i.MX8 HSM API

Revision_2.1

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Contents

1 HSM API

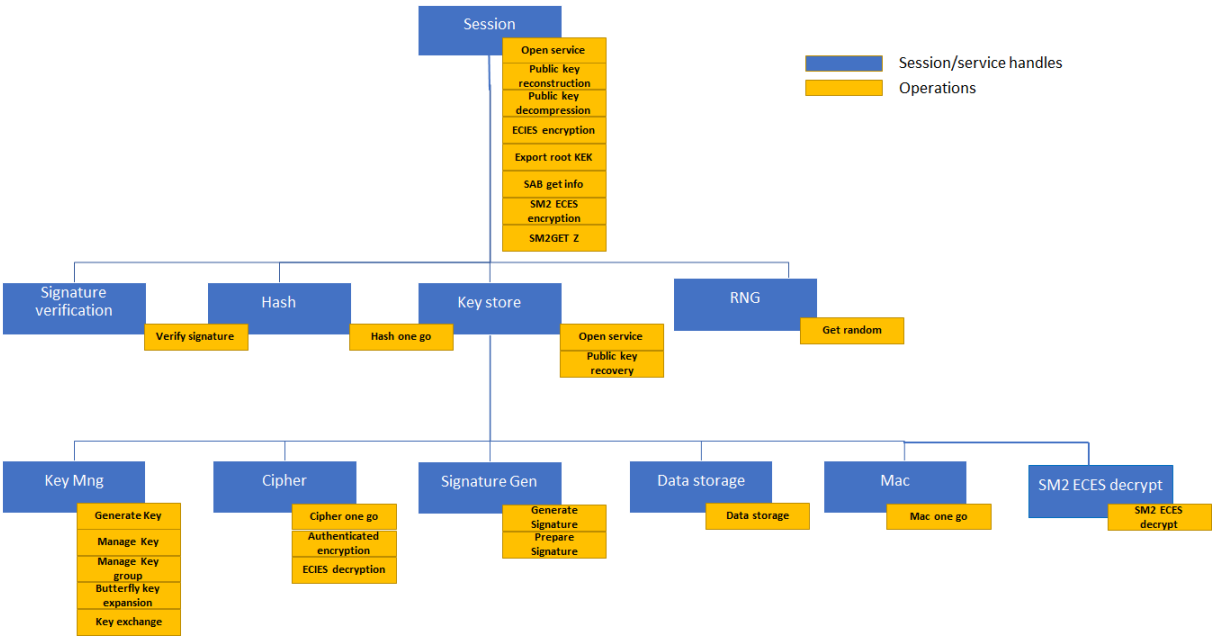
This document is a software referece description of the API provided by the i.MX8 HSM solutions.

2 Revision History

Revision	date	description
0.1 - subject to change	Mar 29 2019	Preliminary draft
0.8 - subject to change	May 24 2019	It adds the following API: -signature generation -signature verification -rng -hash -butterfly key expansion -ECIES enc/dec -public key reconstruction -public key decompression
0.9 - subject to change	May 28 2019	Explicit addresses are replaced by pointers.
1.0 - subject to change	May 29 2019	- bug/typos fix. - Change HSM_SVC_KEY_STORE_FLAGS definition
1.1 - subject to change	July 31 2019	- hsm_butterfly_key_expansion argument definition: dest_key_↩ identifier is now a pointer. - add error code definition. - improve argument comments clarity
1.5 - subject to change	Sept 13 2019	- manage key argument: fix padding size - butterfly key expansion: change argument definition - introduce public key recovery API
1.6 - subject to change	Oct 14 2019	- add Key store section in chapter 3 - change key_info and flags definition, substitute key_type_ext with group_id - hsm_generate_key, hsm_manage_key, hsm_butterfly_key_↩ expansion: change argument definition - hsm_manage_key: change argument definition - add hsm_manage_key_group API
1.7 - subject to change	Dec 20 2019	- add generic data storage API - add GCM and CMAC support - add support for AES 192/256 key size for all cipher algorithms - add root KEK export API - add key import functionality - add get info API

Revision	date	description
2.0 - subject to change	Feb 21 2020	- fix HSM_KEY_INFO_TRANSIENT definition: delete erroneous "not supported" comment - add Key Encryption Key (HSM_KEY_INFO_KEK) support - key store open service API: adding signed message support for key store reprovisionning - naming consistency: remove "hsm_" prefix from hsm_op_ecies_dec_args_t hsm_op_pub_key_rec_args_t hsm_op_pub_key_dec_args_t hsm_op_ecies_enc_args_t hsm_op_pub_key_recovery_args_t hsm_op_get_info_args_t
2.1 - subject to change	Apr 16 2020	- Preliminary version: Add the support of the chinese algorithms and update for i.MX8DXL

3 General concepts related to the API



3.1 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.

3.2 Service flow

For a given category of services, 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.

3.3 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 hash service - it grants access to hashing operations */
hsm_open_hash_service (session_hdl, &open_svc_hash_args, &hash_hdl);
/* Open cipher service - it grants access to ciphering operations */
hsm_open_cipher_service(key_store_hdl, &open_svc_cipher_args, &cipher_hdl);

/* Perform AES ECB, CCB ... */
hsm_cipher_one_go (cipher_hdl, &op_cipher_one_go_args);
/* Perform authenticate and encryption algos: e.g AES 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);
```

3.4 Key store

A key store can be created by specifying the CREATE flag in the hsm_open_key_store_service API. Please note that the created key store will be not stored in the NVM till a key is generated/imported specyfing 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.

3.4.1 Key management

Keys are divided in groups, keys belonging to the same group are written/read from the NVM as a monolitic block.
Up to 3 key groups can be handled in the HSM local memory (those immediatly available to perform crypto operation), while up to 1024 key groups can be handled in the external NVM and imported in the local memory as needed.
If the local memory is full (3 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 must 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.

3.4.2 NVM writing

All the APIs modyfing the content of the key store (key generation, key_management, key derivation functions) provide a "STRICT OPERATION" flag. If the flag is set, the HSM triggers and export of the encrypted key group into the external NVM and increments (blows one bit) the OTP monotonic counter used as roll back protection. Please note that the "STRICT OPERATION" has effect only on the current key group.

Any update to the key store must be considered as effective only after an operation specifing the flag "STRICT O↩ PERATION" is aknowledged 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 (QXPB0 up to 1620 update available by default), the user should, when possible, perform multiple udates before setting the "STRICT OPERATION" flag (i.e. keys to be updated should be kept in the same key group).
Once the monotonic counter is completely blown a warning is returned on each update operation to inform the user that the new updates are not roll-back protected.

3.5 implementation specificities

HSM API is supported on different versions of the i.MX8 family. The API description below is the same for all of them but some features may not be available on some chips. The details of the supported features per chip can be found here:

- for i.MX8QXP: i.MX8QXP specificities
- for i.MX8DXL: i.MX8DXL specificities

4 Module Index

4.1 Modules

Here is a list of all modules:

5 Module Documentation

5.1 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_GENERAL_ERROR = 0xFF }

5.1.1 Detailed Description

5.1.2 Enumeration Type Documentation

5.1.2.1 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 doesn't respect the API requirements.

HSM_UNKNOWN_ID The provided identifier is not known.

HSM_INVALID_PARAM One of the parameter 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" doesn't 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 max 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 firwmare.

HSM_GENERAL_ERROR Error not covered by other codes occured.

5.2 Session

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct open_session_args_t

Macros

- #define HSM_OPEN_SESSION_PRIORITY_LOW (0x00U)

  Low priority. Should be the default setting on platforms that doesn't support sessions 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 session will be 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)

  No key store will be attached to this session. May provide better performances on some operation depending on the implementation. Usage of the session will be restricted to operations that doesn't involve secret keys (e.g. hash, signature verification, 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.

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)

5.2.1 Detailed Description

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.

5.2.2 Data Structure Documentation

5.2.2.1 struct open_session_args_t

Data Fields

uint8↩ _t	session_priority	Priority of the operations performed in this session. ∗/.
uint8↩ _t	operating_mode	Options for the session to be opened (bitfield). ∗/.
uint16↩ _t	reserved	

5.2.3 Function Documentation

5.2.3.1 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 error code.

5.2.3.2 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 error code.

5.3 Key store

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct open_svc_key_store_args_t

Macros

- #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 will be stored in the NVM only once a key is generated/imported specyfing the STRICT OPERATION flag.
- #define HSM_SVC_KEY_STORE_FLAGS_UPDATE ((hsm_svc_key_store_flags_t)(1u << 2))

  It must be specified in order to open a key management service flow.
- #define HSM_SVC_KEY_STORE_FLAGS_DELETE ((hsm_svc_key_store_flags_t)(1u << 3))

  It must be specified to delete an existing key store.

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)

5.3.1 Detailed Description

User must open a key store service flow in order 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.

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

5.3.2 Data Structure Documentation

5.3.2.1 struct open_svc_key_store_args_t

Data Fields

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 accesing the key store.
uint16_t	max_updates_number	maximum number of updates authorized for the key store. Valid only for create operation. This parameter has the goal to limit the occupation of the monotonic counter used as anti-rollback protection. If the maximum number of updates is reached, HSM still allows key store updates but without updating the monotonic counter giving the opportunity for rollback attacks.
hsm_svc_key_store_↩ flags_t	flags	bitmap specifying the services properties.
uint8_t	reserved	
uint8_t *	signed_message	pointer to signed_message to be sent only in case of key store re-provisioning
uint16_t	signed_msg_size	size of the signed_message to be sent only in case of key store re-provisioning
uint8_t	reserved_1[2]	

5.3.3 Function Documentation

5.3.3.1 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 error code.

5.3.3.2 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

handle	identifying the key store service flow to be closed.

Returns

error_code error code.

5.4 Key management

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct open_svc_key_management_args_t
- struct op_generate_key_args_t
- struct op_manage_key_args_t
- struct op_manage_key_group_args_t
- struct op_butt_key_exp_args_t

Macros

- #define **HSM_KEY_TYPE_ECDSA_NIST_P256** ((hsm_key_type_t)0x02u)
- #define **HSM_KEY_TYPE_ECDSA_NIST_P384** ((hsm_key_type_t)0x03u)
- #define **HSM_KEY_TYPE_ECDSA_NIST_P521** ((hsm_key_type_t)0x04u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_R1_256** ((hsm_key_type_t)0x13u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_R1_320** ((hsm_key_type_t)0x14u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_R1_384** ((hsm_key_type_t)0x15u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_R1_512** ((hsm_key_type_t)0x16u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_256** ((hsm_key_type_t)0x23u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_320** ((hsm_key_type_t)0x24u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_384** ((hsm_key_type_t)0x25u)
- #define **HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_512** ((hsm_key_type_t)0x26u)
- #define **HSM_KEY_TYPE_AES_128** ((hsm_key_type_t)0x30u)
- #define **HSM_KEY_TYPE_AES_192** ((hsm_key_type_t)0x31u)
- #define **HSM_KEY_TYPE_AES_256** ((hsm_key_type_t)0x32u)
- #define **HSM_KEY_TYPE_DSA_SM2_FP_256** ((hsm_key_type_t)0x42u)
- #define **HSM_KEY_TYPE_SM4_128** ((hsm_key_type_t)0x50u)
- #define HSM_OP_KEY_GENERATION_FLAGS_UPDATE ((hsm_op_key_gen_flags_t)(1u << 0))

  User can replace an existing key only by generating a key with the same type of the original one.
- #define HSM_OP_KEY_GENERATION_FLAGS_CREATE ((hsm_op_key_gen_flags_t)(1u << 1))

  Create a new key.
- #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 has been written in the NVM. This applicable for persistent key only.
- #define HSM_KEY_INFO_PERSISTENT ((hsm_key_info_t)(0u << 1))

  Persistent keys are stored in the external NVM. The entire key group is written in the NVM at the next STRICT operation.
- #define HSM_KEY_INFO_PERMANENT ((hsm_key_info_t)(1u << 0))

  When set, the key is permanent (write locked). Once created, it will not be possible to update or delete the key anymore. Transient keys will be anyway deleted after a PoR or when the corresponding key store service flow is closed. This bit can never be reset.
- #define HSM_KEY_INFO_TRANSIENT ((hsm_key_info_t)(1u << 1))

  Transient keys are deleted when the corresponding key store service flow is closed or after a PoR. Transient keys cannot be in the same key group than persistent keys.
- #define HSM_KEY_INFO_MASTER ((hsm_key_info_t)(1u << 2))

When set, the key is considered as a master key. Only master keys can be used as input of key derivation functions (i.e butterfly key expansion).

- #define HSM_KEY_INFO_KEK ((hsm_key_info_t)(1u << 3))

  When set, the key is considered as a key encryption key. KEK keys can only be used to wrap and import other keys into the key store, all other operation are not allowed. Only keys imported in the key store through the hsm_mange↩ _key API can get this attribute.

- #define HSM_OP_MANAGE_KEY_FLAGS_IMPORT_UPDATE ((hsm_op_manage_key_flags_t)(1u << 0))

  User can replace an existing key only by importing a key with the same type of the original one.

- #define HSM_OP_MANAGE_KEY_FLAGS_IMPORT_CREATE ((hsm_op_manage_key_flags_t)(1u << 1))

  Import a key and create a new identifier.

- #define HSM_OP_MANAGE_KEY_FLAGS_DELETE ((hsm_op_manage_key_flags_t)(1u << 2))

  Delete an existing key.

- #define HSM_OP_MANAGE_KEY_FLAGS_PART_UNIQUE_ROOT_KEK ((hsm_op_manage_key_flags_↩ t)(1u << 3))

  The key to be imported is encrypted using the part-unique root kek.

- #define HSM_OP_MANAGE_KEY_FLAGS_COMMON_ROOT_KEK ((hsm_op_manage_key_flags_t)(1u << 4))

  The key to be imported is encrypted using the common root kek.

- #define HSM_OP_MANAGE_KEY_FLAGS_STRICT_OPERATION ((hsm_op_manage_key_flags_t)(1u << 7))

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

- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_LOCKDOWN ((hsm_op_manage_key_↩ group_flags_t)(1u << 0))

  The entire key group will be cached in the HSM local memory.

- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_UNLOCK ((hsm_op_manage_key_group_↩ flags_t)(1u << 1))

  HSM may export the key group in the external NVM to free up the local memory. HSM will copy the key group in the local memory again in case of key group usage/update.

- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_DELETE ((hsm_op_manage_key_group_flags_t)(1u << 2))

  Delete an existing key group.

- #define HSM_OP_MANAGE_KEY_GROUP_FLAGS_STRICT_OPERATION ((hsm_op_manage_key_↩ group_flags_t)(1u << 7))

  The request is completed only when the update has been written in the NVM. Not applicable for cache lock-down/unlock.

- #define HSM_OP_BUTTERFLY_KEY_FLAGS_UPDATE ((hsm_op_but_key_exp_flags_t)(1u << 0))

  User can replace an existing key only by generating a key with the same type of the original one.

- #define HSM_OP_BUTTERFLY_KEY_FLAGS_CREATE ((hsm_op_but_key_exp_flags_t)(1u << 1))

  Create a new key.

- #define HSM_OP_BUTTERFLY_KEY_FLAGS_IMPLICIT_CERTIF ((hsm_op_but_key_exp_flags_t)(0u << 2))

  butterfly key expansion using implicit certificate.

- #define HSM_OP_BUTTERFLY_KEY_FLAGS_EXPLICIT_CERTIF ((hsm_op_but_key_exp_flags_t)(1u << 2))

  butterfly key expansion using explicit certificate.

- #define HSM_OP_BUTTERFLY_KEY_FLAGS_STRICT_OPERATION ((hsm_op_but_key_exp_flags_t)(1u << 7))

  The request is completed only when the new key has been written in the NVM.

Typedefs

- typedef uint8_t **hsm_svc_key_management_flags_t**
- typedef uint8_t **hsm_op_key_gen_flags_t**
- typedef uint8_t **hsm_key_type_t**
- typedef uint16_t **hsm_key_info_t**
- typedef uint16_t **hsm_key_group_t**
- typedef uint8_t **hsm_op_manage_key_flags_t**
- typedef uint8_t **hsm_op_manage_key_group_flags_t**
- typedef uint8_t **hsm_op_but_key_exp_flags_t**

Functions

- 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_generate_key (hsm_hdl_t key_management_hdl, op_generate_key_args_t *args)
- hsm_err_t hsm_manage_key (hsm_hdl_t key_management_hdl, op_manage_key_args_t *args)
- hsm_err_t hsm_manage_key_group (hsm_hdl_t key_management_hdl, op_manage_key_group_args_t *args)
- hsm_err_t hsm_butterfly_key_expansion (hsm_hdl_t key_management_hdl, op_butt_key_exp_args_t *args)
- hsm_err_t hsm_close_key_management_service (hsm_hdl_t key_management_hdl)

5.4.1 Detailed Description

5.4.2 Data Structure Documentation

5.4.2.1 struct open_svc_key_management_args_t

Data Fields

hsm_svc_key_management_↩ flags_t	flags	bitmap specifying the services properties.
uint8_t	reserved[3]	

5.4.2.2 struct op_generate_key_args_t

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 will be stored in this location.
uint16_t	out_size	length in bytes of the generated key. 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, relevant only in case of create operation. it must be a value in the range 0-1023. Keys belonging to the same group can be cached in the HSM local memory throug the hsm_manage_key_group API.

Data Fields

hsm_key_info_t	key_info	bitmap specifying the properties of the key.
uint8_t *	out_key	pointer to the output area where the generated public key must be written.

5.4.2.3 struct op_manage_key_args_t

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 will be stored in this location.
uint32_t	kek_identifier	identifier of the key to be used to decrypt the key to be imported (Key Encryption Key), only AES-256 key can be uses as KEK. It must be 0 if the HSM_OP_MANAGE_KEY↩ _FLAGS_PART_UNIQUE_ROOT_KEK or HSM_OP_MANAGE_KEY_FLAGS_COMMON_ROOT_KEK flags are set.
uint16_t	input_size	length in bytes of the input key area. It must be eqaul to the length of the IV (12 bytes) + ciphertext + Tag (16 bytes). It must be 0 in case of delete operation.
hsm_op_manage_key_↩ flags_t	flags	bitmap specifying the operation properties.
hsm_key_type_t	key_type	indicates the type of the key to be managed.
hsm_key_group_t	key_group	key group of the imported key, only relevant in case of create operation (it must be 0 otherwise). It must be a value in the range 0-1023. Keys belonging to the same group can be cached in the HSM local memory throug the hsm_manage_key_group API.
hsm_key_info_t	key_info	bitmap specifying the properties of the key, in case of update operation it will replace the existing value. It must be 0 in case of delete operation.
uint8_t *	input_data	pointer to the input buffer. The input buffer is the concatenation of the IV, the encrypted key to be imported and the tag. It must be 0 in case of delete operation.

5.4.2.4 struct op_manage_key_group_args_t

Data Fields

hsm_key_group_t	key_group	it must be a value in the range 0-1023. Keys belonging to the same group can be cached in the HSM local memory throug the hsm_manage_key_group API.
hsm_op_manage_key_group_↩ flags_t	flags	bitmap specifying the operation properties.
uint8_t	reserved	

5.4.2.5 struct op_butt_key_exp_args_t

Data Fields

uint32_t	key_identifier	identifier of the key to be expanded.
uint8_t *	expansion_function_value	pointer to the expansion function value input
uint8_t *	hash_value	pointer to the hash value input. In case of explicit certificate, the hash value address must be set to 0.
uint8_t *	pr_reconstruction_value	pointer to the private reconstruction value input. In case of explicit certificate, the pr_reconstruction_value address must be set to 0.
uint8_t	expansion_function_value_size	length in bytes of the expansion function input
uint8_t	hash_value_size	length in bytes of the hash value input. In case of explicit certificate, the hash_value_size parameter must be set to 0.
uint8_t	pr_reconstruction_value_size	length in bytes of the private reconstruction value input. In case of explicit certificate, the pr_reconstruction_value_size parameter must be set to 0.
hsm_op_but_key_exp_↩ flags_t	flags	bitmap specifying the operation properties
uint32_t *	dest_key_identifier	pointer to identifier of the derived key to be used for the operation. In case of create operation the new destination key identifier will be stored in this location.
uint8_t *	output	pointer to the output area where the public key must be written.
uint16_t	output_size	length in bytes of the generated key, if the size is 0, no key is copied in the output.
hsm_key_type_t	key_type	indicates the type of the key to be derived.
uint8_t	reserved	
hsm_key_group_t	key_group	it must be a value in the range 0-1023. Keys belonging to the same group can be cached in the HSM local memory throug the hsm_manage_key_group API
hsm_key_info_t	key_info	bitmap specifying the properties of the derived key.

5.4.3 Function Documentation

5.4.3.1 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
User must open this service flow in order 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 error code.

5.4.3.2 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.
User 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

5.4.3.3 hsm_err_t hsm_manage_key (hsm_hdl_t *key_management_hdl,* op_manage_key_args_t * *args*)

This command is designed to perform the following operations:

- import a key creating a new key identifier (import and create)
- import a key using an existing key identifier (import and update)
- delete an existing key

The key encryption key (KEK) can be previously pre-shared or stored in the key store.

The key to be imported must be encrypted by using the KEK as following:

- Algorithm: AES GCM
- Key: root KEK
- AAD = 0
- IV = 12 bytes
- Tag = 16 bytes
- Plaintext: key to be imported

User 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

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

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 local memory as needed
- delete an existing key group

User 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

5.4.3.5 hsm_err_t hsm_butterfly_key_expansion (hsm_hdl_t *key_management_hdl,* op_butt_key_exp_args_t * *args*)

This command is designed to perform the butterfly key expansion operation on an ECC private key in case of implicit and explicit certificates. Optionally the resulting public key is exported.
The result of the key expansion function f_k is calculated outside the HSM and passed as input. The expansion function is defined as f_k = f_k_int mod l , where l is the order of the group of points on the curve.
User can call this function only after having opened a key management service flow.

Explicit certificates:

- f_k = expansion function value

out_key = Key + f_k

Implicit certificates:

- f_k = expansion function value,
- hash = hash value used in the derivation of the pseudonym ECC key,
- pr_v = private reconstruction value

out_key = (Key + f_k)∗hash + pr_v

Parameters

key_management_hdl	handle identifying the key store management service flow.
args	pointer to the structure containing the function arguments.

Returns

error code

5.4.3.6 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

5.5 Ciphering

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct open_svc_cipher_args_t
- struct op_cipher_one_go_args_t
- struct op_auth_enc_args_t
- struct op_ecies_dec_args_t

Macros

- #define **HSM_CIPHER_ONE_GO_ALGO_AES_ECB** ((hsm_op_cipher_one_go_algo_t)(0x00u))
- #define **HSM_CIPHER_ONE_GO_ALGO_AES_CBC** ((hsm_op_cipher_one_go_algo_t)(0x01u))
- #define HSM_CIPHER_ONE_GO_ALGO_AES_CCM ((hsm_op_cipher_one_go_algo_t)(0x04u))

  Perform AES CCM with following constraints: AES CCM where Adata = 0, Tlen = 16 bytes, nonce size = 12 bytes.
- #define **HSM_CIPHER_ONE_GO_ALGO_SM4_ECB** ((hsm_op_cipher_one_go_algo_t)(0x10u))
- #define **HSM_CIPHER_ONE_GO_ALGO_SM4_CBC** ((hsm_op_cipher_one_go_algo_t)(0x11u))
- #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_AUTH_ENC_ALGO_AES_GCM ((hsm_op_auth_enc_algo_t)(0x00u))

  Perform AES GCM with following constraints: AES GCM where AAD supported, Tag len = 16 bytes, IV len = 12 bytes.
- #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))

Typedefs

- typedef uint8_t **hsm_svc_cipher_flags_t**
- typedef uint8_t **hsm_op_cipher_one_go_algo_t**
- typedef uint8_t **hsm_op_cipher_one_go_flags_t**
- typedef uint8_t **hsm_op_auth_enc_algo_t**
- typedef uint8_t **hsm_op_auth_enc_flags_t**
- typedef uint8_t **hsm_op_ecies_dec_flags_t**

Functions

- 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_auth_enc (hsm_hdl_t cipher_hdl, op_auth_enc_args_t *args)
- hsm_err_t hsm_ecies_decryption (hsm_hdl_t cipher_hdl, op_ecies_dec_args_t *args)
- hsm_err_t hsm_close_cipher_service (hsm_hdl_t cipher_hdl)

5.5.1 Detailed Description

5.5.2 Data Structure Documentation

5.5.2.1 struct open_svc_cipher_args_t

Data Fields

hsm_svc_cipher_↩ flags_t	flags	bitmap specifying the services properties.
uint8_t	reserved[3]	

5.5.2.2 struct op_cipher_one_go_args_t

Data Fields

uint32_t	key_identifier	identifier of the key to be used for the operation
uint8_t *	iv	pointer to the initialization vector (nonce in case of AES CCM)
uint16_t	iv_size	length in bytes of the initialization vector it must be 0 for algorithms not using the initialization vector. It must be 12 for AES in CCM mode
hsm_op_cipher_one_go_algo↩ _t	cipher_algo	algorithm to be used for the operation
hsm_op_cipher_one_go_↩ flags_t	flags	bitmap specifying the operation attributes
uint8_t *	input	pointer to the input area plaintext for encryption ciphertext for decryption (in case of CCM is the purported ciphertext)
uint8_t *	output	pointer to the output area ciphertext for encryption (in case of CCM is the output of the generation-encryption process) plaintext for decryption
uint32_t	input_size	length in bytes of the input
uint32_t	output_size	length in bytes of the output

5.5.2.3 struct op_auth_enc_args_t

Data Fields

uint32_t	key_identifier	identifier of the key to be used for the operation
uint8_t *	iv	pointer to the initialization vector or nonce
uint16_t	iv_size	length in bytes of the initialization vector 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) for encryption plaintext for decryption if the Tag is verified
uint32_t	input_size	length in bytes of the input

Data Fields

uint32_t	output_size	length in bytes of the output

5.5.2.4 struct op_ecies_dec_args_t

Data Fields

uint32_t	key_identifier	identifier of the private key to be used for the operation
uint8_t *	input	pointer to the VCT input
uint8_t *	p1	pointer to the KDF P1 input parameter
uint8_t *	p2	pointer to the MAC P2 input parameter should be NULL
uint8_t *	output	pointer to the output area where the plaintext must be written
uint32_t	input_size	length in bytes of the input VCT should be equal to 96 bytes
uint32_t	output_size	length in bytes of the output plaintext should be equal to 16 bytes
uint16_t	p1_size	length in bytes of the KDF P1 parameter should be equal to 32 bytes
uint16_t	p2_size	length in bytes of the MAC P2 parameter should be zero reserved for generic use cases
uint16_t	mac_size	length in bytes of the requested message authentication code should be equal to 16 bytes
hsm_key_type_t	key_type	indicates the type of the used key
hsm_op_ecies_dec_↩ flags_t	flags	bitmap specifying the operation attributes.

5.5.3 Function Documentation

5.5.3.1 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
User can call this function only after having opened a key store service flow.
User must open this service in order to perform cipher 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.

Returns

error code

5.5.3.2 hsm_err_t hsm_cipher_one_go (hsm_hdl_t *cipher_hdl*, op_cipher_one_go_args_t * *args*)

Perform ciphering operation
User 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

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

Perform authenticated encryption operation
User 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

5.5.3.4 hsm_err_t hsm_ecies_decryption (hsm_hdl_t *cipher_hdl,* op_ecies_dec_args_t * *args*)

Decrypt data usign ECIES
User can call this function only after having opened a cipher store service flow.
ECIES is supported with the constraints specified in 1609.2-2016.

Parameters

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

Returns

error code

5.5.3.5 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

error code

5.6 Signature generation

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct open_svc_sign_gen_args_t
- struct op_generate_sign_args_t
- struct op_prepare_sign_args_t

Macros

- #define **HSM_SIGNATURE_SCHEME_ECDSA_NIST_P256_SHA_256** ((hsm_signature_scheme_id_t)0x02u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_NIST_P384_SHA_384** ((hsm_signature_scheme_id_t)0x03u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_NIST_P521_SHA_512** ((hsm_signature_scheme_id_t)0x04u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_R1_256_SHA_256** ((hsm_signature_scheme_id_t)0x13u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_R1_320_SHA_384** ((hsm_signature_scheme_id_t)0x14u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_R1_384_SHA_384** ((hsm_signature_scheme_id_t)0x15u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_R1_512_SHA_512** ((hsm_signature_scheme_id_t)0x16u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_256_SHA_256** ((hsm_signature_scheme_id_t)0x23u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_320_SHA_384** ((hsm_signature_scheme_id_t)0x24u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_384_SHA_384** ((hsm_signature_scheme_id_t)0x25u)
- #define **HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_512_SHA_512** ((hsm_signature_scheme_id_t)0x26u)
- #define **HSM_SIGNATURE_SCHEME_DSA_SM2_FP_256_SM3** ((hsm_signature_scheme_id_t)0x43u)
- #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_COMPRESSED_POINT** ((hsm_op_generate_sign_flags_t)(1u << 1))
- #define **HSM_OP_GENERATE_SIGN_FLAGS_LOW_LATENCY_SIGNATURE** ((hsm_op_generate_sign_flags_t)(1u << 2))
- #define **HSM_OP_PREPARE_SIGN_INPUT_DIGEST** ((hsm_op_prepare_signature_flags_t)(0u << 0))
- #define **HSM_OP_PREPARE_SIGN_INPUT_MESSAGE** ((hsm_op_prepare_signature_flags_t)(1u << 0))
- #define **HSM_OP_PREPARE_SIGN_COMPRESSED_POINT** ((hsm_op_prepare_signature_flags_t)(1u << 1))

Typedefs

- typedef uint8_t **hsm_svc_signature_generation_flags_t**
- typedef uint8_t **hsm_signature_scheme_id_t**
- typedef uint8_t **hsm_op_generate_sign_flags_t**
- typedef uint8_t **hsm_op_prepare_signature_flags_t**

Functions

- 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_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)

5.6.1 Detailed Description

5.6.2 Data Structure Documentation

5.6.2.1 struct open_svc_sign_gen_args_t

Data Fields

hsm_svc_signature_generation_flags_t	flags	bitmap specifying the services properties.
uint8_t	reserved[3]	

5.6.2.2 struct op_generate_sign_args_t

Data Fields

uint32_t	key_identifier	identifier of the key to be used for the operation
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 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.
uint32_t	message_size	length in bytes of the input
uint16_t	signature_size	length in bytes of the output
hsm_signature_scheme_id_t	scheme_id	identifier of the digital signature scheme to be used for the operation
hsm_op_generate_sign_flags_t	flags	bitmap specifying the operation attributes

5.6.2.3 struct op_prepare_sign_args_t

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
uint16_t	reserved	

5.6.3 Function Documentation

5.6.3.1 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
User can call this function only after having opened a key store service flow.
User must open this service in order 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

5.6.3.2 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

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

Generate a digital signature according to the signature scheme
User 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.

In case of HSM_SIGNATURE_SCHEME_DSA_SM2_FP_256_SM3, message of op_generate_sign_args_t should be (as specified in GB/T 32918):

- equal to Z||M in case of HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE
- equal to SM3(Z||M) in case of HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST

Parameters

signature_gen_hdl	handle identifying the signature generation service flow.
args	pointer to the structure containing the function arguments.

Returns

error code

5.6.3.4 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 not dependencies on the input message.
The pre-calculated value will be stored internally and used once call hsm_generate_signature
User 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

5.7 Signature verification

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct open_svc_sign_ver_args_t
- struct op_verify_sign_args_t
- struct op_import_public_key_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))

  when set the value passed by the key argument is considered as the internal reference of a key imported through the hsm_import_pub_key API.
- #define **HSM_VERIFICATION_STATUS_SUCCESS** ((hsm_verification_status_t)(0x5A3CC3A5u))

Typedefs

- typedef uint8_t **hsm_svc_signature_verification_flags_t**
- typedef uint8_t **hsm_op_verify_sign_flags_t**
- typedef uint32_t **hsm_verification_status_t**
- typedef uint8_t **hsm_op_import_public_key_flags_t**

Functions

- 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_verify_signature (hsm_hdl_t signature_ver_hdl, op_verify_sign_args_t *args, hsm_verification_status_t *status)
- hsm_err_t hsm_import_public_key (hsm_hdl_t signature_ver_hdl, op_import_public_key_args_t *args, uint32_t *key_ref)
- hsm_err_t hsm_close_signature_verification_service (hsm_hdl_t signature_ver_hdl)

5.7.1 Detailed Description

5.7.2 Data Structure Documentation

5.7.2.1 struct open_svc_sign_ver_args_t

Data Fields

hsm_svc_signature_verification_↩ flags_t	flags	bitmap indicating the service flow properties
uint8_t	reserved[3]	

5.7.2.2 struct op_verify_sign_args_t

Data Fields

uint8_t *	key	pointer to the public key to be used for the verification. If the HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL is set, it must point to the key reference returned by the hsm_import_public_key API.
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 will be 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
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_signature_scheme_↩ id_t	scheme_id	identifier of the digital signature scheme to be used for the operation
hsm_op_verify_sign_flags↩ _t	flags	bitmap specifying the operation attributes
uint16_t	reserved	

5.7.2.3 struct op_import_public_key_args_t

Data Fields

uint8_t *	key	pointer to the public key to be imported
uint16_t	key_size	length in bytes of the input key
hsm_key_type_t	key_type	indicates the type of the key to be imported.
hsm_op_import_public_key_↩ flags_t	flags	bitmap specifying the operation attributes

5.7.3 Function Documentation

5.7.3.1 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*)

User must open this service in order to perform signature verification operations.
User can call this function only after having opened a session.

Parameters

session_hdl	handle identifying the current session.
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

5.7.3.2 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
User can call this function only after having opened 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 will be 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.

In case of HSM_SIGNATURE_SCHEME_DSA_SM2_FP_256_SM3, message of op_verify_sign_args_t should be (as specified in GB/T 32918):

- equal to Z||M in case of HSM_OP_VERIFY_SIGN_FLAGS_INPUT_MESSAGE
- equal to SM3(Z||M) in case of HSM_OP_VERIFY_SIGN_FLAGS_INPUT_DIGEST

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 suceed the value HSM_VERIFICATION_STATUS_SUCCESS is returned.

Returns

error code

5.7.3.3 hsm_err_t hsm_import_public_key (hsm_hdl_t *signature_ver_hdl*, op_import_public_key_args_t * *args*, uint32_t * *key_ref*)

Import a public key to be used for several verification operations, a reference to the imported key is returned.
User can use the returned reference in the hsm_verify_signature API by setting the HSM_OP_VERIFY_SIGN_F↩LAGS_KEY_INTERNAL flag
Only not-compressed keys (x,y) can be imported by this command. Compressed keys can be decompressed by using the dedicated API. User can call this function only after having opened a signature verification service flow.

Parameters

signature_ver_hdl	handle identifying the signature verification service flow.
args	pointer to the structure containing the function arguments.
key_ref	pointer to where the 4 bytes key reference to be used as key in the hsm_verify_signature will be stored

Returns

error code

5.7.3.4 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

5.8 Random number generation

Data Structures

- struct open_svc_rng_args_t
- struct op_get_random_args_t

Typedefs

- typedef uint8_t **hsm_svc_rng_flags_t**

Functions

- hsm_err_t hsm_open_rng_service (hsm_hdl_t session_hdl, open_svc_rng_args_t *args, hsm_hdl_t *rng_hdl)
- hsm_err_t hsm_close_rng_service (hsm_hdl_t rng_hdl)
- hsm_err_t hsm_get_random (hsm_hdl_t rng_hdl, op_get_random_args_t *args)

5.8.1 Detailed Description

5.8.2 Data Structure Documentation

5.8.2.1 struct open_svc_rng_args_t

Data Fields

hsm_svc_rng_flags_t	flags	bitmap indicating the service flow properties
uint8_t	reserved[3]	

5.8.2.2 struct op_get_random_args_t

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.

5.8.3 Function Documentation

5.8.3.1 hsm_err_t hsm_open_rng_service (hsm_hdl_t *session_hdl*, open_svc_rng_args_t * *args*, hsm_hdl_t * *rng_hdl*)

Open a random number generation service flow
User can call this function only after having opened a session.
User must open this service in order to perform rng operations.

Parameters

session_hdl	handle identifying the current session.
args	pointer to the structure containing the function arguments.
rng_hdl	pointer to where the rng service flow handle must be written.

Returns

error code

5.8.3.2 hsm_err_t hsm_close_rng_service (hsm_hdl_t *rng_hdl*)

Terminate a previously opened rng service flow

Parameters

rng_hdl	handle identifying the rng service flow to be closed.

Returns

error code

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

Get a freshly generated random number
User can call this function only after having opened a rng service flow

Parameters

rng_hdl	handle identifying the rng service flow.
args	pointer to the structure containing the function arguments.

Returns

error code

5.9 Hashing

Modules

- i.MX8QXP specificities

Data Structures

- struct open_svc_hash_args_t
- struct op_hash_one_go_args_t

Macros

- #define **HSM_HASH_ALGO_SHA_224** ((hsm_hash_algo_t)(0x0u))
- #define **HSM_HASH_ALGO_SHA_256** ((hsm_hash_algo_t)(0x1u))
- #define **HSM_HASH_ALGO_SHA_384** ((hsm_hash_algo_t)(0x2u))
- #define **HSM_HASH_ALGO_SHA_512** ((hsm_hash_algo_t)(0x3u))
- #define **HSM_HASH_ALGO_SM3_256** ((hsm_hash_algo_t)(0x11u))

Typedefs

- typedef uint8_t **hsm_svc_hash_flags_t**
- typedef uint8_t **hsm_hash_algo_t**
- typedef uint8_t **hsm_op_hash_one_go_flags_t**

Functions

- hsm_err_t hsm_open_hash_service (hsm_hdl_t session_hdl, open_svc_hash_args_t *args, hsm_hdl_t *hash_hdl)
- hsm_err_t hsm_close_hash_service (hsm_hdl_t hash_hdl)
- hsm_err_t hsm_hash_one_go (hsm_hdl_t hash_hdl, op_hash_one_go_args_t *args)

5.9.1 Detailed Description

5.9.2 Data Structure Documentation

5.9.2.1 struct open_svc_hash_args_t

Data Fields

hsm_svc_hash_flags_t	flags	bitmap indicating the service flow properties
uint8_t	reserved[3]	

5.9.2.2 struct op_hash_one_go_args_t

Data Fields

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_op_hash_one_go_↩ flags_t	flags	flags bitmap specifying the operation attributes.
uint16_t	reserved	

5.9.3 Function Documentation

5.9.3.1 hsm_err_t hsm_open_hash_service (hsm_hdl_t *session_hdl*, open_svc_hash_args_t * *args*, hsm_hdl_t * *hash_hdl*)

Open an hash service flow
User can call this function only after having opened a session.
User must open this service in order to perform hash operations.

Parameters

session_hdl	handle identifying the current session.
args	pointer to the structure containing the function arguments.
hash_hdl	pointer to where the hash service flow handle must be written.

Returns

error code

5.9.3.2 hsm_err_t hsm_close_hash_service (hsm_hdl_t *hash_hdl*)

Terminate a previously opened hash service flow

Parameters

hash_hdl	handle identifying the hash service flow to be closed.

Returns

error code

5.9.3.3 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
User can call this function only after having opened 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

5.10 Public key reconstruction

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct op_pub_key_rec_args_t

Typedefs

- typedef uint8_t **hsm_op_pub_key_rec_flags_t**

Functions

- hsm_err_t hsm_pub_key_reconstruction (hsm_hdl_t session_hdl, op_pub_key_rec_args_t *args)

5.10.1 Detailed Description

5.10.2 Data Structure Documentation

5.10.2.1 struct op_pub_key_rec_args_t

Data Fields

uint8_t *	pub_rec	pointer to the public reconstruction value extracted from the implicit certificate.
uint8_t *	hash	pointer to the input hash value. In the butterfly scheme it corresponds to the hash value calculated over PCA certificate and, concatenated, the implicit certificat.
uint8_t *	ca_key	pointer to the CA public key
uint8_t *	out_key	pointer to the output area where the reconstructed public key must be written.
uint16_t	pub_rec_size	length in bytes of the public reconstruction value
uint16_t	hash_size	length in bytes of the input hash
uint16_t	ca_key_size	length in bytes of the input CA public key
uint16_t	out_key_size	length in bytes of the output key
hsm_key_type_t	key_type	indicates the type of the managed key.
hsm_op_pub_key_rec_↩ flags_t	flags	flags bitmap specifying the operation attributes.
uint16_t	reserved	

5.10.3 Function Documentation

5.10.3.1 hsm_err_t hsm_pub_key_reconstruction (hsm_hdl_t *session_hdl,* op_pub_key_rec_args_t * *args*)

Reconstruct an ECC public key provided by an implicit certificate
User can call this function only after having opened a session
This API implements the followign formula:
out_key = (pub_rec * hash) + ca_key

Parameters

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

Returns

error code

5.11 Public key decompression

Data Structures

- struct op_pub_key_dec_args_t

Typedefs

- typedef uint8_t **hsm_op_pub_key_dec_flags_t**

Functions

- hsm_err_t hsm_pub_key_decompression (hsm_hdl_t session_hdl, op_pub_key_dec_args_t *args)

5.11.1 Detailed Description

5.11.2 Data Structure Documentation

5.11.2.1 struct op_pub_key_dec_args_t

Data Fields

uint8_t *	key	pointer to the compressed ECC public key. The expected key format is x||lsb_y where lsb_y is 1 byte having value 1 if the least-significant bit of the original (uncompressed) y coordinate is set, and 0 otherwise.
uint8_t *	out_key	pointer to the output area where the decompressed public key must be written.
uint16_t	key_size	length in bytes of the input compressed public key
uint16_t	out_key_size	length in bytes of the resulting public key
hsm_key_type_t	key_type	indicates the type of the manged keys.
hsm_op_pub_key_dec_↩ flags_t	flags	bitmap specifying the operation attributes.
uint16_t	reserved	

5.11.3 Function Documentation

5.11.3.1 hsm_err_t hsm_pub_key_decompression (hsm_hdl_t *session_hdl,* op_pub_key_dec_args_t * *args*)

Decompress an ECC public key
The expected key format is x||lsb_y where lsb_y is 1 byte having value 1 if the least-significant bit of the original (uncompressed) y coordinate is set, and 0 otherwise.
User can call this function only after having opened a session

Parameters

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

Returns

error code

5.12 ECIES encryption

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct op_ecies_enc_args_t

Typedefs

- typedef uint8_t **hsm_op_ecies_enc_flags_t**

Functions

- hsm_err_t hsm_ecies_encryption (hsm_hdl_t session_hdl, op_ecies_enc_args_t *args)

5.12.1 Detailed Description

5.12.2 Data Structure Documentation

5.12.2.1 struct op_ecies_enc_args_t

Data Fields

uint8_t *	input	pointer to the input plaintext
uint8_t *	pub_key	pointer to the input recipient public key
uint8_t *	p1	pointer to the KDF P1 input parameter
uint8_t *	p2	pointer to the MAC P2 input parameter should be NULL
uint8_t *	output	pointer to the output area where the VCT must be written
uint32_t	input_size	length in bytes of the input plaintext should be equal to 16 bytes
uint16_t	p1_size	length in bytes of the KDF P1 parameter should be equal to 32 bytes
uint16_t	p2_size	length in bytes of the MAC P2 parameter should be zero reserved for generic use cases
uint16_t	pub_key_size	length in bytes of the recipient public key should be equal to 64 bytes
uint16_t	mac_size	length in bytes of the requested message authentication code should be equal to 16 bytes
uint32_t	out_size	length in bytes of the output VCT should be equal to 96 bytes
hsm_key_type_t	key_type	indicates the type of the recipient public key
hsm_op_ecies_enc_↩ flags_t	flags	bitmap specifying the operation attributes.
uint16_t	reserved	

5.12.3 Function Documentation

5.12.3.1 hsm_err_t hsm_ecies_encryption (hsm_hdl_t *session_hdl*, op_ecies_enc_args_t * *args*)

Encrypt data usign ECIES
User can call this function only after having opened a session.
ECIES is supported with the constraints specified in 1609.2-2016.

Parameters

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

Returns

error code

5.13 Public key recovery

Data Structures

- struct op_pub_key_recovery_args_t

Typedefs

- typedef uint8_t **hsm_op_pub_key_recovery_flags_t**

Functions

- hsm_err_t hsm_pub_key_recovery (hsm_hdl_t key_store_hdl, op_pub_key_recovery_args_t *args)

5.13.1 Detailed Description

5.13.2 Data Structure Documentation

5.13.2.1 struct op_pub_key_recovery_args_t

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
hsm_key_type_t	key_type	indicates the type of the key to be recovered
hsm_op_pub_key_recovery_↩ flags_t	flags	bitmap specifying the operation attributes.

5.13.3 Function Documentation

5.13.3.1 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
User 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

5.14 Data storage

Data Structures

- struct open_svc_data_storage_args_t
- struct op_data_storage_args_t

Macros

- #define HSM_OP_DATA_STORAGE_FLAGS_STORE ((hsm_op_data_storage_flags_t)(1u << 0))

  Store data.
- #define HSM_OP_DATA_STORAGE_FLAGS_RETRIEVE ((hsm_op_data_storage_flags_t)(0u << 0))

  Retrieve data.

Typedefs

- typedef uint8_t **hsm_svc_data_storage_flags_t**
- typedef uint8_t **hsm_op_data_storage_flags_t**

Functions

- 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_close_data_storage_service (hsm_hdl_t data_storage_hdl)

5.14.1 Detailed Description

5.14.2 Data Structure Documentation

5.14.2.1 struct open_svc_data_storage_args_t

Data Fields

hsm_svc_data_storage_flags_t	flags	bitmap specifying the services properties.
uint8_t	reserved[3]	

5.14.2.2 struct op_data_storage_args_t

Data Fields

uint8_t *	data	pointer to the data. In case of store request, it will be the input data to store. In case of retrieve, it will be the the pointer where to load data.
uint32_t	data_size	length in bytes of the data
uint16_t	data_id	id of the data

Data Fields

hsm_op_data_storage_↩ flags_t	flags	flags bitmap specifying the operation attributes.
uint8_t	reserved	

5.14.3 Function Documentation

5.14.3.1 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
User must open this service flow in order to store/retreive 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 error code.

5.14.3.2 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

5.14.3.3 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

5.15 Root KEK export

Data Structures

- struct op_export_root_kek_args_t

Macros

- #define **HSM_OP_EXPORT_ROOT_KEK_FLAGS_COMMON_KEK** ((hsm_op_export_root_kek_flags_t)(1u << 0))
- #define **HSM_OP_EXPORT_ROOT_KEK_FLAGS_UNIQUE_KEK** ((hsm_op_export_root_kek_flags_t)(0u << 0))

Typedefs

- typedef uint8_t **hsm_op_export_root_kek_flags_t**

Functions

- hsm_err_t hsm_export_root_key_encryption_key (hsm_hdl_t session_hdl, op_export_root_kek_args_t *args)

5.15.1 Detailed Description

5.15.2 Data Structure Documentation

5.15.2.1 struct op_export_root_kek_args_t

Data Fields

uint8_t *	signed_message	pointer to signed_message authorizing the operation
uint8_t *	out_root_kek	pointer to the output area where the derived root kek (key encryption key) must be written
uint16_t	signed_msg_size	size of the signed_message authorizing the operation
uint8_t	root_kek_size	length in bytes of the root kek. Must be 32 bytes.
hsm_op_export_root_kek_flags_t	flags	flags bitmap specifying the operation attributes.
uint8_t	reserved[2]	

5.15.3 Function Documentation

5.15.3.1 hsm_err_t hsm_export_root_key_encryption_key (hsm_hdl_t *session_hdl,* op_export_root_kek_args_t * *args*)

Export the root key encryption key. This key is derived on chip. It can be common or chip unique. This key will be used to import key in the key store through the manage key API.

Parameters

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

Returns

error code

5.16 Get info

Data Structures

- struct op_get_info_args_t

Functions

- hsm_err_t hsm_get_info (hsm_hdl_t session_hdl, op_get_info_args_t *args)

5.16.1 Detailed Description

5.16.2 Data Structure Documentation

5.16.2.1 struct op_get_info_args_t

Data Fields

uint32_t *	user_sab_id	pointer to the output area where the user identifier (32bits) must be written
uint8_t *	chip_unique_id	pointer to the output area where the chip unique identifier (64bits) must be written
uint16_t *	chip_monotonic_counter	pointer to the output are where the chip monotonic counter value (16bits) must be written
uint16_t *	chip_life_cycle	pointer to the output area where the chip current life cycle (16bits) must be written
uint32_t *	version	pointer to the output area where the module version (32bits) must be written
uint32_t *	version_ext	pointer to the output area where module extended version (32bits) must be written
uint8_t *	fips_mode	pointer to the output area where the FIPS mode of operation (8bits) must be written

5.16.3 Function Documentation

5.16.3.1 hsm_err_t hsm_get_info (hsm_hdl_t *session_hdl*, op_get_info_args_t * *args*)

Parameters

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

Returns

error code

5.17 Mac

Data Structures

- struct open_svc_mac_args_t
- struct op_mac_one_go_args_t

Macros

- #define **HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION** ((hsm_op_mac_one_go_flags_t)(0u << 0))
- #define **HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION** ((hsm_op_mac_one_go_flags_t)(1u << 0))
- #define **HSM_OP_MAC_ONE_GO_ALGO_AES_CMAC** ((hsm_op_mac_one_go_algo_t)(0x01u))
- #define **HSM_MAC_VERIFICATION_STATUS_SUCCESS** ((hsm_mac_verification_status_t)(0x6C1AA1↩C6u))

Typedefs

- typedef uint8_t **hsm_svc_mac_flags_t**
- typedef uint8_t **hsm_op_mac_one_go_algo_t**
- typedef uint8_t **hsm_op_mac_one_go_flags_t**
- typedef uint32_t **hsm_mac_verification_status_t**

Functions

- 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_close_mac_service (hsm_hdl_t mac_hdl)

5.17.1 Detailed Description

5.17.2 Data Structure Documentation

5.17.2.1 struct open_svc_mac_args_t

Data Fields

hsm_svc_mac_↩flags_t	flags	bitmap specifying the services properties.
uint8_t	reserved[3]	

5.17.2.2 struct op_mac_one_go_args_t

Data Fields

uint32_t	key_identifier	identifier of the key to be used for the operation
hsm_op_mac_one_go_algo↩ _t	algorithm	algorithm to be used for the operation
hsm_op_mac_one_go_↩ flags_t	flags	bitmap specifying the operation attributes
uint8_t *	payload	pointer to the payload area
uint8_t *	mac	pointer to the tag area
uint16_t	payload_size	length in bytes of the payload
uint16_t	mac_size	length in bytes of the tag the value is in range from 4 to 16 bytes.

5.17.3 Function Documentation

5.17.3.1 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
User can call this function only after having opened a key store service flow.
User must open this service in order 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

5.17.3.2 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*)

Perform mac operation
User can call this function only after having opened a mac service flow

Parameters

mac_hdl	handle identifying the mac service flow.
args	pointer to the structure containing the function arguments.

Returns

error code

5.17.3.3 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

5.18 SM2 Get Z

Modules

- i.MX8QXP specificities

Data Structures

- struct op_sm2_get_z_args_t

Typedefs

- typedef uint8_t **hsm_op_sm2_get_z_flags_t**

Functions

- hsm_err_t hsm_sm2_get_z (hsm_hdl_t session_hdl, op_sm2_get_z_args_t *args)

5.18.1 Detailed Description

5.18.2 Data Structure Documentation

5.18.2.1 struct op_sm2_get_z_args_t

Data Fields

uint8_t *	public_key	pointer to the sender public key
uint8_t *	identifier	pointer to the sender identifier
uint8_t *	z_value	pointer to the output area where the Z value must be written
uint16_t	public_key_size	length in bytes of the sender public key should be equal to 64 bytes
uint8_t	id_size	length in bytes of the identifier
uint8_t	z_size	length in bytes of Z should be at least 32 bytes
hsm_key_type_t	key_type	indicates the type of the sender public key. Only HSM_KEY_TYPE_DSA_SM2_FP_256 is supported.
hsm_op_sm2_get_z_↩ flags_t	flags	bitmap specifying the operation attributes.
uint8_t	reserved[2]	

5.18.3 Function Documentation

5.18.3.1 hsm_err_t hsm_sm2_get_z (hsm_hdl_t *session_hdl*, op_sm2_get_z_args_t * *args*)

This command is designed to compute Z = SM3(Entl || ID || a || b || xG || yG || xpubk || ypubk)

- ID, Entl: user distinguishing identifier and length,

- a, b, xG and yG : curve parameters,
- xpubk , ypubk : public key

This value is used for SM2 public key cryptography algorithms, as specified in GB/T 32918. User can call this function only after having opened a session.

Parameters

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

Returns

error code

5.19 SM2 ECES decryption

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct open_svc_sm2_eces_args_t
- struct op_sm2_eces_dec_args_t

Typedefs

- typedef uint8_t **hsm_svc_sm2_eces_flags_t**
- typedef uint8_t **hsm_op_sm2_eces_dec_flags_t**

Functions

- hsm_err_t hsm_open_sm2_eces_service (hsm_hdl_t key_store_hdl, open_svc_sm2_eces_args_t *args, hsm_hdl_t *sm2_eces_hdl)
- hsm_err_t hsm_close_sm2_eces_service (hsm_hdl_t sm2_eces_hdl)
- hsm_err_t hsm_sm2_eces_decryption (hsm_hdl_t sm2_eces_hdl, op_sm2_eces_dec_args_t *args)

5.19.1 Detailed Description

5.19.2 Data Structure Documentation

5.19.2.1 struct open_svc_sm2_eces_args_t

Data Fields

hsm_svc_sm2_eces_↩ flags_t	flags	bitmap indicating the service flow properties
uint8_t	reserved[3]	

5.19.2.2 struct op_sm2_eces_dec_args_t

Data Fields

uint32_t	key_identifier	identifier of the private key to be used for the operation
uint8_t *	input	pointer to the input ciphertext
uint8_t *	output	pointer to the output area where the plaintext must be written
uint32_t	input_size	length in bytes of the input ciphertext
uint32_t	output_size	length in bytes of the output plaintext
hsm_key_type_t	key_type	indicates the type of the used key. Only HSM_KEY_TYPE_DSA_SM2_FP_256 is supported.

Data Fields

hsm_op_sm2_eces_dec_↩ flags_t	flags	bitmap specifying the operation attributes.
uint16_t	reserved	

5.19.3 Function Documentation

5.19.3.1 hsm_err_t hsm_open_sm2_eces_service (hsm_hdl_t *key_store_hdl,* open_svc_sm2_eces_args_t * *args,* hsm_hdl_t * *sm2_eces_hdl*)

Open a SM2 ECES decryption service flow
User can call this function only after having opened a key store.
User must open this service in order to perform SM2 decryption.

Parameters

session_hdl	handle identifying the current session.
args	pointer to the structure containing the function arguments.
sm2_eces_hdl	pointer to where the sm2 eces service flow handle must be written.

Returns

error code

5.19.3.2 hsm_err_t hsm_close_sm2_eces_service (hsm_hdl_t *sm2_eces_hdl*)

Terminate a previously opened SM2 ECES service flow

Parameters

sm2_eces_hdl	handle identifying the SM2 ECES service flow to be closed.

Returns

error code

5.19.3.3 hsm_err_t hsm_sm2_eces_decryption (hsm_hdl_t *sm2_eces_hdl,* op_sm2_eces_dec_args_t * *args*)

Decrypt data usign SM2 ECES
User can call this function only after having opened a SM2 ECES service flow.

Parameters

sm2_eces_hdl	handle identifying the SM2 ECES
args	pointer to the structure containing the function arguments.

Returns

error code

5.20 SM2 ECES encryption

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct op_sm2_eces_enc_args_t

Typedefs

- typedef uint8_t **hsm_op_sm2_eces_enc_flags_t**

Functions

- hsm_err_t hsm_sm2_eces_encryption (hsm_hdl_t session_hdl, op_sm2_eces_enc_args_t *args)

5.20.1 Detailed Description

5.20.2 Data Structure Documentation

5.20.2.1 struct op_sm2_eces_enc_args_t

Data Fields

uint8_t *	input	pointer to the input plaintext
uint8_t *	output	pointer to the output area where the ciphertext must be written
uint8_t *	pub_key	pointer to the input recipient public key
uint32_t	input_size	length in bytes of the input plaintext
uint32_t	output_size	length in bytes of the output ciphertext
uint16_t	pub_key_size	length in bytes of the recipient public key should be equal to 64 bytes
hsm_key_type_t	key_type	indicates the type of the recipient public key. Only HSM_KEY_TYPE_DSA_SM2_FP_256 is supported.
hsm_op_sm2_eces_enc_↩ flags_t	flags	bitmap specifying the operation attributes.

5.20.3 Function Documentation

5.20.3.1 hsm_err_t hsm_sm2_eces_encryption (hsm_hdl_t *session_hdl*, op_sm2_eces_enc_args_t * *args*)

Encrypt data usign SM2 ECES
User can call this function only after having opened a session.

Parameters

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

Returns

error code

5.21 Key exchange

Modules

- i.MX8QXP specificities
- i.MX8DXL specificities

Data Structures

- struct op_key_exchange_args_t

Macros

- #define **HSM_KDF_ALG_AES_CMAC** ((hsm_kdf_algo_id_t)0x00u)
- #define **HSM_KDF_ALG_FOR_SM2** ((hsm_kdf_algo_id_t)0x10u)
- #define **HSM_KE_SCHEME_ECDH_P256** ((hsm_key_exchange_scheme_id_t)0x00u)
- #define **HSM_KE_SCHEME_SM2** ((hsm_key_exchange_scheme_id_t)0x10u)
- #define HSM_OP_KEY_EXCHANGE_FLAGS_UPDATE ((hsm_op_key_exchange_flags_t)(1u << 0))

  User can replace an existing key only by the derived key which should have the same type of the original one.
- #define HSM_OP_KEY_EXCHANGE_FLAGS_CREATE ((hsm_op_key_exchange_flags_t)(1u << 1))

  Create a new key.
- #define HSM_OP_KEY_EXCHANGE_FLAGS_USE_EPHEMERAL ((hsm_op_key_exchange_flags_t)(1u << 2))

  Use an ephemeral key (freshly generated key)
- #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 applicable for persistent key only.

Typedefs

- typedef uint8_t **hsm_kdf_algo_id_t**
- typedef uint8_t **hsm_key_exchange_scheme_id_t**
- typedef uint8_t **hsm_op_key_exchange_flags_t**

Functions

- hsm_err_t hsm_key_exchange (hsm_hdl_t key_management_hdl, op_key_exchange_args_t *args)

5.21.1 Detailed Description

5.21.2 Data Structure Documentation

5.21.2.1 struct op_key_exchange_args_t

Data Fields

uint32_t	key_identifier	identifier of the key used for derivation. It must be zero, if HSM_OP_KEY_EXCHANGE_FLA↩ GS_USE_EPHEMERAL is set.
uint32_t *	shared_key_identifier	pointer to identifier of the derived key In case of create operation the new destination key identifier will be stored in this location.
uint8_t *	ke_input	pointer to the initiator input data related to the key exchange function
uint8_t *	ke_output	pointer to the output area where the data related to the key exchange function must be written. It corresponds to the receiver public data. It must be zero, if HSM_OP_KEY_EXCHAN↩ GE_FLAGS_USE_EPHEMERAL is set.
uint8_t *	kdf_input	pointer to the input data of the KDF
uint8_t *	kdf_output	pointer to the output area where the non sensitive output data related to the KDF
hsm_key_group_t	shared_key_group	it must be a value in the range 0-1023. Keys belonging to the same group can be cached in the HSM local memory throug the hsm_manage_key_group API
hsm_key_info_t	shared_key_info	bitmap specifying the properties of the derived key.
hsm_key_type_t	shared_key_type	indicates the type of the key to be derived.
hsm_key_type_t	public_data_type	indicates the key type of the initiator and receiver
hsm_key_exchange_scheme_↩ id_t	key_exchange_scheme	indicates the key exchange scheme
hsm_kdf_algo_id_t	kdf_algorithm	indicates the KDF algorithm
uint16_t	ke_input_size	length in bytes of the input data of the key exchange function
uint16_t	ke_output_size	length in bytes of the output data of the key exchange function
uint8_t	kdf_input_size	length in bytes of the input data of the KDF
uint8_t	kdf_output_size	length in bytes of the non sensitive output data related to the KDF
hsm_op_key_exchange_flags_t	flags	bitmap specifying the operation properties
uint8_t	reserved	

5.21.3 Function Documentation

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

This command is designed to to derive a secret key that will be stored in the key store as a new key or as an update of an existing key. For this secret key derivation, we can use, as input, a freshly generated key or an existing key from the key store. User can call this function only after having opened a key management service flow

Parameters

key_management_hdl	handle identifying the key store management service flow.
args	pointer to the structure containing the function arguments.

Returns

error code

5.22 i.MX8QXP specificities

Session

i.MX8QXP HSM is implemented only on SECO core which doesn't offer priority management neither low latencies.

- HSM_OPEN_SESSION_FIPS_MODE_MASK not supported and ignored
- HSM_OPEN_SESSION_EXCLUSIVE_MASK not supported and ignored
- session_priority field of open_session_args_t is ignored.
- HSM_OPEN_SESSION_LOW_LATENCY_MASK not supported and ignored.

Key store

- HSM_SVC_KEY_STORE_FLAGS_UPDATE is not supported.
- HSM_SVC_KEY_STORE_FLAGS_DELETE is not supported.

Key management

- HSM_OP_MANAGE_KEY_GROUP_FLAGS_DELETE is not supported.
- HSM_KEY_TYPE_ECDSA_NIST_P521 is not supported.
- HSM_KEY_TYPE_ECDSA_BRAINPOOL_R1_320 is not supported.
- HSM_KEY_TYPE_ECDSA_BRAINPOOL_R1_512 is not supported.
- HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_256 is not supported.
- HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_320 is not supported.
- HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_384 is not supported.
- HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_512 is not supported.
- HSM_KEY_TYPE_DSA_SM2_FP_256 is not supported.
- HSM_KEY_TYPE_SM4_128 is not supported.
- hsm_key_type_t of op_butt_key_exp_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256 and HSM_KE↩ Y_TYPE_ECDSA_BRAINPOOL_R1_256 are supported.

Ciphering

- HSM_CIPHER_ONE_GO_ALGO_SM4_ECB is not supported.
- HSM_CIPHER_ONE_GO_ALGO_SM4_CBC is not supported.
- hsm_key_type_t of op_ecies_dec_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256 and HSM_KEY_T↩ YPE_ECDSA_BRAINPOOL_R1_256 are supported.

Signature generation

- HSM_SIGNATURE_SCHEME_ECDSA_NIST_P521_SHA_512 is not supported.

- HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_R1_320_SHA_384 is not supported.
- HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_R1_512_SHA_512 is not supported.
- HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_256_SHA_256 is not supported.
- HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_320_SHA_384 is not supported.
- HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_384_SHA_384 is not supported.
- HSM_SIGNATURE_SCHEME_ECDSA_BRAINPOOL_T1_512_SHA_512 is not supported.
- HSM_SIGNATURE_SCHEME_DSA_SM2_FP_256_SM3 is not supported.

Signature generation

- HSM_HASH_ALGO_SM3_256 is not supported.

Public key reconstruction

- hsm_key_type_t of op_pub_key_rec_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256 and HSM_KEY↩ _TYPE_ECDSA_BRAINPOOL_R1_256 are supported.

ECIES encryption

- hsm_key_type_t of op_ecies_enc_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256 and HSM_KEY_T↩ YPE_ECDSA_BRAINPOOL_R1_256 are supported.

SM2 Get Z

- This API is not supported.

SM2 ECES decryption

- All the APIs related the SM2 ECES decryption are not supported.

SM2 ECES encryption

- This API is not supported.

Key exchange

- This API should be considered as a preliminary version.
- HSM_KDF_ALG_FOR_SM2 and HSM_KE_SCHEME_ALG_SM2 are not supported.

5.23 i.MX8DXL specificities

Session

i.MX8DXL has 2 separate implementations of HSM on SECO and on V2X cores.

- HSM_OPEN_SESSION_FIPS_MODE_MASK not supported and ignored
- HSM_OPEN_SESSION_EXCLUSIVE_MASK not supported and ignored
- If HSM_OPEN_SESSION_LOW_LATENCY_MASK is unset then SECO implementation will be used. In this case session_priority field of open_session_args_t is ignored.
- If HSM_OPEN_SESSION_LOW_LATENCY_MASK is set then V2X implementation is used. session_priority field of open_session_args_t and HSM_OPEN_SESSION_NO_KEY_STORE_MASK are considered.

Key store

- HSM_SVC_KEY_STORE_FLAGS_UPDATE is not supported.
- HSM_SVC_KEY_STORE_FLAGS_DELETE is not supported.

Key management

- HSM_OP_MANAGE_KEY_GROUP_FLAGS_DELETE is not supported.
- hsm_key_type_t of op_butt_key_exp_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256, HSM_KEY_T↩YPE_ECDSA_BRAINPOOL_R1_256 and HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_256 are supported.

Ciphering

- hsm_key_type_t of op_ecies_dec_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256, HSM_KEY_TYP↩E_ECDSA_BRAINPOOL_R1_256 and HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_256 are supported.

Signature generation

- HSM_OP_GENERATE_SIGN_FLAGS_COMPRESSED_POINT is not supported, in case of HSM_SIGNA↩TURE_SCHEME_DSA_SM2_FP_256_SM3.

Signature generation

- HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT is not supported, in case of HSM_SIGNATUR↩E_SCHEME_DSA_SM2_FP_256_SM3.

Public key reconstruction

- hsm_key_type_t of op_pub_key_rec_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256, HSM_KEY_T↩YPE_ECDSA_BRAINPOOL_R1_256 and HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_256 are supported.

ECIES encryption

- hsm_key_type_t of op_ecies_enc_args_t: Only HSM_KEY_TYPE_ECDSA_NIST_P256, HSM_KEY_TYP↩E_ECDSA_BRAINPOOL_R1_256 and HSM_KEY_TYPE_ECDSA_BRAINPOOL_T1_256 are supported.

SM2 ECES decryption

- All the APIs related the SM2 ECES decryption should be considered as a preliminary version.

SM2 ECES encryption

- This API should be considered as a preliminary version.

Key exchange

- This API should be considered as a preliminary version.

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