My Project

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Chapter 1

File Index

1.1 File List

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

Chapter 2

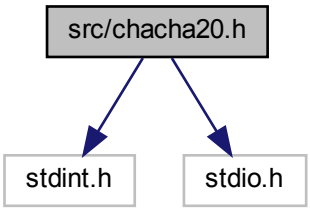
File Documentation

2.1 src/chacha20.h File Reference

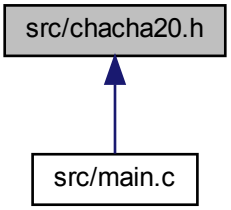
Header file for ChaCha20 stream cipher implementation.

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

Include dependency graph for chacha20.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define **ROTL32**(v, n) ((v << n) | (v >> (32 - n)))

  Rotates a 32-bit unsigned integer `v` left by `n` bits.

Functions

- uint8_t * get_key ()

  Prompts the user for a password and returns a 32-byte key.
- uint8_t * get_nonce ()

  Generates a 12-byte nonce using /dev/urandom or fallback to rand().
- uint32_t load32_le (const uint8_t *src)

  Loads a 32-bit unsigned integer from a little-endian byte array.
- void store32_le (uint8_t *dst, uint32_t w)

  Stores a 32-bit unsigned integer into a byte array in little-endian format.
- void quarterround (uint32_t *a, uint32_t *b, uint32_t *c, uint32_t *d)

  Applies the ChaCha20 quarter round function to four 32-bit words.
- void chacha20_block (uint32_t state[16], uint8_t output[64])

  Executes the ChaCha20 block function on a given 512-bit state.
- void poly1305_auth (uint8_t *mac, const uint8_t *msg, size_t msg_len, const uint8_t key[32])

  Generates a Poly1305 authentication tag for the given message.

2.1.1 Detailed Description

Header file for ChaCha20 stream cipher implementation.

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Implements the functions defined in chacha20.h

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This file provides the function declarations and macros needed to use the ChaCha20 encryption block function, along with helper routines for key and nonce handling.

2.1.2 Function Documentation

2.1.2.1 chacha20_block()

```
void chacha20_block (
            uint32_t state[16],
            uint8_t output[64] )
```

Executes the ChaCha20 block function on a given 512-bit state.

The output is 64 bytes (512 bits) of keystream, generated from 10 double-rounds.

Parameters

state	Pointer to the 16-word (64-byte) input state.
output	Pointer to a 64-byte buffer where output will be stored.

2.1.2.2 get_key()

```
uint8_t * get_key ( )
```

Prompts the user for a password and returns a 32-byte key.

The password entered by the user is truncated or zero-padded to 32 bytes.

Returns

Pointer to a heap-allocated 32-byte buffer containing the key. Must be freed by the caller.

2.1.2.3 get_nonce()

```
uint8_t * get_nonce ( )
```

Generates a 12-byte nonce using /dev/urandom or fallback to rand().

Tries to read from `/dev/urandom`; falls back to `rand()` if unavailable.

Returns

Pointer to a heap-allocated 12-byte buffer containing the nonce. Must be freed by the caller.

2.1.2.4 load32_le()

```
uint32_t load32_le (
            const uint8_t * src )
```

Loads a 32-bit unsigned integer from a little-endian byte array.

Parameters

src	Pointer to 4 bytes in memory in little-endian order.

Returns

32-bit unsigned integer.

2.1.2.5 poly1305_auth()

```
void poly1305_auth (
            uint8_t * mac,
            const uint8_t * msg,
            size_t msg_len,
            const uint8_t key[32] )
```

Generates a Poly1305 authentication tag for the given message.

This tag is used for message authentication in the ChaCha20-Poly1305 scheme.

Parameters

mac	Pointer to a 16-byte buffer for the generated tag.
msg	Pointer to the message to be authenticated.
msg_len	Length of the message in bytes.
key	32-byte key for Poly1305.

2.1.2.6 quarterround()

```
void quarterround (
            uint32_t * a,
            uint32_t * b,
            uint32_t * c,
            uint32_t * d )
```

Applies the ChaCha20 quarter round function to four 32-bit words.

This function performs 4 rounds of ARX (Add-Rotate-XOR) operations on the inputs. b ^= (a+d) <<< 7; c ^= (b+a) <<< 9; d ^= (c+b) <<< 13; a ^= (d+c) <<< 18;

2.1.2.7 store32_le()

```
void store32_le (
            uint8_t * dst,
            uint32_t w )
```

Stores a 32-bit unsigned integer into a byte array in little-endian format.

Parameters

dst	Destination pointer to a 4-byte memory location.
w	32-bit unsigned integer to store.

2.2 chacha20.h

Go to the documentation of this file.

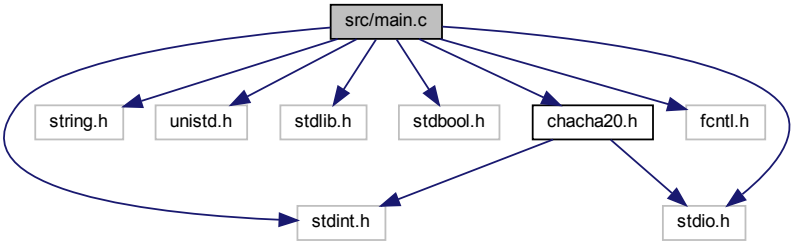
```
1
13 #ifndef CHACHA_20_H
14 #define CHACHA_20_H
15
16 #include <stdint.h>
17 #include <stdio.h>
18 #include <stdint.h>
19
28 uint8_t *
29 get_key();
30
39 uint8_t *
40 get_nonce();
41
48 uint32_t
49 load32_le(const uint8_t *src);
50
57 void
58 store32_le(uint8_t *dst, uint32_t w);
59
63 #define ROTL32(v, n) ((v « n) | (v » (32 - n)))
64
65
75 void quarterround(uint32_t *a, uint32_t *b, uint32_t *c, uint32_t *d);
76
85 void chacha20_block(uint32_t state[16], uint8_t output[64]);
86
97 void poly1305_auth(uint8_t *mac, const uint8_t *msg, size_t msg_len, const uint8_t key[32]);
98
99 #endif /* chacha20.h included */
```

2.3 src/main.c File Reference

Entry point for the ChaCha20 file encryption/decryption utility.

```
#include <stdint.h>
#include <string.h>
#include <unistd.h>
#include <stdlib.h>
#include <stdbool.h>
#include <stdio.h>
#include <fcntl.h>
#include "chacha20.h"
```

Include dependency graph for main.c:



Functions

- int main (int argc, char **argv)

  Main function to handle encryption/decryption based on command-line arguments.

2.3.1 Detailed Description

Entry point for the ChaCha20 file encryption/decryption utility.

This program encrypts or decrypts a file using the ChaCha20 stream cipher. It reads from an input file, processes 64-byte blocks, and writes to an output file. It uses a password-derived key and a 12-byte nonce.

Usage: ./program <filename> <e|d>

- 'e' to encrypt the file
- 'd' to decrypt a previously encrypted file

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2.3.2 Function Documentation

2.3.2.1 main()

```
int main (
            int argc,
            char ** argv )
```

Main function to handle encryption/decryption based on command-line arguments.

The program uses a password-derived key for encryption or decryption of a file. For encryption, it generates a random 12-byte nonce and writes it to the output file. For decryption, it reads the nonce from the input file.

Parameters

argc	Argument count.
argv	Argument vector. argv[1]: input filename argv[2]: 'e' for encryption, 'd' for decryption

Returns

int Exit status code (0 for success, 1 for argument error, or other error codes).

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