args_t

Structure detailing the public key recovery opeation member arguments.

Data Fields

uint32_t	key_identifier	Pointer to the identifier of the key to be used for the operation.
uint8_t *	out_key	Pointer to the output area where the generated public key must be written.
uint16_t	out_key_size	Length in bytes of the output key.
uint16_t	exp_out_key_size	Expected output key buffer size, valid in case of `HSM_OUT_TOO_SMALL (0x1D)` resp code.

3.21.3 Function documentation

3.21.3.1 hsm_pub_key_recovery()

```
hsm_err_t hsm_pub_key_recovery (
hsm_hdl_t key_store_hdl,
op_pub_key_recovery_args_t * args)
```

Recover Public key from private key present in key store.

Users can call this function only after opening a key store.

Parameters

key_store_hdl	Handle identifying the current key store.

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Parameters...*continued*

args	Pointer to the structure containing the function arguments.

Returns

Error code

3.22 Key store

User must open a key store service flow to perform the following operations.

Data Structures

- struct open_svc_key_store_args_t
- struct op_key_store_reprov_en_args_t

Macros

- #define HSM_SVC_KEY_STORE_FLAGS_LOAD ((hsm_svc_key_store_flags_t)(0u << 0))
  It must be specified to load a previously created key store.
- #define HSM_SVC_KEY_STORE_FLAGS_CREATE ((hsm_svc_key_store_flags_t)(1u << 0))
- #define HSM_SVC_KEY_STORE_FLAGS_SHARED ((hsm_svc_key_store_flags_t)(1u << 2))
- #define HSM_SVC_KEY_STORE_FLAGS_SET_MAC_LEN ((hsm_svc_key_store_flags_t)(1u << 3))
- #define HSM_SVC_KEY_STORE_FLAGS_MONOTONIC ((hsm_svc_key_store_flags_t)(1u << 5))
- #define HSM_SVC_KEY_STORE_FLAGS_STRICT_OPERATION ((hsm_svc_key_store_flags_t)(1u << 7))

Typedefs

- typedef uint8_t hsm_svc_key_store_flags_t

Functions

- hsm_err_t hsm_open_key_store_service (hsm_hdl_t session_hdl, open_svc_key_store_args_t *args, hsm_hdl_t *key_store_hdl)
- hsm_err_t hsm_close_key_store_service (hsm_hdl_t key_store_hdl)
- hsm_err_t hsm_key_store_reprov_en (hsm_hdl_t session_hdl, op_key_store_reprov_en_args_t *args)

3.22.1 Detailed description

Users must open a key store service flow to perform the following operations:

- Create a new key store.
- Perform operations involving keys stored in the key store (ciphering, signature generation...)
- Perform a key store reprovisioning using a signed message. A key store re-provisioning results in erasing all the key stores handled by the HSM.

Grant access to the key store. The caller is authenticated against the domain ID (DID) and Messaging Unit used at the keystore creation. In addition, an authentication nonce can be provided.

3.22.2 Data structure documentation

3.22.2.1 struct open_svc_key_store_args_t

Structure specifying the open key store service member arguments.

Data Fields

uint32_t	key_store_hdl	Handle identifying the key store service flow.

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Data Fields...*continued*

uint32_t	key_store_identifier	User defined ID identifying the key store. Only one key store service can be opened on a given `key_store_identifier`.
uint32_t	authentication_nonce	User defined nonce used as authentication proof for accessing the key store.
uint8_t	flags	Bitmap specifying the services properties.

3.22.2.2 struct op_key_store_reprov_en_args_t

Structure describing the key store reprovisioning enable operation arguments.

Data Fields

uint8_t *	signed_message	Signed content payload.
uint32_t	signed_msg_size	Signed content payload size in bytes.

3.22.3 Macro definition documentation

3.22.3.1 HSM_SVC_KEY_STORE_FLAGS_CREATE

```
#define HSM_SVC_KEY_STORE_FLAGS_CREATE ((hsm_svc_key_store_flags_t)(1u << 0))
```

It must be specified to create a new key store. The key store is stored in the NVM only if the STRICT OPERATION flag is set.

3.22.3.2 HSM_SVC_KEY_STORE_FLAGS_SHARED

```
#define HSM_SVC_KEY_STORE_FLAGS_SHARED ((hsm_svc_key_store_flags_t)(1u << 2))
```

It must be specified to create or load a shared key store.

3.22.3.3 HSM_SVC_KEY_STORE_FLAGS_SET_MAC_LEN

```
#define HSM_SVC_KEY_STORE_FLAGS_SET_MAC_LEN ((hsm_svc_key_store_flags_t) (1u <<
 3))
```

If set, the minimum MAC length specified in the `min_mac_length` field is stored in the key store when creating the key store. It must only be set at key store creation.

3.22.3.4 HSM_SVC_KEY_STORE_FLAGS_MONOTONIC

```
#define HSM_SVC_KEY_STORE_FLAGS_MONOTONIC  ((hsm_svc_key_store_flags_t)(1u <<
 5))
```

When used in conjunction with the STRICT flag, the request is completed only when the monotonic counter has been updated.

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3.22.3.5 HSM_SVC_KEY_STORE_FLAGS_STRICT_OPERATION

```
#define HSM_SVC_KEY_STORE_FLAGS_STRICT_OPERATION ((hsm_svc_key_store_flags_t)
 (1u << 7))
```

The request is completed only when the new key store is written in the NVM. This is applicable for CREATE operations only.

3.22.4 Typedef documentation

3.22.4.1 hsm_svc_key_store_flags_t

```
typedef uint8_t hsm_svc_key_store_flags_t
```

Bitmap specifying the open key store service supported attributes.

3.22.5 Function documentation

3.22.5.1 hsm_open_key_store_service()

```
hsm_err_t hsm_open_key_store_service (
hsm_hdl_t session_hdl,
open_svc_key_store_args_t * args,
hsm_hdl_t * key_store_hdl)
```

Open a service flow on the specified key store. Only one key store service can be opened on a given key store.

Parameters

session_hdl	Pointer to the handle identifying the current session.
args	Pointer to the structure containing the function arguments.
key_store_hdl	Pointer to where the key store service flow handle must be written.

Returns

Error code.

3.22.5.2 hsm_close_key_store_service()

```
hsm_err_t hsm_close_key_store_service (hsm_hdl_t key_store_hdl)
```

Close a previously opened key store service flow. The key store is deleted from the HSM local memory. Any update not written in the NVM is lost.

Parameters

key_store_hdl	Handle identifying the key store service flow to be closed.

Returns

Error code.

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3.22.5.3 hsm_key_store_reprov_en()

```
hsm_err_t hsm_key_store_reprov_en (
hsm_hdl_t  session_hdl,
op_key_store_reprov_en_args_t *  args)
```

Table 19. Parameters

session_hdl	Pointer to the handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.23 Life cycle update

Data Structures

- struct op_lc_update_msg_args_t

Enumerations

- enum hsm_lc_new_state_t {
  HSM_NXP_PROVISIONED_STATE = (1u << 0),
  HSM_OEM_OPEN_STATE = (1u << 1),
  HSM_OEM_CLOSE_STATE = (1u << 3),
  HSM_OEM_FIELD_RET_STATE = (1u << 4),
  HSM_NXP_FIELD_RET_STATE = (1u << 5),
  HSM_OEM_LOCKED_STATE = (1u << 7) }

Functions

- hsm_err_t hsm_lc_update (hsm_hdl_t session_hdl, op_lc_update_msg_args_t *args)

3.23.1 Detailed description

None.

3.23.2 Data structure documentation

3.23.2.1 struct op_lc_update_msg_args_t

Structure specifying the life cycle update message arguments.

Data Fields

hsm_lc_new_state_t	new_lc_state	-

3.23.3 Enumeration type documentation

3.23.3.1 hsm_lc_new_state_t

```
enum hsm_lc_new_state_t
```

Enum specifying the Life Cycle state.

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3.23.4 Function documentation

3.23.4.1 hsm_lc_update()

```
hsm_err_t hsm_lc_update (
hsm_hdl_t session_hdl,
op_lc_update_msg_args_t * args)
```

This API performs the Life Cycle update.

Parameters

session_hdl	Handle identifying the session handle.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.24 Configure monotonic counter

Data Structures

- struct op_dev_mono_counter_args_t

Functions

- hsm_err_t hsm_dev_mono_counter (hsm_hdl_t sess_hdl, op_dev_mono_counter_args_t *args)

3.24.1 Detailed description

This API is used to configure the montonic counter fuse value for V2X HSM, V2X SHE, and ELE HSM. This API can be called only once with the sum of all three fuse word values equal to the available fuse words for the monotonic counter for the SoC.

3.24.2 Data structure documentation

3.24.2.1 struct op_dev_mono_counter_args_t

Structure detailing the device mono counter operation member arguments.

Data Fields

uint8_t	ele_hsm_fuse_word	Count of ELE HSM fuse word.
uint8_t	v2x_hsm_fuse_word	Count of V2X HSM fuse word.
uint8_t	v2x_she_fuse_word	Count of V2X SHE fuse word. The sum of the three above should not exceed the total available monotonic counter fuse words on the board.
uint8_t	enforce_fuse	Set this flag to configure any ELE/V2X counter to zero.
uint8_t	warning	Warning returned by the mono counter operation.

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3.24.3 Function documentation

3.24.3.1 hsm_err_t hsm_dev_mono_counter ()

```
hsm_err_t hsm_dev_mono_counter (hsm_hdl_t sess_hdl, op_dev_mono_counter_args_t *
 args)
```

Perform a mono counter operation. Users can call this function only after having opened the session. This function is used to partition monotonic counter fuse words between HSMs. The configuration can only be issued once per device. If no configuration is present in OTP and a monotonic counter operation is triggered, a warning will be issued and no rollback protection will be applied.

If a valid configuration has already been issued, the written configuration is returned. All available monotonic counter fuse words must be used. If the sum of the configured fuse words is different from the total amount available, the configuration will be considered invalid.

A null configuration (all HSM words at 0) is considered as a read configuration operation and will succeed on a provisioned device. If there is no existing configuration, it will fail.

Table 20. Parameters

sess_hdl	Handle identifying the active session.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.25 Boot mode

Data Structures

- struct op_get_boot_mode_args_t
- struct op_set_boot_mode_args_t

Functions

- crrm_err_t crrm_get_boot_mode (crrm_hdl_t crrm_hdl, op_get_boot_mode_args_t *args)
- crrm_err_t crrm_set_boot_mode (crrm_hdl_t crrm_hdl, op_set_boot_mode_args_t *args)

3.25.1 Detailed description

CRRM APIs to get and set the boot mode.

3.25.2 Data structure documentation

3.25.2.1 struct op_get_boot_mode_args_t

Structure describing the member arguments for the getting boot mode operation.

Data Fields

uint8_t	boot_mode	Stores the boot mode. Indicates the reason for the previous boot: • 0x69 = Normal (no CRRM events) • 0x3c = Recovery download (timeout of CRRM watchdog) • 0x5a = Recovery install (recovery image available)

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Data Fields...*continued*

		• Other values reserved
uint8_t	timer_id	If the current mode was entered due to timer expiry, provides the ID of the timer. Value 0xFF indicates no timer expired.

3.25.2.2 struct op_set_boot_mode_args_t

Structure describing the member arguments for the setting boot mode operation.

Data Fields

uint8_t	new_boot_mode	Stores the new boot mode to be set: • 0x69 = Normal • 0x3c = Recovery download • 0x5a = Recovery install • All other values reserved
uint8_t	stored_boot_mode	Indicates the stored boot mode (may be different from requested mode if forbidden transition requested): • 0x69 = Normal • 0x3c = Recovery download • 0x5a = Recovery install • All other values reserved

3.25.3 Function documentation

3.25.3.1 crrm_err_t crrm_get_boot_mode ()

```
crrm_err_t crrm_get_boot_mode (crrm_hdl_t  crrm_hdl, op_get_boot_mode_args_t *
 args)
```

Perform the operation of getting boot mode. Users can call this function only after CRRM initiation has been done. Get CRRM handle before calling this API. This API requests the boot mode information from the BBSM. For the case that the BBSM has just been initialized, the boot mode is indicated as normal boot.

Table 21. Parameters

crrm_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.25.3.2 crrm_err_t crrm_set_boot_mode ()

```
crrm_err_t crrm_set_boot_mode (crrm_hdl_t  crrm_hdl, op_set_boot_mode_args_t *
 args)
```

Perform the operation of setting boot mode. Users can call this function only after CRRM initiation has been done. Get CRRM handle before calling this API.

This API sets the boot mode information in the BBSM. It is used by the recovery OS to request a mode transition. Only specific transitions are accepted, and others are ignored. Accepted transitions are:

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- Recovery download -> recovery install (after recovery image successfully downloaded)
- Recovery install -> normal (after recovery image successfully installed)
- Recovery install -> recovery download (encountered error in recovery image installation)

Only one transition can be requested per boot cycle.

Table 22. Parameters

crrm_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.26 Get AWDT status

Data Structures

- struct AWDT_timer
- struct op_get_AWDT_status_args_t

Macros

- #define TIMER_INFO_SIZE 16
- #define AWDT_TIMER_STATUS_SIZE sizeof (AWDT_timer)

Functions

- crrm_err_t crrm_get_AWDT_status (crrm_hdl_t crrm_hdl, op_get_AWDT_status_args_t *args)

3.26.1 Detailed description

CRRM API to retrieve information about the current status of the AWDT timer.

3.26.2 Data structure documentation

3.26.2.1 struct AWDT_timer

Structure describing the AWDT timer status parameters.

Table 23. Data Fields

uint8_t	initialized	0 = not initialized, 1 = initialized
uint8_t	running	0 = not running, 1 = running
uint16_t	BBSM_running	0 = not running, 1 = running
uint32_t	curr_timer_value	Current timer value in ms
uint32_t	safety_period	Safety period in ms
uint32_t	max_timer_value	Maximum timer value in ms
uint32_t	BBSM_timer_value	Stored timer value in ms
uint16_t	timer_info_len	Length of timer information
uint8_t	timer_info[]	Variable-length timer information data

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3.26.2.2 struct op_get_AWDT_status_args_t

Structure describing the member arguments for the getting status operation.

Table 24. Data Fields

uint8_t	timer_id	Timer ID
uint8_t *	Addr	AWDT status report address
uint32_t	input_size	AWDT status report size
uint32_t	output_size	AWDT status report size provided by the FW
AWDT_timer *	status	Status of the timer with ID `timer_id`

3.26.3 Function documentation

3.26.3.1 crrm_err_t crrm_get_AWDT_status ()

```
crrm_err_t crrm_get_AWDT_status (crrm_hdl_t  crrm_hdl, op_get_AWDT_status_args_t
 *  args)
```

Perform the operation of getting AWDT status. Users can call this function only after CRRM initiation has been done. Get CRRM handle before calling this API.

This API request a status report for a given timer. The status data is output to the memory address provided. If the buffer to copy this data is too small, no data will be copied.

Table 25. Parameters

crrm_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.27 Get nonce

Data Structures

- struct nonce_info
- struct op_get_nonce_args_t

Macros

- #define NONCE_DATA_SIZE 32

Functions

- crrm_err_t crrm_get_nonce (crrm_hdl_t crrm_hdl, op_get_nonce_args_t *args)

3.27.1 Detailed description

CRRM API to get nonce information for the AWDT timer.

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3.27.2 Data structure documentation

3.27.2.1 struct nonce_info

Structure describing the nonce information parameters.

Table 26. Data Fields

uint8_t	nonce_data[NONCE_DATA_SIZE]	Nonce data
uint8_t	timer_info[]	Variable-length timer information data

3.27.2.2 struct op_get_nonce_args_t

Structure describing the member arguments for the getting nonce operation.

Table 27. Data Fields

uint8_t	timer_id	Timer ID
uint8_t *	nonce_addr	Nonce information address
uint32_t	nonce_size	Nonce information input size
uint32_t	output_size	Nonce information size provided by FW
nonce_info *	Info	Nonce information (nonce data + timer information)

3.27.3 Function documentation

3.27.3.1 crrm_err_t crrm_get_nonce ()

```
crrm_err_t crrm_get_nonce (crrm_hdl_t  crrm_hdl, op_get_nonce_args_t *  args)
```

Perform the operation of getting nonce. Users can call this function only after CRRM initiation has been done. Get CRRM handle before calling this API.

This API request a new nonce value for a given timer. This nonce value invalidates any previous nonce values for the given timer. The nonce plus programmed timer information will be output.

If the buffer to copy this data is too small, no data will be copied, but the nonce will still be updated inside the Sentinel.

Table 28. Parameters

crrm_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.28 Handle

Typedefs

- typedef uint32_t crrm_hdl_t
- typedef hsm_err_t crrm_err_t

Functions

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- crrm_hdl_t get_session_handle (void)

3.28.1 Detailed description

First API to be called before calling any other CRM API. This API returns the handle to be used in calling the CRRM API.

3.28.2 Typedef documentation

3.28.2.1 typedef uint32_t crrm_hdl_t

Defines the CRRM handle type.

3.28.2.2 typedef hsm_err_t crrm_err_t

Defines the CRRM error type.

3.28.3 Function documentation

3.28.3.1 crrm_hdl_t get_session_handle (void)

Returns the CRRM handle to be used while requesting CRRM services.

Check if you have received a valid (non-zero) session handle before continuing.

This is the first API to be called.

Returns

CRRM handle.

3.29 Refresh AWDT

Data Structures

- struct signature_data
- struct request_data
- struct op_refresh_AWDT_args_t

Macros

- #define NONCE_DATA_SIZE 32

Functions

- crrm_err_t crrm_refresh_AWDT (crrm_hdl_t crrm_hdl, op_refresh_AWDT_args_t *args)

3.29.1 Detailed description

CRRM API to refresh the timeout value of the AWDT timer for the provided timer ID.

3.29.2 Data structure documentation

3.29.2.1 struct signature_data

Structure describing the signature data parameters to be signed.

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Table 29. Data Fields

uint8_t	timer_id	Timer ID
uint8_t	pub_key_index	Public key index
uint16_t	reserved	Reserved value
uint32_t	new_timer_value	New value for timer
uint8_t	nonce_data [NONCE_DATA_SIZE]	Nonce data
uint8_t	timer_info []	Variable-length timer information data

3.29.2.2 struct request_data

Structure describing the request data parameters.

Table 30. Data Fields

uint32_t	new_timer_value	New value for timer
uint16_t	signature_length	Length of the signature field
uint8_t	signature []	Signature calculated on the signature data

3.29.2.3 struct op_refresh_AWDT_args_t

Structure describing the refresh AWDT operation member arguments.

Table 31. Data Fields

uint8_t	timer_id	Timer ID
uint8_t	pub_key_index	Public key index
uint8_t *	req_data_addr	Nonce information address
uint32_t	req_data_size	Nonce information input size
uint32_t	new_timer_value	New value for timer

3.29.3 Function documentation

3.29.3.1 crrm_err_t crrm_refresh_AWDT ()

```
crrm_err_t crrm_refresh_AWDT (crrm_hdl_t  crrm_hdl, op_refresh_AWDT_args_t *
 args)
```

Perform the operation of refreshing AWDT. Users can call this function only after CRRM initiation has been done. Get CRRM handle before calling this API.

This API is used to refresh the specified AWDT.

The message contains a signature, which is calculated over the concatenation of the following information:

- Word 1 of the message below (public key index and timer ID)
- The new TimerValue from the request structure
- Current nonce value for the requested timer
- Timer information for the requested timer if present

If the signature is valid, the corresponding AWDT timer is refreshed.

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Table 32. Parameters

crrm_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.30 Get event

Data Structures

- struct hsm_event_report_info_t
- struct op_get_event_msg_args_t

Macros

- #define MAX_NUM_EVENT_REPORT 8

Functions

- hsm_err_t hsm_get_event (hsm_hdl_t session_hdl, op_get_event_msg_args_t *args)

3.30.1 Detailed description

None.

3.30.2 Data structure documentation

3.30.2.1 struct hsm_event_report_info_t

Structure describing the event report information parameters.

Table 33. Data Fields

uint16_t	event_rsp_code	Response code helps identify the reason for reporting the event.
uint8_t	event_cmd_id	Command ID, for which event is reported.
uint8_t	event_ipc_id	IPC ID (0x01 = MU RTD, 0x02 = MU APPS), for which event is reported.

3.30.2.2 struct op_get_event_msg_args_t

Structure specifying the members that will enable reporting the first `n` events from the FW, where `n` is defined by the macro `MAX_NUM_EVENT_REPORT`.

Table 34. Data Fields

uint16_t	num_event_report	Number of events reported since the last power cycle.
hsm_event_report_info_t	hsm_event_report_list [MAX_NUM_EVENT_REPORT]	List of events reported since the last power cycle.

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3.30.3 Function documentation

3.30.3.1 hsm_get_event ()

```
hsm_err_t hsm_get_event (hsm_hdl_t  session_hdl, op_get_event_msg_args_t *
 args)
```

This API reports the first `n` reported events from the FW, where `n` is defined by the macro `MAX_NUM_EVENT_REPORT`.

Table 35. Parameters

session_hdl	Handle identifying the session handle.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.31 Blob Unblob

Data Structures

- struct op_blob_unblob_msg_args_t

Macros

- #define HSM_OP_BLOB_UNBLOB_FLAG_USE_MU_IN_DER_CTX ((hsm_op_key_gen_flags_t)(1u << 0))
- #define HSM_OP_BLOB_UNBLOB_FLAG_USE_BOOT_STAGE_IN_DER_CTX ((hsm_op_key_gen_flags_t)(1u << 1))
- #define HSM_OP_BLOB_UNBLOB_FLAG_USE_UUID_IN_DER_CTX ((hsm_op_key_gen_flags_t)(1u << 2))

Typedefs

- typedef uint8_t hsm_op_blob_unblob_flags_t

Enumerations

- enum hsm_op_blob_unblob_mode_t {
  HSM_OP_BLOB_UNBLOB_MODE_WRAP = 0x55,
  HSM_OP_BLOB_UNBLOB_MODE_UNWRAP = 0xAA, }

Functions

- hsm_err_t hsm_blob_unblob (hsm_hdl_t session_hdl, op_blob_unblob_msg_args_t *args)

3.31.1 Detailed description

None.

3.31.2 Data structure documentation

3.31.2.1 struct op_blob_unblob_msg_args_t

Structure specifying the blob-unblob request.

Table 36. Data Fields

uint32_t *	in_addr	Input address where blob or plain-text can be found.

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Table 36. Data Fields...*continued*

uint32_t *	out_addr	Output address where blob or plain-text can be found.
uint32_t *	usr_ctx_addr	Address space, where user input to blob-key derivation context, can be found.
uint32_t	in_size	Size in bytes of Input.
uint32_t	out_size	Size in bytes of Output.
uint32_t	usr_ctx_size	Size in bytes of user-input. Can be zero.
uint8_t	flags	Bitmap specifying the operation properties as defined by `hsm_op_key_gen_flags_t`.
uint8_t	mode	Input mode to specify: `HSM_OP_BLOB_UNBLOB_MODE_WRAP` or `HSM_OP_BLOB_UNBLOB_MODE_UNWRAP`.
uint32_t	exp_out_size	Expected size in bytes of Output.

3.31.3 Macro definition documentation

3.31.3.1 HSM_OP_BLOB_UNBLOB_FLAG_USE_MU_IN_DER_CTX

```
#define HSM_OP_BLOB_UNBLOB_FLAG_USE_MU_IN_DER_CTX  ((hsm_op_key_gen_flags_t)(1u
 << 0))
```

Use MU Attributes in the blob-key derivation context. Blob is binded to the MU attributes (sec/priv, masternum, did, and MU index).

3.31.3.2 HSM_OP_BLOB_UNBLOB_FLAG_USE_BOOT_STAGE_IN_DER_CTX

```
#define HSM_OP_BLOB_UNBLOB_FLAG_USE_BOOT_STAGE_IN_DER_CTX
 ((hsm_op_key_gen_flags_t)(1u << 1))
```

Use the boot stage value in the derivation context.

3.31.3.3 HSM_OP_BLOB_UNBLOB_FLAG_USE_UUID_IN_DER_CTX

```
#define HSM_OP_BLOB_UNBLOB_FLAG_USE_UUID_IN_DER_CTX  ((hsm_op_key_gen_flags_t)
(1u << 2))
```

Use the unique ID in the derivation context.

3.31.4 Typedef documentation

3.31.4.1 hsm_op_blob_unblob_flags_t

```
typedef uint8_t hsm_op_blob_unblob_flags_t
```


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3.31.5 Enumeration type documentation

3.31.5.1 hsm_op_blob_unblob_mode_t

Enum describing the mode of the operation: wrap or unwrap.

3.31.6 Function documentation

3.31.6.1 hsm_blob_unblob ()

```
hsm_err_t hsm_blob_unblob (hsm_hdl_t  session_hdl, op_blob_unblob_msg_args_t *
 args)
```

This API enables:

- Creating blob by wraping a plain-text, using the wrapping key.
- Un-blob, by un-wraping the blob to plain-text, using the same wrapping key.

Table 37. Parameters

session_hdl	Handle identifying the session handle.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.32 Boot stage

Data Structures

- struct op_boot_stage_ctx_args_t

Enumerations

- enum hsm_op_code_bs_ctx_t {
  HSM_OP_BOOT_STAGE_CTX_SET_VAL = 0x55,
  HSM_OP_BOOT_STAGE_CTX_GET_VAL = 0xAA, }

Functions

- hsm_err_t hsm_bsctx_ops (hsm_hdl_t session_hdl, op_boot_stage_ctx_args_t *args)

3.32.1 Detailed description

None.

3.32.2 Data structure documentation

3.32.2.1 struct op_boot_stage_ctx_args_t

Structure specifying the boot stage context operation request.

Data Fields

uint8_t	op_code	Operation code to specify if `HSM_OP_BOOT_STAGE_CTX_SET_VAL` or `HSM_OP_BOOT_STAGE_CTX_GET_VAL`.

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Data Fields...*continued*

uint32_t	bs_ctx_val	Value to be written in context when `HSM_OP_BOOT_STAGE_CTX_SET_VAL` operation is set.
uint32_t	exp_bs_ctx_val	Value read from the context when `HSM_OP_BOOT_STAGE_CTX_GET_VAL` operation is set.

3.32.3 Enumeration type documentation

3.32.3.1 hsm_op_code_bs_ctx_t

Enum describing the mode of operation: set or get the boot-stage context value.

3.32.4 Function documentation

3.32.4.1 hsm_err_t hsm_bsctx_ops ()

```
hsm_err_t hsm_bsctx_ops (hsm_hdl_t  session_hdl, op_boot_stage_ctx_args_t *
 args)
```

This API reports the first `n` reported events from the FW, where `n` is defined by the macro `MAX_NUM_EVENT_REPORT`.

Table 38. Parameters

session_hdl	Handle identifying the session handle.
args	Pointer to the structure containing the function arguments.

Returns

Error code.

3.33 Global information

Data Structures

- struct global_info_s

Macros

- #define SOC_IMX8ULP 0x84d
- #define SOC_IMX91 0x9100
- #define SOC_IMX93 0x9300
- #define SOC_IMX95 0x9500
- #define SOC_IMX943 0x9430
- #define SOC_REV_A0 0xa000
- #define SOC_REV_A1 0xa100
- #define SOC_REV_A2 0xa200
- #define HSM_API_VERSION_1 0x1
- #define HSM_API_VERSION_2 0x2
- #define HSM_API_VERSION_3 0x3
- #define SOC_LF_OPEN 0x1
- #define SOC_LF_CLOSED 0x2

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- #define SOC_LF_CLOSED_LOCKED 0x4

Functions

- void populate_global_info (hsm_hdl_t hsm_session_hdl)
- void show_global_info (void)
- bool is_global_info_populated (void)
- uint8_t hsm_get_dev_attest_api_ver (void)
- uint8_t se_get_board_type(void)
- uint16_t se_get_soc_id (void)
- uint16_t se_get_soc_rev (void)
- uint16_t se_get_chip_lifecycle (void)
- uint8_t se_get_fips_mode (void)
- uint8_t se_get_lib_newness_ver (void)
- uint8_t se_get_lib_major_ver (void)
- uint8_t se_get_lib_minor_ver (void)
- uint8_t se_get_nvm_newness_ver (void)
- uint8_t se_get_nvm_major_ver (void)
- uint8_t se_get_nvm_minor_ver (void)
- const char * se_get_commit_id (void)
- const char * se_get_lib_version (void)
- const char * se_get_nvm_version (void)
- const char * get_soc_id_str (uint16_t soc_id)
- const char * get_board_type_str (uint8_t board_type)
- const char * get_soc_rev_str (uint16_t soc_rev)
- const char * get_soc_lf_str (uint16_t lifecycle)
- void se_get_info (uint32_t session_hdl, op_get_info_args_t *args)
- void se_get_soc_info (uint32_t session_hdl, uint16_t *soc_id, uint16_t *soc_rev)

Variables

- struct global_info_s global_info

3.33.1 Detailed description

3.33.2 Data structure documentation

3.33.2.1 struct global_info_s

Global Information structure contains the information about SoC and the Library. It is used globally to take platform specific decisions.

Data Fields

bool	is_populated	To ensure global information is populated once.
uint8_t	ver	Supported version of HSM APIs.
uint8_t	fips_mode	Fips mode.
uint16_t	soc_id	SoC ID.
uint16_t	soc_rev	SoC revision.
uint16_t	lifecycle	Device lifecycle.

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Data Fields...*continued*

uint32_t	lib_newness_ver	Secure Enclave Library Newness version.
uint32_t	lib_major_ver	Secure Enclave Library major version.
uint32_t	lib_minor_ver	Secure Enclave Library minor version.
uint32_t	nvm_newness_ver	NVM Library Newness version.
uint32_t	nvm_major_ver	NVM Library major version.
uint32_t	nvm_minor_ver	NVM Library minor version.
char	se_commit_id[GINFO_COMMIT_ID_SZ]	Secure Enclave Build Commit ID.
char	lib_version[GINFO_LIB_VERSION_LEN]	Secure Enclave Library version string.
char	nvm_version[GINFO_NVM_VERSION_LEN]	NVM version string.

3.33.3 Function documentation

3.33.3.1 populate_global_info()

```
void populate_global_info (hsm_hdl_t hsm_session_hdl)
```

This function is called to populate the Global Information structure.

Parameters

hsm_session_hdl	Identifying the active session.

3.33.3.2 show_global_info()

```
void show_global_info (void )
```

This function prints the Global Information of the library.

3.33.3.3 is_global_info_populated()

```
bool is_global_info_populated (void )
```

This function gets the status of Global Info, if populated or not.

3.33.3.4 hsm_get_dev_attest_api_ver()

```
uint8_t hsm_get_dev_attest_api_ver (void )
```

This function returns the version supported for Device Attestation.

3.33.3.5 se_get_board_type()

```
uint8_t se_get_board_type (void)
```

Get the board type.

Note: *This API is useful when there are multiple variations of boards e.g., i.MX 8DXL, which has three different types of boards, DL1, DL2 and DL3.*

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3.33.3.6 se_get_soc_id()

```
uint16_t se_get_soc_id (void )
```

Get the SoC ID.

3.33.3.7 se_get_soc_rev()

```
uint16_t se_get_soc_rev (void )
```

Get the SoC revision.

3.33.3.8 se_get_chip_lifecycle()

```
uint16_t se_get_chip_lifecycle (void )
```

Get the chip lifecycle.

3.33.3.9 se_get_fips_mode()

```
uint8_t se_get_fips_mode (void )
```

Get the Fips mode.

3.33.3.10 se_get_lib_newness_ver()

```
uint8_t se_get_lib_newness_ver (void )
```

Get the library newness version.

3.33.3.11 se_get_lib_major_ver()

```
uint8_t se_get_lib_major_ver (void )
```

Get the library major version.

3.33.3.12 se_get_lib_minor_ver()

```
uint8_t se_get_lib_minor_ver (void )
```

Get the library minor version.

3.33.3.13 se_get_nvm_newness_ver()

```
uint8_t se_get_nvm_newness_ver (void )
```

Get the NVM newness version.

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3.33.3.14 se_get_nvm_major_ver()

```
uint8_t se_get_nvm_major_ver (void )
```

Get the NVM major version.

3.33.3.15 se_get_nvm_minor_ver()

```
uint8_t se_get_nvm_minor_ver (void )
```

Get the NVM minor version.

3.33.3.16 se_get_commit_id()

```
const char* se_get_commit_id (void )
```

Get the build commit ID.

3.33.3.17 se_get_lib_version()

```
const char* se_get_lib_version (void )
```

Get the library version string.

3.33.3.18 se_get_nvm_version()

```
const char* se_get_nvm_version (void )
```

Get the NVM version string.

3.33.3.19 get_board_type_str()

```
const char* get_board_type_str (uint8_t board_type)
```

Get the string representating board type.

Parameters

board_type	Board Type fetched from `Global Info`.

Returns

String representation of the board type.

3.33.3.20 get_soc_id_str()

```
const char* get_soc_id_str (uint16_t soc_id)
```

This function returns a string representating SoC ID.

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Parameters

soc_id	SoC ID fetched from Global Information.

Returns

String represention of the SoC ID.

3.33.3.21 get_soc_rev_str()

```
const char* get_soc_rev_str (uint16_t soc_rev)
```

This function returns a string representating SoC Revision.

Table 39. Parameters

soc_rev	SoC Revision fetched from Global Information.

Returns

String represention of the SoC revision.

3.33.3.22 get_soc_lf_str()

```
const char* get_soc_lf_str (uint16_t lifecycle)
```

This function returns a string representating Lifecycle.

Table 40. Parameters

lifecycle	Value fetched from Global Information.

Returns

A string represention of Lifecycle

3.33.3.23 se_get_info()

```
void se_get_info (
uint32_t session_hdl,
op_get_info_args_t * args )
```

Get the information for Global Info setup.

3.33.3.24 se_get_soc_info()

```
void se_get_soc_info (
                      uint32_t session_hdl,
                      uint16_t * soc_id,
                      uint16_t * soc_rev,
                      uint8_t * board_type)
```

Get the SoC information for Global Info setup generated.

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3.33.4 Variable documentation

3.33.4.1 global_info

```
struct global_info_s global_info
```

Global Information structure instance, which is populated and then is used for getting the required platform or library details.

3.34 Common algorithms

Enumerations

- enum hsm_sha_algo_t {
  ALGO_HASH_SHA224 = 0x02000008,
  ALGO_HASH_SHA256 = 0x02000009,
  ALGO_HASH_SHA384 = 0x0200000A,
  ALGO_HASH_SHA512 = 0x0200000B,
  ALGO_HASH_SM3 = 0x02000014,
  };
- enum hsm_hmac_algo_t {
  ALGO_HMAC_SHA256 = 0x03800009,
  ALGO_HMAC_SHA384 = 0x0380000A,
  ALGO_CMAC = 0x03C00200,
  };
- enum hsm_cipher_algo_t {
  ALGO_CIPHER_CTR = 0x04C01000,
  ALGO_CIPHER_CFB = 0x04C01100,
  ALGO_CIPHER_OFB = 0x04C01200,
  ALGO_CIPHER_ECB_NO_PAD = 0x04404400,
  ALGO_CIPHER_CBC_NO_PAD = 0x04404000,
  ALGO_CIPHER_ALL = 0x84C0FF00,
  ALGO_CIPHER_KEK_CBC = 0x84404000,
  };
- enum hsm_signature_algo_t {
  ALGO_ECDSA_SHA224 = 0x06000608,
  ALGO_ECDSA_SHA256 = 0x06000609,
  ALGO_ECDSA_SHA384 = 0x0600060A,
  ALGO_ECDSA_SHA512 = 0x0600060B,
  ALGO_ED25519PH = 0x0600090B,
  ALGO_ED448PH = 0x06000915,
  ALGO_PURE_EDDSA = 0x06000800,
  ALGO_EDDSA_ALL = 0x86000800,
  ALGO_RSA_PKCS1_V15_SHA224 = 0x06000208,
  ALGO_RSA_PKCS1_V15_SHA256 = 0x06000209,
  ALGO_RSA_PKCS1_V15_SHA384 = 0x0600020A,
  ALGO_RSA_PKCS1_V15_SHA512 = 0x0600020B,
  ALGO_RSA_PKCS1_V15_SHA_ANY = 0x060002FF,
  ALGO_RSA_PKCS1_PSS_MGF1_SHA224 = 0x06000308,
  ALGO_RSA_PKCS1_PSS_MGF1_SHA256 = 0x06000309,
  ALGO_RSA_PKCS1_PSS_MGF1_SHA384 = 0x0600030A,
  ALGO_RSA_PKCS1_PSS_MGF1_SHA512 = 0x0600030B,

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ALGO_RSA_PKCS1_PSS_MGF1_SHA_ANY = 0x060003FF,
ALGO_RSA_SIGNATURE_ALL = 0x8600FF00,
};

- enum hsm_pub_key_attest_algo_t {
  ALGO_ATTEST_CMAC = 0x83C00200,
  ALGO_ATTEST_ECDSA_SHA224 = 0x86000608,
  ALGO_ATTEST_ECDSA_SHA256 = 0x86000609,
  ALGO_ATTEST_ECDSA_SHA384 = 0x8600060A,
  ALGO_ATTEST_ECDSA_SHA512 = 0x8600060B,
  };
- enum hsm_asymmetric_crypto_algo_t {
  ALGO_RSA_PKCS1_V15_CRYPT = 0x07000200,
  ALGO_RSA_PKCS1_OAEP_SHA1 = 0x07000305,
  ALGO_RSA_PKCS1_OAEP_SHA224 = 0x07000308,
  ALGO_RSA_PKCS1_OAEP_SHA256 = 0x07000309,
  ALGO_RSA_PKCS1_OAEP_SHA384 = 0x0700030A,
  ALGO_RSA_PKCS1_OAEP_SHA512 = 0x0700030B,
  };
- enum hsm_aead_algo_t {
  ALGO_CCM = 0x05500100,
  ALGO_GCM = 0x05500200,
  ALGO_CHACHA20_POLY1305 = 0x05100500,
  };
- enum hsm_key_exchange_algo_t {
  ALGO_ECDH_HKDF_SHA256_KEY_IMPORT = 0x09020109,
  ALGO_ECDH_HKDF_SHA384_KEY_IMPORT = 0x0902010A,
  ALGO_ECDH_HKDF_SHA_ANY_KEY_IMPORT = 0x090201FF,
  ALGO_ECDH_HKDF_SHA256 = 0x89020109,
  ALGO_ECDH_HKDF_SHA384 = 0x8902010A,
  ALGO_ECDH_HKDF_SHA_ANY = 0x890201FF,
  };
- enum hsm_key_derivation_algo_t {
  ALGO_HKDF_SHA256 = 0x08000109,
  ALGO_HKDF_SHA384 = 0x0800010A,
  ALGO_HKDF_EXTRACT_SHA256 = 0x08000409,
  ALGO_HKDF_EXTRACT_SHA384 = 0x0800040A,
  ALGO_HKDF_EXTRACT_SHA_ANY = 0x080004FF,
  ALGO_HKDF_EXPAND_SHA256 = 0x08000509,
  ALGO_HKDF_EXPAND_SHA384 = 0x0800050A,
  };
- enum hsm_key_derivation_tls1_3_algo_t {
  ALGO_TLS1_3_ES_SHA256 = 0x8800D009,
  ALGO_TLS1_3_ES_SHA384 = 0x8800D00A,
  ALGO_TLS1_3_HS_SHA256 = 0x8800D109,
  ALGO_TLS1_3_HS_SHA384 = 0x8800D10A,
  ALGO_TLS1_3_MS_SHA256 = 0x8800D209,
  ALGO_TLS1_3_MS_SHA384 = 0x8800D20A,
  ALGO_TLS1_3_MS_SHA_ANY = 0x8800D2FF,
  ALGO_TLS1_3_KM_SHA256 = 0x8800D309,
  ALGO_TLS1_3_KM_SHA384 = 0x8800D30A,
  ALGO_TLS1_3_IV_SHA256 = 0x8800D409,
  ALGO_TLS1_3_IV_SHA384 = 0x8800D40A,

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};

- enum hsm_key_derivation_tls1_2_algo_t {
  ALGO_TLS1_2_MASTER_SECRET_SHA256 = 0x8800E009,
  ALGO_TLS1_2_MASTER_SECRET_SHA384 = 0x8800E00A,
  ALGO_TLS1_2_MASTER_SECRET_SHA_ANY = 0x8800E0FF,
  ALGO_TLS1_2_KEY_BLOCK_SHA256 = 0x8800E109,
  ALGO_TLS1_2_KEY_BLOCK_SHA384 = 0x8800E10A,
  ALGO_TLS1_2_IV_SHA256 = 0x8800E209,
  ALGO_TLS1_2_IV_SHA384 = 0x8800E20A,
  ALGO_TLS1_2_VERIFY_DATA_SHA256 = 0x8800E409,
  ALGO_TLS1_2_VERIFY_DATA_SHA384 = 0x8800E40A,
  };
- enum hsm_algo_t {
  ALGO_HMAC_KDF_SHA256 = 0x08000109,
  ALGO_ALL_CIPHER = 0x84C0FF00,
  ALGO_ALL_AEAD = 0x8550FF00,
  };

3.35 Error codes

Enumerations

- enum hsm_err_t {
  HSM_NO_ERROR = 0x0,
  HSM_INVALID_MESSAGE = 0x1,
  HSM_INVALID_ADDRESS = 0x2,
  HSM_UNKNOWN_ID = 0x3,
  HSM_INVALID_PARAM = 0x4,
  HSM_NVM_ERROR = 0x5,
  HSM_OUT_OF_MEMORY = 0x6,
  HSM_UNKNOWN_HANDLE = 0x7,
  HSM_UNKNOWN_KEY_STORE = 0x8,
  HSM_KEY_STORE_AUTH = 0x9,
  HSM_KEY_STORE_ERROR = 0xA,
  HSM_ID_CONFLICT = 0xB,
  HSM_RNG_NOT_STARTED = 0xC,
  HSM_CMD_NOT_SUPPORTED = 0xD,
  HSM_INVALID_LIFECYCLE = 0xE,
  HSM_KEY_STORE_CONFLICT = 0xF,
  HSM_KEY_STORE_COUNTER = 0x10,
  HSM_FEATURE_NOT_SUPPORTED = 0x11,
  HSM_SELF_TEST_FAILURE = 0x12,
  HSM_NOT_READY_RATING = 0x13,
  HSM_FEATURE_DISABLED = 0x14,
  HSM_KEY_GROUP_FULL = 0x19,
  HSM_CANNOT_RETRIEVE_KEY_GROUP = 0x1A,
  HSM_KEY_NOT_SUPPORTED = 0x1B,
  HSM_CANNOT_DELETE_PERMANENT_KEY = 0x1C,
  HSM_OUT_TOO_SMALL = 0x1D,
  HSM_INVALID_SIGNATURE_VERIFICATION_HANDLE = 0x21,
  HSM_CRC_CHECK_ERR = 0xB9,
  HSM_INCONSISTENT_PARAM_ERR = 0xBC,
  HSM_OEM_CLOSED_LC_SIGNED_MSG_VERIFICATION_FAIL = 0xF0,

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HSM_OEM_OPEN_LC_SIGNED_MSG_VERIFICATION_FAIL = 0xF0,
HSM_FATAL_FAILURE = 0x29,
HSM_LIB_ERROR = 0xEF,
HSM_INVALID_LIFECYCLE_OP = 0xF2,
HSM_SERVICES_DISABLED = 0xF4,
HSM_UNKNOWN_WARNING = 0xFC,
HSM_SIGNATURE_INVALID = 0xFD,
HSM_UNKNOWN_ERROR = 0xFE,
HSM_GENERAL_ERROR = 0xFF }

3.35.1 Detailed description

3.35.2 Enumeration type documentation

3.35.2.1 hsm_err_t enum hsm_err_t

Error codes returned by HSM functions.

Enumerator

HSM_NO_ERROR	Success.
HSM_INVALID_MESSAGE	The received message is invalid or unknown.
HSM_INVALID_ADDRESS	The provided address is invalid or does not respect the API requirements.
HSM_UNKNOWN_ID	The provided identifier is not known.
HSM_INVALID_PARAM	One of the parameters provided in the command is invalid.
HSM_NVM_ERROR	NVM generic issue.
HSM_OUT_OF_MEMORY	There is not enough memory to handle the requested operation.
HSM_UNKNOWN_HANDLE	Unknown session/service handle.
HSM_UNKNOWN_KEY_STORE	The key store identified by the provided “key store Id” does not exist and the “create” flag is not set.
HSM_KEY_STORE_AUTH	Key store authentication fails.
HSM_KEY_STORE_ERROR	An error occurred in the key store internal processing.
HSM_ID_CONFLICT	An element (key store, key…) with the provided ID already exists.
HSM_RNG_NOT_STARTED	The internal RNG is not started.
HSM_CMD_NOT_SUPPORTED	The functionality is not supported for the current session/ service/key store configuration.
HSM_INVALID_LIFECYCLE	Invalid lifecycle for requested operation.
HSM_KEY_STORE_CONFLICT	A key store with the same attributes already exists.
HSM_KEY_STORE_COUNTER	The current key store reaches the maximum number of monotonic counter updates. Updates are still allowed but monotonic counter will not be blown.
HSM_FEATURE_NOT_SUPPORTED	The requested feature is not supported by the firwware.
HSM_SELF_TEST_FAILURE	Self-tests report an issue.

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Enumerator...*continued*

HSM_NOT_READY_RATING	The HSM is not ready to handle the current request.
HSM_FEATURE_DISABLED	The required service/operation is disabled.
HSM_KEY_GROUP_FULL	Not enough space to store the key in the key group.
HSM_CANNOT_RETRIEVE_KEY_GROUP	Impossible to retrieve key group.
HSM_KEY_NOT_SUPPORTED	Key not supported.
HSM_CANNOT_DELETE_PERMANENT_KEY	Trying to delete a permanent key.
HSM_OUT_TOO_SMALL	Output buffer size is too small.
HSM_INVALID_SIGNATURE_VERIFICATION_HANDLE	Invalid Signature verification handle: Opaque key cannot be used.
HSM_CRC_CHECK_ERR	Command CRC check error.
HSM_INCONSISTENT_PARAM_ERR	Inconsistent parameter provided in the message request.
HSM_OEM_CLOSED_LC_SIGNED_MSG_VERIFICATION_FAIL	In OEM closed lifecycle, Signed message signature verification failure.
HSM_OEM_OPEN_LC_SIGNED_MSG_VERIFICATION_FAIL	In OEM open lifecycles, Signed message signature verification failure.
HSM_FATAL_FAILURE	A fatal failure occurs. The HSM goes in unrecoverable error state not replying to further requests.
HSM_SERVICES_DISABLED	Message neither handled by ROM nor FW.
HSM_LIB_ERROR	HSM library failure.
HSM_INVALID_LIFECYCLE_OP	Invalid Lifecycle operation (ROM).
HSM_UNKNOWN_WARNING	Unknown warnings.
HSM_SIGNATURE_INVALID	Failure in verification status of operations such as MAC verification, Signature verification.
HSM_UNKNOWN_ERROR	Unknown errors.
HSM_GENERAL_ERROR	Error in case General Error is received.

3.36 i.MX 8ULP

Ciphering

- HSM_CIPHER_ONE_GO_ALGO_OFB is not supported.
- HSM_AEAD_ALGO_GCM is not supported.
- HSM_AEAD_ALGO_ALL_AEAD is not supported.
- ALGO_RSA_PKCS1_V15_SHA224 is not supported.
- ALGO_RSA_PKCS1_V15_SHA256 is not supported.
- ALGO_RSA_PKCS1_V15_SHA384 is not supported.
- ALGO_RSA_PKCS1_V15_SHA512 is not supported.
- ALGO_RSA_PKCS1_V15_SHA_ANY is not supported.
- ALGO_RSA_PKCS1_PSS_MGF1_SHA_ANY is not supported.
- ALGO_RSA_PKCS1_PSS_MGF1 _SHA224 is not supported.
- ALGO_RSA_PKCS1 _PSS_MGF1_SHA256 is not supported.
- ALGO_RSA_PKCS1_PSS_MGF1_SHA384 is not supported.
- ALGO_RSA_PKCS1_PSS_MGF1_SHA512 is not supported.

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Generic Crypto: AEAD

- HSM_GC_AEAD_ALGO_AES_GCM is not supported.
- HSM_GC_AEAD_ALGO_CHACHA20_POLY1305 is not supported.

Key exchange: TLS 1.2, TLS 1.3, and HKDF options are not supported.

Signature Verification operation using Opaque key is not supported.

3.37 i.MX 91

Signature Verification operation using Opaque key is not supported.

3.38 i.MX 93

Signature Verification operation using Opaque key is not supported.

3.39 i.MX 95

Key exchange: Key Exchange for Key Import and Key Import ELE option is not supported.

Generic Crypto APIs are not supported.

3.40 i.MX 943

Key Exchange API is not supported.

Generic Crypto APIs are not supported.

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5 Revision History

This table provides the revision history.

Revision history

Document ID	Release date	Description
RM00284 v4.1	25 September 2025	• Added support for Signature Verification using the Opaque Key on i.MX 95 and i.MX 943. • Added Get Event (0xA2) API support. • Added Blob Unblob (0xBF) API support. • Added Boot Stage (0xBE) API support. • Updated Key Exchange - ECDH-HKDF algorithms.
RM00284 v4.0	26 June 2025	Added supports: • TLS 1.3 x448. • Ed448 key gen, sign, verify (eddsa and eddsaPH). • New algorithms to replace HKDF Expand: TLS_13_KM and TLS_13_IV (only `TLS_13_IV` allows plaintext output). • SHAKE256 HASH algorithm. • `ChaCha20_Poly1305` key type. Removed supports: • Key Exchange API - HKDF operation. • Key Exchange API - TLS output plaintext flag. • i.MX 95 B0, i.MX 943: The legacy AEAD API (`hsm_auth_enc`) support removed. Replaced by new AEAD API (`hsm_auth_enc_new`). • i.MX 95 B0, i.MX 943: All Generic crypto APIs.
RM00284 v3.3	31 March 2025	Upgraded for the Linux LF6.12.3_1.0.0 release.
RM00284 v3.2	16 December 2024	Upgraded for the Linux LF6.6.52_2.2.0 release.
RM00284 v3.1	30 September 2024	Upgraded for the Linux LF6.6.36_2.1.0 release.
RM00284 v3.0	28 June 2024	Upgraded for the Linux LF6.6.23_2.0.0 release.
RM00284 v2.0	29 March 2024	Upgraded for the Linux LF6.6.3_1.0.0 release.
RM00284 v1.0	15 December 2023	Initial release.

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