Nano cryptocurrency C library with P2PoW/DPoW support for Embedded

1.0.0

Contents

Chapter 1

Overview

myNanoEmbedded is a lightweight C library of source files that integrates `Nano Cryptocurrency` to low complexity computational devices to send/receive digital money to anywhere in the world with fast trasnsaction and with a small fee by delegating a Proof of Work with your choice:

- DPoW (Distributed Proof of Work)
- P2PoW (a Descentralized P2P Proof of Work)

API features

- Attaches a random function to TRNG hardware (if available)
- Self entropy verifier to ensure excelent TRNG or PRNG entropy
- Creates a encrypted by password your stream or file to store your Nano SEED
- Bip39 and Brainwallet support
- Convert raw data to Base32
- Parse SEED and Bip39 to JSON
- Sign a block using Blake2b hash with Ed25519 algorithm
- ARM-A, ARM-M, Thumb, Xtensa-LX6 and IA64 compatible
- Linux desktop, Raspberry PI, ESP32 and Olimex A20 tested platforms
- Communication over `Fenix protocol` bridge over TLS
- Libsodium and mbedTLS libraries with smaller resources and best performance
- Optmized for size and speed
- Non static functions (all data is cleared before processed for security)
- Fully written in C for maximum performance and portability

To add this API in your project you must first:

1. Download the latest version.

   ```
   git clone https://github.com/devfabiosilva/myNanoEmbedded.git --recurse-submodules
   ```

2. Include the main library files in the client application.

   ```
   #include "f_nano_crypto_util.h"
   ```

Initialize API

Function	Description
f_random_attach() (p. **??**)	Initializes the PRNG or TRNG to be used in this API

Transmit/Receive transactions

To transmit/receive your transaction you must use `Fenix` protocol to stabilish a DPoW/P2PoW support

Examples using platforms

The repository has some examples with most common embedded and Linux systems

- `Native Linux`
- `Raspberry Pi`
- `ESP32`
- `Olimex A20`
- `STM`

Credits

Author

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Date

Feb 2020

Version

1.0

Copyright

License MIT `see here`

References:

[1] - Colin LeMahieu - *Nano: A Feeless Distributed Cryptocurrency Network* - (2015)

[2] - Z. S. Spakovszky - *7.3 A Statistical Definition of Entropy* - (2005) - NOTE: Entropy function for cryptography is implemented based on `Definition (7.12)` of this amazing topic

[3] - Kaique Anarkrypto - *Delegated Proof of Work* - (2019)

[4] - `docs.nano.org` - *Node RPCs documentation*

Chapter 2

Data Structure Index

2.1 Data Structures

Here are the data structures with brief descriptions:

Chapter 3

File Index

3.1 Files

Here is a list of all files with brief descriptions:

Chapter 4

Data Structure Documentation

4.1   f_bitcoin_serialize_t Struct Reference

```
#include <f_bitcoin.h>
```

Data Fields

- uint8_t **version_bytes** [4]
- uint8_t **master_node**
- uint8_t **finger_print** [4]
- uint8_t **child_number** [4]
- uint8_t **chain_code** [32]
- uint8_t **sk_or_pk_data** [33]
- uint8_t **chksum** [4]

4.1.1   Detailed Description

Definition at line **24** of file **f_bitcoin.h**.

4.1.2   Field Documentation

4.1.2.1   chain_code

```
uint8_t chain_code[32]
```

Definition at line **29** of file **f_bitcoin.h**.

4.1.2.2 child_number

```
uint8_t child_number[4]
```

Definition at line **28** of file **f_bitcoin.h**.

4.1.2.3 chksum

```
uint8_t chksum[4]
```

Definition at line **31** of file **f_bitcoin.h**.

4.1.2.4 finger_print

```
uint8_t finger_print[4]
```

Definition at line **27** of file **f_bitcoin.h**.

4.1.2.5 master_node

```
uint8_t master_node
```

Definition at line **26** of file **f_bitcoin.h**.

4.1.2.6 sk_or_pk_data

```
uint8_t sk_or_pk_data[33]
```

Definition at line **30** of file **f_bitcoin.h**.

4.1.2.7 version_bytes

```
uint8_t version_bytes[4]
```

Definition at line **25** of file **f_bitcoin.h**.

The documentation for this struct was generated from the following file:

- **f_bitcoin.h**

4.2 f_block_transfer_t Struct Reference

`#include <f_nano_crypto_util.h>`

Data Fields

- uint8_t **preamble** [32]
- uint8_t **account** [32]
- uint8_t **previous** [32]
- uint8_t **representative** [32]
- **f_uint128_t balance**
- uint8_t **link** [32]
- uint8_t **signature** [64]
- uint8_t **prefixes**
- uint64_t **work**

4.2.1 Detailed Description

Nano signed block raw data defined in this `reference`

Definition at line **266** of file **f_nano_crypto_util.h**.

4.2.2 Field Documentation

4.2.2.1 account

`uint8_t account[32]`

Account in raw binary data.

Definition at line **270** of file **f_nano_crypto_util.h**.

4.2.2.2 balance

f_uint128_t `balance`

Big number 128 bit raw balance.

See also

> **f_uint128_t** (p. **??**)

Definition at line **278** of file **f_nano_crypto_util.h**.

4.2.2.3 link

```
uint8_t link[32]
```

link or destination account

Definition at line **280** of file **f_nano_crypto_util.h**.

4.2.2.4 preamble

```
uint8_t preamble[32]
```

Block preamble.

Definition at line **268** of file **f_nano_crypto_util.h**.

4.2.2.5 prefixes

```
uint8_t prefixes
```

Internal use for this API.

Definition at line **284** of file **f_nano_crypto_util.h**.

4.2.2.6 previous

```
uint8_t previous[32]
```

Previous block.

Definition at line **272** of file **f_nano_crypto_util.h**.

4.2.2.7 representative

```
uint8_t representative[32]
```

Representative for current account.

Definition at line **274** of file **f_nano_crypto_util.h**.

4.2.2.8 signature

```
uint8_t signature[64]
```

Signature of the block.

Definition at line **282** of file **f_nano_crypto_util.h**.

4.2.2.9 work

```
uint64_t work
```

Internal use for this API.

Definition at line **286** of file **f_nano_crypto_util.h**.

The documentation for this struct was generated from the following file:

- **f_nano_crypto_util.h**

4.3 f_file_info_err_t Struct Reference

```
#include <f_nano_crypto_util.h>
```

4.3.1 Detailed Description

Error enumerator for info file functions.

The documentation for this struct was generated from the following file:

- **f_nano_crypto_util.h**

4.4 f_nano_crypto_wallet_t Struct Reference

```
#include <f_nano_crypto_util.h>
```

Data Fields

- uint8_t **nano_hdr** [sizeof(NANO_WALLET_MAGIC)]
- uint32_t **ver**
- uint8_t **description** [F_DESC_SZ]
- uint8_t **salt** [32]
- uint8_t **iv** [16]
- F_ENCRYPTED_BLOCK **seed_block**

4.4.1 Detailed Description

struct of the block of encrypted file to store Nano SEED

Definition at line **400** of file **f_nano_crypto_util.h**.

4.4.2 Field Documentation

4.4.2.1 description

```
uint8_t description[F_DESC_SZ]
```

File description.

Definition at line **406** of file **f_nano_crypto_util.h**.

4.4.2.2 iv

```
uint8_t iv[16]
```

Initial vector of first encryption layer.

Definition at line **410** of file **f_nano_crypto_util.h**.

4.4.2.3 nano_hdr

```
uint8_t nano_hdr[sizeof(NANO_WALLET_MAGIC)]
```

Header of the file.

Definition at line **402** of file **f_nano_crypto_util.h**.

4.4.2.4 salt

```
uint8_t salt[32]
```

Salt of the first encryption layer.

Definition at line **408** of file **f_nano_crypto_util.h**.

4.4.2.5 seed_block

`F_ENCRYPTED_BLOCK seed_block`

Second encrypted block for Nano SEED.

Definition at line **412** of file **f_nano_crypto_util.h**.

4.4.2.6 ver

`uint32_t ver`

Version of the file.

Definition at line **404** of file **f_nano_crypto_util.h**.

The documentation for this struct was generated from the following file:

- **f_nano_crypto_util.h**

4.5   f_nano_encrypted_wallet_t Struct Reference

`#include <f_nano_crypto_util.h>`

Data Fields

- uint8_t **sub_salt** [32]
- uint8_t **iv** [16]
- uint8_t **reserved** [16]
- uint8_t **hash_sk_unencrypted** [32]
- uint8_t **sk_encrypted** [32]

4.5.1   Detailed Description

struct of the block of encrypted file to store Nano SEED

Definition at line **372** of file **f_nano_crypto_util.h**.

4.5.2   Field Documentation

4.5.2.1 hash_sk_unencrypted

`uint8_t hash_sk_unencrypted[32]`

hash of Nano SEED when unencrypted

Definition at line **380** of file **f_nano_crypto_util.h**.

4.5.2.2 iv

`uint8_t iv[16]`

Initial sub vector.

Definition at line **376** of file **f_nano_crypto_util.h**.

4.5.2.3 reserved

`uint8_t reserved[16]`

Reserved (not used)

Definition at line **378** of file **f_nano_crypto_util.h**.

4.5.2.4 sk_encrypted

`uint8_t sk_encrypted[32]`

Secret.

SEED encrypted (second layer)

Definition at line **382** of file **f_nano_crypto_util.h**.

4.5.2.5 sub_salt

`uint8_t sub_salt[32]`

Salt of the sub block to be stored.

Definition at line **374** of file **f_nano_crypto_util.h**.

The documentation for this struct was generated from the following file:

- **f_nano_crypto_util.h**

4.6   f_nano_wallet_info_bdy_t Struct Reference

```
#include <f_nano_crypto_util.h>
```

Data Fields

- uint8_t **wallet_prefix**
- uint32_t **last_used_wallet_number**
- char **wallet_representative** [**MAX_STR_NANO_CHAR**]
- char **max_fee** [F_RAW_STR_MAX_SZ]
- uint8_t **reserved** [44]

4.6.1   Detailed Description

struct of the body block of the info file

Definition at line **484** of file **f_nano_crypto_util.h**.

4.6.2   Field Documentation

4.6.2.1   last_used_wallet_number

```
uint32_t last_used_wallet_number
```

Last used wallet number.

Definition at line **488** of file **f_nano_crypto_util.h**.

4.6.2.2   max_fee

```
char max_fee[F_RAW_STR_MAX_SZ]
```

Custom preferred max fee of Proof of Work.

Definition at line **492** of file **f_nano_crypto_util.h**.

4.6.2.3   reserved

```
uint8_t reserved[44]
```

Reserved.

Definition at line **494** of file **f_nano_crypto_util.h**.

4.6.2.4 wallet_prefix

```
uint8_t wallet_prefix
```

Wallet prefix: 0 for NANO; 1 for XRB.

Definition at line **486** of file **f_nano_crypto_util.h**.

4.6.2.5 wallet_representative

```
char wallet_representative[ MAX_STR_NANO_CHAR]
```

Wallet representative.

Definition at line **490** of file **f_nano_crypto_util.h**.

The documentation for this struct was generated from the following file:

- **f_nano_crypto_util.h**

4.7   f_nano_wallet_info_t Struct Reference

```
#include <f_nano_crypto_util.h>
```

Data Fields

- uint8_t **header** [sizeof(F_NANO_WALLET_INFO_MAGIC)]
- uint16_t **version**
- char **desc** [F_NANO_DESC_SZ]
- uint8_t **nanoseed_hash** [32]
- uint8_t **file_info_integrity** [32]
- F_NANO_WALLET_INFO_BODY **body**

4.7.1   Detailed Description

struct of the body block of the info file

Definition at line **516** of file **f_nano_crypto_util.h**.

4.7.2   Field Documentation

4.7.2.1 body

`F_NANO_WALLET_INFO_BODY body`

Body of the file info.

Definition at line **528** of file **f_nano_crypto_util.h**.

4.7.2.2 desc

`char desc[F_NANO_DESC_SZ]`

Description.

Definition at line **522** of file **f_nano_crypto_util.h**.

4.7.2.3 file_info_integrity

`uint8_t file_info_integrity[32]`

File info integrity of the body block.

Definition at line **526** of file **f_nano_crypto_util.h**.

4.7.2.4 header

`uint8_t header[sizeof(F_NANO_WALLET_INFO_MAGIC)]`

Header magic.

Definition at line **518** of file **f_nano_crypto_util.h**.

4.7.2.5 nanoseed_hash

`uint8_t nanoseed_hash[32]`

Nano SEED hash file.

Definition at line **524** of file **f_nano_crypto_util.h**.

4.7.2.6 version

`uint16_t version`

Version.

Definition at line **520** of file **f_nano_crypto_util.h**.

The documentation for this struct was generated from the following file:

- **f_nano_crypto_util.h**

Chapter 5

File Documentation

5.1   errors.h File Reference

Macros

- #define **ERROR_SUCCESS** 0
- #define **ERROR_GEN_TOKEN_NO_RAND_NUM_GEN** 3858
- #define **ERROR_INVALID_NANO_ADDRESS_VERIFY_CHKSUM** 23
- #define **INVALID_RAW_BALANCE** 8893
- #define **CANT_OPEN_DICTIONARY_FILE** 2580
- #define **MISSING_PASSWORD** 7153
- #define **EMPTY_PASSWORD** 7169
- #define **WRONG_PASSWORD** 7167
- #define **ERROR_25519_IS_NOT_CANONICAL_OR_HAS_NOT_SMALL_ORDER** 12621
- #define **ERROR_NANO_BLOCK** 13014
- #define **ERROR_P2POW_BLOCK** 13015
- #define **ERROR_BRAINWALLET_ALLOW_MODE_NOT_ACCEPTED** 0x3C00
- #define **ERROR_MISSING_BRAINWALLET** 0x3C01
- #define **ERROR_MISSING_SALT** 0x3C02

Enumerations

- enum **f_nano_account_or_pk_string_to_pk_util_err_t** {
  NANO_ACCOUNT_TO_PK_OK =0, **NANO_ACCOUNT_TO_PK_OVFL** =8100, **NANO_ACCOUNT_TO↵
  _PK_NULL_STRING**, **NANO_ACCOUNT_WRONG_PK_STR_SZ**,
  NANO_ACCOUNT_WRONG_HEX_STRING, **NANO_ACCOUNT_BASE32_CONVERT_ERROR**, **NAN↵
  O_ACCOUNT_TO_PK_WRONG_ACCOUNT_LEN** }

5.1.1   Macro Definition Documentation

5.1.1.1 CANT_OPEN_DICTIONARY_FILE

`#define CANT_OPEN_DICTIONARY_FILE 2580`

Dictionary file not found or filesystem error.

Definition at line **49** of file **errors.h**.

5.1.1.2 EMPTY_PASSWORD

`#define EMPTY_PASSWORD 7169`

Empty password error.

Definition at line **61** of file **errors.h**.

5.1.1.3 ERROR_25519_IS_NOT_CANONICAL_OR_HAS_NOT_SMALL_ORDER

`#define ERROR_25519_IS_NOT_CANONICAL_OR_HAS_NOT_SMALL_ORDER 12621`

Error in Elliptic Curve Ed25519: Is not canonical or has small order.

Definition at line **73** of file **errors.h**.

5.1.1.4 ERROR_BRAINWALLET_ALLOW_MODE_NOT_ACCEPTED

`#define ERROR_BRAINWALLET_ALLOW_MODE_NOT_ACCEPTED 0x3C00`

Definition at line **91** of file **errors.h**.

5.1.1.5 ERROR_GEN_TOKEN_NO_RAND_NUM_GEN

`#define ERROR_GEN_TOKEN_NO_RAND_NUM_GEN 3858`

No random number generation.

Add one to *myNanoEmbedded* library.

See also

> **f_random_attach()** (p. **??**)

Definition at line **14** of file **errors.h**.

5.1.1.6 ERROR_INVALID_NANO_ADDRESS_VERIFY_CHKSUM

#define ERROR_INVALID_NANO_ADDRESS_VERIFY_CHKSUM 23

Nano address checksum invalid.

Definition at line **21** of file **errors.h**.

5.1.1.7 ERROR_MISSING_BRAINWALLET

#define ERROR_MISSING_BRAINWALLET 0x3C01

Definition at line **97** of file **errors.h**.

5.1.1.8 ERROR_MISSING_SALT

#define ERROR_MISSING_SALT 0x3C02

Definition at line **103** of file **errors.h**.

5.1.1.9 ERROR_NANO_BLOCK

#define ERROR_NANO_BLOCK 13014

Nano block error.

Definition at line **79** of file **errors.h**.

5.1.1.10 ERROR_P2POW_BLOCK

#define ERROR_P2POW_BLOCK 13015

Nano P2PoW block error.

Definition at line **85** of file **errors.h**.

5.1.1.11 ERROR_SUCCESS

```
#define ERROR_SUCCESS 0
```

Error success.

Most of the *myNanoEmbedded* functions returns **ERROR_SUCCESS** when execution success.

Definition at line **7** of file **errors.h**.

5.1.1.12 INVALID_RAW_BALANCE

```
#define INVALID_RAW_BALANCE 8893
```

Invalid raw balance error.

Definition at line **42** of file **errors.h**.

5.1.1.13 MISSING_PASSWORD

```
#define MISSING_PASSWORD 7153
```

Missing password error.

Definition at line **55** of file **errors.h**.

5.1.1.14 WRONG_PASSWORD

```
#define WRONG_PASSWORD 7167
```

Wrong password error.

Definition at line **67** of file **errors.h**.

5.1.2 Enumeration Type Documentation

5.1.2.1 f_nano_account_or_pk_string_to_pk_util_err_t

```
enum  f_nano_account_or_pk_string_to_pk_util_err_t
```

Nano account or public key string error enumerator.

Enumerator

NANO_ACCOUNT_TO_PK_OK	
NANO_ACCOUNT_TO_PK_OVFL	
NANO_ACCOUNT_TO_PK_NULL_STRING	
NANO_ACCOUNT_WRONG_PK_STR_SZ	
NANO_ACCOUNT_WRONG_HEX_STRING	
NANO_ACCOUNT_BASE32_CONVERT_ERROR	
NANO_ACCOUNT_TO_PK_WRONG_ACCOUNT_LEN	

Definition at line **27** of file **errors.h**.

5.2   errors.h

```
00001 //mon apr 26 20:56:00 -03 2021
00002
00007 #define ERROR_SUCCESS 0
00008
00014 #define ERROR_GEN_TOKEN_NO_RAND_NUM_GEN 3858
00015
00016 //nano_base_32_2_hex
00021 #define ERROR_INVALID_NANO_ADDRESS_VERIFY_CHKSUM 23
00022
00027 enum f_nano_account_or_pk_string_to_pk_util_err_t {
00028     NANO_ACCOUNT_TO_PK_OK=0,
00029     NANO_ACCOUNT_TO_PK_OVFL=8100,
00030     NANO_ACCOUNT_TO_PK_NULL_STRING,
00031     NANO_ACCOUNT_WRONG_PK_STR_SZ,
00032     NANO_ACCOUNT_WRONG_HEX_STRING,
00033     NANO_ACCOUNT_BASE32_CONVERT_ERROR,
00034     NANO_ACCOUNT_TO_PK_WRONG_ACCOUNT_LEN
00035 };
00036
00037 //valid_raw_balance
00042 #define INVALID_RAW_BALANCE 8893
00043
00044 //f_nano_seed_to_bip39
00049 #define CANT_OPEN_DICTIONARY_FILE 2580
00050
00055 #define MISSING_PASSWORD 7153
00056
00061 #define EMPTY_PASSWORD 7169
00062
00067 #define WRONG_PASSWORD 7167
00068
00073 #define ERROR_25519_IS_NOT_CANONICAL_OR_HAS_NOT_SMALL_ORDER 12621
00074
00079 #define ERROR_NANO_BLOCK 13014
00080
00085 #define ERROR_P2POW_BLOCK 13015
00086
00091 #define ERROR_BRAINWALLET_ALLOW_MODE_NOT_ACCEPTED 0x3C00
00092
00097 #define ERROR_MISSING_BRAINWALLET 0x3C01
00098
00103 #define ERROR_MISSING_SALT 0x3C02
00104
```

5.3   f_add_bn_288_le.h File Reference

```
#include <stdint.h>
```

Typedefs

- typedef uint8_t **F_ADD_288**[36]

5.3.1 Detailed Description

Low level implementation of Nano Cryptocurrency C library.

Definition in file **f_add_bn_288_le.h**.

5.3.2 Typedef Documentation

5.3.2.1 F_ADD_288

```
F_ADD_288
```

288 bit big number

Definition at line **19** of file **f_add_bn_288_le.h**.

5.4 f_add_bn_288_le.h

```
00001 /*
00002     AUTHOR: Fábio Pereira da Silva
00003     YEAR: 2019-20
00004     LICENSE: MIT
00005     EMAIL: fabioegel@gmail.com or fabioegel@protonmail.com
00006 */
00007
00008 #include <stdint.h>
00009
00019 typedef uint8_t F_ADD_288[36];
00020
00021
00022 #ifndef F_DOC_SKIP
00023
00033  void f_add_bn_288_le(F_ADD_288, F_ADD_288, F_ADD_288, int *, int);
00034  void f_sl_elv_add_le(F_ADD_288, int);
00035
00036 #endif
00037
```

5.5 f_bitcoin.h File Reference

```
#include <mbedtls/bignum.h>
```

Data Structures

- struct **f_bitcoin_serialize_t**

Macros

- #define **F_BITCOIN_WIF_MAINNET** (uint8_t)0x80
- #define **F_BITCOIN_WIF_TESTNET** (uint8_t)0xEF
- #define **F_BITCOIN_P2PKH** (uint8_t)0x00
- #define **F_BITCOIN_T2PKH** (uint8_t)0x6F
- #define **F_BITCOIN_BUF_SZ** (size_t)512
- #define **F_MAX_BASE58_LENGTH** (size_t)112
- #define **F_BITCOIN_SEED_GENERATOR** "Bitcoin seed"
- #define **MAINNET_PUBLIC** (size_t)0
- #define **MAINNET_PRIVATE** (size_t)1
- #define **TESTNET_PUBLIC** (size_t)2
- #define **TESTNET_PRIVATE** (size_t)3
- #define **F_VERSION_BYTES_IDX_LEN** (size_t)(sizeof(**F_VERSION_BYTES**)/(4∗sizeof(uint8_t)))
- #define **F_XPRIV_BASE58** (int)1
- #define **F_XPUB_BASE58** (int)2
- #define **DERIVE_XPRIV_XPUB_DYN_OUT_BASE58** (int)8
- #define **DERIVE_XPRIV_XPUB_DYN_OUT_XPRIV** (int)16
- #define **DERIVE_XPRIV_XPUB_DYN_OUT_XPUB** (int)32
- #define **F_GET_XKEY_IS_BASE58** (int)0x00008000

Typedefs

- typedef enum **error_load_master_key_from_entropy_bits_e ERROR_LOAD_FROM_MASTER_KEY↩_FROM_ENTROPY_BITS**
- typedef enum **master_key_entropy_bits_e MASTER_KEY_ENTROPY_BITS**

Enumerations

- enum **error_load_master_key_from_entropy_bits_e** { **ERR_INVALID_ENTROPY_BITS** = 20300, **ER↩R_INVALID_VERSION_BYTES**, **ERR_MASTER_KEY_FROM_ENTROPY_ALLOC** }
- enum **master_key_entropy_bits_e** { **MK_128** = 16, **MK_256** = 32, **MK_512** = 64 }

Functions

- struct **f_bitcoin_serialize_t __attribute__** ((packed)) BITCOIN_SERIALIZE
- int **f_decode_b58_util** (uint8_t ∗, size_t, size_t ∗, const char ∗)
- int **f_encode_b58** (char ∗, size_t, size_t ∗, uint8_t ∗, size_t)
- int **f_private_key_to_wif** (char ∗, size_t, size_t ∗, uint8_t, uint8_t ∗)
- int **f_wif_to_private_key** (uint8_t ∗, unsigned char ∗, const char ∗)
- int **f_generate_master_key** (BITCOIN_SERIALIZE ∗, size_t, uint32_t)
- int **f_bitcoin_valid_bip32** (BITCOIN_SERIALIZE ∗, int ∗, void ∗, int)
- int **f_uncompress_elliptic_curve** (uint8_t ∗, size_t, size_t ∗, mbedtls_ecp_group_id, uint8_t ∗, size_t)
- int **f_bip32_to_public_key_or_private_key** (uint8_t ∗, int ∗, uint8_t ∗, uint8_t ∗, uint8_t ∗, uint32_t, const void ∗, int)
- int **f_public_key_to_address** (char ∗, size_t, size_t ∗, uint8_t ∗, uint8_t)
- int **f_xpriv2xpub** (void ∗, size_t, size_t ∗, void ∗, int)
- int **load_master_private_key** (void ∗, unsigned char ∗, size_t)
- int **f_fingerprint** (uint8_t ∗, uint8_t ∗, uint8_t ∗)
- int **f_get_xkey_type** (void ∗)
- int **f_derive_xpriv_or_xpub_dynamic** (void ∗∗, uint8_t ∗, uint32_t ∗, void ∗, uint32_t, int)
- int **f_derive_xkey_dynamic** (void ∗∗, void ∗, const char ∗, int)
- int **f_check_if_invalid_btc_public_key** (uint8_t ∗)
- **ERROR_LOAD_FROM_MASTER_KEY_FROM_ENTROPY_BITS f_load_from_master_key_from_↩entropy_bits** (BITCOIN_SERIALIZE ∗, size_t, const uint8_t ∗, **MASTER_KEY_ENTROPY_BITS**)

Variables

- static const uint8_t **F_VERSION_BYTES** [ ][4]
- uint8_t **version_bytes** [4]
- uint8_t **master_node**
- uint8_t **finger_print** [4]
- uint8_t **child_number** [4]
- uint8_t **chain_code** [32]
- uint8_t **sk_or_pk_data** [33]
- uint8_t **chksum** [4]

5.5.1 Macro Definition Documentation

5.5.1.1 DERIVE_XPRIV_XPUB_DYN_OUT_BASE58

```
#define DERIVE_XPRIV_XPUB_DYN_OUT_BASE58 (int)8
```

Definition at line **58** of file **f_bitcoin.h**.

5.5.1.2 DERIVE_XPRIV_XPUB_DYN_OUT_XPRIV

```
#define DERIVE_XPRIV_XPUB_DYN_OUT_XPRIV (int)16
```

Definition at line **59** of file **f_bitcoin.h**.

5.5.1.3 DERIVE_XPRIV_XPUB_DYN_OUT_XPUB

```
#define DERIVE_XPRIV_XPUB_DYN_OUT_XPUB (int)32
```

Definition at line **60** of file **f_bitcoin.h**.

5.5.1.4 F_BITCOIN_BUF_SZ

```
#define F_BITCOIN_BUF_SZ (size_t)512
```

Definition at line **7** of file **f_bitcoin.h**.

5.5.1.5 F_BITCOIN_P2PKH

```
#define F_BITCOIN_P2PKH (uint8_t)0x00
```

Definition at line **5** of file **f_bitcoin.h**.

5.5.1.6 F_BITCOIN_SEED_GENERATOR

```
#define F_BITCOIN_SEED_GENERATOR "Bitcoin seed"
```

Definition at line **9** of file **f_bitcoin.h**.

5.5.1.7 F_BITCOIN_T2PKH

```
#define F_BITCOIN_T2PKH (uint8_t)0x6F
```

Definition at line **6** of file **f_bitcoin.h**.

5.5.1.8 F_BITCOIN_WIF_MAINNET

```
#define F_BITCOIN_WIF_MAINNET (uint8_t)0x80
```

Definition at line **3** of file **f_bitcoin.h**.

5.5.1.9 F_BITCOIN_WIF_TESTNET

```
#define F_BITCOIN_WIF_TESTNET (uint8_t)0xEF
```

Definition at line **4** of file **f_bitcoin.h**.

5.5.1.10 F_GET_XKEY_IS_BASE58

```
#define F_GET_XKEY_IS_BASE58 (int)0x00008000
```

Definition at line **62** of file **f_bitcoin.h**.

5.5.1.11 F_MAX_BASE58_LENGTH

```
#define F_MAX_BASE58_LENGTH (size_t)112
```

Definition at line **8** of file **f_bitcoin.h**.

5.5.1.12 F_VERSION_BYTES_IDX_LEN

```
#define F_VERSION_BYTES_IDX_LEN (size_t)(sizeof( F_VERSION_BYTES)/(4*sizeof(uint8_t)))
```

Definition at line **22** of file **f_bitcoin.h**.

5.5.1.13 F_XPRIV_BASE58

```
#define F_XPRIV_BASE58 (int)1
```

Definition at line **52** of file **f_bitcoin.h**.

5.5.1.14 F_XPUB_BASE58

```
#define F_XPUB_BASE58 (int)2
```

Definition at line **53** of file **f_bitcoin.h**.

5.5.1.15 MAINNET_PRIVATE

```
#define MAINNET_PRIVATE (size_t)1
```

Definition at line **12** of file **f_bitcoin.h**.

5.5.1.16 MAINNET_PUBLIC

```
#define MAINNET_PUBLIC (size_t)0
```

Definition at line **11** of file **f_bitcoin.h**.

5.5.1.17 TESTNET_PRIVATE

`#define TESTNET_PRIVATE (size_t)3`

Definition at line **14** of file **f_bitcoin.h**.

5.5.1.18 TESTNET_PUBLIC

`#define TESTNET_PUBLIC (size_t)2`

Definition at line **13** of file **f_bitcoin.h**.

5.5.2 Typedef Documentation

5.5.2.1 ERROR_LOAD_FROM_MASTER_KEY_FROM_ENTROPY_BITS

`typedef enum` **error_load_master_key_from_entropy_bits_e** **ERROR_LOAD_FROM_MASTER_KEY_FROM_ENT↩**
ROPY_BITS

5.5.2.2 MASTER_KEY_ENTROPY_BITS

`typedef enum` **master_key_entropy_bits_e** **MASTER_KEY_ENTROPY_BITS**

5.5.3 Enumeration Type Documentation

5.5.3.1 error_load_master_key_from_entropy_bits_e

`enum` **error_load_master_key_from_entropy_bits_e**

Enumerator

ERR_INVALID_ENTROPY_BITS	
ERR_INVALID_VERSION_BYTES	
ERR_MASTER_KEY_FROM_ENTROPY_ALLOC	

Definition at line **68** of file **f_bitcoin.h**.

5.5.3.2 master_key_entropy_bits_e

enum **master_key_entropy_bits_e**

Enumerator

MK_128	
MK_256	
MK_512	

Definition at line **74** of file **f_bitcoin.h**.

5.5.4 Function Documentation

5.5.4.1 __attribute__()

struct **f_nano_wallet_info_t** __attribute__ (
        (packed))

5.5.4.2 f_bip32_to_public_key_or_private_key()

int f_bip32_to_public_key_or_private_key (
        uint8_t * ,
        int * ,
        uint8_t * ,
        uint8_t * ,
        uint8_t * ,
        uint32_t ,
        const void * ,
        int)

5.5.4.3 f_bitcoin_valid_bip32()

int f_bitcoin_valid_bip32 (
        BITCOIN_SERIALIZE * ,
        int * ,
        void * ,
        int)

5.5.4.4 f_check_if_invalid_btc_public_key()

```
int f_check_if_invalid_btc_public_key (
            uint8_t *  )
```

5.5.4.5 f_decode_b58_util()

```
int f_decode_b58_util (
            uint8_t * ,
            size_t ,
            size_t * ,
            const char *  )
```

5.5.4.6 f_derive_xkey_dynamic()

```
int f_derive_xkey_dynamic (
            void ** ,
            void * ,
            const char * ,
            int  )
```

5.5.4.7 f_derive_xpriv_or_xpub_dynamic()

```
int f_derive_xpriv_or_xpub_dynamic (
            void ** ,
            uint8_t * ,
            uint32_t * ,
            void * ,
            uint32_t ,
            int  )
```

5.5.4.8 f_encode_b58()

```
int f_encode_b58 (
            char * ,
            size_t ,
            size_t * ,
            uint8_t * ,
            size_t  )
```

5.5.4.9 f_fingerprint()

```
int f_fingerprint (
            uint8_t * ,
            uint8_t * ,
            uint8_t *  )
```

5.5.4.10 f_generate_master_key()

```
int f_generate_master_key (
            BITCOIN_SERIALIZE * ,
            size_t ,
            uint32_t  )
```

5.5.4.11 f_get_xkey_type()

```
int f_get_xkey_type (
            void *  )
```

5.5.4.12 f_load_from_master_key_from_entropy_bits()

```
 ERROR_LOAD_FROM_MASTER_KEY_FROM_ENTROPY_BITS f_load_from_master_key_from_entropy_bits (
            BITCOIN_SERIALIZE * ,
            size_t ,
            const uint8_t * ,
             MASTER_KEY_ENTROPY_BITS  )
```

5.5.4.13 f_private_key_to_wif()

```
int f_private_key_to_wif (
            char * ,
            size_t ,
            size_t * ,
            uint8_t ,
            uint8_t *  )
```

5.5.4.14   f_public_key_to_address()

```
int f_public_key_to_address (
            char * ,
            size_t ,
            size_t * ,
            uint8_t * ,
            uint8_t  )
```

5.5.4.15   f_uncompress_elliptic_curve()

```
int f_uncompress_elliptic_curve (
            uint8_t * ,
            size_t ,
            size_t * ,
            mbedtls_ecp_group_id ,
            uint8_t * ,
            size_t  )
```

5.5.4.16   f_wif_to_private_key()

```
int f_wif_to_private_key (
            uint8_t * ,
            unsigned char * ,
            const char *  )
```

5.5.4.17   f_xpriv2xpub()

```
int f_xpriv2xpub (
            void * ,
            size_t ,
            size_t * ,
            void * ,
            int  )
```

5.5.4.18   load_master_private_key()

```
int load_master_private_key (
            void * ,
            unsigned char * ,
            size_t  )
```

5.5.5 Variable Documentation

5.5.5.1 chain_code

```
uint8_t chain_code[32]
```

Definition at line **21** of file **f_bitcoin.h**.

5.5.5.2 child_number

```
uint8_t child_number[4]
```

Definition at line **20** of file **f_bitcoin.h**.

5.5.5.3 chksum

```
uint8_t chksum[4]
```

Definition at line **23** of file **f_bitcoin.h**.

5.5.5.4 F_VERSION_BYTES

```
const uint8_t F_VERSION_BYTES[][4]  [static]
```

Initial value:

```
= {
   {0x04, 0x88, 0xB2, 0x1E},
   {0x04, 0x88, 0xAD, 0xE4},
   {0x04, 0x35, 0x87, 0xCF},
   {0x04, 0x35, 0x83, 0x94}
}
```

Definition at line **16** of file **f_bitcoin.h**.

5.5.5.5 finger_print

```
uint8_t finger_print[4]
```

Definition at line **19** of file **f_bitcoin.h**.

5.5.5.6 master_node

```
uint8_t master_node
```

Definition at line **18** of file **f_bitcoin.h**.

5.5.5.7 sk_or_pk_data

```
uint8_t sk_or_pk_data[33]
```

Definition at line **22** of file **f_bitcoin.h**.

5.5.5.8 version_bytes

```
uint8_t version_bytes[4]
```

Definition at line **17** of file **f_bitcoin.h**.

5.6 f_bitcoin.h

```
00001 #include <mbedtls/bignum.h>
00002
00003 #define F_BITCOIN_WIF_MAINNET (uint8_t)0x80
00004 #define F_BITCOIN_WIF_TESTNET (uint8_t)0xEF
00005 #define F_BITCOIN_P2PKH (uint8_t)0x00 // P2PKH address
00006 #define F_BITCOIN_T2PKH (uint8_t)0x6F // Testnet Address
00007 #define F_BITCOIN_BUF_SZ (size_t)512
00008 #define F_MAX_BASE58_LENGTH (size_t)112//52 // including null char
00009 #define F_BITCOIN_SEED_GENERATOR "Bitcoin seed"
00010
00011 #define MAINNET_PUBLIC (size_t)0
00012 #define MAINNET_PRIVATE (size_t)1
00013 #define TESTNET_PUBLIC (size_t)2
00014 #define TESTNET_PRIVATE (size_t)3
00015
00016 static const uint8_t F_VERSION_BYTES[][4] = {
00017     {0x04, 0x88, 0xB2, 0x1E}, //mainnet public
00018     {0x04, 0x88, 0xAD, 0xE4}, //mainnet private
00019     {0x04, 0x35, 0x87, 0xCF}, //testnet public
00020     {0x04, 0x35, 0x83, 0x94} // testnet private
00021 };
00022 #define F_VERSION_BYTES_IDX_LEN (size_t)(sizeof(F_VERSION_BYTES)/(4*sizeof(uint8_t)))
00023
00024 typedef struct f_bitcoin_serialize_t {
00025     uint8_t version_bytes[4];
00026     uint8_t master_node;
00027     uint8_t finger_print[4];
00028     uint8_t child_number[4];
00029     uint8_t chain_code[32];
00030     uint8_t sk_or_pk_data[33];
00031     uint8_t chksum[4];
00032 } __attribute__((packed)) BITCOIN_SERIALIZE;
00033
00034 int f_decode_b58_util(uint8_t *, size_t, size_t *, const char *);
00035 int f_encode_b58(char *, size_t, size_t *, uint8_t *, size_t);
00036 int f_private_key_to_wif(char *, size_t, size_t *, uint8_t, uint8_t *);
00037 int f_wif_to_private_key(uint8_t *, unsigned char *, const char *);
00038 int f_generate_master_key(BITCOIN_SERIALIZE *, size_t, uint32_t);
00039 int f_bitcoin_valid_bip32(BITCOIN_SERIALIZE *, int *, void *, int);
00040 int f_uncompress_elliptic_curve(uint8_t *, size_t, size_t *, mbedtls_ecp_group_id, uint8_t *, size_t);
00041 int f_bip32_to_public_key_or_private_key(
00042     uint8_t *,
```

```
00043    int *,
00044    uint8_t *,
00045    uint8_t *,
00046    uint8_t *,
00047    uint32_t,
00048    const void *,
00049    int
00050 );
00051 int f_public_key_to_address(char *, size_t, size_t *, uint8_t *, uint8_t);
00052 #define F_XPRIV_BASE58 (int)1
00053 #define F_XPUB_BASE58 (int)2
00054 int f_xpriv2xpub(void *, size_t, size_t *, void *, int);
00055 int load_master_private_key(void *, unsigned char *, size_t);
00056 int f_fingerprint(uint8_t *, uint8_t *, uint8_t *);
00057
00058 #define DERIVE_XPRIV_XPUB_DYN_OUT_BASE58 (int)8
00059 #define DERIVE_XPRIV_XPUB_DYN_OUT_XPRIV (int)16
00060 #define DERIVE_XPRIV_XPUB_DYN_OUT_XPUB (int)32
00061
00062 #define F_GET_XKEY_IS_BASE58 (int)0x00008000
00063 int f_get_xkey_type(void *);
00064 int f_derive_xpriv_or_xpub_dynamic(void **, uint8_t *, uint32_t *, void *, uint32_t, int);
00065 int f_derive_xkey_dynamic(void **, void *, const char *, int);
00066 int f_check_if_invalid_btc_public_key(uint8_t *);
00067
00068 typedef enum error_load_master_key_from_entropy_bits_e {
00069    ERR_INVALID_ENTROPY_BITS = 20300,
00070    ERR_INVALID_VERSION_BYTES,
00071    ERR_MASTER_KEY_FROM_ENTROPY_ALLOC
00072 } ERROR_LOAD_FROM_MASTER_KEY_FROM_ENTROPY_BITS;
00073
00074 typedef enum master_key_entropy_bits_e {
00075    MK_128 = 16,
00076    MK_256 = 32,
00077    MK_512 = 64
00078 } MASTER_KEY_ENTROPY_BITS;
00079
00080 ERROR_LOAD_FROM_MASTER_KEY_FROM_ENTROPY_BITS
00081 f_load_from_master_key_from_entropy_bits(
00082    BITCOIN_SERIALIZE *,
00083    size_t,
00084    const uint8_t *,
00085    MASTER_KEY_ENTROPY_BITS
00086 );
00087
```

5.7 f_nano_crypto_util.h File Reference

```
#include <errors.h>
#include <stdint.h>
#include <f_util.h>
#include <f_bitcoin.h>
```

Data Structures

- struct **f_block_transfer_t**
- struct **f_nano_encrypted_wallet_t**
- struct **f_nano_crypto_wallet_t**
- struct **f_nano_wallet_info_bdy_t**
- struct **f_nano_wallet_info_t**

Macros

- #define **F_NANO_POW_MAX_THREAD** (size_t)10
- #define **MAX_STR_NANO_CHAR** (size_t)70
- #define **PUB_KEY_EXTENDED_MAX_LEN** (size_t)40

- #define **NANO_PREFIX** "nano_"
- #define **XRB_PREFIX** "xrb_"
- #define **NANO_ENCRYPTED_SEED_FILE** "/spiffs/secure/nano.nse"
- #define **NANO_PASSWD_MAX_LEN** (size_t)80
- #define **STR_NANO_SZ** (size_t)66
- #define **NANO_FILE_WALLETS_INFO** "/spiffs/secure/walletsinfo.i"
- #define **F_BLOCK_TRANSFER_SIZE** (size_t)sizeof(F_BLOCK_TRANSFER)
- #define **F_P2POW_BLOCK_TRANSFER_SIZE** 2∗ **F_BLOCK_TRANSFER_SIZE**
- #define **REP_XRB** (uint8_t)0x4
- #define **SENDER_XRB** (uint8_t)0x02
- #define **DEST_XRB** (uint8_t)0x01
- #define **F_BRAIN_WALLET_VERY_POOR** (uint32_t)0
- #define **F_BRAIN_WALLET_POOR** (uint32_t)1
- #define **F_BRAIN_WALLET_VERY_BAD** (uint32_t)2
- #define **F_BRAIN_WALLET_BAD** (uint32_t)3
- #define **F_BRAIN_WALLET_VERY_WEAK** (uint32_t)4
- #define **F_BRAIN_WALLET_WEAK** (uint32_t)5
- #define **F_BRAIN_WALLET_STILL_WEAK** (uint32_t)6
- #define **F_BRAIN_WALLET_MAYBE_GOOD** (uint32_t)7
- #define **F_BRAIN_WALLET_GOOD** (uint32_t)8
- #define **F_BRAIN_WALLET_VERY_GOOD** (uint32_t)9
- #define **F_BRAIN_WALLET_NICE** (uint32_t)10
- #define **F_BRAIN_WALLET_PERFECT** (uint32_t)11
- #define **F_SIGNATURE_RAW** (uint32_t)1
- #define **F_SIGNATURE_STRING** (uint32_t)2
- #define **F_SIGNATURE_OUTPUT_RAW_PK** (uint32_t)4
- #define **F_SIGNATURE_OUTPUT_STRING_PK** (uint32_t)8
- #define **F_SIGNATURE_OUTPUT_XRB_PK** (uint32_t)16
- #define **F_SIGNATURE_OUTPUT_NANO_PK** (uint32_t)32
- #define **F_IS_SIGNATURE_RAW_HEX_STRING** (uint32_t)64
- #define **F_MESSAGE_IS_HASH_STRING** (uint32_t)128
- #define **F_DEFAULT_THRESHOLD** (uint64_t) 0xfffffc000000000
- #define **F_VERIFY_SIG_NANO_WALLET** (uint32_t)1
- #define **F_PUBLIC_KEY_RAW_HEX** (uint32_t)2
- #define **F_PUBLIC_KEY_ASCII_HEX** (uint32_t)4
- #define **F_BALANCE_RAW_128** F_NANO_A_RAW_128
- #define **F_BALANCE_REAL_STRING** F_NANO_A_REAL_STRING
- #define **F_BALANCE_RAW_STRING** F_NANO_A_RAW_STRING
- #define **F_VALUE_SEND_RECEIVE_RAW_128** F_NANO_B_RAW_128
- #define **F_VALUE_SEND_RECEIVE_REAL_STRING** F_NANO_B_REAL_STRING
- #define **F_VALUE_SEND_RECEIVE_RAW_STRING** F_NANO_B_RAW_STRING
- #define **F_VALUE_TO_SEND** (int)(1<<0)
- #define **F_VALUE_TO_RECEIVE** (int)(1<<1)
- #define **F_FEE_VALUE_RAW_128** F_NANO_B_RAW_128
- #define **F_FEE_VALUE_REAL_STRING** F_NANO_B_REAL_STRING
- #define **F_FEE_VALUE_RAW_STRING** F_NANO_B_RAW_STRING

Typedefs

- typedef uint8_t **F_TOKEN**[16]
- typedef uint8_t **NANO_SEED**[crypto_sign_SEEDBYTES]
- typedef uint8_t **f_uint128_t**[16]
- typedef uint8_t **NANO_PRIVATE_KEY**[sizeof(**NANO_SEED**)]
- typedef uint8_t **NANO_PRIVATE_KEY_EXTENDED**[crypto_sign_ed25519_SECRETKEYBYTES]
- typedef uint8_t **NANO_PUBLIC_KEY**[crypto_sign_ed25519_PUBLICKEYBYTES]
- typedef uint8_t **NANO_PUBLIC_KEY_EXTENDED**[**PUB_KEY_EXTENDED_MAX_LEN**]
- typedef enum **f_nano_err_t f_nano_err**
- typedef enum **f_write_seed_err_t f_write_seed_err**
- typedef enum **f_file_info_err_t F_FILE_INFO_ERR**
- typedef enum **f_nano_create_block_dyn_err_t F_NANO_CREATE_BLOCK_DYN_ERR**
- typedef enum **f_nano_p2pow_block_dyn_err_t F_NANO_P2POW_BLOCK_DYN_ERR**

Enumerations

- enum **f_nano_err_t** {
  NANO_ERR_OK =0, **NANO_ERR_CANT_PARSE_BN_STR** =5151, **NANO_ERR_MALLOC**, **NANO_E**↩
  RR_CANT_PARSE_FACTOR,
  NANO_ERR_MPI_MULT, **NANO_ERR_CANT_PARSE_TO_BLK_TRANSFER**, **NANO_ERR_EMPTY_**↩
  STR, **NANO_ERR_CANT_PARSE_VALUE**,
  NANO_ERR_PARSE_MPI_TO_STR, **NANO_ERR_CANT_COMPLETE_NULL_CHAR**, **NANO_ERR_C**↩
  ANT_PARSE_TO_MPI, **NANO_ERR_INSUFICIENT_FUNDS**,
  NANO_ERR_SUB_MPI, **NANO_ERR_ADD_MPI**, **NANO_ERR_NO_SENSE_VALUE_TO_SEND_NEG**↩
  ATIVE, **NANO_ERR_NO_SENSE_VALUE_TO_SEND_ZERO**,
  NANO_ERR_NO_SENSE_BALANCE_NEGATIVE, **NANO_ERR_VAL_A_INVALID_MODE**, **NANO_ER**↩
  R_CANT_PARSE_TO_TEMP_UINT128_T, **NANO_ERR_VAL_B_INVALID_MODE**,
  NANO_ERR_CANT_PARSE_RAW_A_TO_MPI, **NANO_ERR_CANT_PARSE_RAW_B_TO_MPI**, **NAN**↩
  O_ERR_UNKNOWN_ADD_SUB_MODE, **NANO_ERR_INVALID_RES_OUTPUT** }
- enum **f_write_seed_err_t** {
  WRITE_ERR_OK =0, **WRITE_ERR_NULL_PASSWORD** =7180, **WRITE_ERR_EMPTY_STRING**, **WRI**↩
  TE_ERR_MALLOC,
  WRITE_ERR_ENCRYPT_PRIV_KEY, **WRITE_ERR_GEN_SUB_PRIV_KEY**, **WRITE_ERR_GEN_MAIN**↩
  _PRIV_KEY, **WRITE_ERR_ENCRYPT_SUB_BLOCK**,
  WRITE_ERR_UNKNOWN_OPTION, **WRITE_ERR_FILE_ALREDY_EXISTS**, **WRITE_ERR_CREATING**↩
  _FILE, **WRITE_ERR_WRITING_FILE** }
- enum **f_file_info_err_t** {
  F_FILE_INFO_ERR_OK =0, **F_FILE_INFO_ERR_CANT_OPEN_INFO_FILE** =7001, **F_FILE_INFO_ER**↩
  R_NANO_SEED_ENCRYPTED_FILE_NOT_FOUND, **F_FILE_INFO_ERR_CANT_DELETE_NANO_IN**↩
  FO_FILE,
  F_FILE_INFO_ERR_MALLOC, **F_FILE_INFO_ERR_CANT_READ_NANO_SEED_ENCRYPTED_FILE**,
  F_FILE_INFO_ERR_CANT_READ_INFO_FILE, **F_FILE_INFO_INVALID_HEADER_FILE**,
  F_FILE_INFO_ERR_INVALID_SHA256_INFO_FILE, **F_FILE_INFO_ERR_NANO_SEED_HASH_FAIL**,
  F_FILE_INFO_ERR_NANO_INVALID_REPRESENTATIVE, **F_FILE_INFO_ERR_NANO_INVALID_MA**↩
  X_FEE_VALUE,
  F_FILE_INFO_ERR_OPEN_FOR_WRITE_INFO, **F_FILE_INFO_ERR_EXISTING_FILE**, **F_FILE_INFO**↩
  _ERR_CANT_WRITE_FILE_INFO }
- enum **f_nano_create_block_dyn_err_t** {
  NANO_CREATE_BLK_DYN_OK = 0, **NANO_CREATE_BLK_DYN_BLOCK_NULL** = 8000, **NANO_CR**↩
  EATE_BLK_DYN_ACCOUNT_NULL, **NANO_CREATE_BLK_DYN_COMPARE_BALANCE**,
  NANO_CREATE_BLK_DYN_GENESIS_WITH_NON_EMPTY_BALANCE, **NANO_CREATE_BLK_DY**↩
  N_CANT_SEND_IN_GENESIS_BLOCK, **NANO_CREATE_BLK_DYN_REP_NULL**, **NANO_CREATE_**↩
  BLK_DYN_BALANCE_NULL,
  NANO_CREATE_BLK_DYN_SEND_RECEIVE_NULL, **NANO_CREATE_BLK_DYN_LINK_NULL**, **NA**↩
  NO_CREATE_BLK_DYN_BUF_MALLOC, **NANO_CREATE_BLK_DYN_MALLOC**,

NANO_CREATE_BLK_DYN_WRONG_PREVIOUS_SZ, NANO_CREATE_BLK_DYN_WRONG_PREVI↩
OUS_STR_SZ, NANO_CREATE_BLK_DYN_PARSE_STR_HEX_ERR, NANO_CREATE_BLK_DYN_↩
FORBIDDEN_AMOUNT_TYPE,
NANO_CREATE_BLK_DYN_COMPARE, NANO_CREATE_BLK_DYN_EMPTY_VAL_TO_SEND_OR_↩
REC, NANO_CREATE_BLK_DYN_INVALID_DIRECTION_OPTION }

- enum **f_nano_p2pow_block_dyn_err_t** {
NANO_P2POW_CREATE_BLOCK_OK = 0, NANO_P2POW_CREATE_BLOCK_INVALID_USER_BLO↩
CK = 8400, NANO_P2POW_CREATE_BLOCK_MALLOC, NANO_P2POW_CREATE_BLOCK_NULL,
NANO_P2POW_CREATE_OUTPUT, NANO_P2POW_CREATE_OUTPUT_MALLOC }

Functions

- struct **f_block_transfer_t __attribute__** ((packed)) F_BLOCK_TRANSFER
- double **to_multiplier** (uint64_t, uint64_t)
- uint64_t **from_multiplier** (double, uint64_t)
- void **f_set_dictionary_path** (const char ∗)
- char ∗ **f_get_dictionary_path** (void)
- int **f_generate_token** (**F_TOKEN**, void ∗, size_t, const char ∗)
- int **f_verify_token** (**F_TOKEN**, void ∗, size_t, const char ∗)
- int **f_cloud_crypto_wallet_nano_create_seed** (size_t, char ∗, char ∗)
- int **f_generate_nano_seed** (**NANO_SEED**, uint32_t)
- int **pk_to_wallet** (char ∗, char ∗, **NANO_PUBLIC_KEY_EXTENDED**)
- int **f_seed_to_nano_wallet** (**NANO_PRIVATE_KEY**, **NANO_PUBLIC_KEY**, **NANO_SEED**, uint32_t)
- int **f_nano_is_valid_block** (F_BLOCK_TRANSFER ∗)
- int **f_nano_block_to_json** (char ∗, size_t ∗, size_t, F_BLOCK_TRANSFER ∗)
- int **f_nano_get_block_hash** (uint8_t ∗, F_BLOCK_TRANSFER ∗)
- int **f_nano_get_p2pow_block_hash** (uint8_t ∗, uint8_t ∗, F_BLOCK_TRANSFER ∗)
- int **f_nano_p2pow_to_JSON** (char ∗, size_t ∗, size_t, F_BLOCK_TRANSFER ∗)
- char ∗ **f_nano_key_to_str** (char ∗, unsigned char ∗)
- int **f_nano_seed_to_bip39** (char ∗, size_t, size_t ∗, **NANO_SEED**, char ∗)
- int **f_bip39_to_nano_seed** (uint8_t ∗, char ∗, char ∗)
- int **f_parse_nano_seed_and_bip39_to_JSON** (char ∗, size_t, size_t ∗, void ∗, int, const char ∗)
- int **f_read_seed** (uint8_t ∗, const char ∗, void ∗, int, int)
- int **f_nano_raw_to_string** (char ∗, size_t ∗, size_t, void ∗, int)
- int **f_nano_valid_nano_str_value** (const char ∗)
- int **valid_nano_wallet** (const char ∗)
- int **nano_base_32_2_hex** (uint8_t ∗, char ∗)
- int **f_nano_transaction_to_JSON** (char ∗, size_t, size_t ∗, **NANO_PRIVATE_KEY_EXTENDED**, F_BL↩
OCK_TRANSFER ∗)
- int **valid_raw_balance** (const char ∗)
- int **is_null_hash** (uint8_t ∗)
- int **is_nano_prefix** (const char ∗, const char ∗)
- **F_FILE_INFO_ERR f_get_nano_file_info** (F_NANO_WALLET_INFO ∗)
- **F_FILE_INFO_ERR f_set_nano_file_info** (F_NANO_WALLET_INFO ∗, int)
- **f_nano_err f_nano_value_compare_value** (void ∗, void ∗, uint32_t ∗)
- **f_nano_err f_nano_verify_nano_funds** (void ∗, void ∗, void ∗, uint32_t)
- **f_nano_err f_nano_parse_raw_str_to_raw128_t** (uint8_t ∗, const char ∗)
- **f_nano_err f_nano_parse_real_str_to_raw128_t** (uint8_t ∗, const char ∗)
- **f_nano_err f_nano_add_sub** (void ∗, void ∗, void ∗, uint32_t)
- int **f_nano_sign_block** (F_BLOCK_TRANSFER ∗, F_BLOCK_TRANSFER ∗, **NANO_PRIVATE_KEY_E↩
XTENDED**)
- **f_write_seed_err f_write_seed** (void ∗, int, uint8_t ∗, char ∗)
- **f_nano_err f_nano_balance_to_str** (char ∗, size_t, size_t ∗, **f_uint128_t**)
- int **f_extract_seed_from_brainwallet** (uint8_t ∗, char ∗∗, uint32_t, const char ∗, const char ∗)

- int **f_verify_work** (uint64_t ∗, const unsigned char ∗, uint64_t ∗, uint64_t)
- int **f_sign_data** (unsigned char ∗ **signature**, void ∗out_public_key, uint32_t ouput_type, const unsigned char ∗message, size_t msg_len, const unsigned char ∗private_key)
- int **f_verify_signed_data** (const unsigned char ∗, const unsigned char ∗, size_t, const void ∗, uint32_t)
- int **f_is_valid_nano_seed_encrypted** (void ∗, size_t, int)
- int **nano_create_block_dynamic** (F_BLOCK_TRANSFER ∗∗, const void ∗, size_t, const void ∗, size_t, const void ∗, size_t, const void ∗, const void ∗, uint32_t, const void ∗, size_t, int)
- int **nano_create_p2pow_block_dynamic** (F_BLOCK_TRANSFER ∗∗, F_BLOCK_TRANSFER ∗, const void ∗, size_t, const void ∗, uint32_t, const void ∗, size_t)
- int **f_verify_signed_block** (F_BLOCK_TRANSFER ∗)
- int **f_nano_pow** (uint64_t ∗, unsigned char ∗, const uint64_t, int)

Variables

- uint8_t **preamble** [32]
- uint8_t **account** [32]
- uint8_t **previous** [32]
- uint8_t **representative** [32]
- **f_uint128_t balance**
- uint8_t **link** [32]
- uint8_t **signature** [64]
- uint8_t **prefixes**
- uint64_t **work**
- uint8_t **sub_salt** [32]
- uint8_t **iv** [16]
- uint8_t **reserved** [16]
- uint8_t **hash_sk_unencrypted** [32]
- uint8_t **sk_encrypted** [32]
- uint8_t **nano_hdr** [sizeof(NANO_WALLET_MAGIC)]
- uint32_t **ver**
- uint8_t **description** [F_DESC_SZ]
- uint8_t **salt** [32]
- F_ENCRYPTED_BLOCK **seed_block**
- uint8_t **wallet_prefix**
- uint32_t **last_used_wallet_number**
- char **wallet_representative** [**MAX_STR_NANO_CHAR**]
- char **max_fee** [F_RAW_STR_MAX_SZ]
- uint8_t **header** [sizeof(F_NANO_WALLET_INFO_MAGIC)]
- uint16_t **version**
- char **desc** [F_NANO_DESC_SZ]
- uint8_t **nanoseed_hash** [32]
- uint8_t **file_info_integrity** [32]
- F_NANO_WALLET_INFO_BODY **body**

5.7.1 Detailed Description

This API Integrates Nano Cryptocurrency to low computational devices.

Definition in file **f_nano_crypto_util.h**.

5.7.2 Macro Definition Documentation

5.7.2.1 DEST_XRB

```
#define DEST_XRB (uint8_t)0x01
```

Definition at line **438** of file **f_nano_crypto_util.h**.

5.7.2.2 F_BALANCE_RAW_128

```
#define F_BALANCE_RAW_128 F_NANO_A_RAW_128
```

Balance is RAW 128 bit.

Definition at line **1450** of file **f_nano_crypto_util.h**.

5.7.2.3 F_BALANCE_RAW_STRING

```
#define F_BALANCE_RAW_STRING F_NANO_A_RAW_STRING
```

Balance is raw string.

Definition at line **1462** of file **f_nano_crypto_util.h**.

5.7.2.4 F_BALANCE_REAL_STRING

```
#define F_BALANCE_REAL_STRING F_NANO_A_REAL_STRING
```

Balance is real string.

Definition at line **1456** of file **f_nano_crypto_util.h**.

5.7.2.5 F_BLOCK_TRANSFER_SIZE

```
#define F_BLOCK_TRANSFER_SIZE (size_t)sizeof(F_BLOCK_TRANSFER)
```

Definition at line **289** of file **f_nano_crypto_util.h**.

5.7.2.6   F_BRAIN_WALLET_BAD

```
#define F_BRAIN_WALLET_BAD (uint32_t)3
```

[bad].

Crack within one day

Definition at line **1207** of file **f_nano_crypto_util.h**.

5.7.2.7   F_BRAIN_WALLET_GOOD

```
#define F_BRAIN_WALLET_GOOD (uint32_t)8
```

[good].

Crack within one thousand year

Definition at line **1238** of file **f_nano_crypto_util.h**.

5.7.2.8   F_BRAIN_WALLET_MAYBE_GOOD

```
#define F_BRAIN_WALLET_MAYBE_GOOD (uint32_t)7
```

[maybe good for you].

Crack within one century

Definition at line **1231** of file **f_nano_crypto_util.h**.

5.7.2.9   F_BRAIN_WALLET_NICE

```
#define F_BRAIN_WALLET_NICE (uint32_t)10
```

[very nice].

Crack withing one hundred thousand year

Definition at line **1250** of file **f_nano_crypto_util.h**.

5.7.2.10 F_BRAIN_WALLET_PERFECT

`#define F_BRAIN_WALLET_PERFECT (uint32_t)11`

[Perfect!] 3.34x10^{53} Years to crack

Definition at line **1256** of file **f_nano_crypto_util.h**.

5.7.2.11 F_BRAIN_WALLET_POOR

`#define F_BRAIN_WALLET_POOR (uint32_t)1`

[poor].

Crack within minutes

Definition at line **1195** of file **f_nano_crypto_util.h**.

5.7.2.12 F_BRAIN_WALLET_STILL_WEAK

`#define F_BRAIN_WALLET_STILL_WEAK (uint32_t)6`

[still weak].

Crack within one year

Definition at line **1225** of file **f_nano_crypto_util.h**.

5.7.2.13 F_BRAIN_WALLET_VERY_BAD

`#define F_BRAIN_WALLET_VERY_BAD (uint32_t)2`

[very bad].

Crack within one hour

Definition at line **1201** of file **f_nano_crypto_util.h**.

5.7.2.14 F_BRAIN_WALLET_VERY_GOOD

```
#define F_BRAIN_WALLET_VERY_GOOD (uint32_t)9
```

[very good].

Crack within ten thousand year

Definition at line **1244** of file **f_nano_crypto_util.h**.

5.7.2.15 F_BRAIN_WALLET_VERY_POOR

```
#define F_BRAIN_WALLET_VERY_POOR (uint32_t)0
```

[very poor].

Crack within seconds or less

Definition at line **1189** of file **f_nano_crypto_util.h**.

5.7.2.16 F_BRAIN_WALLET_VERY_WEAK

```
#define F_BRAIN_WALLET_VERY_WEAK (uint32_t)4
```

[very weak].

Crack within one week

Definition at line **1213** of file **f_nano_crypto_util.h**.

5.7.2.17 F_BRAIN_WALLET_WEAK

```
#define F_BRAIN_WALLET_WEAK (uint32_t)5
```

[weak].

Crack within one month

Definition at line **1219** of file **f_nano_crypto_util.h**.

5.7.2.18 F_DEFAULT_THRESHOLD

```
#define F_DEFAULT_THRESHOLD (uint64_t) 0xffffffc000000000
```

Default Nano Proof of Work Threshold.

Definition at line **1359** of file **f_nano_crypto_util.h**.

5.7.2.19 F_FEE_VALUE_RAW_128

```
#define F_FEE_VALUE_RAW_128 F_NANO_B_RAW_128
```

P2PoW fee value is raw 128 bit.

Definition at line **1498** of file **f_nano_crypto_util.h**.

5.7.2.20 F_FEE_VALUE_RAW_STRING

```
#define F_FEE_VALUE_RAW_STRING F_NANO_B_RAW_STRING
```

P2PoW fee value is raw string.

Definition at line **1510** of file **f_nano_crypto_util.h**.

5.7.2.21 F_FEE_VALUE_REAL_STRING

```
#define F_FEE_VALUE_REAL_STRING F_NANO_B_REAL_STRING
```

P2PoW fee value is real string.

Definition at line **1504** of file **f_nano_crypto_util.h**.

5.7.2.22 F_IS_SIGNATURE_RAW_HEX_STRING

```
#define F_IS_SIGNATURE_RAW_HEX_STRING (uint32_t)64
```

Signature is raw hex string flag.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1346** of file **f_nano_crypto_util.h**.

5.7.2.23 F_MESSAGE_IS_HASH_STRING

```
#define F_MESSAGE_IS_HASH_STRING (uint32_t)128
```

Message is raw hex hash string.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1353** of file **f_nano_crypto_util.h**.

5.7.2.24 F_NANO_POW_MAX_THREAD

```
#define F_NANO_POW_MAX_THREAD (size_t)10
```

(desktop only) Number of threads for Proof of Work routines.

Default 10

Definition at line **138** of file **f_nano_crypto_util.h**.

5.7.2.25 F_P2POW_BLOCK_TRANSFER_SIZE

```
#define F_P2POW_BLOCK_TRANSFER_SIZE 2* F_BLOCK_TRANSFER_SIZE
```

Definition at line **290** of file **f_nano_crypto_util.h**.

5.7.2.26 F_PUBLIC_KEY_ASCII_HEX

```
#define F_PUBLIC_KEY_ASCII_HEX (uint32_t)4
```

Public key is a hex ASCII encoded string.

See also

> **f_verify_signed_data()** (p. **??**)

Definition at line **1411** of file **f_nano_crypto_util.h**.

5.7.2.27 F_PUBLIC_KEY_RAW_HEX

`#define F_PUBLIC_KEY_RAW_HEX (uint32_t)2`

Public key raw 32 bytes data.

See also

> **f_verify_signed_data()** (p. **??**)

Definition at line **1404** of file **f_nano_crypto_util.h**.

5.7.2.28 F_SIGNATURE_OUTPUT_NANO_PK

`#define F_SIGNATURE_OUTPUT_NANO_PK (uint32_t)32`

Public key is a NANO wallet encoded base32 string.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1339** of file **f_nano_crypto_util.h**.

5.7.2.29 F_SIGNATURE_OUTPUT_RAW_PK

`#define F_SIGNATURE_OUTPUT_RAW_PK (uint32_t)4`

Public key is raw data.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1318** of file **f_nano_crypto_util.h**.

5.7.2.30 F_SIGNATURE_OUTPUT_STRING_PK

`#define F_SIGNATURE_OUTPUT_STRING_PK (uint32_t)8`

Public key is hex ASCII encoded string.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1325** of file **f_nano_crypto_util.h**.

5.7.2.31 F_SIGNATURE_OUTPUT_XRB_PK

```
#define F_SIGNATURE_OUTPUT_XRB_PK (uint32_t)16
```

Public key is a XRB wallet encoded base32 string.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1332** of file **f_nano_crypto_util.h**.

5.7.2.32 F_SIGNATURE_RAW

```
#define F_SIGNATURE_RAW (uint32_t)1
```

Signature is raw data.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1304** of file **f_nano_crypto_util.h**.

5.7.2.33 F_SIGNATURE_STRING

```
#define F_SIGNATURE_STRING (uint32_t)2
```

Signature is hex ASCII encoded string.

See also

> **f_sign_data()** (p. **??**)

Definition at line **1311** of file **f_nano_crypto_util.h**.

5.7.2.34 F_VALUE_SEND_RECEIVE_RAW_128

```
#define F_VALUE_SEND_RECEIVE_RAW_128 F_NANO_B_RAW_128
```

Value to send or receive is RAW 128 bit.

Definition at line **1468** of file **f_nano_crypto_util.h**.

5.7.2.35 F_VALUE_SEND_RECEIVE_RAW_STRING

```
#define F_VALUE_SEND_RECEIVE_RAW_STRING F_NANO_B_RAW_STRING
```

Value to send or receive is raw string.

Definition at line **1480** of file **f_nano_crypto_util.h**.

5.7.2.36 F_VALUE_SEND_RECEIVE_REAL_STRING

```
#define F_VALUE_SEND_RECEIVE_REAL_STRING F_NANO_B_REAL_STRING
```

Value to send or receive is real string.

Definition at line **1474** of file **f_nano_crypto_util.h**.

5.7.2.37 F_VALUE_TO_RECEIVE

```
#define F_VALUE_TO_RECEIVE (int)(1<<1)
```

Value to receive.

Definition at line **1492** of file **f_nano_crypto_util.h**.

5.7.2.38 F_VALUE_TO_SEND

```
#define F_VALUE_TO_SEND (int)(1<<0)
```

Value to send.

Definition at line **1486** of file **f_nano_crypto_util.h**.

5.7.2.39 F_VERIFY_SIG_NANO_WALLET

```
#define F_VERIFY_SIG_NANO_WALLET (uint32_t)1
```

Public key is a NANO wallet with *XRB* or *NANO* prefixes encoded base32 string.

See also

> **f_verify_signed_data()** (p. **??**)

Definition at line **1397** of file **f_nano_crypto_util.h**.

5.7.2.40 MAX_STR_NANO_CHAR

```
#define MAX_STR_NANO_CHAR (size_t)70
```

Defines a max size of Nano char (70 bytes)

Definition at line **150** of file **f_nano_crypto_util.h**.

5.7.2.41 NANO_ENCRYPTED_SEED_FILE

```
#define NANO_ENCRYPTED_SEED_FILE "/spiffs/secure/nano.nse"
```

Path to non deterministic encrypted file with password.

File containing the SEED of the Nano wallets generated by TRNG (if available in your Hardware) or PRNG. Default name: "nano.nse"

Definition at line **192** of file **f_nano_crypto_util.h**.

5.7.2.42 NANO_FILE_WALLETS_INFO

```
#define NANO_FILE_WALLETS_INFO "/spiffs/secure/walletsinfo.i"
```

Custom information file path about Nano SEED wallet stored in "walletsinfo.i".

Definition at line **210** of file **f_nano_crypto_util.h**.

5.7.2.43 NANO_PASSWD_MAX_LEN

```
#define NANO_PASSWD_MAX_LEN (size_t)80
```

Password max length.

Definition at line **198** of file **f_nano_crypto_util.h**.

5.7.2.44 NANO_PREFIX

```
#define NANO_PREFIX "nano_"
```

Nano prefix.

Definition at line **162** of file **f_nano_crypto_util.h**.

5.7.2.45 PUB_KEY_EXTENDED_MAX_LEN

`#define PUB_KEY_EXTENDED_MAX_LEN (size_t)40`

Max size of public key (extended)

Definition at line **156** of file **f_nano_crypto_util.h**.

5.7.2.46 REP_XRB

`#define REP_XRB (uint8_t)0x4`

Representative XRB flag.

Destination XRB flag.

Sender XRB flag.

5.7.2.47 SENDER_XRB

`#define SENDER_XRB (uint8_t)0x02`

Definition at line **432** of file **f_nano_crypto_util.h**.

5.7.2.48 STR_NANO_SZ

`#define STR_NANO_SZ (size_t)66`

String size of Nano encoded Base32 including NULL char.

Definition at line **204** of file **f_nano_crypto_util.h**.

5.7.2.49 XRB_PREFIX

`#define XRB_PREFIX "xrb_"`

XRB (old Raiblocks) prefix.

Definition at line **168** of file **f_nano_crypto_util.h**.

5.7.3 Typedef Documentation

5.7.3.1 F_FILE_INFO_ERR

` F_FILE_INFO_ERR `

Typedef Error enumerator for info file functions.

5.7.3.2 F_NANO_CREATE_BLOCK_DYN_ERR

`typedef enum ` **`f_nano_create_block_dyn_err_t`** ` ` **`F_NANO_CREATE_BLOCK_DYN_ERR`**

5.7.3.3 f_nano_err

` f_nano_err `

Error function enumerator.

See also

> **f_nano_err_t** (p. **??**)

5.7.3.4 F_NANO_P2POW_BLOCK_DYN_ERR

`typedef enum ` **`f_nano_p2pow_block_dyn_err_t`** ` ` **`F_NANO_P2POW_BLOCK_DYN_ERR`**

5.7.3.5 F_TOKEN

`typedef uint8_t F_TOKEN[16]`

Definition at line **216** of file **f_nano_crypto_util.h**.

5.7.3.6 f_uint128_t

` f_uint128_t `

128 bit big number of Nano balance

Definition at line **228** of file **f_nano_crypto_util.h**.

5.7.3.7 f_write_seed_err

typedef enum **f_write_seed_err_t f_write_seed_err**

5.7.3.8 NANO_PRIVATE_KEY

NANO_PRIVATE_KEY

Size of Nano Private Key.

Definition at line **238** of file **f_nano_crypto_util.h**.

5.7.3.9 NANO_PRIVATE_KEY_EXTENDED

NANO_PRIVATE_KEY_EXTENDED

Size of Nano Private Key extended.

Definition at line **244** of file **f_nano_crypto_util.h**.

5.7.3.10 NANO_PUBLIC_KEY

NANO_PUBLIC_KEY

Size of Nano Public Key.

Definition at line **250** of file **f_nano_crypto_util.h**.

5.7.3.11 NANO_PUBLIC_KEY_EXTENDED

NANO_PUBLIC_KEY_EXTENDED

Size of Public Key Extended.

Definition at line **256** of file **f_nano_crypto_util.h**.

5.7.3.12 NANO_SEED

NANO_SEED

Size of Nano SEED.

Definition at line **222** of file **f_nano_crypto_util.h**.

5.7.4 Enumeration Type Documentation

5.7.4.1 f_file_info_err_t

enum **f_file_info_err_t**

Enumerator

F_FILE_INFO_ERR_OK	SUCCESS.
F_FILE_INFO_ERR_CANT_OPEN_INFO_FILE	Can't open info file.
F_FILE_INFO_ERR_NANO_SEED_ENCRYPTED_FILE_NO↵T_FOUND	Encrypted file with Nano SEED not found.
F_FILE_INFO_ERR_CANT_DELETE_NANO_INFO_FILE	Can not delete Nano info file.
F_FILE_INFO_ERR_MALLOC	Fatal Error MALLOC.
F_FILE_INFO_ERR_CANT_READ_NANO_SEED_ENCRYP↵TED_FILE	Can not read encrypted Nano SEED in file.
F_FILE_INFO_ERR_CANT_READ_INFO_FILE	Can not read info file.
F_FILE_INFO_INVALID_HEADER_FILE	Invalid info file header.
F_FILE_INFO_ERR_INVALID_SHA256_INFO_FILE	Invalid SHA256 info file.
F_FILE_INFO_ERR_NANO_SEED_HASH_FAIL	Nano SEED hash failed.
F_FILE_INFO_ERR_NANO_INVALID_REPRESENTATIVE	Invalid representative.
F_FILE_INFO_ERR_NANO_INVALID_MAX_FEE_VALUE	Invalid max fee value.
F_FILE_INFO_ERR_OPEN_FOR_WRITE_INFO	Can not open info file for write.
F_FILE_INFO_ERR_EXISTING_FILE	Error File Exists.
F_FILE_INFO_ERR_CANT_WRITE_FILE_INFO	Can not write info file.

Definition at line **544** of file **f_nano_crypto_util.h**.

5.7.4.2 f_nano_create_block_dyn_err_t

enum **f_nano_create_block_dyn_err_t**

Enumerator

NANO_CREATE_BLK_DYN_OK	
NANO_CREATE_BLK_DYN_BLOCK_NULL	
NANO_CREATE_BLK_DYN_ACCOUNT_NULL	
NANO_CREATE_BLK_DYN_COMPARE_BALANCE	
NANO_CREATE_BLK_DYN_GENESIS_WITH_NON_EMPTY_BALANCE	
NANO_CREATE_BLK_DYN_CANT_SEND_IN_GENESIS_BLOCK	
NANO_CREATE_BLK_DYN_REP_NULL	
NANO_CREATE_BLK_DYN_BALANCE_NULL	
NANO_CREATE_BLK_DYN_SEND_RECEIVE_NULL	
NANO_CREATE_BLK_DYN_LINK_NULL	
NANO_CREATE_BLK_DYN_BUF_MALLOC	
NANO_CREATE_BLK_DYN_MALLOC	
NANO_CREATE_BLK_DYN_WRONG_PREVIOUS_SZ	
NANO_CREATE_BLK_DYN_WRONG_PREVIOUS_STR_SZ	
NANO_CREATE_BLK_DYN_PARSE_STR_HEX_ERR	
NANO_CREATE_BLK_DYN_FORBIDDEN_AMOUNT_TYPE	
NANO_CREATE_BLK_DYN_COMPARE	
NANO_CREATE_BLK_DYN_EMPTY_VAL_TO_SEND_OR_REC	
NANO_CREATE_BLK_DYN_INVALID_DIRECTION_OPTION	

Definition at line **604** of file **f_nano_crypto_util.h**.

5.7.4.3 f_nano_err_t

enum **f_nano_err_t**

Enumerator

NANO_ERR_OK	SUCCESS.
NANO_ERR_CANT_PARSE_BN_STR	Can not parse string big number.
NANO_ERR_MALLOC	Fatal ERROR MALLOC.
NANO_ERR_CANT_PARSE_FACTOR	Can not parse big number factor.
NANO_ERR_MPI_MULT	Error multiplication MPI.
NANO_ERR_CANT_PARSE_TO_BLK_TRANSFER	Can not parse to block transfer.
NANO_ERR_EMPTY_STR	Error empty string.
NANO_ERR_CANT_PARSE_VALUE	Can not parse value.
NANO_ERR_PARSE_MPI_TO_STR	Can not parse MPI to string.
NANO_ERR_CANT_COMPLETE_NULL_CHAR	Can not complete NULL char.
NANO_ERR_CANT_PARSE_TO_MPI	Can not parse to MPI.
NANO_ERR_INSUFICIENT_FUNDS	Insuficient funds.
NANO_ERR_SUB_MPI	Error subtract MPI.
NANO_ERR_ADD_MPI	Error add MPI.
NANO_ERR_NO_SENSE_VALUE_TO_SEND_NEGATIVE	Does not make sense send negativative balance.
NANO_ERR_NO_SENSE_VALUE_TO_SEND_ZERO	Does not make sense send empty value.
NANO_ERR_NO_SENSE_BALANCE_NEGATIVE	Does not make sense negative balance.
NANO_ERR_VAL_A_INVALID_MODE	Invalid A mode value.
NANO_ERR_CANT_PARSE_TO_TEMP_UINT128_T	Can not parse temporary memory to uint_128_t.
NANO_ERR_VAL_B_INVALID_MODE	Invalid A mode value.
NANO_ERR_CANT_PARSE_RAW_A_TO_MPI	Can not parse raw A value to MPI.
NANO_ERR_CANT_PARSE_RAW_B_TO_MPI	Can not parse raw B value to MPI.
NANO_ERR_UNKNOWN_ADD_SUB_MODE	Unknown ADD/SUB mode.
NANO_ERR_INVALID_RES_OUTPUT	Invalid output result.

Definition at line **303** of file **f_nano_crypto_util.h**.

5.7.4.4 f_nano_p2pow_block_dyn_err_t

enum **f_nano_p2pow_block_dyn_err_t**

Enumerator

NANO_P2POW_CREATE_BLOCK_OK	
NANO_P2POW_CREATE_BLOCK_INVALID_USER_BLOCK	
NANO_P2POW_CREATE_BLOCK_MALLOC	
NANO_P2POW_CREATE_BLOCK_NULL	
NANO_P2POW_CREATE_OUTPUT	
NANO_P2POW_CREATE_OUTPUT_MALLOC	

Definition at line **627** of file **f_nano_crypto_util.h**.

5.7.4.5 f_write_seed_err_t

enum **f_write_seed_err_t**

Enumerator

WRITE_ERR_OK	Error SUCCESS.
WRITE_ERR_NULL_PASSWORD	Error NULL password.
WRITE_ERR_EMPTY_STRING	Empty string.
WRITE_ERR_MALLOC	Error MALLOC.
WRITE_ERR_ENCRYPT_PRIV_KEY	Error encrypt private key.
WRITE_ERR_GEN_SUB_PRIV_KEY	Can not generate sub private key.
WRITE_ERR_GEN_MAIN_PRIV_KEY	Can not generate main private key.
WRITE_ERR_ENCRYPT_SUB_BLOCK	Can not encrypt sub block.
WRITE_ERR_UNKNOWN_OPTION	Unknown option.
WRITE_ERR_FILE_ALREDY_EXISTS	File already exists.
WRITE_ERR_CREATING_FILE	Can not create file.
WRITE_ERR_WRITING_FILE	Can not write file.

Definition at line **440** of file **f_nano_crypto_util.h**.

5.7.5 Function Documentation

5.7.5.1 __attribute__()

struct **f_block_transfer_t** __attribute__ (
        (packed))

5.7.5.2 f_bip39_to_nano_seed()

int f_bip39_to_nano_seed (
        uint8_t * *seed,*
        char * *str,*
        char * *dictionary*)

Parse Nano Bip39 encoded string to raw Nano SEED given a dictionary file.

Parameters

out	*seed*	Nano SEED
in	*str*	A encoded Bip39 string pointer
in	*dictionary*	A string pointer path to file

WARNING Sensive data. Do not share any SEED or Bip39 encoded string !

Return values

0	On Success, otherwise Error

See also

> **f_nano_seed_to_bip39()** (p. **??**)

5.7.5.3 f_cloud_crypto_wallet_nano_create_seed()

```
int f_cloud_crypto_wallet_nano_create_seed (
            size_t entropy,
            char * file_name,
            char * password )
```

Generates a new SEED and saves it to an non deterministic encrypted file.

password is mandatory

Parameters

in	*entropy*	Entropy type. Entropy type are: F_ENTROPY_TYPE_PARANOIC F_ENTROPY_TYPE_EXCELENT F_ENTROPY_TYPE_GOOD F_ENTROPY_TYPE_NOT_ENOUGH F_ENTROPY_TYPE_NOT_RECOMENDED
in	*file_name*	The file and path to be stored in your file system directory. It can be *NULL*. If you parse a *NULL* value then file will be stored in *NANO_ENCRYPTED_SEED_FILE* variable file system pointer.
in	*password*	Password of the encrypted file. It can NOT be *NULL* or EMPTY

WARNING

f_cloud_crypto_wallet_nano_create_seed() (p. **??***) does not verify your password. It is recommended to use a strong password like symbols, capital letters and numbers to keep your SEED safe and avoid brute force attacks.

You can use *f_pass_must_have_at_least()* (p. **??***) function to check passwords strength

---

Return values

0	On Success, otherwise Error

5.7.5.4 f_extract_seed_from_brainwallet()

```
int f_extract_seed_from_brainwallet (
            uint8_t * seed,
            char ** warning_msg,
            uint32_t allow_mode,
            const char * brainwallet,
            const char * salt )
```

Analyzes a text given a *mode* and if pass then the text in *braiwallet* is translated to a Nano SEED.

Parameters

out	*seed*	Output Nano SEED extracted from *brainwallet*
out	*warning_msg*	Warning message parsed to application. It can be NULL
in	*allow_mode*	Allow *mode*. Funtion will return SUCCESS only if permitted mode set by user
		Allow mode are:
		• *F_BRAIN_WALLET_VERY_POOR* Crack within seconds or less
		• *F_BRAIN_WALLET_POOR* Crack within minutes
		• *F_BRAIN_WALLET_VERY_BAD* Crack within one hour
		• *F_BRAIN_WALLET_BAD* Crack within one day
		• *F_BRAIN_WALLET_VERY_WEAK* Crack within one week
		• *F_BRAIN_WALLET_WEAK* Crack within one month
		• *F_BRAIN_WALLET_STILL_WEAK* Crack within one year
		• *F_BRAIN_WALLET_MAYBE_GOOD* Crack within one century
		• *F_BRAIN_WALLET_GOOD* Crack within one thousand year
		• *F_BRAIN_WALLET_VERY_GOOD* Crack within ten thousand year
		• *F_BRAIN_WALLET_NICE* Crack withing one hundred thousand year
		• *F_BRAIN_WALLET_PERFECT* 3.34×10^{53} Years to crack
in	*brainwallet*	Brainwallet text to be parsed. It can be NOT NULL or null string
in	*salt*	Salt of the Braiwallet. It can be NOT NULL or null string

Return values

0	If success, otherwise error.

See also

> **f_bip39_to_nano_seed()** (p. **??**)

5.7.5.5   f_generate_nano_seed()

```
int f_generate_nano_seed (
              NANO_SEED seed,
          uint32_t entropy )
```

Generates a new SEED and stores it to *seed* pointer.

Parameters

out	*seed*	SEED generated in system PRNG or TRNG
in	*entropy*	Entropy type. Entropy type are: F_ENTROPY_TYPE_PARANOIC F_ENTROPY_TYPE_EXCELENT F_ENTROPY_TYPE_GOOD F_ENTROPY_TYPE_NOT_ENOUGH F_ENTROPY_TYPE_NOT_RECOMENDED

Return values

0	On Success, otherwise Error

5.7.5.6   f_generate_token()

```
int f_generate_token (
              F_TOKEN signature,
          void * data,
          size_t data_sz,
          const char * password )
```

Generates a non deterministic token given a message data and a password.

Parameters

out	*signature*	128 bit non deterministic token
in	*data*	Data to be signed in token
in	*data_sz*	Size of data
in	*password*	Password

Return values

0	On Success, otherwise Error

See also

> **f_verify_token()** (p. **??**)

5.7.5.7 f_get_dictionary_path()

```
char * f_get_dictionary_path (
            void  )
```

Get default dictionary path in **myNanoEmbedded** library.

Return values

Path	and name of the dictionary file

See also

> **f_set_dictionary_path()** (p. **??**)

5.7.5.8 f_get_nano_file_info()

```
F_FILE_INFO_ERR f_get_nano_file_info (
            F_NANO_WALLET_INFO * info )
```

Opens default file *walletsinfo.i* (if exists) containing information *F_NANO_WALLET_INFO* structure and parsing to pointer *info* if success.

Parameters

out	*info*	Pointer to buffer to be parsed struct from *$PATH/walletsinfo.i* file.

Return values

F_FILE_INFO_ERR_OK	If Success, otherwise *F_FILE_INFO_ERR* enum type error

See also

> **F_FILE_INFO_ERR** (p. **??**) enum type error for detailed error and **f_nano_wallet_info_t** (p. **??**) for info type details

5.7.5.9 f_is_valid_nano_seed_encrypted()

```
int f_is_valid_nano_seed_encrypted (
            void * stream,
            size_t stream_len,
            int read_from )
```

Verifies if ecrypted Nano SEED is valid.

Parameters

in	*stream*	Encrypted binary data block coming from memory or file
in	*stream_len*	size of *stream* data
in	*read_from*	Source *READ_SEED_FROM_STREAM* if encrypted binary data is in memory or *READ_SEED_FROM_FILE* is in a file.

Return values

0	If invalid, greater than zero if is valid or error if less than zero.

5.7.5.10 f_nano_add_sub()

```
f_nano_err f_nano_add_sub (
            void * res,
            void * valA,
            void * valB,
            uint32_t mode )
```

Add/Subtract two Nano balance values and stores value in *res*

Parameters

out	*res*	Result value res = valA + valB or res = valA - valB
in	*valA*	Input balance A value
in	*valB*	Input balance B value

Parameters

in	*mode*	Mode type:
		• *F_NANO_ADD_A_B* valA + valB
		• *F_NANO_SUB_A_B* valA - valB
		• *F_NANO_RES_RAW_128* Output is a raw data 128 bit big number result
		• *F_NANO_RES_RAW_STRING* Output is a 128 bit Big Integer string
		• *F_NANO_RES_REAL_STRING* Output is a Real string value
		• *F_NANO_A_RAW_128* if *balance* is big number raw buffer type
		• *F_NANO_A_RAW_STRING* if *balance* is big number raw string type
		• *F_NANO_A_REAL_STRING* if *balance* is real number string type
		• *F_NANO_B_RAW_128* if *value_to_send* is big number raw buffer type
		• *F_NANO_B_RAW_STRING* if *value_to_send* is big number raw string type
		• *F_NANO_B_REAL_STRING* if *value_to_send* is real number string type

Return values

NANO_ERR_OK	If Success, otherwise f_nano_err_t enum type error

See also

> **f_nano_err_t** (p. **??**) for **f_nano_err** (p. **??**) enum error type

5.7.5.11 f_nano_balance_to_str()

```
f_nano_err f_nano_balance_to_str (
          char * str,
          size_t str_len,
          size_t * out_len,
          f_uint128_t value )
```

Converts a raw Nano balance to string raw balance.

Parameters

out	*str*	Output string pointer
in	*str_len*	Size of string pointer memory
out	*out_len*	Output length of converted value to string. If *out_len* is NULL then *str* returns converted value with NULL terminated string
in	*value*	Raw Nano balance value

Return values

0	If success, otherwise error.

See also

> function **f_nano_parse_raw_str_to_raw128_t()** (p. **??**) and return errors **f_nano_err** (p. **??**)

5.7.5.12 f_nano_block_to_json()

```
int f_nano_block_to_json (
            char * dest,
            size_t * olen,
            size_t dest_size,
            F_BLOCK_TRANSFER * user_block )
```

Parse a Nano Block to JSON.

Parameters

out	*dest*	Destination of the converted JSON block
out	*olen*	Output length of the converted JSON block. *olen* can be NULL. If NULL, destination size contains a NULL char
in	*dest_size*	Size of *destmemory buffer*
in	*user_block*	*User Nano block*

Returns

> *0 if success, non zero if error*

5.7.5.13 f_nano_get_block_hash()

```
int f_nano_get_block_hash (
            uint8_t * hash,
            F_BLOCK_TRANSFER * block )
```

Gets a hash from Nano block.

Parameters

out	*hash*	Output hash
in	*block*	Nano Block

Returns

0 if success, non zero if error

5.7.5.14   f_nano_get_p2pow_block_hash()

```
int f_nano_get_p2pow_block_hash (
            uint8_t * user_hash,
            uint8_t * fee_hash,
            F_BLOCK_TRANSFER * block )
```

Get Nano user block hash and Nano fee block hashes from P2PoW block.

Parameters

out	*user_hash*	Hash of the user block
out	*fee_hash*	Hash of the P2PoW block
in	*block*	Input Nano Block

Returns

0 if success, non zero if error

5.7.5.15   f_nano_is_valid_block()

```
int f_nano_is_valid_block (
            F_BLOCK_TRANSFER * block )
```

Checks if Binary Nano Block is valid.

Parameters

in	*block*	Nano Block

Returns

0 if is invalid block or 1 if is valid block

5.7.5.16   f_nano_key_to_str()

```
char * f_nano_key_to_str (
            char * out,
            unsigned char * key )
```

Parse a raw binary public key to string.

Parameters

out	*out*	Pointer to outuput string
in	*in*	Pointer to raw public key

Returns

A pointer to output string

5.7.5.17 f_nano_p2pow_to_JSON()

```
int f_nano_p2pow_to_JSON (
            char * buffer,
            size_t * olen,
            size_t buffer_sz,
            F_BLOCK_TRANSFER * block )
```

Parse binary P2PoW block to JSON.

Parameters

out	*buffer*	Output JSON string
out	*olen*	Output JSON string size. *olen* can be NULL. If NULL, *buffer* will be terminated with a NULL char
in	*buffer_sz*	Size of memory buffer
in	*block*	P2PoW block

Returns

0 if success, non zero if error

5.7.5.18 f_nano_parse_raw_str_to_raw128_t()

```
 f_nano_err f_nano_parse_raw_str_to_raw128_t (
            uint8_t * res,
            const char * raw_str_value )
```

Parse a raw string balance to raw big number 128 bit.

Parameters

out	*res*	Binary raw balance
in	*raw_str_value*	Raw balance string

Return values

NANO_ERR_OK	If Success, otherwise f_nano_err_t enum type error

See also

> **f_nano_err_t** (p. **??**) for **f_nano_err** (p. **??**) enum error type

5.7.5.19   f_nano_parse_real_str_to_raw128_t()

```
 f_nano_err f_nano_parse_real_str_to_raw128_t (
            uint8_t * res,
            const char * real_str_value )
```

Parse a real string balance to raw big number 128 bit.

Parameters

out	*res*	Binary raw balance
in	*real_str_value*	Real balance string

Return values

NANO_ERR_OK	If Success, otherwise f_nano_err_t enum type error

See also

> **f_nano_err_t** (p. **??**) for **f_nano_err** (p. **??**) enum error type

5.7.5.20   f_nano_pow()

```
int f_nano_pow (
            uint64_t * PoW_res,
            unsigned char * hash,
            const uint64_t threshold,
            int n_thr )
```

Calculates a Proof of Work given a *hash*, *threshold* and number of threads *n_thr*

Parameters

out	*PoW_res*	Output Proof of Work
in	*hash*	Input *hash*
in	*threshold*	Input *threshold*
in	*n_thr*	Number of threads. Default maximum value: 10. You can modify
		F_NANO_POW_MAX_THREAD in **f_nano_crypto_util.h** (p. **??**)

Mandatory: You need to enable attach a random function to your project using **f_random_attach()** (p. **??**)

Return values

| 0 | If success, otherwise error. |

See also

> **f_verify_work()** (p. **??**)

5.7.5.21 f_nano_raw_to_string()

```
int f_nano_raw_to_string (
            char * str,
            size_t * olen,
            size_t str_sz,
            void * raw,
            int raw_type )
```

Converts Nano raw balance [string | f_uint128_t] to real string value.

Parameters

out	*str*	Output real string value
out	*olen*	Size of output real string value. It can be NULL. If NULL output *str* will have a NULL char at the end.
in	*str_sz*	Size of *str* buffer
in	*raw*	Raw balance.
in	*raw_type*	Raw balance type:
		• F_RAW_TO_STR_UINT128 for raw **f_uint128_t** balance
		• F_RAW_TO_STR_STRING for raw **char** balance

Return values

| 0 | On Success, otherwise Error |

See also

> **f_nano_valid_nano_str_value()** (p. **??**)

5.7.5.22 f_nano_seed_to_bip39()

```
int f_nano_seed_to_bip39 (
            char * buf,
```

```
            size_t buf_sz,
            size_t * out_buf_len,
             NANO_SEED seed,
            char * dictionary_file )
```

Parse Nano SEED to Bip39 encoding given a dictionary file.

Parameters

out	*buf*	Output string containing encoded Bip39 SEED
in	*buf_sz*	Size of memory of buf pointer
out	*out_buf_len*	If *out_buf_len* is NOT NULL then *out_buf_len* returns the size of string encoded Bip39 and *out* with non NULL char. If *out_buf_len* is NULL then *out* has a string encoded Bip39 with a NULL char.
in	*seed*	Nano SEED
in	*dictionary_file*	Path to dictionary file

WARNING Sensive data. Do not share any SEED or Bip39 encoded string !

Return values

0	On Success, otherwise Error

See also

> **f_bip39_to_nano_seed()** (p. **??**)

5.7.5.23 f_nano_sign_block()

```
int f_nano_sign_block (
            F_BLOCK_TRANSFER * user_block,
            F_BLOCK_TRANSFER * fee_block,
             NANO_PRIVATE_KEY_EXTENDED private_key )
```

Signs *user_block* and worker *fee_block* given a private key *private_key*

Parameters

in,out	*user_block*	User block to be signed with a private key *private_key*
in,out	*fee_block*	Fee block to be signed with a private key *private_key*. Can be NULL if worker does not require fee
in	*private_key*	Private key to sign block(s)

Return values

0	If Success, otherwise error

See also

f_nano_transaction_to_JSON() (p. **??**)

5.7.5.24 f_nano_transaction_to_JSON()

```
int f_nano_transaction_to_JSON (
            char * str,
            size_t str_len,
            size_t * str_out,
             NANO_PRIVATE_KEY_EXTENDED private_key,
            F_BLOCK_TRANSFER * block_transfer )
```

Sign a block pointed in *block_transfer* with a given *private_key* and stores signed block to *block_transfer* and parse to JSON Nano RPC.

Parameters

out	*str*	A string pointer to store JSON Nano RPC
in	*str_len*	Size of buffer in *str* pointer
out	*str_out*	Size of JSON string. *str_out* can be NULL
in	*private_key*	Private key to sign the block *block_transfer*
in,out	*block_transfer*	Nano block containing raw data to be stored in Nano Blockchain

WARNING Sensive data. Do not share any PRIVATE KEY

Return values

0	On Success, otherwise Error

5.7.5.25 f_nano_valid_nano_str_value()

```
int f_nano_valid_nano_str_value (
            const char * str )
```

Check if a real string or raw string are valid Nano balance.

Parameters

in	*str*	Value to be checked

Return values

0	If valid, otherwise is invalid

See also

> **f_nano_raw_to_string()** (p. **??**)

5.7.5.26 f_nano_value_compare_value()

```
f_nano_err f_nano_value_compare_value (
            void * valA,
            void * valB,
            uint32_t * mode_compare )
```

Comparare two Nano balance.

Parameters

in	*valA*	Nano balance value A
in	*valB*	Nano balance value B
in,out	*mode_compare*	Input mode and output result Input mode: • *F_NANO_A_RAW_128* if *valA* is big number raw buffer type • *F_NANO_A_RAW_STRING* if *valA* is big number raw string type • *F_NANO_A_REAL_STRING* if *valA* is real number string type • *F_NANO_B_RAW_128* if *valB* is big number raw buffer type • *F_NANO_B_RAW_STRING* if *valB* is big number raw string type • *F_NANO_B_REAL_STRING* if *valB* is real number string type Output type: • *F_NANO_COMPARE_EQ* If *valA* is equal *valB* • *F_NANO_COMPARE_LT* if *valA* is lesser than *valB* • *F_NANO_COMPARE_GT* if *valA* is greater than *valB*

Return values

NANO_ERR_OK	If Success, otherwise f_nano_err_t enum type error

See also

> **f_nano_err_t** (p. **??**) for **f_nano_err** (p. **??**) enum error type

5.7.5.27   f_nano_verify_nano_funds()

```
f_nano_err f_nano_verify_nano_funds (
            void * balance,
            void * value_to_send,
            void * fee,
            uint32_t mode )
```

Check if Nano balance has sufficient funds.

Parameters

in	*balance*	Nano balance
in	*value_to_send*	Value to send
in	*fee*	Fee value (it can be NULL)
in	*mode*	Value type mode
		• *F_NANO_A_RAW_128* if *balance* is big number raw buffer type
		• *F_NANO_A_RAW_STRING* if *balance* is big number raw string type
		• *F_NANO_A_REAL_STRING* if *balance* is real number string type
		• *F_NANO_B_RAW_128* if *value_to_send* is big number raw buffer type
		• *F_NANO_B_RAW_STRING* if *value_to_send* is big number raw string type
		• *F_NANO_B_REAL_STRING* if *value_to_send* is real number string type
		• *F_NANO_C_RAW_128* if *fee* is big number raw buffer type (can be ommited if *fee* is NULL)
		• *F_NANO_C_RAW_STRING* if *fee* is big number raw string type (can be ommited if *fee* is NULL)
		• *F_NANO_C_REAL_STRING* if *fee* is real number string type (can be ommited if *fee* is NULL)

Return values

NANO_ERR_OK	If Success, otherwise f_nano_err_t enum type error

See also

> **f_nano_err_t** (p. **??**) for **f_nano_err** (p. **??**) enum error type

5.7.5.28   f_parse_nano_seed_and_bip39_to_JSON()

```
int f_parse_nano_seed_and_bip39_to_JSON (
            char * dest,
            size_t dest_sz,
            size_t * olen,
            void * source_data,
```

```
        int source,
        const char * password )
```

Parse Nano SEED and Bip39 to JSON given a encrypted data in memory or encrypted data in file or unencrypted seed in memory.

Parameters

out	*dest*	Destination JSON string pointer
in	*dest_sz*	Buffer size of *dest* pointer
out	*olen*	Size of the output JSON string. If NULL string JSON returns a NULL char at the end of string otherwise it will return the size of the string is stored into *olen* variable without NULL string in *dest*
in	*source_data*	Input data source (encrypted file | encrypted data in memory | unencrypted seed in memory)
in	*source*	Source data type: • PARSE_JSON_READ_SEED_GENERIC: If seed are in memory pointed in *source_data*. Password is ignored. Can be NULL. • READ_SEED_FROM_STREAM: Read encrypted data from stream pointed in *source_data*. Password is required. • READ_SEED_FROM_FILE: Read encrypted data stored in a file where *source_data* is path to file. Password is required.
in	*password*	Required for READ_SEED_FROM_STREAM and READ_SEED_FROM_FILE sources

WARNING Sensive data. Do not share any SEED or Bip39 encoded string !

Return values

0	On Success, otherwise Error

See also

> **f_read_seed()** (p. **??**)

5.7.5.29 f_read_seed()

```
int f_read_seed (
        uint8_t * seed,
        const char * passwd,
        void * source_data,
        int force_read,
        int source )
```

Extracts a Nano SEED from encrypted stream in memory or in a file.

Parameters

out	*seed*	Output Nano SEED
in	*passwd*	Password (always required)
in	*source_data*	Encrypted source data from memory or path pointed in *source_data*
in	*force_read*	If non zero value then forces reading from a corrupted file. This param is ignored when reading *source_data* from memory
in	*source*	Source data type: • READ_SEED_FROM_STREAM: Read encrypted data from stream pointed in *source_data*. Password is required. • READ_SEED_FROM_FILE: Read encrypted data stored in a file where *source_data* is path to file. Password is required.

WARNING Sensive data. Do not share any SEED !

Return values

0	On Success, otherwise Error

See also

> **f_parse_nano_seed_and_bip39_to_JSON()** (p. **??**) **f_write_seed()** (p. **??**)

5.7.5.30 f_seed_to_nano_wallet()

```
int f_seed_to_nano_wallet (
            NANO_PRIVATE_KEY private_key,
            NANO_PUBLIC_KEY public_key,
            NANO_SEED seed,
        uint32_t wallet_number )
```

Extracts one key pair from Nano SEED given a wallet number.

Parameters

out	*private_key*	Private key of the *wallet_number* from given *seed*
out	*public_key*	Public key of the *wallet_number* from given *seed*
in,out	*seed*	Nano SEED
in	*wallet_number*	Wallet number of key pair to be extracted from Nano SEED

WARNING 1:

• Seed must be read from memory

• Seed is destroyed when extracting public and private keys

WARNING 2:

- Never expose SEED and private key. This function destroys seed and any data after execution and finally parse public and private keys to output.

Return values

0	On Success, otherwise Error

5.7.5.31 f_set_dictionary_path()

```
void f_set_dictionary_path (
            const char * path )
```

Set default dictionary file and path to **myNanoEmbedded** library.

Parameters

in	*path*	Path to dictionary file

If **f_set_dictionary_path()** (p. **??**) is not used in **myNanoEmbedded** library then default path stored in *BIP39_D↩ICTIONARY* is used

See also

> **f_get_dictionary_path()** (p. **??**)

5.7.5.32 f_set_nano_file_info()

```
F_FILE_INFO_ERR f_set_nano_file_info (
            F_NANO_WALLET_INFO * info,
            int overwrite_existing_file )
```

Saves wallet information stored at buffer struct *info* to file *walletsinfo.i*

Parameters

in	*info*	Pointer to data to be saved at *$PATH/walletsinfo.i* file.
in	*overwrite_existing_file*	If non zero then overwrites file *$PATH/walletsinfo.i*

Return values

F_FILE_INFO_ERR_OK	If Success, otherwise *F_FILE_INFO_ERR* enum type error

See also

> **F_FILE_INFO_ERR** (p. **??**) enum type error for detailed error and **f_nano_wallet_info_t** (p. **??**) for info type details

5.7.5.33 f_sign_data()

```
int f_sign_data (
        unsigned char * signature,
        void * out_public_key,
        uint32_t ouput_type,
        const unsigned char * message,
        size_t msg_len,
        const unsigned char * private_key )
```

Signs a *message* with a deterministic signature given a *private key*

Parameters

out	*signature*	Output signature
out	*out_public_key*	Output public key. It can be NULL
in	*output_type*	Output type of public key. Public key types are: • *F_SIGNATURE_RAW* Signature is raw 64 bytes long • *F_SIGNATURE_STRING* Singnature is hex ASCII encoded string • *F_SIGNATURE_OUTPUT_RAW_PK* Public key is raw 32 bytes data • *F_SIGNATURE_OUTPUT_STRING_PK* Public key is hes ASCII encoded string • *F_SIGNATURE_OUTPUT_XRB_PK* Public key is a XRB wallet encoded base32 string • *F_SIGNATURE_OUTPUT_NANO_PK* Public key is a NANO wallet encoded base32 string
in	*message*	Message to be signed with Elliptic Curve Ed25519 with blake2b hash
in	*msg_len*	Size of message to be signed
in	*private_key*	Private key to sign message

Return values

0	If success, otherwise error.

See also

> **f_verify_signed_data()** (p. **??**)

5.7.5.34   f_verify_signed_block()

```
int f_verify_signed_block (
            F_BLOCK_TRANSFER *  )
```

5.7.5.35   f_verify_signed_data()

```
int f_verify_signed_data (
            const unsigned char * signature,
            const unsigned char * message,
            size_t message_len,
            const void * public_key,
            uint32_t pk_type )
```

Verifies if a signed message is valid.

Parameters

in	*signature*	Signature of the *message*
in	*message*	Message to be verified
in	*message_len*	Length of the message
in	*public_key*	Public key to verify signed message
in	*pk_type*	Type of the public key. Types are: • *F_VERIFY_SIG_NANO_WALLET* Public key is a NANO wallet with *XRB* or *NANO* prefixes encoded base32 string • *F_VERIFY_SIG_RAW_HEX* Public key is raw 32 bytes data • *F_PUBLIC_KEY_ASCII_HEX* Public key is a hex ASCII encoded string

Return value are

• Greater than zero if *signature* is VALID

• 0 (zero) if *signature* is INVALID

• Negative if ERROR occurred

See also

> **f_sign_data()** (p. **??**)

5.7.5.36   f_verify_token()

```
int f_verify_token (
            F_TOKEN signature,
            void * data,
            size_t data_sz,
            const char * password )
```

Verifies if a token is valid given data and password.

Parameters

in	*signature*	128 bit non deterministic token
in	*data*	Data to be signed in token
in	*data_sz*	Size of data
in	*password*	Password

Return values

0	On if invalid; 1 if valid ; less than zero if an error occurs

See also

f_generate_token() (p. **??**)

5.7.5.37   f_verify_work()

```
int f_verify_work (
            uint64_t * result,
            const unsigned char * hash,
            uint64_t * work,
            uint64_t threshold )
```

Verifies if Proof of Work of a given *hash* is valid.

Parameters

out	*result*	Result of work. It can be NULL
in	*hash*	Input *hash* for verification
in	*work*	Work previously calculated to be checked
in	*threshold*	Input *threshold*

Return values

0	If is not valid or less than zero if error or greater than zero if is valid

See also

     f_nano_pow() (p. **??**)

5.7.5.38 f_write_seed()

```
 f_write_seed_err f_write_seed (
          void * source_data,
          int source,
          uint8_t * seed,
          char * passwd )
```

Writes a SEED into a ecrypted with password with non deterministic stream in memory or file.

Parameters

out	*source_data*	Memory pointer or file name
in	*source*	Source of output data: • *WRITE_SEED_TO_STREAM* Output data is a pointer to memory to store encrypted Nano SEED data • *WRITE_SEED_TO_FILE* Output is a string filename to store encrypted Nano SEED data
in	*seed*	Nano SEED to be stored in encrypted stream or file
in	*passwd*	(Mandatory) It can not be null string or NULL. See *f_pass_must_have_at_least()* (p. **??**) function to check passwords strength

Return values

0	If Success, otherwise error

See also

     f_read_seed() (p. **??**)

5.7.5.39 from_multiplier()

```
uint64_t from_multiplier (
          double multiplier,
          uint64_t base_difficulty )
```

Calculates a PoW given a multiplier and base difficulty.

Parameters

in	*multiplier*	Multiplier of the work
in	*base_difficulty*	Base difficulty Details here

See also

to_multiplier() (p. **??**)

Return values

Calculated	value

5.7.5.40 is_nano_prefix()

```
int is_nano_prefix (
            const char * nano_wallet,
            const char * prefix )
```

Checks *prefix* in *nano_wallet*

Parameters

in	*nano_wallet*	Base32 Nano wallet encoded string
in	*prefix*	Prefix type • NANO_PREFIX for nano_ • XRB_PREFIX for xrb_

Return values

1	If *prefix* in *nano_wallet*, otherwise 0

5.7.5.41 is_null_hash()

```
int is_null_hash (
            uint8_t * hash )
```

Check if 32 bytes hash is filled with zeroes.

Parameters

in	*hash*	32 bytes binary *hash*

Return values

1	If zero filled buffer, otherwise 0

5.7.5.42 nano_base_32_2_hex()

```
int nano_base_32_2_hex (
            uint8_t * res,
            char * str_wallet )
```

Parse Nano Base32 wallet string to public key binary.

Parameters

out	*res*	Output raw binary public key
in	*str_wallet*	Valid Base32 encoded Nano string to be parsed

Return values

0	On Success, otherwise Error

See also

> **pk_to_wallet()** (p. **??**)

5.7.5.43 nano_create_block_dynamic()

```
int nano_create_block_dynamic (
            F_BLOCK_TRANSFER ** block,
            const void * account,
            size_t account_len,
            const void * previous,
            size_t previous_len,
            const void * representative,
            size_t representative_len,
            const void * balance,
            const void * value_to_send_or_receive,
            uint32_t balance_and_val_to_send_or_rec_types,
            const void * link,
            size_t link_len,
            int direction )
```

Creates a Nano block dynamically in memory.

Parameters

out	*block*	Pointer to new allocated Nano block
in	*account*	*nano* or *xrb* or *raw hex string* or raw *hex binary* **account** (public key)
in	*account_len*	Account length. If zero it is assumed as *nano*, *xrb* or *raw hex string* public key

Parameters

in	*previous*	*Hex string* or *raw hex binary* **previous** block
in	*previous_len*	Previous length size. If zero it is assumed **previous** is a *NULL* terminated string
in	*representative*	*nano* or *xrb* or *raw hex string* or raw *hex binary* **representative** account
in	*representative_len*	Representative length. If zero it is assumed as *nano*, *xrb* or *raw hex string* representative
in	*balance*	*Real balance* or *raw string balance* or *raw binary balance*
in	*value_to_send_or_receive*	*Real value to send or receive* or *raw string value to send or receive* or *raw value to send or receive*
in	*balance_and_val_to_send_or_rec_types*	Balance and value to send/receive types: • *F_BALANCE_RAW_128* Balance is *raw binary 128 bit* • *F_BALANCE_REAL_STRING* Balance is *real string* • *F_BALANCE_RAW_STRING* Balance is *raw string* • *F_VALUE_SEND_RECEIVE_RAW_128* Value to send/receive is *raw binary 128 bit* • *F_VALUE_SEND_RECEIVE_REAL_STRING* Value to send/receive is *real string* • *F_VALUE_SEND_RECEIVE_RAW_STRING* Value to send/receive is *raw string*
in	*link*	*nano* or *xrb* or *raw hex string* or raw *hex binary* **link**
in	*link_len*	Link length. If zero it is assumed as *nano*, *xrb* or *raw hex string* link
in	*direction*	Direction of the Nano block: • *F_VALUE_TO_SEND* Value to send to **link** = *destination account* • *F_VALUE_TO_RECEIVE* Value to receive from **link** = *receive amount*

WARNING: *block* must be free after used.

Return values

ERROR_SUCCESS	when success or non zero otherwise

See also

nano_create_p2pow_block_dynamic() (p. **??**)

5.7.5.44 nano_create_p2pow_block_dynamic()

```
int nano_create_p2pow_block_dynamic (
            F_BLOCK_TRANSFER ** ,
            F_BLOCK_TRANSFER * ,
            const void * ,
            size_t ,
            const void * ,
            uint32_t ,
            const void * ,
            size_t  )
```

5.7.5.45 pk_to_wallet()

```
int pk_to_wallet (
            char * out,
            char * prefix,
             NANO_PUBLIC_KEY_EXTENDED pubkey_extended )
```

Parse a Nano public key to Base32 Nano wallet string.

Parameters

`out`	*out*	Output string containing the wallet
`in`	*prefix*	Nano prefix. *NANO_PREFIX* for nano_ *XRB_PREFIX* for xrb_
`in,out`	*pubkey_extended*	Public key to be parsed to string

WARNING: *pubkey_extended* is destroyed when parsing to Nano base32 encoding

Return values

0	On Success, otherwise Error

See also

> **nano_base_32_2_hex()** (p. **??**)

5.7.5.46 to_multiplier()

```
double to_multiplier (
            uint64_t difficulty,
            uint64_t base_difficulty )
```

Calculates a relative difficulty compared PoW with another.

Parameters

in	*dificulty*	Work difficulty
in	*base_difficulty*	Base difficulty Details `here`

See also

> **from_multiplier()** (p. **??**)

Return values

Calculated	value

5.7.5.47 valid_nano_wallet()

```
int valid_nano_wallet (
            const char * wallet )
```

Check if a string containing a Base32 Nano wallet is valid.

Parameters

in	*wallet*	Base32 Nano wallet encoded string

Return values

0	If valid wallet otherwise is invalid

5.7.5.48 valid_raw_balance()

```
int valid_raw_balance (
            const char * balance )
```

Checks if a string buffer pointed in *balance* is a valid raw balance.

Parameters

in	*balance*	Pointer containing a string buffer

Return values

0	On Success, otherwise Error

5.7.6 Variable Documentation

5.7.6.1 account

```
uint8_t account[32]
```

Account in raw binary data.

Definition at line **260** of file **f_nano_crypto_util.h**.

5.7.6.2 balance

f_uint128_t `balance`

Big number 128 bit raw balance.

See also

> **f_uint128_t** (p. **??**)

Definition at line **268** of file **f_nano_crypto_util.h**.

5.7.6.3 body

```
F_NANO_WALLET_INFO_BODY body
```

Body of the file info.

Definition at line **268** of file **f_nano_crypto_util.h**.

5.7.6.4 desc

```
char desc[F_NANO_DESC_SZ]
```

Description.

Definition at line **262** of file **f_nano_crypto_util.h**.

5.7.6.5 description

```
uint8_t description[F_DESC_SZ]
```

File description.

Definition at line **262** of file **f_nano_crypto_util.h**.

5.7.6.6 file_info_integrity

```
uint8_t file_info_integrity[32]
```

File info integrity of the body block.

Definition at line **266** of file **f_nano_crypto_util.h**.

5.7.6.7 hash_sk_unencrypted

```
uint8_t hash_sk_unencrypted[32]
```

hash of Nano SEED when unencrypted

Definition at line **264** of file **f_nano_crypto_util.h**.

5.7.6.8 header

```
uint8_t header[sizeof(F_NANO_WALLET_INFO_MAGIC)]
```

Header magic.

Definition at line **258** of file **f_nano_crypto_util.h**.

5.7.6.9 iv

```
uint8_t iv
```

Initial sub vector.

Initial vector of first encryption layer.

Definition at line **260** of file **f_nano_crypto_util.h**.

5.7.6.10 last_used_wallet_number

```
uint32_t last_used_wallet_number
```

Last used wallet number.

Definition at line **260** of file **f_nano_crypto_util.h**.

5.7.6.11 link

```
uint8_t link[32]
```

link or destination account

Definition at line **270** of file **f_nano_crypto_util.h**.

5.7.6.12 max_fee

```
char max_fee[F_RAW_STR_MAX_SZ]
```

Custom preferred max fee of Proof of Work.

Definition at line **264** of file **f_nano_crypto_util.h**.

5.7.6.13 nano_hdr

```
uint8_t nano_hdr[sizeof(NANO_WALLET_MAGIC)]
```

Header of the file.

Definition at line **258** of file **f_nano_crypto_util.h**.

5.7.6.14 nanoseed_hash

```
uint8_t nanoseed_hash[32]
```

Nano SEED hash file.

Definition at line **264** of file **f_nano_crypto_util.h**.

5.7.6.15 preamble

```
uint8_t preamble[32]
```

Block preamble.

Definition at line **258** of file **f_nano_crypto_util.h**.

5.7.6.16 prefixes

```
uint8_t prefixes
```

Internal use for this API.

Definition at line **274** of file **f_nano_crypto_util.h**.

5.7.6.17 previous

```
uint8_t previous[32]
```

Previous block.

Definition at line **262** of file **f_nano_crypto_util.h**.

5.7.6.18 representative

```
uint8_t representative[32]
```

Representative for current account.

Definition at line **264** of file **f_nano_crypto_util.h**.

5.7.6.19 reserved

```
uint8_t reserved
```

Reserved (not used)

Reserved.

Definition at line **262** of file **f_nano_crypto_util.h**.

5.7.6.20   salt

```
uint8_t salt[32]
```

Salt of the first encryption layer.

Definition at line **264** of file **f_nano_crypto_util.h**.

5.7.6.21   seed_block

```
F_ENCRYPTED_BLOCK seed_block
```

Second encrypted block for Nano SEED.

Definition at line **268** of file **f_nano_crypto_util.h**.

5.7.6.22   signature

```
uint8_t signature[64]
```

Signature of the block.

Definition at line **272** of file **f_nano_crypto_util.h**.

5.7.6.23   sk_encrypted

```
uint8_t sk_encrypted[32]
```

Secret.

SEED encrypted (second layer)

Definition at line **266** of file **f_nano_crypto_util.h**.

5.7.6.24   sub_salt

```
uint8_t sub_salt[32]
```

Salt of the sub block to be stored.

Definition at line **258** of file **f_nano_crypto_util.h**.

5.7.6.25 ver

`uint32_t ver`

Version of the file.

Definition at line **260** of file **f_nano_crypto_util.h**.

5.7.6.26 version

`uint16_t version`

Version.

Definition at line **260** of file **f_nano_crypto_util.h**.

5.7.6.27 wallet_prefix

`uint8_t wallet_prefix`

Wallet prefix: 0 for NANO; 1 for XRB.

Definition at line **258** of file **f_nano_crypto_util.h**.

5.7.6.28 wallet_representative

`char wallet_representative[` **MAX_STR_NANO_CHAR**`]`

Wallet representative.

Definition at line **262** of file **f_nano_crypto_util.h**.

5.7.6.29 work

`uint64_t work`

Internal use for this API.

Definition at line **276** of file **f_nano_crypto_util.h**.

5.8 f_nano_crypto_util.h

```
00001 /*
00002     AUTHOR: Fábio Pereira da Silva
00003     YEAR: 2019-20
00004     LICENSE: MIT
00005     EMAIL: fabioegel@gmail.com or fabioegel@protonmail.com
00006 */
00007
00008 #include <errors.h>
00009 #include <stdint.h>
00010 #include <f_util.h>
00011 #include <f_bitcoin.h>
00012
00013 #ifndef F_DOC_SKIP
00014
00015  #ifdef F_XTENSA
00016
00017   #ifndef F_ESP32
00018    #define F_ESP32
00019   #endif
00020
00021   #include "esp_system.h"
00022
00023  #endif
00024
00025  #include "sodium/crypto_generichash.h"
00026  #include "sodium/crypto_sign.h"
00027  #include "sodium.h"
00028
00029  #ifdef F_ESP32
00030
00031   #include "sodium/private/curve25519_ref10.h"
00032
00033  #else
00034
00035   #include "sodium/private/ed25519_ref10.h"
00036
00037   #define ge_p3 ge25519_p3
00038   #define sc_reduce sc25519_reduce
00039   #define sc_muladd sc25519_muladd
00040   #define ge_scalarmult_base ge25519_scalarmult_base
00041   #define ge_p3_tobytes ge25519_p3_tobytes
00042
00043  #endif
00044
00045 #endif
00046
00129 #ifdef __cplusplus
00130 extern "C" {
00131 #endif
00132
00133
00138 #define F_NANO_POW_MAX_THREAD (size_t)10
00139
00140 #ifndef F_DOC_SKIP
00141  #ifdef F_ESP32
00142   #undef F_NANO_POW_MAX_THREAD
00143  #endif
00144 #endif
00145
00150 #define MAX_STR_NANO_CHAR (size_t)70 //5+56+8+1
00151
00156 #define PUB_KEY_EXTENDED_MAX_LEN (size_t)40
00157
00162 #define NANO_PREFIX "nano_"
00163
00168 #define XRB_PREFIX "xrb_"
00169
00170 #ifdef F_ESP32
00171
00176 #define BIP39_DICTIONARY "/spiffs/dictionary.dic"
00177 #else
00178
00179  #ifndef F_DOC_SKIP
00180   #define BIP39_DICTIONARY_SAMPLE "../../dictionary.dic"
00181   #define BIP39_DICTIONARY "dictionary.dic"
00182  #endif
00183
00184 #endif
00185
00192 #define NANO_ENCRYPTED_SEED_FILE "/spiffs/secure/nano.nse"
00193
00198 #define NANO_PASSWD_MAX_LEN (size_t)80
00199
00204 #define STR_NANO_SZ (size_t)66// 65+1 Null included
```

```
00205
00210 #define NANO_FILE_WALLETS_INFO "/spiffs/secure/walletsinfo.i"
00211
00216 typedef uint8_t F_TOKEN[16];
00217
00222 typedef uint8_t NANO_SEED[crypto_sign_SEEDBYTES];
00223
00228 typedef uint8_t f_uint128_t[16];
00229
00230 #ifndef F_DOC_SKIP
00231  #define EXPORT_KEY_TO_CHAR_SZ (size_t)sizeof(NANO_SEED)+1
00232 #endif
00233
00238 typedef uint8_t NANO_PRIVATE_KEY[sizeof(NANO_SEED)];
00239
00244 typedef uint8_t NANO_PRIVATE_KEY_EXTENDED[crypto_sign_ed25519_SECRETKEYBYTES];
00245
00250 typedef uint8_t NANO_PUBLIC_KEY[crypto_sign_ed25519_PUBLICKEYBYTES];
00251
00256 typedef uint8_t NANO_PUBLIC_KEY_EXTENDED[PUB_KEY_EXTENDED_MAX_LEN];
00257
00266 typedef struct f_block_transfer_t {
00268     uint8_t preamble[32];
00270     uint8_t account[32];
00272     uint8_t previous[32];
00274     uint8_t representative[32];
00278     f_uint128_t balance;
00280     uint8_t link[32];
00282     uint8_t signature[64];
00284     uint8_t prefixes;
00286     uint64_t work;
00287 } __attribute__((packed)) F_BLOCK_TRANSFER;
00288
00289 #define F_BLOCK_TRANSFER_SIZE (size_t)sizeof(F_BLOCK_TRANSFER)
00290 #define F_P2POW_BLOCK_TRANSFER_SIZE 2*F_BLOCK_TRANSFER_SIZE
00291
00292 #ifndef F_DOC_SKIP
00293  #define F_BLOCK_TRANSFER_SIGNABLE_SZ
      (size_t)(sizeof(F_BLOCK_TRANSFER)-64-sizeof(uint64_t)-sizeof(uint8_t))
00294 #endif
00295
00303 typedef enum f_nano_err_t {
00305     NANO_ERR_OK=0,
00307     NANO_ERR_CANT_PARSE_BN_STR=5151,
00309     NANO_ERR_MALLOC,
00311     NANO_ERR_CANT_PARSE_FACTOR,
00313     NANO_ERR_MPI_MULT,
00315     NANO_ERR_CANT_PARSE_TO_BLK_TRANSFER,
00317     NANO_ERR_EMPTY_STR,
00319     NANO_ERR_CANT_PARSE_VALUE,
00321     NANO_ERR_PARSE_MPI_TO_STR,
00323     NANO_ERR_CANT_COMPLETE_NULL_CHAR,
00325     NANO_ERR_CANT_PARSE_TO_MPI,
00327     NANO_ERR_INSUFICIENT_FUNDS,
00329     NANO_ERR_SUB_MPI,
00331     NANO_ERR_ADD_MPI,
00333     NANO_ERR_NO_SENSE_VALUE_TO_SEND_NEGATIVE,
00335     NANO_ERR_NO_SENSE_VALUE_TO_SEND_ZERO,
00337     NANO_ERR_NO_SENSE_BALANCE_NEGATIVE,
00339     NANO_ERR_VAL_A_INVALID_MODE,
00341     NANO_ERR_CANT_PARSE_TO_TEMP_UINT128_T,
00343     NANO_ERR_VAL_B_INVALID_MODE,
00345     NANO_ERR_CANT_PARSE_RAW_A_TO_MPI,
00347     NANO_ERR_CANT_PARSE_RAW_B_TO_MPI,
00349     NANO_ERR_UNKNOWN_ADD_SUB_MODE,
00351     NANO_ERR_INVALID_RES_OUTPUT
00352 } f_nano_err;
00353
00354 #ifndef F_DOC_SKIP
00355
00356  #define READ_SEED_FROM_STREAM (int)1
00357  #define READ_SEED_FROM_FILE (int)2
00358  #define WRITE_SEED_TO_STREAM (int)4
00359  #define WRITE_SEED_TO_FILE (int)8
00360  #define PARSE_JSON_READ_SEED_GENERIC (int)16
00361  #define F_STREAM_DATA_FILE_VERSION (uint32_t)((1<<16)|0)
00362
00363 #endif
00364
00372 typedef struct f_nano_encrypted_wallet_t {
00374     uint8_t sub_salt[32];
00376     uint8_t iv[16];
00378     uint8_t reserved[16];
00380     uint8_t hash_sk_unencrypted[32];
00382     uint8_t sk_encrypted[32];
00383 } __attribute__ ((packed)) F_ENCRYPTED_BLOCK;
00384
```

```
00385 #ifndef F_DOC_SKIP
00386
00387   static const uint8_t NANO_WALLET_MAGIC[] = {'_', 'n', 'a', 'n', 'o', 'w', 'a', 'l', 'l', 'e', 't', 'f',
       'i', 'l', 'e', '_'};
00388   #define F_NANO_FILE_DESC "NANO Seed Encrypted file/stream. Keep it safe and backup it. This file is
       protected by password. BUY BITCOIN and NANO !!!"
00389   #define F_DESC_SZ (size_t) (160-sizeof(uint32_t))
00390
00391 #endif
00392
00400 typedef struct f_nano_crypto_wallet_t {
00402    uint8_t nano_hdr[sizeof(NANO_WALLET_MAGIC)];
00404    uint32_t ver;
00406    uint8_t description[F_DESC_SZ];
00408    uint8_t salt[32];
00410    uint8_t iv[16];
00412    F_ENCRYPTED_BLOCK seed_block;
00413 } __attribute__ ((packed)) F_NANO_CRYPTOWALLET;
00414
00415 #ifndef F_DOC_SKIP
00416
00417 _Static_assert((sizeof(F_NANO_CRYPTOWALLET)&0x1F)==0, "Error 1");
00418 _Static_assert((sizeof(F_ENCRYPTED_BLOCK)&0x1F)==0, "Error 2");
00419
00420 #endif
00421
00426 #define REP_XRB (uint8_t)0x4
00427
00432 #define SENDER_XRB (uint8_t)0x02
00433
00438 #define DEST_XRB (uint8_t)0x01
00439
00440 typedef enum f_write_seed_err_t {
00442    WRITE_ERR_OK=0,
00444    WRITE_ERR_NULL_PASSWORD=7180,
00446    WRITE_ERR_EMPTY_STRING,
00448    WRITE_ERR_MALLOC,
00450    WRITE_ERR_ENCRYPT_PRIV_KEY,
00452    WRITE_ERR_GEN_SUB_PRIV_KEY,
00454    WRITE_ERR_GEN_MAIN_PRIV_KEY,
00456    WRITE_ERR_ENCRYPT_SUB_BLOCK,
00458    WRITE_ERR_UNKNOWN_OPTION,
00460    WRITE_ERR_FILE_ALREDY_EXISTS,
00462    WRITE_ERR_CREATING_FILE,
00464    WRITE_ERR_WRITING_FILE
00465 } f_write_seed_err;
00466
00467 #ifndef F_DOC_SKIP
00468
00469   #define F_RAW_TO_STR_UINT128 (int)1
00470   #define F_RAW_TO_STR_STRING (int)2
00471   #define F_RAW_STR_MAX_SZ (size_t)41 // 39 + '\0' + '.' -> 39 = log10(2^128)
00472   #define F_MAX_STR_RAW_BALANCE_MAX (size_t)40 //39+'\0'
00473   #define F_NANO_EMPTY_BALANCE "0.0"
00474
00475 #endif
00476
00484 typedef struct f_nano_wallet_info_bdy_t {
00486    uint8_t wallet_prefix; // 0 for NANO; 1 for XRB
00488    uint32_t last_used_wallet_number;
00490    char wallet_representative[MAX_STR_NANO_CHAR];
00492    char max_fee[F_RAW_STR_MAX_SZ];
00494    uint8_t reserved[44];
00495 } __attribute__((packed)) F_NANO_WALLET_INFO_BODY;
00496
00497 #ifndef F_DOC_SKIP
00498
00499   _Static_assert((sizeof(F_NANO_WALLET_INFO_BODY)&0x1F)==0, "Error F_NANO_WALLET_INFO_BODY is not byte
       aligned");
00500
00501   #define F_NANO_WALLET_INFO_DESC "Nano file descriptor used for fast custom access. BUY BITCOIN AND NANO."
00502   #define F_NANO_WALLET_INFO_VERSION (uint16_t)((1<<8)|1)
00503   static const uint8_t F_NANO_WALLET_INFO_MAGIC[] = {'_', 'n', 'a', 'n', 'o', 'w', 'a', 'l', 'l', 'e', 't',
       '_', 'n', 'f', 'o', '_'};
00504
00505   #define F_NANO_DESC_SZ (size_t)78
00506
00507 #endif
00508
00516 typedef struct f_nano_wallet_info_t {
00518    uint8_t header[sizeof(F_NANO_WALLET_INFO_MAGIC)];
00520    uint16_t version;
00522    char desc[F_NANO_DESC_SZ];
00524    uint8_t nanoseed_hash[32];
00526    uint8_t file_info_integrity[32];
00528    F_NANO_WALLET_INFO_BODY body;
00529 } __attribute__((packed)) F_NANO_WALLET_INFO;
```

```
00530
00531 #ifndef F_DOC_SKIP
00532
00533 _Static_assert((sizeof(F_NANO_WALLET_INFO)&0x1F)==0, "Error F_NANO_WALLET_INFO is not byte aligned");
00534
00535 #endif
00536
00544 typedef enum f_file_info_err_t {
00546     F_FILE_INFO_ERR_OK=0,
00548     F_FILE_INFO_ERR_CANT_OPEN_INFO_FILE=7001,
00550     F_FILE_INFO_ERR_NANO_SEED_ENCRYPTED_FILE_NOT_FOUND,
00552     F_FILE_INFO_ERR_CANT_DELETE_NANO_INFO_FILE,
00554     F_FILE_INFO_ERR_MALLOC,
00556     F_FILE_INFO_ERR_CANT_READ_NANO_SEED_ENCRYPTED_FILE,
00558     F_FILE_INFO_ERR_CANT_READ_INFO_FILE,
00560     F_FILE_INFO_INVALID_HEADER_FILE,
00562     F_FILE_INFO_ERR_INVALID_SHA256_INFO_FILE,
00564     F_FILE_INFO_ERR_NANO_SEED_HASH_FAIL,
00566     F_FILE_INFO_ERR_NANO_INVALID_REPRESENTATIVE,
00568     F_FILE_INFO_ERR_NANO_INVALID_MAX_FEE_VALUE,
00570     F_FILE_INFO_ERR_OPEN_FOR_WRITE_INFO,
00572     F_FILE_INFO_ERR_EXISTING_FILE,
00574     F_FILE_INFO_ERR_CANT_WRITE_FILE_INFO
00575 } F_FILE_INFO_ERR;
00576
00577 #ifndef F_DOC_SKIP
00578
00579  #define F_NANO_ADD_A_B (uint32_t)(1<<0)
00580  #define F_NANO_SUB_A_B (uint32_t)(1<<1)
00581  #define F_NANO_A_RAW_128 (uint32_t)(1<<2)
00582  #define F_NANO_A_RAW_STRING (uint32_t)(1<<3)
00583  #define F_NANO_A_REAL_STRING (uint32_t)(1<<4)
00584  #define F_NANO_B_RAW_128 (uint32_t)(1<<5)
00585  #define F_NANO_B_RAW_STRING (uint32_t)(1<<6)
00586  #define F_NANO_B_REAL_STRING (uint32_t)(1<<7)
00587  #define F_NANO_RES_RAW_128 (uint32_t)(1<<8)
00588  #define F_NANO_RES_RAW_STRING (uint32_t)(1<<9)
00589  #define F_NANO_RES_REAL_STRING (uint32_t)(1<<10)
00590  #define F_NANO_C_RAW_128 (uint32_t)(F_NANO_B_RAW_128<<16)
00591  #define F_NANO_C_RAW_STRING (uint32_t)(F_NANO_B_RAW_STRING<<16)
00592  #define F_NANO_C_REAL_STRING (uint32_t)(F_NANO_B_REAL_STRING<<16)
00593
00594  #define F_NANO_COMPARE_EQ (uint32_t)(1<<16) //Equal
00595  #define F_NANO_COMPARE_LT (uint32_t)(1<<17) // Lesser than
00596  #define F_NANO_COMPARE_LEQ (F_NANO_COMPARE_LT|F_NANO_COMPARE_EQ) // Less or equal
00597  #define F_NANO_COMPARE_GT (uint32_t)(1<<18) // Greater
00598  #define F_NANO_COMPARE_GEQ (F_NANO_COMPARE_GT|F_NANO_COMPARE_EQ) // Greater or equal
00599  #define DEFAULT_MAX_FEE "0.001"
00600
00601 #endif
00602
00603 #ifndef F_ESP32
00604 typedef enum f_nano_create_block_dyn_err_t {
00605     NANO_CREATE_BLK_DYN_OK = 0,
00606     NANO_CREATE_BLK_DYN_BLOCK_NULL = 8000,
00607     NANO_CREATE_BLK_DYN_ACCOUNT_NULL,
00608 //   NANO_CREATE_BLK_DYN_PREV_NULL,
00609     NANO_CREATE_BLK_DYN_COMPARE_BALANCE,
00610     NANO_CREATE_BLK_DYN_GENESIS_WITH_NON_EMPTY_BALANCE,
00611     NANO_CREATE_BLK_DYN_CANT_SEND_IN_GENESIS_BLOCK,
00612     NANO_CREATE_BLK_DYN_REP_NULL,
00613     NANO_CREATE_BLK_DYN_BALANCE_NULL,
00614     NANO_CREATE_BLK_DYN_SEND_RECEIVE_NULL,
00615     NANO_CREATE_BLK_DYN_LINK_NULL,
00616     NANO_CREATE_BLK_DYN_BUF_MALLOC,
00617     NANO_CREATE_BLK_DYN_MALLOC,
00618     NANO_CREATE_BLK_DYN_WRONG_PREVIOUS_SZ,
00619     NANO_CREATE_BLK_DYN_WRONG_PREVIOUS_STR_SZ,
00620     NANO_CREATE_BLK_DYN_PARSE_STR_HEX_ERR,
00621     NANO_CREATE_BLK_DYN_FORBIDDEN_AMOUNT_TYPE,
00622     NANO_CREATE_BLK_DYN_COMPARE,
00623     NANO_CREATE_BLK_DYN_EMPTY_VAL_TO_SEND_OR_REC,
00624     NANO_CREATE_BLK_DYN_INVALID_DIRECTION_OPTION
00625 } F_NANO_CREATE_BLOCK_DYN_ERR;
00626
00627 typedef enum f_nano_p2pow_block_dyn_err_t {
00628     NANO_P2POW_CREATE_BLOCK_OK = 0,
00629     NANO_P2POW_CREATE_BLOCK_INVALID_USER_BLOCK = 8400,
00630     NANO_P2POW_CREATE_BLOCK_MALLOC,
00631     NANO_P2POW_CREATE_BLOCK_NULL,
00632     NANO_P2POW_CREATE_OUTPUT,
00633     NANO_P2POW_CREATE_OUTPUT_MALLOC
00634 } F_NANO_P2POW_BLOCK_DYN_ERR;
00635
00636 #endif
00637
00649 double to_multiplier(uint64_t, uint64_t);
```

```
00650
00662 uint64_t from_multiplier(double, uint64_t);
00663
00673 void f_set_dictionary_path(const char *);
00674
00682 char *f_get_dictionary_path(void);
00683
00696 int f_generate_token(F_TOKEN, void *, size_t, const char *);
00697
00710 int f_verify_token(F_TOKEN, void *, size_t, const char *);
00711
00734 int f_cloud_crypto_wallet_nano_create_seed(size_t, char *, char *);
00735
00748 int f_generate_nano_seed(NANO_SEED, uint32_t);
00749
00764 int pk_to_wallet(char *, char *, NANO_PUBLIC_KEY_EXTENDED);
00765
00783 int f_seed_to_nano_wallet(NANO_PRIVATE_KEY, NANO_PUBLIC_KEY, NANO_SEED, uint32_t);
00784
00794 int f_nano_is_valid_block(F_BLOCK_TRANSFER *);
00795
00808 int f_nano_block_to_json(char *, size_t *, size_t, F_BLOCK_TRANSFER *);
00809
00820 int f_nano_get_block_hash(uint8_t *, F_BLOCK_TRANSFER *);
00821
00833 int f_nano_get_p2pow_block_hash(uint8_t *, uint8_t *, F_BLOCK_TRANSFER *);
00834
00847 int f_nano_p2pow_to_JSON(char *, size_t *, size_t, F_BLOCK_TRANSFER *);
00848
00858 char *f_nano_key_to_str(char *, unsigned char *);
00859
00878 int f_nano_seed_to_bip39(char *, size_t, size_t *, NANO_SEED, char *);
00879
00894 int f_bip39_to_nano_seed(uint8_t *, char *, char *);
00895
00917 int f_parse_nano_seed_and_bip39_to_JSON(char *, size_t, size_t *, void *, int, const char *);
00918
00936 int f_read_seed(uint8_t *, const char *, void *, int, int);
00937
00952 int f_nano_raw_to_string(char *, size_t *, size_t, void *, int);
00953
00962 int f_nano_valid_nano_str_value(const char *);
00963
00971 int valid_nano_wallet(const char *);
00972
00982 int nano_base_32_2_hex(uint8_t *, char *);
00983
00998 int f_nano_transaction_to_JSON(char *, size_t *, size_t, NANO_PRIVATE_KEY_EXTENDED, F_BLOCK_TRANSFER *);
00999
01007 int valid_raw_balance(const char *);
01008
01016 int is_null_hash(uint8_t *);
01017
01029 int is_nano_prefix(const char *, const char *);
01030
01039 F_FILE_INFO_ERR f_get_nano_file_info(F_NANO_WALLET_INFO *);
01040
01050 F_FILE_INFO_ERR f_set_nano_file_info(F_NANO_WALLET_INFO *, int);
01051
01073 f_nano_err f_nano_value_compare_value(void *, void *, uint32_t *);
01074
01095 f_nano_err f_nano_verify_nano_funds(void *, void *, void *, uint32_t);
01096
01106 f_nano_err f_nano_parse_raw_str_to_raw128_t(uint8_t *, const char *);
01107
01117 f_nano_err f_nano_parse_real_str_to_raw128_t(uint8_t *, const char *);
01118
01141 f_nano_err f_nano_add_sub(void *, void *, void *, uint32_t);
01142
01153 int f_nano_sign_block(F_BLOCK_TRANSFER *, F_BLOCK_TRANSFER *, NANO_PRIVATE_KEY_EXTENDED);
01154
01168 f_write_seed_err f_write_seed(void *, int, uint8_t *, char *);
01169
01182 f_nano_err f_nano_balance_to_str(char *, size_t, size_t *, f_uint128_t);
01183
01184
01189 #define F_BRAIN_WALLET_VERY_POOR (uint32_t)0
01190
01195 #define F_BRAIN_WALLET_POOR (uint32_t)1
01196
01201 #define F_BRAIN_WALLET_VERY_BAD (uint32_t)2
01202
01207 #define F_BRAIN_WALLET_BAD (uint32_t)3
01208
01213 #define F_BRAIN_WALLET_VERY_WEAK (uint32_t)4
01214
01219 #define F_BRAIN_WALLET_WEAK (uint32_t)5
```

```
01220
01225 #define F_BRAIN_WALLET_STILL_WEAK (uint32_t)6
01226
01231 #define F_BRAIN_WALLET_MAYBE_GOOD (uint32_t)7
01232
01233
01238 #define F_BRAIN_WALLET_GOOD (uint32_t)8
01239
01244 #define F_BRAIN_WALLET_VERY_GOOD (uint32_t)9
01245
01250 #define F_BRAIN_WALLET_NICE (uint32_t)10
01251
01256 #define F_BRAIN_WALLET_PERFECT (uint32_t)11
01257
01284 int f_extract_seed_from_brainwallet(uint8_t *, char **, uint32_t, const char *, const char *);
01285
01297 int f_verify_work(uint64_t *, const unsigned char *, uint64_t *, uint64_t);
01298
01304 #define F_SIGNATURE_RAW (uint32_t)1
01305
01311 #define F_SIGNATURE_STRING (uint32_t)2
01312
01318 #define F_SIGNATURE_OUTPUT_RAW_PK (uint32_t)4
01319
01325 #define F_SIGNATURE_OUTPUT_STRING_PK (uint32_t)8
01326
01332 #define F_SIGNATURE_OUTPUT_XRB_PK (uint32_t)16
01333
01339 #define F_SIGNATURE_OUTPUT_NANO_PK (uint32_t)32
01340
01346 #define F_IS_SIGNATURE_RAW_HEX_STRING (uint32_t)64
01347
01353 #define F_MESSAGE_IS_HASH_STRING (uint32_t)128
01354
01359 #define F_DEFAULT_THRESHOLD (uint64_t) 0xffffffc000000000
01360
01384 int f_sign_data(
01385    unsigned char *signature,
01386    void *out_public_key,
01387    uint32_t ouput_type,
01388    const unsigned char *message,
01389    size_t msg_len,
01390    const unsigned char *private_key);
01391
01397 #define F_VERIFY_SIG_NANO_WALLET (uint32_t)1
01398
01404 #define F_PUBLIC_KEY_RAW_HEX (uint32_t)2
01405
01411 #define F_PUBLIC_KEY_ASCII_HEX (uint32_t)4
01412
01433 int f_verify_signed_data( const unsigned char *, const unsigned char *, size_t, const void *, uint32_t);
01434
01444 int f_is_valid_nano_seed_encrypted(void *, size_t, int);
01445
01450 #define F_BALANCE_RAW_128 F_NANO_A_RAW_128
01451
01456 #define F_BALANCE_REAL_STRING F_NANO_A_REAL_STRING
01457
01462 #define F_BALANCE_RAW_STRING F_NANO_A_RAW_STRING
01463
01468 #define F_VALUE_SEND_RECEIVE_RAW_128 F_NANO_B_RAW_128
01469
01474 #define F_VALUE_SEND_RECEIVE_REAL_STRING F_NANO_B_REAL_STRING
01475
01480 #define F_VALUE_SEND_RECEIVE_RAW_STRING F_NANO_B_RAW_STRING
01481
01486 #define F_VALUE_TO_SEND (int)(1<<0)
01487
01492 #define F_VALUE_TO_RECEIVE (int)(1<<1)
01493
01498 #define F_FEE_VALUE_RAW_128 F_NANO_B_RAW_128
01499
01504 #define F_FEE_VALUE_REAL_STRING F_NANO_B_REAL_STRING
01505
01510 #define F_FEE_VALUE_RAW_STRING F_NANO_B_RAW_STRING
01511
01558 int nano_create_block_dynamic(
01559    F_BLOCK_TRANSFER **,
01560    const void *,
01561    size_t,
01562    const void *,
01563    size_t,
01564    const void *,
01565    size_t,
01566    const void *,
01567    const void *,
01568    uint32_t,
```

```
01569     const void *,
01570     size_t,
01571     int
01572 );
01573
01574 int nano_create_p2pow_block_dynamic(
01575     F_BLOCK_TRANSFER **,
01576     F_BLOCK_TRANSFER *,
01577     const void *,
01578     size_t,
01579     const void *,
01580     uint32_t,
01581     const void *,
01582     size_t
01583 );
01584
01585 int f_verify_signed_block(F_BLOCK_TRANSFER *);
01586
01599 int f_nano_pow(uint64_t *, unsigned char *, const uint64_t, int);
01600
01601 #ifdef __cplusplus
01602 }
01603 #endif
01604
```

5.9 f_util.h File Reference

```
#include <stdint.h>
#include "mbedtls/sha256.h"
#include "mbedtls/aes.h"
#include "mbedtls/ecdsa.h"
```

Macros

- #define **F_ENTROPY_TYPE_PARANOIC** (uint32_t)1477682819
- #define **F_ENTROPY_TYPE_EXCELENT** (uint32_t)1476885281
- #define **F_ENTROPY_TYPE_GOOD** (uint32_t)1472531015
- #define **F_ENTROPY_TYPE_NOT_ENOUGH** (uint32_t)1471001808
- #define **F_ENTROPY_TYPE_NOT_RECOMENDED** (uint32_t)1470003345
- #define **ENTROPY_BEGIN** f_verify_system_entropy_begin();
- #define **ENTROPY_END** f_verify_system_entropy_finish();
- #define **F_PASS_MUST_HAVE_AT_LEAST_NONE** (int)0
- #define **F_PASS_MUST_HAVE_AT_LEAST_ONE_NUMBER** (int)1
- #define **F_PASS_MUST_HAVE_AT_LEAST_ONE_SYMBOL** (int)2
- #define **F_PASS_MUST_HAVE_AT_LEAST_ONE_UPPER_CASE** (int)4
- #define **F_PASS_MUST_HAVE_AT_LEAST_ONE_LOWER_CASE** (int)8
- #define **F_PASS_IS_TOO_LONG** (int)256
- #define **F_PASS_IS_TOO_SHORT** (int)512
- #define **F_PASS_IS_OUT_OVF** (int)1024
- #define **F_GET_CH_MODE_NO_ECHO** (int)(1<<16)
- #define **F_GET_CH_MODE_ANY_KEY** (int)(1<<17)
- #define **CLEAR_AND_FREE**(ptr, size) free(memset(ptr, 0, size));

Typedefs

- typedef void(∗ **rnd_fn**) (void ∗, size_t)
- typedef int(∗ **fn_det**) (void ∗, unsigned char ∗, size_t)
- typedef enum **err_ecdsa_secret_key_valid_e** **ERR_ECDSA_SECRET_KEY_VALID**

Enumerations

- enum **err_ecdsa_secret_key_valid_e** { **ERR_KEY_SK_SIZE_ZERO** = 476, **ERR_SK_MALLOC**, **ERR↩ _SK_READ_BINARY**, **ERR_SK_CHECK** }

Functions

- int **f_verify_system_entropy** (uint32_t, void ∗, size_t, int)
- int **f_pass_must_have_at_least** (char ∗, size_t, size_t, size_t, int)
- int **f_passwd_comp_safe** (char ∗, char ∗, size_t, size_t, size_t)
- char ∗ **f_get_entropy_name** (uint32_t)
- uint32_t **f_sel_to_entropy_level** (int)
- int **f_str_to_hex** (uint8_t ∗, char ∗)
- void **f_random_attach** (**rnd_fn**)
- void **f_random** (void ∗, size_t)
- int **get_console_passwd** (char ∗, size_t)
- int **f_get_char_no_block** (int)
- int **f_convert_to_long_int** (unsigned long int ∗, char ∗, size_t)
- int **f_convert_to_unsigned_int** (unsigned int ∗, char ∗, size_t)
- int **f_convert_to_long_int0x** (unsigned long int ∗, char ∗, size_t)
- int **f_convert_to_long_int0** (unsigned long int ∗, char ∗, size_t)
- int **f_convert_to_long_int_std** (unsigned long int ∗, char ∗, size_t)
- void ∗ **f_is_random_attached** ()
- void **f_random_detach** ()
- int **f_convert_to_unsigned_int0x** (unsigned int ∗val, char ∗value, size_t value_sz)
- int **f_convert_to_unsigned_int0** (unsigned int ∗val, char ∗value, size_t value_sz)
- int **f_convert_to_unsigned_int_std** (unsigned int ∗val, char ∗value, size_t value_sz)
- int **f_convert_to_double** (double ∗, const char ∗)
- uint32_t **crc32_init** (unsigned char ∗, size_t, uint32_t)
- int **f_reverse** (unsigned char ∗, size_t)
- f_md_hmac_sha512 **f_hmac_sha512** (unsigned char ∗, const unsigned char ∗, size_t, const unsigned char ∗, size_t)
- **ERR_ECDSA_SECRET_KEY_VALID f_ecdsa_secret_key_valid** (mbedtls_ecp_group_id, unsigned char ∗, size_t)
- int **f_ecdsa_public_key_valid** (mbedtls_ecp_group_id, unsigned char ∗, size_t)
- f_ecdsa_key_pair_err **f_gen_ecdsa_key_pair** (f_ecdsa_key_pair ∗, int, **fn_det**, void ∗)
- int **f_uncompress_elliptic_curve** (uint8_t ∗, size_t, size_t ∗, mbedtls_ecp_group_id, uint8_t ∗, size_t)
- uint8_t ∗ **f_ripemd160** (const uint8_t ∗, size_t)
- int **f_url_encode** (char ∗, size_t, size_t ∗, uint8_t ∗, size_t)
- int **f_encode_to_base64_dynamic** (char ∗∗, size_t ∗, void ∗, size_t)
- int **f_base64_decode_dynamic** (void ∗∗, size_t ∗, const char ∗, size_t)
- int **f_base64url_encode_dynamic** (void ∗∗, size_t ∗, void ∗, size_t)
- int **f_encode_to_base64** (char ∗, size_t, size_t ∗, void ∗, size_t)
- int **f_base64url_encode** (char ∗, size_t, size_t ∗, void ∗, size_t)
- int **f_base64url_decode** (void ∗, size_t, size_t ∗, const char ∗, size_t)
- int **f_url_base64_to_base64_dynamic** (char ∗∗, size_t ∗, const char ∗, size_t)
- int **f_url_decode** (void ∗, size_t, size_t ∗, const char ∗, size_t)

5.9.1 Detailed Description

This ABI is a utility for myNanoEmbedded library and sub routines are implemented here.

Definition in file **f_util.h**.

5.9.2 Macro Definition Documentation

5.9.2.1 CLEAR_AND_FREE

```
#define CLEAR_AND_FREE(
            ptr,
            size ) free(memset(ptr, 0, size));
```

Definition at line **608** of file **f_util.h**.

5.9.2.2 ENTROPY_BEGIN

```
#define ENTROPY_BEGIN f_verify_system_entropy_begin();
```

Begins and prepares a entropy function.

See also

> **f_verify_system_entropy()** (p. **??**)

Definition at line **153** of file **f_util.h**.

5.9.2.3 ENTROPY_END

```
#define ENTROPY_END f_verify_system_entropy_finish();
```

Ends a entropy function.

See also

> **f_verify_system_entropy()** (p. **??**)

Definition at line **160** of file **f_util.h**.

5.9.2.4 F_ENTROPY_TYPE_EXCELENT

```
#define F_ENTROPY_TYPE_EXCELENT (uint32_t)1476885281
```

Type of the excelent entropy used for verifier.

Slow

Definition at line **125** of file **f_util.h**.

5.9.2.5 F_ENTROPY_TYPE_GOOD

`#define F_ENTROPY_TYPE_GOOD (uint32_t)1472531015`

Type of the good entropy used for verifier.

Not so slow

Definition at line **132** of file **f_util.h**.

5.9.2.6 F_ENTROPY_TYPE_NOT_ENOUGH

`#define F_ENTROPY_TYPE_NOT_ENOUGH (uint32_t)1471001808`

Type of the moderate entropy used for verifier.

Fast

Definition at line **139** of file **f_util.h**.

5.9.2.7 F_ENTROPY_TYPE_NOT_RECOMENDED

`#define F_ENTROPY_TYPE_NOT_RECOMENDED (uint32_t)1470003345`

Type of the not recommended entropy used for verifier.

Very fast

Definition at line **146** of file **f_util.h**.

5.9.2.8 F_ENTROPY_TYPE_PARANOIC

`#define F_ENTROPY_TYPE_PARANOIC (uint32_t)1477682819`

Type of the very excelent entropy used for verifier.

Very slow

Definition at line **118** of file **f_util.h**.

5.9.2.9 F_GET_CH_MODE_ANY_KEY

```
#define F_GET_CH_MODE_ANY_KEY (int)(1<<17)
```

See also

> **f_get_char_no_block()** (p. **??**)

Definition at line **380** of file **f_util.h**.

5.9.2.10 F_GET_CH_MODE_NO_ECHO

```
#define F_GET_CH_MODE_NO_ECHO (int)(1<<16)
```

See also

> **f_get_char_no_block()** (p. **??**)

Definition at line **374** of file **f_util.h**.

5.9.2.11 F_PASS_IS_OUT_OVF

```
#define F_PASS_IS_OUT_OVF (int)1024
```

Password is overflow and cannot be stored.

Definition at line **208** of file **f_util.h**.

5.9.2.12 F_PASS_IS_TOO_LONG

```
#define F_PASS_IS_TOO_LONG (int)256
```

Password is too long.

Definition at line **196** of file **f_util.h**.

5.9.2.13 F_PASS_IS_TOO_SHORT

```
#define F_PASS_IS_TOO_SHORT (int)512
```

Password is too short.

Definition at line **202** of file **f_util.h**.

5.9.2.14 F_PASS_MUST_HAVE_AT_LEAST_NONE

```
#define F_PASS_MUST_HAVE_AT_LEAST_NONE (int)0
```

Password does not need any criteria to pass.

Definition at line **166** of file **f_util.h**.

5.9.2.15 F_PASS_MUST_HAVE_AT_LEAST_ONE_LOWER_CASE

```
#define F_PASS_MUST_HAVE_AT_LEAST_ONE_LOWER_CASE (int)8
```

Password must have at least one lower case.

Definition at line **190** of file **f_util.h**.

5.9.2.16 F_PASS_MUST_HAVE_AT_LEAST_ONE_NUMBER

```
#define F_PASS_MUST_HAVE_AT_LEAST_ONE_NUMBER (int)1
```

Password must have at least one number.

Definition at line **172** of file **f_util.h**.

5.9.2.17 F_PASS_MUST_HAVE_AT_LEAST_ONE_SYMBOL

```
#define F_PASS_MUST_HAVE_AT_LEAST_ONE_SYMBOL (int)2
```

Password must have at least one symbol.

Definition at line **178** of file **f_util.h**.

5.9.2.18 F_PASS_MUST_HAVE_AT_LEAST_ONE_UPPER_CASE

```
#define F_PASS_MUST_HAVE_AT_LEAST_ONE_UPPER_CASE (int)4
```

Password must have at least one upper case.

Definition at line **184** of file **f_util.h**.

5.9.3 Typedef Documentation

5.9.3.1 ERR_ECDSA_SECRET_KEY_VALID

typedef enum **err_ecdsa_secret_key_valid_e** **ERR_ECDSA_SECRET_KEY_VALID**

5.9.3.2 fn_det

typedef int(* fn_det) (void *, unsigned char *, size_t)

Definition at line **544** of file **f_util.h**.

5.9.3.3 rnd_fn

rnd_fn

Pointer caller for random function.

Definition at line **339** of file **f_util.h**.

5.9.4 Enumeration Type Documentation

5.9.4.1 err_ecdsa_secret_key_valid_e

enum **err_ecdsa_secret_key_valid_e**

ECDSA secret key error checker enumerator.

Enumerator

ERR_KEY_SK_SIZE_ZERO	
ERR_SK_MALLOC	Key size is zero.
ERR_SK_READ_BINARY	Error alloc memory for check.
ERR_SK_CHECK	Error binary read. Secret key invalid

Definition at line **575** of file **f_util.h**.

5.9.5 Function Documentation

5.9.5.1 crc32_init()

```
uint32_t crc32_init (
            unsigned char * p,
            size_t len,
            uint32_t crcinit )
```

Performs a CRC32 of a given data.

Parameters

in	*p*	Pointer of the data
in	*len*	Size of data in pointer *p*
in	*crcinit*	Init vector of the CRC32

Return values

CRC32	hash

5.9.5.2 f_base64_decode_dynamic()

```
int f_base64_decode_dynamic (
            void ** ,
            size_t * ,
            const char * ,
            size_t  )
```

5.9.5.3 f_base64url_decode()

```
int f_base64url_decode (
            void * ,
            size_t ,
            size_t * ,
            const char * ,
            size_t  )
```

5.9.5.4 f_base64url_encode()

```
int f_base64url_encode (
            char * ,
            size_t ,
            size_t * ,
            void * ,
            size_t  )
```

5.9.5.5 f_base64url_encode_dynamic()

```
int f_base64url_encode_dynamic (
            void ** ,
            size_t * ,
            void * ,
            size_t  )
```

5.9.5.6 f_convert_to_double()

```
int f_convert_to_double (
            double * val,
            const char * value )
```

Convert any valid number im *value* and converts it to double *val*

Parameters

out	*val*	Value converted to double
in	*value*	Value in string to be converted

Return values

0	On Success, Otherwise error

5.9.5.7 f_convert_to_long_int()

```
int f_convert_to_long_int (
            unsigned long int * val,
            char * value,
            size_t value_sz )
```

Converts a string value to unsigned long int.

Parameters

out	*val*	Value stored in a unsigned long int variable
in	*value*	Input value to be parsed to unsigned long int
in	*value_sz*	Max size allowed in *value* string.

Return values

0	On Success, Otherwise error

See also

> **f_convert_to_unsigned_int()** (p. **??**)

5.9.5.8 f_convert_to_long_int0()

```
int f_convert_to_long_int0 (
            unsigned long int * val,
            char * value,
            size_t value_sz )
```

Converts a octal value in ASCII string to unsigned long int.

Parameters

out	*val*	Value stored in a unsigned long int variable
in	*value*	Input value to be parsed to unsigned long int
in	*value_sz*	Max size allowed in *value* string.

Return values

0	On Success, Otherwise error

See also

> **f_convert_to_long_int0x()** (p. **??**)

5.9.5.9 f_convert_to_long_int0x()

```
int f_convert_to_long_int0x (
            unsigned long int * val,
            char * value,
            size_t value_sz )
```

Converts a hex value in ASCII string to unsigned long int.

Parameters

out	*val*	Value stored in a unsigned long int variable
in	*value*	Input value to be parsed to unsigned long int
in	*value_sz*	Max size allowed in *value* string.

Return values

0	On Success, Otherwise error

See also

> **f_convert_to_long_int0()** (p. **??**)

5.9.5.10 f_convert_to_long_int_std()

```
int f_convert_to_long_int_std (
            unsigned long int * val,
            char * value,
            size_t value_sz )
```

Converts a actal/decimal/hexadecimal into ASCII string to unsigned long int.

Parameters

out	*val*	Value stored in a unsigned long int variable
in	*value*	Input value to be parsed to unsigned long int • If a string contains only numbers, it will be parsed to unsigned long int decimal • If a string begins with 0 it will be parsed to octal EX.: 010(octal) = 08(decimal) • If a string contais 0x or 0X it will be parsed to hexadecimal. EX.: 0x10(hexadecimal) = 16 (decimal)
in	*value_sz*	Max size allowed in *value* string.

Return values

0	On Success, Otherwise error

See also

> **f_convert_to_long_int()** (p. **??**)

5.9.5.11 f_convert_to_unsigned_int()

```
int f_convert_to_unsigned_int (
            unsigned int * val,
            char * value,
            size_t value_sz )
```

Converts a string value to unsigned int.

Parameters

out	val	Value stored in a unsigned int variable
in	value	Input value to be parsed to unsigned int
in	value_sz	Max size allowed in value string.

Return values

0	On Success, Otherwise error

See also

> **f_convert_to_long_int()** (p. **??**)

5.9.5.12 f_convert_to_unsigned_int0()

```
int f_convert_to_unsigned_int0 (
            unsigned int * val,
            char * value,
            size_t value_sz )
```

Converts a octal value in ASCII string to unsigned int.

Parameters

out	val	Value stored in a unsigned int variable
in	value	Input value to be parsed to unsigned int
in	value_sz	Max size allowed in value string.

Return values

0	On Success, Otherwise error

See also

> **f_convert_to_unsigned_int0x()** (p. **??**)

5.9.5.13 f_convert_to_unsigned_int0x()

```
int f_convert_to_unsigned_int0x (
          unsigned int * val,
          char * value,
          size_t value_sz )
```

Converts a hex value in ASCII string to unsigned int.

Parameters

out	*val*	Value stored in a unsigned int variable
in	*value*	Input value to be parsed to unsigned int
in	*value_sz*	Max size allowed in *value* string.

Return values

0	On Success, Otherwise error

See also

f_convert_to_unsigned_int0() (p. **??**)

5.9.5.14 f_convert_to_unsigned_int_std()

```
int f_convert_to_unsigned_int_std (
          unsigned int * val,
          char * value,
          size_t value_sz )
```

Converts a actal/decimal/hexadecimal into ASCII string to unsigned int.

Parameters

out	*val*	Value stored in a unsigned int variable
in	*value*	Input value to be parsed to unsigned int • If a string contains only numbers, it will be parsed to unsigned int decimal • If a string begins with 0 it will be parsed to octal EX.: 010(octal) = 08(decimal) • If a string contais 0x or 0X it will be parsed to hexadecimal. EX.: 0x10(hexadecimal) = 16 (decimal)
in	*value_sz*	Max size allowed in *value* string.

Return values

0	On Success, Otherwise error

See also

    f_convert_to_unsigned_int() (p. **??**)

5.9.5.15 f_ecdsa_public_key_valid()

```
int f_ecdsa_public_key_valid (
            mbedtls_ecp_group_id ,
            unsigned char * ,
            size_t  )
```

5.9.5.16 f_ecdsa_secret_key_valid()

```
ERR_ECDSA_SECRET_KEY_VALID f_ecdsa_secret_key_valid (
            mbedtls_ecp_group_id gid,
            unsigned char * secret_key,
            size_t secret_key_len )
```

Checks is ECDSA secret key is valid.

Parameters

in	*gid*	Input EC group *id*
in	*secret_key*	Secret key
in	*secret_key_len*	Size of secret key

Return values

ERROR_SUCCESS	(0) if success or non zero if error

5.9.5.17 f_encode_to_base64()

```
int f_encode_to_base64 (
            char * ,
            size_t ,
            size_t * ,
            void * ,
            size_t  )
```

5.9.5.18 f_encode_to_base64_dynamic()

```
int f_encode_to_base64_dynamic (
            char ** ,
            size_t * ,
            void * ,
            size_t  )
```

5.9.5.19 f_gen_ecdsa_key_pair()

```
f_ecdsa_key_pair_err f_gen_ecdsa_key_pair (
            f_ecdsa_key_pair * ,
            int ,
             fn_det ,
            void * )
```

5.9.5.20 f_get_char_no_block()

```
int f_get_char_no_block (
            int mode )
```

Reads a char from console.

Waits a char and returns its value

Parameters

in	*mode*	Mode and/or character to be returned
		• *F_GET_CH_MODE_NO_ECHO* No echo is on the console string
		• *F_GET_CH_MODE_ANY_KEY* Returns any key pressed

Example:

```
key=f_get_char_no_block(F_GET_CH_MODE_NO_ECHO|'c'); // Waits 'c' char key and returns value 0x00000063
        without echo 'c' on the screen
```

Return values

key	code: On Success, Negative value on error

5.9.5.21   f_get_entropy_name()

```
char * f_get_entropy_name (
            uint32_t val )
```

Returns a entropy name given a index/ASCII index or entropy value.

Parameters

in	*val*	Index/ASCII index or entropy value

Return values:

- *NULL* If no entropy index/ASCII/entropy found in *val*

- *F_ENTROPY_TYPE_∗* name if found in index/ASCII or entropy value

5.9.5.22   f_hmac_sha512()

```
f_md_hmac_sha512 f_hmac_sha512 (
            unsigned char * result,
            const unsigned char * key,
            size_t key_len,
            const unsigned char * data,
            size_t data_len )
```

Calculates SHA512 HMAC.

Parameters

out	*result*	Output result
in	*key*	Pointer of the key address
in	*key_len*	Size of *key*
in	*data*	Data pointer address
in	*data_len*	Size of *data*

Return values

ERROR_SUCCESS	(0) if success or non zero if error

5.9.5.23   f_is_random_attached()

```
void * f_is_random_attached ( )
```

Verifies if system random function is attached in myNanoEmbedded API.

Return values

NULL	if not attached, Otherwise returns the pointer of random number genarator function

See also

    f_random_attach() (p. **??**)

5.9.5.24   f_pass_must_have_at_least()

```
int f_pass_must_have_at_least (
            char * password,
            size_t n,
            size_t min,
            size_t max,
            int must_have )
```

Checks if a given password has enought requirements to be parsed to a function.

Parameters

in	*password*	Password string
in	*n*	Max buffer string permitted to store password including NULL char
in	*min*	Minimum size allowed in password string
in	*max*	Maximum size allowed in password

in	*must_have*	Must have a type:
		
		  • F_PASS_MUST_HAVE_AT_LEAST_NONE Not need any special characters or number
		
		  • F_PASS_MUST_HAVE_AT_LEAST_ONE_NUMBER Must have at least one number
		
		  • F_PASS_MUST_HAVE_AT_LEAST_ONE_SYMBOL Must have at least one symbol
		
		  • F_PASS_MUST_HAVE_AT_LEAST_ONE_UPPER_CASE Must have at least one upper case
		
		  • F_PASS_MUST_HAVE_AT_LEAST_ONE_LOWER_CASE Must have at least one lower case

Return values:

- *0 (zero):* If password is passed in the test

- *F_PASS_IS_OUT_OVF:* If password lenght exceeds *n* value

- *F_PASS_IS_TOO_SHORT:* If password length is less than *min* value

- *F_PASS_IS_TOO_LONG:* If password length is greater tham *m* value

- *F_PASS_MUST_HAVE_AT_LEAST_ONE_UPPER_CASE:* If password is required in *must_have* type upper case characters

- *F_PASS_MUST_HAVE_AT_LEAST_ONE_LOWER_CASE:* If password is required in *must_have* type lower case characters

- *F_PASS_MUST_HAVE_AT_LEAST_ONE_SYMBOL:* If password is required in *must_have* type to have symbol(s)

- *F_PASS_MUST_HAVE_AT_LEAST_ONE_NUMBER:* if password is required in *must_have* type to have number(s)

5.9.5.25 f_passwd_comp_safe()

```
int f_passwd_comp_safe (
            char * pass1,
            char * pass2,
            size_t n,
            size_t min,
            size_t max )
```

Compares two passwords values with safe buffer.

Parameters

in	*pass1*	First password to compare with *pass2*
in	*pass2*	Second password to compare with *pass1*
in	*n*	Size of Maximum buffer of both *pass1* and *pass2*
in	*min*	Minimun value of both *pass1* and *pass2*
in	*max*	Maximum value of both *pass1* and *pass2*

Return values

0	If *pass1* is equal to *pass2*, otherwise value is less than 0 (zero) if password does not match

5.9.5.26 f_random()

```
void f_random (
            void * random,
            size_t random_sz )
```

Random function to be called to generate a *random* data with *random_sz*

Parameters

out	*random*	Random data to be parsed
in	*random_sz*	Size of random data to be filled

See also

> **f_random_attach()** (p. **??**)

5.9.5.27 f_random_attach()

```
void f_random_attach (
            rnd_fn fn )
```

Attachs a function to be called by *f_random() (*p. **??***)*

Parameters

in	*fn*	A function to be called

See also

> **rnd_fn()** (p. **??**)

5.9.5.28 f_random_detach()

```
void f_random_detach ( )
```

Detaches system random numeber genarator from myNanoEmbedded API.

See also

> **f_random_attach()** (p. **??**)

5.9.5.29 f_reverse()

```
int f_reverse (
            unsigned char * val,
            size_t val_sz )
```

Reverse bytes.

Parameters

in	*val*	Pointer to be reversed
in	*val_sz*	Size of *val*

Return values

ERROR_SUCCESS	(0) if success or non zero if error

5.9.5.30 f_ripemd160()

```
uint8_t* f_ripemd160 (
            const uint8_t * ,
            size_t  )
```

5.9.5.31 f_sel_to_entropy_level()

```
uint32_t f_sel_to_entropy_level (
            int sel )
```

Return a given entropy number given a number encoded ASCII or index number.

Parameters

in	*sel*	ASCII or index value

Return values:

- *0 (zero):* If no entropy number found in *sel*

- *F_ENTROPY_TYPE_PARANOIC*

- *F_ENTROPY_TYPE_EXCELENT*

- *F_ENTROPY_TYPE_GOOD*

- *F_ENTROPY_TYPE_NOT_ENOUGH*

- *F_ENTROPY_TYPE_NOT_RECOMENDED*

5.9.5.32 f_str_to_hex()

```
int f_str_to_hex (
            uint8_t * hex_stream,
            char * str )
```

Converts a *str* string buffer to raw *hex_stream* value stream.

Parameters

out	*hex*	Raw hex value
in	*str*	String buffer terminated with NULL char

Return values

0	On Success, otherwise Error

5.9.5.33 f_uncompress_elliptic_curve()

```
int f_uncompress_elliptic_curve (
        uint8_t * ,
        size_t ,
        size_t * ,
        mbedtls_ecp_group_id ,
        uint8_t * ,
        size_t  )
```

5.9.5.34 f_url_base64_to_base64_dynamic()

```
int f_url_base64_to_base64_dynamic (
        char ** ,
        size_t * ,
        const char * ,
        size_t  )
```

5.9.5.35 f_url_decode()

```
int f_url_decode (
        void * ,
        size_t ,
        size_t * ,
        const char * ,
        size_t  )
```

5.9.5.36 f_url_encode()

```
int f_url_encode (
        char * ,
        size_t ,
        size_t * ,
        uint8_t * ,
        size_t  )
```

5.9.5.37 f_verify_system_entropy()

```
int f_verify_system_entropy (
            uint32_t type,
            void * rand,
            size_t rand_sz,
            int turn_on_wdt )
```

Take a random number generator function and returns random value only if randomized data have a desired entropy value.

Parameters

in	*type*	Entropy type. Entropy type values are: • F_ENTROPY_TYPE_PARANOIC Highest level entropy recommended for generate a Nano SEED with a paranoic entropy. Very slow • F_ENTROPY_TYPE_EXCELENT Gives a very excellent entropy for generating Nano SEED. Slow • F_ENTROPY_TYPE_GOOD Good entropy type for generating Nano SEED. Normal. • F_ENTROPY_TYPE_NOT_ENOUGH Moderate entropy for generating Nano SEED. Usually fast to create a temporary Nano SEED. Fast • F_ENTROPY_TYPE_NOT_RECOMENDED Fast but not recommended for generating Nano SEED.
out	*rand*	Random data with a satisfied type of entropy
in	*rand_sz*	Size of random data output
in	*turn_on_wdt*	For ESP32, Arduino platform and other microcontrollers only. Turns on/off WATCH DOG (0: OFF, NON ZERO: ON). For Raspberry PI and Linux native is ommited.

This implementation is based on topic in `Definition 7.12` in MIT opencourseware (7.3 A Statistical Definition of Entropy - 2005)
Many thanks to **Professor Z. S. Spakovszky** for this amazing topic

Return values

0	On Success, otherwise Error

5.9.5.38 get_console_passwd()

```
int get_console_passwd (
            char * pass,
            size_t pass_sz )
```

Reads a password from console.

Parameters

out	*pass*	Password to be parsed to pointer
in	*pass_sz*	Size of buffer *pass*

Return values

0	On Success, otherwise Error

5.10 f_util.h

```
00001 /*
00002     AUTHOR: Fábio Pereira da Silva
00003     YEAR: 2019-20
00004     LICENSE: MIT
00005     EMAIL: fabioegel@gmail.com or fabioegel@protonmail.com
00006 */
00007
00013 #include <stdint.h>
00014 #include "mbedtls/sha256.h"
00015 #include "mbedtls/aes.h"
00016 #include "mbedtls/ecdsa.h"
00017
00018 #ifdef __cplusplus
00019 extern "C" {
00020 #endif
00021
00022 #ifndef F_DOC_SKIP
00023
00024  #define F_LOG_MAX 8*256
00025  #define LICENSE \
00026 "MIT License\n\n\
00027 Copyright (c) 2019 Fábio Pereira da Silva\n\n\
00028 Permission is hereby granted, free of charge, to any person obtaining a copy\n\
00029 of this software and associated documentation files (the \"Software\"), to deal\n\
00030 in the Software without restriction, including without limitation the rights\n\
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00041 OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE\n\
00042 SOFTWARE.\n\n\n"
00043
00044 #endif
00045
00046 #ifdef F_ESP32
00047
00048  #define F_WDT_MAX_ENTROPY_TIME 2*120
00049  #define F_WDT_PANIC true
00050  #define F_WDT_MIN_TIME 20//4
00051
00052 #endif
00053
00071 int f_verify_system_entropy(uint32_t, void *, size_t, int);
00072
00099 int f_pass_must_have_at_least(char *, size_t, size_t, size_t, int);
00100
00101 #ifndef F_DOC_SKIP
00102
00103 int f_verify_system_entropy_begin();
00104 void f_verify_system_entropy_finish();
00105 int f_file_exists(char *);
00106 int f_find_str(size_t *, char *, size_t, char *);
00107 int f_find_replace(char *, size_t *, size_t, char *, size_t, char *, char *);
00108 int f_is_integer(char *, size_t);
00109 int is_filled_with_value(uint8_t *, size_t, uint8_t);
00110
00111 #endif
```

```
00112
00113 //#define F_ENTROPY_TYPE_PARANOIC (uint32_t)1476682819
00118 #define F_ENTROPY_TYPE_PARANOIC (uint32_t)1477682819
00119
00120 //#define F_ENTROPY_TYPE_EXCELENT (uint32_t)1475885281
00125 #define F_ENTROPY_TYPE_EXCELENT (uint32_t)1476885281
00126
00127 //#define F_ENTROPY_TYPE_GOOD (uint32_t)1471531015
00132 #define F_ENTROPY_TYPE_GOOD (uint32_t)1472531015
00133
00134 //#define F_ENTROPY_TYPE_NOT_ENOUGH (uint32_t)1470001808
00139 #define F_ENTROPY_TYPE_NOT_ENOUGH (uint32_t)1471001808
00140
00141 //#define F_ENTROPY_TYPE_NOT_RECOMENDED (uint32_t)1469703345
00146 #define F_ENTROPY_TYPE_NOT_RECOMENDED (uint32_t)1470003345
00147
00153 #define ENTROPY_BEGIN f_verify_system_entropy_begin();
00154
00160 #define ENTROPY_END f_verify_system_entropy_finish();
00161
00166 #define F_PASS_MUST_HAVE_AT_LEAST_NONE (int)0
00167
00172 #define F_PASS_MUST_HAVE_AT_LEAST_ONE_NUMBER (int)1
00173
00178 #define F_PASS_MUST_HAVE_AT_LEAST_ONE_SYMBOL (int)2
00179
00184 #define F_PASS_MUST_HAVE_AT_LEAST_ONE_UPPER_CASE (int)4
00185
00190 #define F_PASS_MUST_HAVE_AT_LEAST_ONE_LOWER_CASE (int)8
00191
00196 #define F_PASS_IS_TOO_LONG (int)256
00197
00202 #define F_PASS_IS_TOO_SHORT (int)512
00203
00208 #define F_PASS_IS_OUT_OVF (int)1024//768
00209
00210 #ifndef F_DOC_SKIP
00211
00212  #define F_PBKDF2_ITER_SZ 2*4096
00213
00214 typedef enum f_pbkdf2_err_t {
00215     F_PBKDF2_RESULT_OK=0,
00216     F_PBKDF2_ERR_CTX=95,
00217     F_PBKDF2_ERR_PKCS5,
00218     F_PBKDF2_ERR_INFO_SHA
00219 } f_pbkdf2_err;
00220
00221 typedef enum f_aes_err {
00222     F_AES_RESULT_OK=0,
00223     F_AES_ERR_ENCKEY=30,
00224     F_AES_ERR_DECKEY,
00225     F_AES_ERR_MALLOC,
00226     F_AES_UNKNOW_DIRECTION,
00227     F_ERR_ENC_DECRYPT_FAILED
00228 } f_aes_err;
00229
00230 typedef enum f_md_hmac_sha512_t {
00231    F_HMAC_SHA512_OK = 0,
00232    F_HMAC_SHA512_MALLOC = 304,
00233    F_HMAC_SHA512_ERR_INFO,
00234    F_HMAC_SHA512_ERR_SETUP,
00235    F_HMAC_SHA512_DIGEST_ERROR
00236 } f_md_hmac_sha512;
00238 typedef enum f_ecdsa_key_pair_err_t {
00239    F_ECDSA_KEY_PAIR_OK = 0,
00240    F_ECDSA_KEY_PAIR_NULL = 330,
00241    F_ECDSA_KEY_PAIR_MALLOC
00242 } f_ecdsa_key_pair_err;
00243
00244 typedef struct f_ecdsa_key_pair_t {
00245     size_t public_key_sz;
00246     size_t private_key_sz;
00247     mbedtls_ecdsa_context *ctx;
00248     mbedtls_ecp_group_id gid;
00249     unsigned char public_key[MBEDTLS_ECDSA_MAX_LEN];
00250     unsigned char private_key[MBEDTLS_ECDSA_MAX_LEN];
00251 } f_ecdsa_key_pair;
00252
00257 enum f_encode_decode_error_t {
00258    F_URL_ENCODE_OK = 0,
00259    F_ENCODE_BASE64_DEST_SMALL=11300,
00260    F_ENCODE_TO_BASE64_MALLOC,
00261    F_BASE64_DECODE_MALLOC,
00262    F_URL_ENCODE_EMPTY,
00263    F_URL_ENCODE_DEST_SMALL,
00264    F_BASE64_URL_DECODE_MALLOC,
00265    F_BASE64_URL_DECODE_MEMORY_SMALL,
```

```
00266    F_BASE64_URL_TO_BASE64_EMPTY_BASE64,
00267    F_BASE64_URL_TO_BASE64_MALLOC,
00268    F_URL_ENCODE_EMPTY_STRING,
00269    F_URL_ENCODE_WAITING_NEXT_NIBBLE,
00270    F_URL_INVALID_HEX_STRING,
00271    F_URL_NO_SPACE_IN_MEMORY_BUFFER,
00272    F_URL_ENCODE_INVALID_STRING
00273 };
00274
00275 char *fhex2strv2(char *, const void *, size_t, int);
00276 int f_sha256_digest(void **, int, uint8_t *, size_t);
00277 f_pbkdf2_err f_pbkdf2_hmac(unsigned char *, size_t, unsigned char *, size_t, uint8_t *);
00278 f_aes_err f_aes256cipher(uint8_t *, uint8_t *, void *, size_t, void *, int);
00279
00280 #endif
00281
00293 int f_passwd_comp_safe(char *, char *, size_t, size_t, size_t);
00294
00305 char *f_get_entropy_name(uint32_t);
00306
00321 uint32_t f_sel_to_entropy_level(int);
00322
00331 int f_str_to_hex(uint8_t *, char *);
00332
00333 #ifndef F_ESP32
00334
00339 typedef void (*rnd_fn)(void *, size_t);
00340
00348 void f_random_attach(rnd_fn);
00349
00358 void f_random(void *, size_t);
00359
00368 int get_console_passwd(char *, size_t);
00369
00374 #define F_GET_CH_MODE_NO_ECHO (int)(1<<16)
00375
00380 #define F_GET_CH_MODE_ANY_KEY (int)(1<<17)
00381
00397 int f_get_char_no_block(int);
00398
00399 #endif
00400
00411 int f_convert_to_long_int(unsigned long int *, char *, size_t);
00412
00413
00424 int f_convert_to_unsigned_int(unsigned int *, char *, size_t);
00425
00436 int f_convert_to_long_int0x(unsigned long int *, char *, size_t);
00437
00448 int f_convert_to_long_int0(unsigned long int *, char *, size_t);
00449
00463 int f_convert_to_long_int_std(unsigned long int *, char *, size_t);
00464
00472 void *f_is_random_attached();
00473
00480 void f_random_detach();
00481
00492 int f_convert_to_unsigned_int0x(unsigned int *val, char *value, size_t value_sz);
00493
00504 int f_convert_to_unsigned_int0(unsigned int *val, char *value, size_t value_sz);
00505
00519 int f_convert_to_unsigned_int_std(unsigned int *val, char *value, size_t value_sz);
00520
00530 int f_convert_to_double(double *, const char *);
00531
00542 uint32_t crc32_init(unsigned char *, size_t, uint32_t);
00543 //
00544 typedef int (*fn_det)(void *, unsigned char *, size_t);
00545
00555 int f_reverse(unsigned char *, size_t);
00556
00569 f_md_hmac_sha512 f_hmac_sha512(unsigned char *, const unsigned char *, size_t, const unsigned char *,
    size_t);
00570
00575 typedef enum err_ecdsa_secret_key_valid_e {
00576    ERR_KEY_SK_SIZE_ZERO = 476,
00577    ERR_SK_MALLOC,
00578    ERR_SK_READ_BINARY,
00579    ERR_SK_CHECK
00580 } ERR_ECDSA_SECRET_KEY_VALID;
00581
00592 ERR_ECDSA_SECRET_KEY_VALID
00593 f_ecdsa_secret_key_valid(mbedtls_ecp_group_id, unsigned char *, size_t);
00594 int f_ecdsa_public_key_valid(mbedtls_ecp_group_id, unsigned char *, size_t);
00595 f_ecdsa_key_pair_err f_gen_ecdsa_key_pair(f_ecdsa_key_pair *, int, fn_det, void *);
00596 int f_uncompress_elliptic_curve(uint8_t *, size_t, size_t *, mbedtls_ecp_group_id, uint8_t *, size_t);
00597 uint8_t *f_ripemd160(const uint8_t *, size_t);
```

```
00598 int f_url_encode(char *, size_t, size_t *, uint8_t *, size_t);
00599 int f_encode_to_base64_dynamic(char **, size_t *, void *, size_t );
00600 int f_base64_decode_dynamic(void **, size_t *, const char *, size_t);
00601 int f_base64url_encode_dynamic(void **, size_t *, void *, size_t);
00602 int f_encode_to_base64(char *, size_t, size_t *, void *, size_t);
00603 int f_base64url_encode(char *, size_t, size_t *, void *, size_t);
00604 int f_base64url_decode(void *, size_t, size_t *, const char *, size_t);
00605 int f_url_base64_to_base64_dynamic(char **, size_t *, const char *, size_t);
00606 int f_url_decode(void *, size_t, size_t *, const char *, size_t);
00607
00608 #define CLEAR_AND_FREE(ptr, size) free(memset(ptr, 0, size));
00609 #ifdef __cplusplus
00610 }
00611 #endif
```

5.11 sodium.h File Reference

```
#include "sodium/version.h"
#include "sodium/core.h"
#include "sodium/crypto_aead_aes256gcm.h"
#include "sodium/crypto_aead_chacha20poly1305.h"
#include "sodium/crypto_aead_xchacha20poly1305.h"
#include "sodium/crypto_auth.h"
#include "sodium/crypto_auth_hmacsha256.h"
#include "sodium/crypto_auth_hmacsha512.h"
#include "sodium/crypto_auth_hmacsha512256.h"
#include "sodium/crypto_box.h"
#include "sodium/crypto_box_curve25519xsalsa20poly1305.h"
#include "sodium/crypto_core_hsalsa20.h"
#include "sodium/crypto_core_hchacha20.h"
#include "sodium/crypto_core_salsa20.h"
#include "sodium/crypto_core_salsa2012.h"
#include "sodium/crypto_core_salsa208.h"
#include "sodium/crypto_generichash.h"
#include "sodium/crypto_generichash_blake2b.h"
#include "sodium/crypto_hash.h"
#include "sodium/crypto_hash_sha256.h"
#include "sodium/crypto_hash_sha512.h"
#include "sodium/crypto_kdf.h"
#include "sodium/crypto_kdf_blake2b.h"
#include "sodium/crypto_kx.h"
#include "sodium/crypto_onetimeauth.h"
#include "sodium/crypto_onetimeauth_poly1305.h"
#include "sodium/crypto_pwhash.h"
#include "sodium/crypto_pwhash_argon2i.h"
#include "sodium/crypto_scalarmult.h"
#include "sodium/crypto_scalarmult_curve25519.h"
#include "sodium/crypto_secretbox.h"
#include "sodium/crypto_secretbox_xsalsa20poly1305.h"
#include "sodium/crypto_secretstream_xchacha20poly1305.h"
#include "sodium/crypto_shorthash.h"
#include "sodium/crypto_shorthash_siphash24.h"
#include "sodium/crypto_sign.h"
#include "sodium/crypto_sign_ed25519.h"
#include "sodium/crypto_stream.h"
#include "sodium/crypto_stream_chacha20.h"
#include "sodium/crypto_stream_salsa20.h"
#include "sodium/crypto_stream_xsalsa20.h"
#include "sodium/crypto_verify_16.h"
#include "sodium/crypto_verify_32.h"
```

```
#include "sodium/crypto_verify_64.h"
#include "sodium/randombytes.h"
#include "sodium/randombytes_internal_random.h"
#include "sodium/randombytes_sysrandom.h"
#include "sodium/runtime.h"
#include "sodium/utils.h"
#include "sodium/crypto_box_curve25519xchacha20poly1305.h"
#include "sodium/crypto_core_ed25519.h"
#include "sodium/crypto_core_ristretto255.h"
#include "sodium/crypto_scalarmult_ed25519.h"
#include "sodium/crypto_scalarmult_ristretto255.h"
#include "sodium/crypto_secretbox_xchacha20poly1305.h"
#include "sodium/crypto_pwhash_scryptsalsa208sha256.h"
#include "sodium/crypto_stream_salsa2012.h"
#include "sodium/crypto_stream_salsa208.h"
#include "sodium/crypto_stream_xchacha20.h"
```

5.12 sodium.h

```
00001
00002 #ifndef sodium_H
00003 #define sodium_H
00004
00005 #include "sodium/version.h"
00006
00007 #include "sodium/core.h"
00008 #include "sodium/crypto_aead_aes256gcm.h"
00009 #include "sodium/crypto_aead_chacha20poly1305.h"
00010 #include "sodium/crypto_aead_xchacha20poly1305.h"
00011 #include "sodium/crypto_auth.h"
00012 #include "sodium/crypto_auth_hmacsha256.h"
00013 #include "sodium/crypto_auth_hmacsha512.h"
00014 #include "sodium/crypto_auth_hmacsha512256.h"
00015 #include "sodium/crypto_box.h"
00016 #include "sodium/crypto_box_curve25519xsalsa20poly1305.h"
00017 #include "sodium/crypto_core_hsalsa20.h"
00018 #include "sodium/crypto_core_hchacha20.h"
00019 #include "sodium/crypto_core_salsa20.h"
00020 #include "sodium/crypto_core_salsa2012.h"
00021 #include "sodium/crypto_core_salsa208.h"
00022 #include "sodium/crypto_generichash.h"
00023 #include "sodium/crypto_generichash_blake2b.h"
00024 #include "sodium/crypto_hash.h"
00025 #include "sodium/crypto_hash_sha256.h"
00026 #include "sodium/crypto_hash_sha512.h"
00027 #include "sodium/crypto_kdf.h"
00028 #include "sodium/crypto_kdf_blake2b.h"
00029 #include "sodium/crypto_kx.h"
00030 #include "sodium/crypto_onetimeauth.h"
00031 #include "sodium/crypto_onetimeauth_poly1305.h"
00032 #include "sodium/crypto_pwhash.h"
00033 #include "sodium/crypto_pwhash_argon2i.h"
00034 #include "sodium/crypto_scalarmult.h"
00035 #include "sodium/crypto_scalarmult_curve25519.h"
00036 #include "sodium/crypto_secretbox.h"
00037 #include "sodium/crypto_secretbox_xsalsa20poly1305.h"
00038 #include "sodium/crypto_secretstream_xchacha20poly1305.h"
00039 #include "sodium/crypto_shorthash.h"
00040 #include "sodium/crypto_shorthash_siphash24.h"
00041 #include "sodium/crypto_sign.h"
00042 #include "sodium/crypto_sign_ed25519.h"
00043 #include "sodium/crypto_stream.h"
00044 #include "sodium/crypto_stream_chacha20.h"
00045 #include "sodium/crypto_stream_salsa20.h"
00046 #include "sodium/crypto_stream_xsalsa20.h"
00047 #include "sodium/crypto_verify_16.h"
00048 #include "sodium/crypto_verify_32.h"
00049 #include "sodium/crypto_verify_64.h"
00050 #include "sodium/randombytes.h"
00051 #include "sodium/randombytes_internal_random.h"
00052 #include "sodium/randombytes_sysrandom.h"
00053 #include "sodium/runtime.h"
00054 #include "sodium/utils.h"
```

```
00055
00056 #ifndef SODIUM_LIBRARY_MINIMAL
00057 # include "sodium/crypto_box_curve25519xchacha20poly1305.h"
00058 # include "sodium/crypto_core_ed25519.h"
00059 # include "sodium/crypto_core_ristretto255.h"
00060 # include "sodium/crypto_scalarmult_ed25519.h"
00061 # include "sodium/crypto_scalarmult_ristretto255.h"
00062 # include "sodium/crypto_secretbox_xchacha20poly1305.h"
00063 # include "sodium/crypto_pwhash_scryptsalsa208sha256.h"
00064 # include "sodium/crypto_stream_salsa2012.h"
00065 # include "sodium/crypto_stream_salsa208.h"
00066 # include "sodium/crypto_stream_xchacha20.h"
00067 #endif
00068
00069 #endif
```

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