

primesieve

5.6.0

Generated by Doxygen 1.8.9.1

Sun Dec 20 2015 07:19:26

Contents

1	Main Page	1
1.1	About	1
1.2	C++ API	1
1.3	C API	1
2	Namespace Index	3
2.1	Namespace List	3
3	Hierarchical Index	5
3.1	Class Hierarchy	5
4	Class Index	7
4.1	Class List	7
5	File Index	9
5.1	File List	9
6	Namespace Documentation	11
6.1	primesieve Namespace Reference	11
6.1.1	Detailed Description	13
6.1.2	Enumeration Type Documentation	13
6.1.2.1	anonymous enum	13
6.1.3	Function Documentation	13
6.1.3.1	callback_primes	13
6.1.3.2	callback_primes	13
6.1.3.3	count_primes	13
6.1.3.4	count_quadruplets	14
6.1.3.5	count_quintuplets	14
6.1.3.6	count_sextuplets	14
6.1.3.7	count_triplets	14
6.1.3.8	count_twins	14
6.1.3.9	generate_n_primes	14
6.1.3.10	generate_primes	15

6.1.3.11	generate_primes	15
6.1.3.12	get_max_stop	15
6.1.3.13	get_num_threads	15
6.1.3.14	nth_prime	15
6.1.3.15	parallel_count_primes	16
6.1.3.16	parallel_count_quadruplets	16
6.1.3.17	parallel_count_quintuplets	16
6.1.3.18	parallel_count_sextuplets	16
6.1.3.19	parallel_count_triplets	16
6.1.3.20	parallel_count_twins	17
6.1.3.21	parallel_nth_prime	17
6.1.3.22	primesieve_test	17
6.1.3.23	print_primes	17
6.1.3.24	print_quadruplets	17
6.1.3.25	print_quintuplets	18
6.1.3.26	print_sextuplets	18
6.1.3.27	print_triplets	18
6.1.3.28	print_twins	18
6.1.3.29	set_num_threads	18
6.1.3.30	set_sieve_size	18
7	Class Documentation	21
7.1	primesieve::Callback< T > Class Template Reference	21
7.1.1	Detailed Description	21
7.2	primesieve::iterator Class Reference	21
7.2.1	Detailed Description	22
7.2.2	Constructor & Destructor Documentation	22
7.2.2.1	iterator	22
7.2.3	Member Function Documentation	22
7.2.3.1	next_prime	22
7.2.3.2	previous_prime	22
7.2.3.3	skipto	23
7.3	primesieve::primesieve_error Class Reference	24
7.3.1	Detailed Description	25
7.4	primesieve_iterator Struct Reference	25
7.4.1	Detailed Description	25
8	File Documentation	27
8.1	Callback.hpp File Reference	27
8.1.1	Detailed Description	28
8.2	iterator.hpp File Reference	28

8.2.1	Detailed Description	29
8.3	primesieve.h File Reference	29
8.3.1	Detailed Description	32
8.3.2	Enumeration Type Documentation	32
8.3.2.1	anonymous enum	32
8.3.3	Function Documentation	32
8.3.3.1	primesieve_callback_primes	32
8.3.3.2	primesieve_count_primes	32
8.3.3.3	primesieve_count_quadruplets	33
8.3.3.4	primesieve_count_quintuplets	33
8.3.3.5	primesieve_count_sextuplets	33
8.3.3.6	primesieve_count_triplets	33
8.3.3.7	primesieve_count_twins	33
8.3.3.8	primesieve_generate_n_primes	33
8.3.3.9	primesieve_generate_primes	34
8.3.3.10	primesieve_get_max_stop	34
8.3.3.11	primesieve_get_num_threads	34
8.3.3.12	primesieve_get_sieve_size	34
8.3.3.13	primesieve_nth_prime	34
8.3.3.14	primesieve_parallel_count_primes	35
8.3.3.15	primesieve_parallel_count_quadruplets	35
8.3.3.16	primesieve_parallel_count_quintuplets	35
8.3.3.17	primesieve_parallel_count_sextuplets	35
8.3.3.18	primesieve_parallel_count_triplets	36
8.3.3.19	primesieve_parallel_count_twins	36
8.3.3.20	primesieve_parallel_nth_prime	36
8.3.3.21	primesieve_print_primes	36
8.3.3.22	primesieve_print_quadruplets	36
8.3.3.23	primesieve_print_quintuplets	37
8.3.3.24	primesieve_print_sextuplets	37
8.3.3.25	primesieve_print_triplets	37
8.3.3.26	primesieve_print_twins	37
8.3.3.27	primesieve_set_num_threads	37
8.3.3.28	primesieve_set_sieve_size	37
8.3.3.29	primesieve_test	38
8.3.3.30	primesieve_version	38
8.4	primesieve.hpp File Reference	38
8.4.1	Detailed Description	40
8.5	primesieve_error.hpp File Reference	40
8.5.1	Detailed Description	41

8.6	primesieve_iterator.h File Reference	41
8.6.1	Detailed Description	43
8.6.2	Function Documentation	43
8.6.2.1	primesieve_free_iterator	43
8.6.2.2	primesieve_init	43
8.6.2.3	primesieve_next_prime	43
8.6.2.4	primesieve_previous_prime	43
8.6.2.5	primesieve_skipto	43
9	Example Documentation	45
9.1	callback_primes.cpp	45
9.2	count_primes.c	45
9.3	count_primes.cpp	45
9.4	nth_prime.c	46
9.5	nth_prime.cpp	46
9.6	previous_prime.c	46
9.7	previous_prime.cpp	47
9.8	primesieve_iterator.c	47
9.9	primesieve_iterator.cpp	47
9.10	store_primes_in_array.c	48
9.11	store_primes_in_vector.cpp	48
	Index	49

Chapter 1

Main Page

1.1 About

primesieve is a C/C++ library for fast prime number generation. It generates the primes below 10^9 in just 0.2 seconds on a single core of an Intel Core i7-6700 3.4GHz CPU. primesieve can generate primes and prime k-tuplets up to 2^{64} . primesieve's memory requirement is about $\pi(\sqrt{n}) * 8$ bytes per thread, its run-time complexity is $O(n \log \log n)$ operations. For more information please visit <http://primesieve.org>.

The recommended way to get started is to first have a look at a few C/C++ example programs. The most common use cases are storing primes in a vector (or array) and iterating over primes using `next_prime()` or `previous_prime()`.

You can install libprimesieve either using your distribution's package manager (if it is available) or you can build and install it yourself, this is explained at <http://primesieve.org/build.html>.

1.2 C++ API

- [primesieve.hpp](#) - primesieve C++ header.
- [store_primes_in_vector.cpp](#) - Example that shows how to store primes in a `std::vector`.
- [primesieve_iterator.cpp](#) - Example that shows how to iterate over primes using `primesieve::iterator`.
- [count_primes.cpp](#) - Example that shows how to count primes.

1.3 C API

- [primesieve.h](#) - primesieve C header.
- [store_primes_in_array.c](#) - Example that shows how to store primes in an array.
- [primesieve_iterator.c](#) - Example that shows how to iterate over primes using `primesieve_iterator`.
- [count_primes.c](#) - Example that shows how to count primes.

Chapter 2

Namespace Index

2.1 Namespace List

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

[primesieve](#)

All of primesieve's C++ functions and classes are declared inside this namespace [11](#)

Chapter 3

Hierarchical Index

3.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

primesieve::Callback< T >	21
primesieve::iterator	21
primesieve_iterator	25
runtime_error	
primesieve::primesieve_error	24

Chapter 4

Class Index

4.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

primesieve::Callback< T >	
Callback interface class	21
primesieve::iterator	
Primesieve::iterator allows to easily iterate over primes both forwards and backwards	21
primesieve::primesieve_error	
Primesieve throws a primesieve_error exception if an error occurs that cannot be handled e.g .	24
primesieve_iterator	
C prime iterator, please refer to primesieve_iterator.h for more information	25

Chapter 5

File Index

5.1 File List

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

Callback.hpp		
Callback interface classes	.....	27
iterator.hpp		
The iterator class allows to easily iterate (forward and backward) over prime numbers	.....	28
primesieve.h		
Primesieve C API	.....	29
primesieve.hpp		
Primesieve C++ API	.....	38
primesieve_error.hpp		
The primesieve_error class is used for all exceptions within primesieve	.....	40
primesieve_iterator.h		
Primesieve_iterator allows to easily iterate over primes both forwards and backwards	.....	41

Chapter 6

Namespace Documentation

6.1 primesieve Namespace Reference

All of primesieve's C++ functions and classes are declared inside this namespace.

Classes

- class [Callback](#)
callback interface class.
- class [iterator](#)
[primesieve::iterator](#) allows to easily iterate over primes both forwards and backwards.
- class [primesieve_error](#)
primesieve throws a [primesieve_error](#) exception if an error occurs that cannot be handled e.g.

Enumerations

- enum { [MAX_THREADS](#) = -1 }

Functions

- template<typename T >
void [generate_primes](#) (uint64_t stop, std::vector< T > *primes)
Store the primes \leq stop in the primes vector.
- template<typename T >
void [generate_primes](#) (uint64_t start, uint64_t stop, std::vector< T > *primes)
Store the primes within the interval [start, stop] in the primes vector.
- template<typename T >
void [generate_n_primes](#) (uint64_t n, std::vector< T > *primes)
Store the first n primes in the primes vector.
- template<typename T >
void [generate_n_primes](#) (uint64_t n, uint64_t start, std::vector< T > *primes)
Store the first n primes \geq start in the primes vector.
- uint64_t [nth_prime](#) (int64_t n, uint64_t start=0)
Find the nth prime.
- uint64_t [parallel_nth_prime](#) (int64_t n, uint64_t start=0)
Find the nth prime in parallel.
- uint64_t [count_primes](#) (uint64_t start, uint64_t stop)

- Count the primes within the interval [start, stop].*

 - uint64_t [count_twins](#) (uint64_t start, uint64_t stop)

Count the twin primes within the interval [start, stop].

 - uint64_t [count_triplets](#) (uint64_t start, uint64_t stop)

Count the prime triplets within the interval [start, stop].

 - uint64_t [count_quadruplets](#) (uint64_t start, uint64_t stop)

Count the prime quadruplets within the interval [start, stop].

 - uint64_t [count_quintuplets](#) (uint64_t start, uint64_t stop)

Count the prime quintuplets within the interval [start, stop].

 - uint64_t [count_sextuplets](#) (uint64_t start, uint64_t stop)

Count the prime sextuplets within the interval [start, stop].

 - uint64_t [parallel_count_primes](#) (uint64_t start, uint64_t stop)

Count the primes within the interval [start, stop] in parallel.

 - uint64_t [parallel_count_twins](#) (uint64_t start, uint64_t stop)

Count the twin primes within the interval [start, stop] in parallel.

 - uint64_t [parallel_count_triplets](#) (uint64_t start, uint64_t stop)

Count the prime triplets within the interval [start, stop] in parallel.

 - uint64_t [parallel_count_quadruplets](#) (uint64_t start, uint64_t stop)

Count the prime quadruplets within the interval [start, stop] in parallel.

 - uint64_t [parallel_count_quintuplets](#) (uint64_t start, uint64_t stop)

Count the prime quintuplets within the interval [start, stop] in parallel.

 - uint64_t [parallel_count_sextuplets](#) (uint64_t start, uint64_t stop)

Count the prime sextuplets within the interval [start, stop] in parallel.

 - void [print_primes](#) (uint64_t start, uint64_t stop)

Print the primes within the interval [start, stop] to the standard output.

 - void [print_twins](#) (uint64_t start, uint64_t stop)

Print the twin primes within the interval [start, stop] to the standard output.

 - void [print_triplets](#) (uint64_t start, uint64_t stop)

Print the prime triplets within the interval [start, stop] to the standard output.

 - void [print_quadruplets](#) (uint64_t start, uint64_t stop)

Print the prime quadruplets within the interval [start, stop] to the standard output.

 - void [print_quintuplets](#) (uint64_t start, uint64_t stop)

Print the prime quintuplets within the interval [start, stop] to the standard output.

 - void [print_sextuplets](#) (uint64_t start, uint64_t stop)

Print the prime sextuplets within the interval [start, stop] to the standard output.

 - void [callback_primes](#) (uint64_t start, uint64_t stop, void(*callback)(uint64_t prime))

Call back the primes within the interval [start, stop].

 - void [callback_primes](#) (uint64_t start, uint64_t stop, [primesieve::Callback](#)< uint64_t > *callback)

Call back the primes within the interval [start, stop].

 - int [get_sieve_size](#) ()

Get the current set sieve size in kilobytes.

 - int [get_num_threads](#) ()

Get the current set number of threads.

 - uint64_t [get_max_stop](#) ()

Returns the largest valid stop number for primesieve.

 - void [set_sieve_size](#) (int sieve_size)

Set the sieve size in kilobytes.

 - void [set_num_threads](#) (int num_threads)

Set the number of threads for use in subsequent primesieve::parallel_ function calls.*

 - bool [primesieve_test](#) ()

Run extensive correctness tests.

 - std::string [primesieve_version](#) ()

Get the primesieve version number, in the form "i.j.k".

6.1.1 Detailed Description

All of primesieve's C++ functions and classes are declared inside this namespace.

6.1.2 Enumeration Type Documentation

6.1.2.1 anonymous enum

Enumerator

MAX_THREADS Use all CPU cores for prime sieving.

6.1.3 Function Documentation

6.1.3.1 void primesieve::callback_primes (uint64_t start, uint64_t stop, void (*)(uint64_t prime) callback)

Call back the primes within the interval [start, stop].

Parameters

<i>callback</i>	A callback function.
-----------------	----------------------

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

Examples:

[callback_primes.cpp](#).

6.1.3.2 void primesieve::callback_primes (uint64_t start, uint64_t stop, primesieve::Callback< uint64_t > * callback)

Call back the primes within the interval [start, stop].

Parameters

<i>callback</i>	An object derived from primesieve::Callback<uint64_t>.
-----------------	--

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

6.1.3.3 uint64_t primesieve::count_primes (uint64_t start, uint64_t stop)

Count the primes within the interval [start, stop].

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

Examples:

[count_primes.cpp](#).

6.1.3.4 `uint64_t primesieve::count_quadruplets (uint64_t start, uint64_t stop)`

Count the prime quadruplets within the interval [start, stop].

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.5 `uint64_t primesieve::count_quintuplets (uint64_t start, uint64_t stop)`

Count the prime quintuplets within the interval [start, stop].

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.6 `uint64_t primesieve::count_sextuplets (uint64_t start, uint64_t stop)`

Count the prime sextuplets within the interval [start, stop].

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.7 `uint64_t primesieve::count_triplets (uint64_t start, uint64_t stop)`

Count the prime triplets within the interval [start, stop].

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.8 `uint64_t primesieve::count_twins (uint64_t start, uint64_t stop)`

Count the twin primes within the interval [start, stop].

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.9 `template<typename T> void primesieve::generate_n_primes (uint64_t n, uint64_t start, std::vector< T > * primes)` `[inline]`

Store the first n primes \geq start in the primes vector.

Precondition

$$\text{start} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.10 `template<typename T> void primesieve::generate_primes (uint64_t stop, std::vector< T > * primes)`
`[inline]`

Store the primes \leq stop in the primes vector.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10$.

Examples:

[store_primes_in_vector.cpp](#).

6.1.3.11 `template<typename T> void primesieve::generate_primes (uint64_t start, uint64_t stop, std::vector< T > * primes)`
`[inline]`

Store the primes within the interval [start, stop] in the primes vector.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10$.

6.1.3.12 `uint64_t primesieve::get_max_stop ()`

Returns the largest valid stop number for primesieve.

Returns

$(2^{64}-1) - (2^{32}-1) * 10$.

6.1.3.13 `int primesieve::get_num_threads ()`

Get the current set number of threads.

Note

By default MAX_THREADS (-1) is returned.

6.1.3.14 `uint64_t primesieve::nth_prime (int64_t n, uint64_t start = 0)`

Find the nth prime.

Parameters

<i>n</i>	if $n = 0$ finds the 1st prime \geq start, if $n > 0$ finds the nth prime $>$ start, if $n < 0$ finds the nth prime $<$ start (backwards).
----------	--

Precondition

$\text{start} \leq 2^{64} - 2^{32} * 11$.

Examples:

[nth_prime.cpp](#).

6.1.3.15 `uint64_t primesieve::parallel_count_primes (uint64_t start, uint64_t stop)`

Count the primes within the interval [start, stop] in parallel.

By default all CPU cores are used, use [primesieve::set_num_threads\(int\)](#) to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

Examples:

[count_primes.cpp](#).

6.1.3.16 `uint64_t primesieve::parallel_count_quadruplets (uint64_t start, uint64_t stop)`

Count the prime quadruplets within the interval [start, stop] in parallel.

By default all CPU cores are used, use [primesieve::set_num_threads\(int\)](#) to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.17 `uint64_t primesieve::parallel_count_quintuplets (uint64_t start, uint64_t stop)`

Count the prime quintuplets within the interval [start, stop] in parallel.

By default all CPU cores are used, use [primesieve::set_num_threads\(int\)](#) to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.18 `uint64_t primesieve::parallel_count_sextuplets (uint64_t start, uint64_t stop)`

Count the prime sextuplets within the interval [start, stop] in parallel.

By default all CPU cores are used, use [primesieve::set_num_threads\(int\)](#) to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.19 `uint64_t primesieve::parallel_count_triplets (uint64_t start, uint64_t stop)`

Count the prime triplets within the interval [start, stop] in parallel.

By default all CPU cores are used, use [primesieve::set_num_threads\(int\)](#) to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.20 `uint64_t primesieve::parallel_count_twins (uint64_t start, uint64_t stop)`

Count the twin primes within the interval [start, stop] in parallel.

By default all CPU cores are used, use `primesieve::set_num_threads(int)` to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.21 `uint64_t primesieve::parallel_nth_prime (int64_t n, uint64_t start = 0)`

Find the nth prime in parallel.

By default all CPU cores are used, use `primesieve::set_num_threads(int)` to change the number of threads.

Parameters

<i>n</i>	if $n = 0$ finds the 1st prime \geq start, if $n > 0$ finds the nth prime $>$ start, if $n < 0$ finds the nth prime $<$ start (backwards).
----------	--

Precondition

$$\text{start} \leq 2^{64} - 2^{32} * 11.$$

6.1.3.22 `bool primesieve::primesieve_test ()`

Run extensive correctness tests.

The tests last about one minute on a quad core CPU from 2013 and use up to 1 gigabyte of memory.

Returns

true if success else false.

6.1.3.23 `void primesieve::print_primes (uint64_t start, uint64_t stop)`

Print the primes within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.24 `void primesieve::print_quadruplets (uint64_t start, uint64_t stop)`

Print the prime quadruplets within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.25 void primesieve::print_quintuplets (uint64_t start, uint64_t stop)

Print the prime quintuplets within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.26 void primesieve::print_sextuplets (uint64_t start, uint64_t stop)

Print the prime sextuplets within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.27 void primesieve::print_triplets (uint64_t start, uint64_t stop)

Print the prime triplets within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.28 void primesieve::print_twins (uint64_t start, uint64_t stop)

Print the twin primes within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

6.1.3.29 void primesieve::set_num_threads (int num_threads)

Set the number of threads for use in subsequent primesieve::parallel_* function calls.

Note that this only changes the number of threads for the current process.

Parameters

<i>num_threads</i>	Number of threads for sieving or MAX_THREADS to use all CPU cores.
--------------------	--

6.1.3.30 void primesieve::set_sieve_size (int sieve_size)

Set the sieve size in kilobytes.

The best sieving performance is achieved with a sieve size of your CPU's L1 data cache size (per core). For sieving $\geq 10^{17}$ a sieve size of your CPU's L2 cache size sometimes performs better.

Parameters

<i>sieve_size</i>	Sieve size in kilobytes.
-------------------	--------------------------

Precondition

`sieve_size >= 1 && sieve_size <= 2048.`

Chapter 7

Class Documentation

7.1 primesieve::Callback< T > Class Template Reference

callback interface class.

```
#include <Callback.hpp>
```

Public Member Functions

- virtual void **callback** (T prime)=0

7.1.1 Detailed Description

```
template<typename T>class primesieve::Callback< T >
```

callback interface class.

Objects derived from this class can be passed to the [primesieve::generate_primes\(\)](#) functions.

Parameters

<i>T</i>	must be uint64_t.
----------	-------------------

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

- [Callback.hpp](#)

7.2 primesieve::iterator Class Reference

[primesieve::iterator](#) allows to easily iterate over primes both forwards and backwards.

```
#include <iterator.hpp>
```

Public Member Functions

- [iterator](#) (uint64_t start=0, uint64_t stop_hint=[get_max_stop](#)())
Create a new iterator object.
- void [skipto](#) (uint64_t start, uint64_t stop_hint=[get_max_stop](#)())
Reinitialize this iterator object to start.
- uint64_t [next_prime](#) ()

Advance the iterator by one position.

- `uint64_t previous_prime ()`

Get the previous prime, or 0 if input ≤ 2 e.g.

7.2.1 Detailed Description

`primesieve::iterator` allows to easily iterate over primes both forwards and backwards.

Generating the first prime has a complexity of $O(r \log \log r)$ operations with $r = n^{0.5}$, after that any additional prime is generated in amortized $O(\log n \log \log n)$ operations. The memory usage is about $\pi(n^{0.5}) * 16$ bytes. `primesieve::iterator` objects are very convenient to use at the cost of being slightly slower than the `callback_primes()` functions.

Examples:

`previous_prime.cpp`, and `primesieve_iterator.cpp`.

7.2.2 Constructor & Destructor Documentation

7.2.2.1 `primesieve::iterator::iterator (uint64_t start = 0, uint64_t stop_hint = get_max_stop ())`

Create a new iterator object.

Parameters

<i>start</i>	Generate primes $>$ start (or $<$ start).
<i>stop_hint</i>	Stop number optimization hint, gives significant speed up if few primes are generated. E.g. if you want to generate the primes below 1000 use <code>stop_hint = 1000</code> .

Precondition

$start \leq 2^{64} - 2^{32} * 10$

7.2.3 Member Function Documentation

7.2.3.1 `uint64_t primesieve::iterator::next_prime () [inline]`

Advance the iterator by one position.

Returns

The next prime.

Examples:

`primesieve_iterator.cpp`.

7.2.3.2 `uint64_t primesieve::iterator::previous_prime () [inline]`

Get the previous prime, or 0 if input ≤ 2 e.g.

`previous_prime(2) = 0`.

Examples:

`previous_prime.cpp`.

7.2.3.3 void primesieve::iterator::skipto (uint64_t *start*, uint64_t *stop_hint* = get_max_stop ())

Reinitialize this iterator object to start.

Parameters

<i>start</i>	Generate primes > start (or < start).
<i>stop_hint</i>	Stop number optimization hint, gives significant speed up if few primes are generated. E.g. if you want to generate the primes below 1000 use stop_hint = 1000.

Precondition

$\text{start} \leq 2^{64} - 2^{32} * 10$

Examples:

[previous_prime.cpp](#).

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

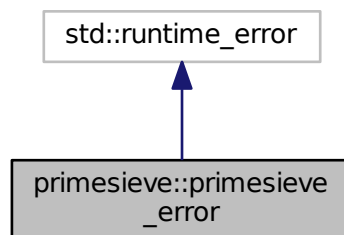
- [iterator.hpp](#)

7.3 primesieve::primesieve_error Class Reference

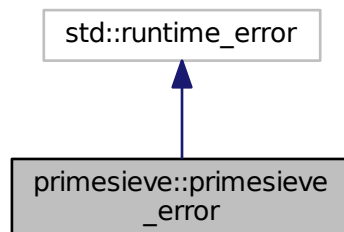
primesieve throws a [primesieve_error](#) exception if an error occurs that cannot be handled e.g.

```
#include <primesieve_error.hpp>
```

Inheritance diagram for primesieve::primesieve_error:



Collaboration diagram for primesieve::primesieve_error:



Public Member Functions

- **primesieve_error** (const std::string &msg)

7.3.1 Detailed Description

primesieve throws a [primesieve_error](#) exception if an error occurs that cannot be handled e.g.

stop > primesieve::max_stop().

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

- [primesieve_error.hpp](#)

7.4 primesieve_iterator Struct Reference

C prime iterator, please refer to [primesieve_iterator.h](#) for more information.

```
#include <primesieve_iterator.h>
```

Public Attributes

- size_t **i_**
- size_t **last_idx_**
- uint64_t * **primes_**
- uint64_t * **primes_pimpl_**
- uint64_t **start_**
- uint64_t **stop_**
- uint64_t **stop_hint_**
- uint64_t **tiny_cache_size_**
- int **is_error_**

7.4.1 Detailed Description

C prime iterator, please refer to [primesieve_iterator.h](#) for more information.

Examples:

[previous_prime.c](#), and [primesieve_iterator.c](#).

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

- [primesieve_iterator.h](#)

Chapter 8

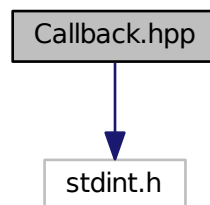
File Documentation

8.1 Callback.hpp File Reference

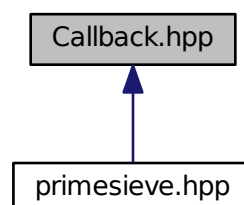
Callback interface classes.

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

Include dependency graph for Callback.hpp:



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



Classes

- class `primesieve::Callback< T >`

callback interface class.

Namespaces

- `primesieve`

All of primesieve's C++ functions and classes are declared inside this namespace.

8.1.1 Detailed Description

Callback interface classes.

Copyright (C) 2015 Kim Walisch, kim.walisch@gmail.com

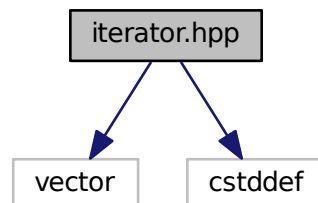
This file is distributed under the BSD License. See the COPYING file in the top level directory.

8.2 iterator.hpp File Reference

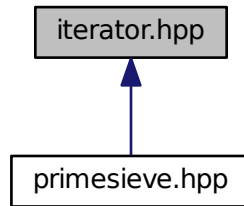
The iterator class allows to easily iterate (forward and backward) over prime numbers.

```
#include <vector>
#include <cstdint>
```

Include dependency graph for iterator.hpp:



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



Classes

- class [primesieve::iterator](#)

[primesieve::iterator](#) allows to easily iterate over primes both forwards and backwards.

Namespaces

- [primesieve](#)

All of primesieve's C++ functions and classes are declared inside this namespace.

Functions

- `uint64_t` [primesieve::get_max_stop\(\)](#)

Returns the largest valid stop number for primesieve.

8.2.1 Detailed Description

The iterator class allows to easily iterate (forward and backward) over prime numbers.

Copyright (C) 2015 Kim Walisch, kim.walisch@gmail.com

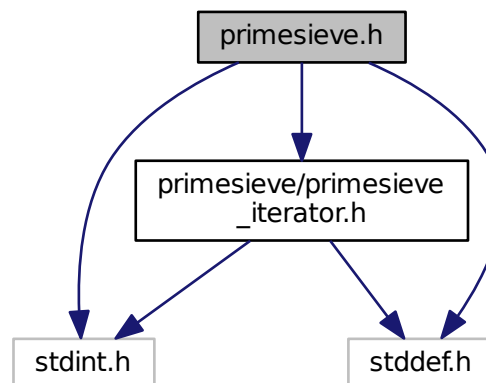
This file is distributed under the BSD License. See the COPYING file in the top level directory.

8.3 primesieve.h File Reference

primesieve C API.

```
#include <primesieve/primesieve_iterator.h>
#include <stdint.h>
#include <stddef.h>
```

Include dependency graph for primesieve.h:



Macros

- `#define PRIMESIEVE_VERSION "5.6.0"`
- `#define PRIMESIEVE_VERSION_MAJOR 5`
- `#define PRIMESIEVE_VERSION_MINOR 6`
- `#define PRIMESIEVE_VERSION_PATCH 0`
- `#define PRIMESIEVE_ERROR ((uint64_t) ~((uint64_t) 0))`
primesieve functions return PRIMESIEVE_ERROR (UINT64_MAX) if any error occurs.

Enumerations

- `enum {`
`MAX_THREADS = -1, SHORT_PRIMES, USHORT_PRIMES, INT_PRIMES,`
`UINT_PRIMES, LONG_PRIMES, ULONG_PRIMES, LONGLONG_PRIMES,`
`ULONGLONG_PRIMES, INT16_PRIMES, UINT16_PRIMES, INT32_PRIMES,`
`UINT32_PRIMES, INT64_PRIMES, UINT64_PRIMES }`

Functions

- `void * primesieve_generate_primes (uint64_t start, uint64_t stop, size_t *size, int type)`
Get an array with the primes inside the interval [start, stop].
- `void * primesieve_generate_n_primes (uint64_t n, uint64_t start, int type)`
Get an array with the first n primes >= start.
- `uint64_t primesieve_nth_prime (int64_t n, uint64_t start)`
Find the nth prime.
- `uint64_t primesieve_parallel_nth_prime (int64_t n, uint64_t start)`
Find the nth prime in parallel.
- `uint64_t primesieve_count_primes (uint64_t start, uint64_t stop)`
Count the primes within the interval [start, stop].
- `uint64_t primesieve_count_twins (uint64_t start, uint64_t stop)`
Count the twin primes within the interval [start, stop].

- uint64_t [primesieve_count_triplets](#) (uint64_t start, uint64_t stop)
Count the prime triplets within the interval [start, stop].
- uint64_t [primesieve_count_quadruplets](#) (uint64_t start, uint64_t stop)
Count the prime quadruplets within the interval [start, stop].
- uint64_t [primesieve_count_quintuplets](#) (uint64_t start, uint64_t stop)
Count the prime quintuplets within the interval [start, stop].
- uint64_t [primesieve_count_sextuplets](#) (uint64_t start, uint64_t stop)
Count the prime sextuplets within the interval [start, stop].
- uint64_t [primesieve_parallel_count_primes](#) (uint64_t start, uint64_t stop)
Count the primes within the interval [start, stop] in parallel.
- uint64_t [primesieve_parallel_count_twins](#) (uint64_t start, uint64_t stop)
Count the twin primes within the interval [start, stop] in parallel.
- uint64_t [primesieve_parallel_count_triplets](#) (uint64_t start, uint64_t stop)
Count the prime triplets within the interval [start, stop] in parallel.
- uint64_t [primesieve_parallel_count_quadruplets](#) (uint64_t start, uint64_t stop)
Count the prime quadruplets within the interval [start, stop] in parallel.
- uint64_t [primesieve_parallel_count_quintuplets](#) (uint64_t start, uint64_t stop)
Count the prime quintuplets within the interval [start, stop] in parallel.
- uint64_t [primesieve_parallel_count_sextuplets](#) (uint64_t start, uint64_t stop)
Count the prime sextuplets within the interval [start, stop] in parallel.
- void [primesieve_print_primes](#) (uint64_t start, uint64_t stop)
Print the primes within the interval [start, stop] to the standard output.
- void [primesieve_print_twins](#) (uint64_t start, uint64_t stop)
Print the twin primes within the interval [start, stop] to the standard output.
- void [primesieve_print_triplets](#) (uint64_t start, uint64_t stop)
Print the prime triplets within the interval [start, stop] to the standard output.
- void [primesieve_print_quadruplets](#) (uint64_t start, uint64_t stop)
Print the prime quadruplets within the interval [start, stop] to the standard output.
- void [primesieve_print_quintuplets](#) (uint64_t start, uint64_t stop)
Print the prime quintuplets within the interval [start, stop] to the standard output.
- void [primesieve_print_sextuplets](#) (uint64_t start, uint64_t stop)
Print the prime sextuplets within the interval [start, stop] to the standard output.
- void [primesieve_callback_primes](#) (uint64_t start, uint64_t stop, void(*callback)(uint64_t prime))
Call back the primes within the interval [start, stop].
- int [primesieve_get_sieve_size](#) ()
Get the current set sieve size in kilobytes.
- int [primesieve_get_num_threads](#) ()
Get the current set number of threads.
- uint64_t [primesieve_get_max_stop](#) ()
Returns the largest valid stop number for primesieve.
- void [primesieve_set_sieve_size](#) (int sieve_size)
Set the sieve size in kilobytes.
- void [primesieve_set_num_threads](#) (int num_threads)
Set the number of threads for use in subsequent primesieve_parallel_ function calls.*
- void [primesieve_free](#) (void *primes)
Deallocate a primes array created using the [primesieve_generate_primes\(\)](#) or [primesieve_generate_n_primes\(\)](#) functions.
- int [primesieve_test](#) ()
Run extensive correctness tests.
- const char * [primesieve_version](#) ()
Get the primesieve version number, in the form "i.j.k".

8.3.1 Detailed Description

primesieve C API.

primesieve is a library for fast prime number generation. In case an error occurs `errno` is set to `EDOM` and `PRIMESIEVE_ERROR` is returned.

Copyright (C) 2015 Kim Walisch, kim.walisch@gmail.com

This file is distributed under the BSD License.

8.3.2 Enumeration Type Documentation

8.3.2.1 anonymous enum

Enumerator

- MAX_THREADS** Use all CPU cores for prime sieving.
- SHORT_PRIMES** Generate primes of short type.
- USHORT_PRIMES** Generate primes of unsigned short type.
- INT_PRIMES** Generate primes of int type.
- UINT_PRIMES** Generate primes of unsigned int type.
- LONG_PRIMES** Generate primes of long type.
- ULONG_PRIMES** Generate primes of unsigned long type.
- LONGLONG_PRIMES** Generate primes of long long type.
- ULONGLONG_PRIMES** Generate primes of unsigned long long type.
- INT16_PRIMES** Generate primes of `int16_t` type.
- UINT16_PRIMES** Generate primes of `uint16_t` type.
- INT32_PRIMES** Generate primes of `int32_t` type.
- UINT32_PRIMES** Generate primes of `uint32_t` type.
- INT64_PRIMES** Generate primes of `int64_t` type.
- UINT64_PRIMES** Generate primes of `uint64_t` type.

8.3.3 Function Documentation

8.3.3.1 void primesieve_callback_primes (uint64_t start, uint64_t stop, void (*)(uint64_t prime) callback)

Call back the primes within the interval [start, stop].

Parameters

<i>callback</i>	A callback function.
-----------------	----------------------

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10$.

8.3.3.2 uint64_t primesieve_count_primes (uint64_t start, uint64_t stop)

Count the primes within the interval [start, stop].

Precondition
$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$
Examples:[count_primes.c](#).**8.3.3.3 uint64_t primesieve_count_quadruplets (uint64_t start, uint64_t stop)**

Count the prime quadruplets within the interval [start, stop].

Precondition
$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$
8.3.3.4 uint64_t primesieve_count_quintuplets (uint64_t start, uint64_t stop)

Count the prime quintuplets within the interval [start, stop].

Precondition
$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$
8.3.3.5 uint64_t primesieve_count_sextuplets (uint64_t start, uint64_t stop)

Count the prime sextuplets within the interval [start, stop].

Precondition
$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$
8.3.3.6 uint64_t primesieve_count_triplets (uint64_t start, uint64_t stop)

Count the prime triplets within the interval [start, stop].

Precondition
$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$
8.3.3.7 uint64_t primesieve_count_twins (uint64_t start, uint64_t stop)

Count the twin primes within the interval [start, stop].

Precondition
$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$
8.3.3.8 void* primesieve_generate_n_primes (uint64_t n, uint64_t start, int type)

Get an array with the first n primes \geq start.

Parameters

<i>type</i>	The type of the primes to generate, e.g. INT_PRIMES.
-------------	--

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

Examples:

[store_primes_in_array.c](#).

8.3.3.9 `void* primesieve_generate_primes (uint64_t start, uint64_t stop, size_t * size, int type)`

Get an array with the primes inside the interval [start, stop].

Parameters

<i>size</i>	The size of the returned primes array.
<i>type</i>	The type of the primes to generate, e.g. INT_PRIMES.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

Examples:

[store_primes_in_array.c](#).

8.3.3.10 `uint64_t primesieve_get_max_stop ()`

Returns the largest valid stop number for primesieve.

Returns

$(2^{64}-1) - (2^{32}-1) * 10.$

8.3.3.11 `int primesieve_get_num_threads ()`

Get the current set number of threads.

Note

By default MAX_THREADS (-1) is returned.

8.3.3.12 `int primesieve_get_sieve_size ()`

Get the current set sieve size in kilobytes.

8.3.3.13 `uint64_t primesieve_nth_prime (int64_t n, uint64_t start)`

Find the nth prime.

Parameters

n	if $n = 0$ finds the 1st prime \geq start, if $n > 0$ finds the n th prime $>$ start, if $n < 0$ finds the n th prime $<$ start (backwards).
-----	--

Precondition

$\text{start} \leq 2^{64} - 2^{32} * 11.$

Examples:

[nth_prime.c](#).

8.3.3.14 `uint64_t primesieve_parallel_count_primes (uint64_t start, uint64_t stop)`

Count the primes within the interval $[\text{start}, \text{stop}]$ in parallel.

By default all CPU cores are used, use [primesieve_set_num_threads\(int\)](#) to change the number of threads.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

Examples:

[count_primes.c](#).

8.3.3.15 `uint64_t primesieve_parallel_count_quadruplets (uint64_t start, uint64_t stop)`

Count the prime quadruplets within the interval $[\text{start}, \text{stop}]$ in parallel.

By default all CPU cores are used, use [primesieve_set_num_threads\(int\)](#) to change the number of threads.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

8.3.3.16 `uint64_t primesieve_parallel_count_quintuplets (uint64_t start, uint64_t stop)`

Count the prime quintuplets within the interval $[\text{start}, \text{stop}]$ in parallel.

By default all CPU cores are used, use [primesieve_set_num_threads\(int\)](#) to change the number of threads.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

8.3.3.17 `uint64_t primesieve_parallel_count_sextuplets (uint64_t start, uint64_t stop)`

Count the prime sextuplets within the interval $[\text{start}, \text{stop}]$ in parallel.

By default all CPU cores are used, use [primesieve_set_num_threads\(int\)](#) to change the number of threads.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10.$

8.3.3.18 `uint64_t primesieve_parallel_count_triplets (uint64_t start, uint64_t stop)`

Count the prime triplets within the interval [start, stop] in parallel.

By default all CPU cores are used, use [primesieve_set_num_threads\(int\)](#) to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

8.3.3.19 `uint64_t primesieve_parallel_count_twins (uint64_t start, uint64_t stop)`

Count the twin primes within the interval [start, stop] in parallel.

By default all CPU cores are used, use [primesieve_set_num_threads\(int\)](#) to change the number of threads.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

8.3.3.20 `uint64_t primesieve_parallel_nth_prime (int64_t n, uint64_t start)`

Find the nth prime in parallel.

By default all CPU cores are used, use [primesieve_set_num_threads\(int\)](#) to change the number of threads.

Parameters

<i>n</i>	if <i>n</i> = 0 finds the 1st prime \geq start, if <i>n</i> > 0 finds the nth prime $>$ start, if <i>n</i> < 0 finds the nth prime $<$ start (backwards).
----------	---

Precondition

$$\text{start} \leq 2^{64} - 2^{32} * 11.$$

8.3.3.21 `void primesieve_print_primes (uint64_t start, uint64_t stop)`

Print the primes within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

8.3.3.22 `void primesieve_print_quadruplets (uint64_t start, uint64_t stop)`

Print the prime quadruplets within the interval [start, stop] to the standard output.

Precondition

$$\text{stop} \leq 2^{64} - 2^{32} * 10.$$

8.3.3.23 void primesieve_print_quintuplets (uint64_t *start*, uint64_t *stop*)

Print the prime quintuplets within the interval [start, stop] to the standard output.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10$.

8.3.3.24 void primesieve_print_sextuplets (uint64_t *start*, uint64_t *stop*)

Print the prime sextuplets within the interval [start, stop] to the standard output.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10$.

8.3.3.25 void primesieve_print_triplets (uint64_t *start*, uint64_t *stop*)

Print the prime triplets within the interval [start, stop] to the standard output.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10$.

8.3.3.26 void primesieve_print_twins (uint64_t *start*, uint64_t *stop*)

Print the twin primes within the interval [start, stop] to the standard output.

Precondition

$\text{stop} \leq 2^{64} - 2^{32} * 10$.

8.3.3.27 void primesieve_set_num_threads (int *num_threads*)

Set the number of threads for use in subsequent primesieve_parallel_* function calls.

Note that this only changes the number of threads for the current process.

Parameters

<i>num_threads</i>	Number of threads for sieving or MAX_THREADS to use all CPU cores.
--------------------	--

8.3.3.28 void primesieve_set_sieve_size (int *sieve_size*)

Set the sieve size in kilobytes.

The best sieving performance is achieved with a sieve size of your CPU's L1 data cache size (per core). For sieving $\geq 10^{17}$ a sieve size of your CPU's L2 cache size sometimes performs better.

Parameters

<code>sieve_size</code>	Sieve size in kilobytes.
-------------------------	--------------------------

Precondition

`sieve_size >= 1 && <= 2048.`

8.3.3.29 int primesieve_test ()

Run extensive correctness tests.

The tests last about one minute on a quad core CPU from 2013 and use up to 1 gigabyte of memory.

Returns

1 if success, 0 if error.

8.3.3.30 const char* primesieve_version ()

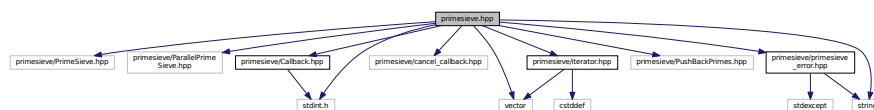
Get the primesieve version number, in the form "i.j.k".

8.4 primesieve.hpp File Reference

primesieve C++ API.

```
#include <primesieve/PrimeSieve.hpp>
#include <primesieve/ParallelPrimeSieve.hpp>
#include <primesieve/Callback.hpp>
#include <primesieve/cancel_callback.hpp>
#include <primesieve/iterator.hpp>
#include <primesieve/PushBackPrimes.hpp>
#include <primesieve/primesieve_error.hpp>
#include <stdint.h>
#include <vector>
#include <string>
```

Include dependency graph for primesieve.hpp:

**Namespaces**

- [primesieve](#)

All of primesieve's C++ functions and classes are declared inside this namespace.

Macros

- `#define PRIMESIEVE_VERSION "5.6.0"`
- `#define PRIMESIEVE_VERSION_MAJOR 5`
- `#define PRIMESIEVE_VERSION_MINOR 6`
- `#define PRIMESIEVE_VERSION_PATCH 0`

Enumerations

- enum { `primesieve::MAX_THREADS` = -1 }

Functions

- template<typename T >
void `primesieve::generate_primes` (uint64_t stop, std::vector< T > *primes)
Store the primes <= stop in the primes vector.
- template<typename T >
void `primesieve::generate_primes` (uint64_t start, uint64_t stop, std::vector< T > *primes)
Store the primes within the interval [start, stop] in the primes vector.
- template<typename T >
void `primesieve::generate_n_primes` (uint64_t n, std::vector< T > *primes)
Store the first n primes in the primes vector.
- template<typename T >
void `primesieve::generate_n_primes` (uint64_t n, uint64_t start, std::vector< T > *primes)
Store the first n primes >= start in the primes vector.
- uint64_t `primesieve::nth_prime` (int64_t n, uint64_t start=0)
Find the nth prime.
- uint64_t `primesieve::parallel_nth_prime` (int64_t n, uint64_t start=0)
Find the nth prime in parallel.
- uint64_t `primesieve::count_primes` (uint64_t start, uint64_t stop)
Count the primes within the interval [start, stop].
- uint64_t `primesieve::count_twins` (uint64_t start, uint64_t stop)
Count the twin primes within the interval [start, stop].
- uint64_t `primesieve::count_triplets` (uint64_t start, uint64_t stop)
Count the prime triplets within the interval [start, stop].
- uint64_t `primesieve::count_quadruplets` (uint64_t start, uint64_t stop)
Count the prime quadruplets within the interval [start, stop].
- uint64_t `primesieve::count_quintuplets` (uint64_t start, uint64_t stop)
Count the prime quintuplets within the interval [start, stop].
- uint64_t `primesieve::count_sextuplets` (uint64_t start, uint64_t stop)
Count the prime sextuplets within the interval [start, stop].
- uint64_t `primesieve::parallel_count_primes` (uint64_t start, uint64_t stop)
Count the primes within the interval [start, stop] in parallel.
- uint64_t `primesieve::parallel_count_twins` (uint64_t start, uint64_t stop)
Count the twin primes within the interval [start, stop] in parallel.
- uint64_t `primesieve::parallel_count_triplets` (uint64_t start, uint64_t stop)
Count the prime triplets within the interval [start, stop] in parallel.
- uint64_t `primesieve::parallel_count_quadruplets` (uint64_t start, uint64_t stop)
Count the prime quadruplets within the interval [start, stop] in parallel.
- uint64_t `primesieve::parallel_count_quintuplets` (uint64_t start, uint64_t stop)
Count the prime quintuplets within the interval [start, stop] in parallel.
- uint64_t `primesieve::parallel_count_sextuplets` (uint64_t start, uint64_t stop)
Count the prime sextuplets within the interval [start, stop] in parallel.
- void `primesieve::print_primes` (uint64_t start, uint64_t stop)
Print the primes within the interval [start, stop] to the standard output.
- void `primesieve::print_twins` (uint64_t start, uint64_t stop)
Print the twin primes within the interval [start, stop] to the standard output.
- void `primesieve::print_triplets` (uint64_t start, uint64_t stop)

Print the prime triplets within the interval [start, stop] to the standard output.

- void [primesieve::print_quadruplets](#) (uint64_t start, uint64_t stop)

Print the prime quadruplets within the interval [start, stop] to the standard output.

- void [primesieve::print_quintuplets](#) (uint64_t start, uint64_t stop)

Print the prime quintuplets within the interval [start, stop] to the standard output.

- void [primesieve::print_sextuplets](#) (uint64_t start, uint64_t stop)

Print the prime sextuplets within the interval [start, stop] to the standard output.

- void [primesieve::callback_primes](#) (uint64_t start, uint64_t stop, void(*callback)(uint64_t prime))

Call back the primes within the interval [start, stop].

- void [primesieve::callback_primes](#) (uint64_t start, uint64_t stop, [primesieve::Callback](#)< uint64_t > *callback)

Call back the primes within the interval [start, stop].

- int [primesieve::get_sieve_size](#) ()

Get the current set sieve size in kilobytes.

- int [primesieve::get_num_threads](#) ()

Get the current set number of threads.

- uint64_t [primesieve::get_max_stop](#) ()

Returns the largest valid stop number for primesieve.

- void [primesieve::set_sieve_size](#) (int sieve_size)

Set the sieve size in kilobytes.

- void [primesieve::set_num_threads](#) (int num_threads)

Set the number of threads for use in subsequent primesieve::parallel_ function calls.*

- bool [primesieve::primesieve_test](#) ()

Run extensive correctness tests.

- std::string [primesieve::primesieve_version](#) ()

Get the primesieve version number, in the form "i.j.k".

8.4.1 Detailed Description

primesieve C++ API.

primesieve is a library for fast prime number generation, in case an error occurs a [primesieve::primesieve_error](#) exception (derived from std::runtime_error) will be thrown.

Copyright (C) 2015 Kim Walisch, kim.walisch@gmail.com

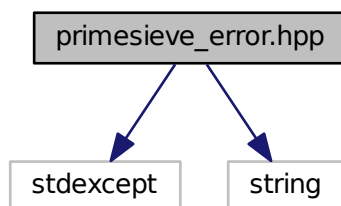
This file is distributed under the BSD License.

8.5 primesieve_error.hpp File Reference

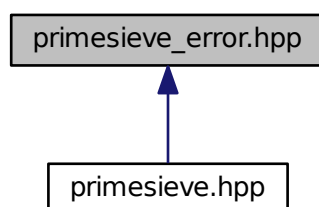
The primesieve_error class is used for all exceptions within primesieve.

```
#include <stdexcept>
#include <string>
```

Include dependency graph for primesieve_error.hpp:



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



Classes

- class `primesieve::primesieve_error`
primesieve throws a `primesieve_error` exception if an error occurs that cannot be handled e.g.

Namespaces

- `primesieve`
All of primesieve's C++ functions and classes are declared inside this namespace.

8.5.1 Detailed Description

The `primesieve_error` class is used for all exceptions within `primesieve`.

Copyright (C) 2013 Kim Walisch, kim.walisch@gmail.com

This file is distributed under the BSD License. See the COPYING file in the top level directory.

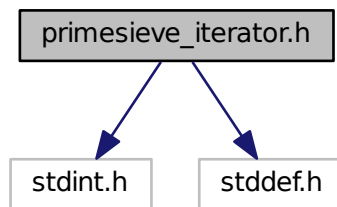
8.6 primesieve_iterator.h File Reference

`primesieve_iterator` allows to easily iterate over primes both forwards and backwards.

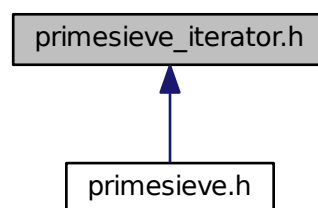
```
#include <stdint.h>
```

```
#include <stddef.h>
```

Include dependency graph for `primesieve_iterator.h`:



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



Classes

- struct `primesieve_iterator`

C prime iterator, please refer to [primesieve_iterator.h](#) for more information.

Functions

- void `primesieve_init` (`primesieve_iterator` *pi)
Initialize the primesieve iterator before first using it.
- void `primesieve_free_iterator` (`primesieve_iterator` *pi)
Free all memory.
- void `primesieve_skip` (`primesieve_iterator` *pi, uint64_t start, uint64_t stop_hint)
Set the primesieve iterator to start.
- static uint64_t `primesieve_next_prime` (`primesieve_iterator` *pi)
Get the next prime.
- static uint64_t `primesieve_previous_prime` (`primesieve_iterator` *pi)
Get the previous prime, or 0 if input ≤ 2 e.g.

8.6.1 Detailed Description

[primesieve_iterator](#) allows to easily iterate over primes both forwards and backwards.

Generating the first prime has a complexity of $O(r \log \log r)$ operations with $r = n^{0.5}$, after that any additional prime is generated in amortized $O(\log n \log \log n)$ operations. The memory usage is about $\pi(n^{0.5}) * 16$ bytes. [primesieve_iterator](#) objects are very convenient to use at the cost of being slightly slower than the [primesieve_↔callback_primes\(\)](#) functions.

The [primesieve_iterator.c](#) example shows how to use [primesieve_iterator](#). If any error occurs `errno` is set to `EDOM` and [primesieve_next_prime\(\)](#) and [primesieve_previous_prime\(\)](#) return `PRIMESIEVE_ERROR`.

Copyright (C) 2015 Kim Walisch, kim.walisch@gmail.com

This file is distributed under the BSD License. See the `COPYING` file in the top level directory.

8.6.2 Function Documentation

8.6.2.1 void primesieve_free_iterator (primesieve_iterator * pi)

Free all memory.

Examples:

[previous_prime.c](#), and [primesieve_iterator.c](#).

8.6.2.2 void primesieve_init (primesieve_iterator * pi)

Initialize the primesieve iterator before first using it.

Examples:

[previous_prime.c](#), and [primesieve_iterator.c](#).

8.6.2.3 static uint64_t primesieve_next_prime (primesieve_iterator * pi) [inline], [static]

Get the next prime.

Examples:

[primesieve_iterator.c](#).

8.6.2.4 static uint64_t primesieve_previous_prime (primesieve_iterator * pi) [inline], [static]

Get the previous prime, or 0 if input ≤ 2 e.g.

`previous_prime(2) = 0`.

Examples:

[previous_prime.c](#).

8.6.2.5 void primesieve_skipto (primesieve_iterator * pi, uint64_t start, uint64_t stop_hint)

Set the primesieve iterator to start.

Parameters

<i>start</i>	Generate primes > start (or < start).
<i>stop_hint</i>	Stop number optimization hint. E.g. if you want to generate the primes below 1000 use stop_hint = 1000, if you don't know use primesieve_get_max_stop() .

Precondition

$\text{start} \leq 2^{64} - 2^{32} * 10$

Examples:

[previous_prime.c](#).

Chapter 9

Example Documentation

9.1 callback_primes.cpp

This example shows how to use callback functions.

```
#include <primesieve.hpp>
#include <stdint.h>
#include <iostream>

void callback(uint64_t prime)
{
    std::cout << prime << std::endl;
}

int main()
{
    primesieve::callback_primes(2, 1000, callback);
    return 0;
}
```

9.2 count_primes.c

C program that shows how to count primes.

```
#include <primesieve.h>
#include <inttypes.h>
#include <stdio.h>

int main()
{
    uint64_t count = primesieve_count_primes(0, 1000);
    printf("Primes below 1000 = %" PRIu64 "\n", count);

    /* use multi-threading for large intervals */
    count = primesieve_parallel_count_primes(0, 1000000000);
    printf("Primes below 10^9 = %" PRIu64 "\n", count);

    return 0;
}
```

9.3 count_primes.cpp

This example shows how to count primes.

```
#include <primesieve.hpp>
#include <stdint.h>
#include <iostream>
```

```
int main()
{
    uint64_t count = primesieve::count_primes(0, 1000);
    std::cout << "Primes below 1000 = " << count << std::endl;

    uint64_t stop = 1000000000;

    // use multi-threading for large intervals
    count = primesieve::parallel_count_primes(0, stop);
    std::cout << "Primes below 10^9 = " << count << std::endl;

    return 0;
}
```

9.4 nth_prime.c

C program that finds the nth prime.

```
#include <primesieve.h>
#include <stdlib.h>
#include <inttypes.h>
#include <stdio.h>

int main(int argc, char** argv)
{
    uint64_t n = 1000;
    if (argv[1])
        n = atol(argv[1]);

    uint64_t prime = primesieve_nth_prime(n, 0);
    printf("%" PRIu64 "th prime = %" PRIu64 "\n", n, prime);

    return 0;
}
```

9.5 nth_prime.cpp

Find the nth prime.

```
#include <primesieve.hpp>
#include <stdint.h>
#include <iostream>
#include <cstdlib>

int main(int, char** argv)
{
    uint64_t n = 1000;
    if (argv[1])
        n = std::atol(argv[1]);

    uint64_t nth_prime = primesieve::nth_prime(n);
    std::cout << n << "th prime = " << nth_prime << std::endl;

    return 0;
}
```

9.6 previous_prime.c

Iterate backwards over primes using [primesieve_iterator](#).

```
#include <primesieve.h>
#include <inttypes.h>
#include <stdio.h>

int main()
{
    primesieve_iterator pi;
```

```

primesieve_init(&pi);

/* primesieve_skipto(primesieve_iterator, start_number, stop_hint) */
primesieve_skipto(&pi, 2000, 1000);
uint64_t prime;

/* iterate backwards over the primes between 2000 and 1000 */
while ((prime = primesieve_previous_prime(&pi)) >= 1000)
    printf("%" PRIu64 "\n", prime);

primesieve_free_iterator(&pi);
return 0;
}

```

9.7 previous_prime.cpp

This example shows how to iterate backwards over primes.

```

#include <primesieve.hpp>
#include <iostream>

int main()
{
    primesieve::iterator pi;
    pi.skipto(2000);

    uint64_t prime;

    // iterate backwards over the primes between 2000 and 1000
    while ((prime = pi.previous_prime()) >= 1000)
        std::cout << prime << std::endl;

    return 0;
}

```

9.8 primesieve_iterator.c

Iterate over primes using C `primesieve_iterator`.

```

#include <primesieve.h>
#include <inttypes.h>
#include <stdio.h>

int main()
{
    primesieve_iterator pi;
    primesieve_init(&pi);

    uint64_t sum = 0;
    uint64_t prime = 0;

    /* iterate over the primes below 10^10 */
    while ((prime = primesieve_next_prime(&pi)) < 10000000000ull)
        sum += prime;

    primesieve_free_iterator(&pi);
    printf("Sum of the primes below 10^10 = %" PRIu64 "\n", sum);
    return 0;
}

```

9.9 primesieve_iterator.cpp

Iterate over primes using a `primesieve::iterator` object.

```

#include <primesieve.hpp>
#include <iostream>

int main()

```

```

{
    primesieve::iterator pi;
    uint64_t sum = 0;
    uint64_t prime;

    // iterate over primes below 10^10
    while ((prime = pi.next_prime()) < 10000000000ull)
        sum += prime;

    std::cout << "Sum of the primes below 10^10 = " << sum << std::endl;
    return 0;
}

```

9.10 store_primes_in_array.c

Store primes in a C array.

```

#include <primesieve.h>
#include <stdio.h>

int main()
{
    uint64_t start = 0;
    uint64_t stop = 1000;
    size_t i;
    size_t size;

    /* store the primes below 1000 */
    int* primes = (int*) primesieve_generate_primes(start, stop, &size,
        INT_PRIMES);

    for (i = 0; i < size; i++)
        printf("%i\n", primes[i]);

    primesieve_free(primes);
    uint64_t n = 1000;

    /* store the first 1000 primes */
    primes = (int*) primesieve_generate_n_primes(n, start,
        INT_PRIMES);

    for (i = 0; i < n; i++)
        printf("%i\n", primes[i]);

    primesieve_free(primes);
    return 0;
}

```

9.11 store_primes_in_vector.cpp

Store primes in a std::vector using primesieve.

```

#include <primesieve.hpp>
#include <vector>

int main()
{
    std::vector<int> primes;

    // Store the primes <= 1000
    primesieve::generate_primes(1000, &primes);

    primes.clear();

    // Store the first 1000 primes
    primesieve::generate_n_primes(1000, &primes);

    return 0;
}

```

Index

Callback.hpp, [27](#)
callback_primes
 primesieve, [13](#)
count_primes
 primesieve, [13](#)
count_quadruplets
 primesieve, [13](#)
count_quintuplets
 primesieve, [14](#)
count_sextuplets
 primesieve, [14](#)
count_triplets
 primesieve, [14](#)
count_twins
 primesieve, [14](#)

generate_n_primes
 primesieve, [14](#)
generate_primes
 primesieve, [14](#), [15](#)
get_max_stop
 primesieve, [15](#)
get_num_threads
 primesieve, [15](#)

INT16_PRIMES
 primesieve.h, [32](#)
INT32_PRIMES
 primesieve.h, [32](#)
INT64_PRIMES
 primesieve.h, [32](#)
INT_PRIMES
 primesieve.h, [32](#)
iterator
 primesieve::iterator, [22](#)
iterator.hpp, [28](#)

LONG_PRIMES
 primesieve.h, [32](#)
LONGLONG_PRIMES
 primesieve.h, [32](#)

MAX_THREADS
 primesieve, [13](#)
 primesieve.h, [32](#)

next_prime
 primesieve::iterator, [22](#)
nth_prime
 primesieve, [15](#)

parallel_count_primes
 primesieve, [15](#)
parallel_count_quadruplets
 primesieve, [16](#)
parallel_count_quintuplets
 primesieve, [16](#)
parallel_count_sextuplets
 primesieve, [16](#)
parallel_count_triplets
 primesieve, [16](#)
parallel_count_twins
 primesieve, [16](#)
parallel_nth_prime
 primesieve, [17](#)
previous_prime
 primesieve::iterator, [22](#)
primesieve, [11](#)
 callback_primes, [13](#)
 count_primes, [13](#)
 count_quadruplets, [13](#)
 count_quintuplets, [14](#)
 count_sextuplets, [14](#)
 count_triplets, [14](#)
 count_twins, [14](#)
 generate_n_primes, [14](#)
 generate_primes, [14](#), [15](#)
 get_max_stop, [15](#)
 get_num_threads, [15](#)
 MAX_THREADS, [13](#)
 nth_prime, [15](#)
 parallel_count_primes, [15](#)
 parallel_count_quadruplets, [16](#)
 parallel_count_quintuplets, [16](#)
 parallel_count_sextuplets, [16](#)
 parallel_count_triplets, [16](#)
 parallel_count_twins, [16](#)
 parallel_nth_prime, [17](#)
 primesieve_test, [17](#)
 print_primes, [17](#)
 print_quadruplets, [17](#)
 print_quintuplets, [17](#)
 print_sextuplets, [18](#)
 print_triplets, [18](#)
 print_twins, [18](#)
 set_num_threads, [18](#)
 set_sieve_size, [18](#)
primesieve.h, [29](#)
 INT16_PRIMES, [32](#)
 INT32_PRIMES, [32](#)

INT64_PRIMES, [32](#)
 INT_PRIMES, [32](#)
 LONG_PRIMES, [32](#)
 LONGLONG_PRIMES, [32](#)
 MAX_THREADS, [32](#)
 primesieve_callback_primes, [32](#)
 primesieve_count_primes, [32](#)
 primesieve_count_quadruplets, [33](#)
 primesieve_count_quintuplets, [33](#)
 primesieve_count_sextuplets, [33](#)
 primesieve_count_triplets, [33](#)
 primesieve_count_twins, [33](#)
 primesieve_generate_n_primes, [33](#)
 primesieve_generate_primes, [34](#)
 primesieve_get_max_stop, [34](#)
 primesieve_get_num_threads, [34](#)
 primesieve_get_sieve_size, [34](#)
 primesieve_nth_prime, [34](#)
 primesieve_parallel_count_primes, [35](#)
 primesieve_parallel_count_quadruplets, [35](#)
 primesieve_parallel_count_quintuplets, [35](#)
 primesieve_parallel_count_sextuplets, [35](#)
 primesieve_parallel_count_triplets, [35](#)
 primesieve_parallel_count_twins, [36](#)
 primesieve_parallel_nth_prime, [36](#)
 primesieve_print_primes, [36](#)
 primesieve_print_quadruplets, [36](#)
 primesieve_print_quintuplets, [36](#)
 primesieve_print_sextuplets, [37](#)
 primesieve_print_triplets, [37](#)
 primesieve_print_twins, [37](#)
 primesieve_set_num_threads, [37](#)
 primesieve_set_sieve_size, [37](#)
 primesieve_test, [38](#)
 primesieve_version, [38](#)
 SHORT_PRIMES, [32](#)
 UINT16_PRIMES, [32](#)
 UINT32_PRIMES, [32](#)
 UINT64_PRIMES, [32](#)
 UINT_PRIMES, [32](#)
 ULONG_PRIMES, [32](#)
 LONGLONG_PRIMES, [32](#)
 USHORT_PRIMES, [32](#)
 primesieve.hpp, [38](#)
 primesieve::Callback< T >, [21](#)
 primesieve::iterator, [21](#)
 iterator, [22](#)
 next_prime, [22](#)
 previous_prime, [22](#)
 skipto, [22](#)
 primesieve::primesieve_error, [24](#)
 primesieve_callback_primes
 primesieve.h, [32](#)
 primesieve_count_primes
 primesieve.h, [32](#)
 primesieve_count_quadruplets
 primesieve.h, [33](#)
 primesieve_count_quintuplets
 primesieve.h, [33](#)
 primesieve_count_sextuplets
 primesieve.h, [33](#)
 primesieve_count_triplets
 primesieve.h, [33](#)
 primesieve_count_twins
 primesieve.h, [33](#)
 primesieve_error.hpp, [40](#)
 primesieve_free_iterator
 primesieve_iterator.h, [43](#)
 primesieve_generate_n_primes
 primesieve.h, [33](#)
 primesieve_generate_primes
 primesieve.h, [34](#)
 primesieve_get_max_stop
 primesieve.h, [34](#)
 primesieve_get_num_threads
 primesieve.h, [34](#)
 primesieve_get_sieve_size
 primesieve.h, [34](#)
 primesieve_init
 primesieve_iterator.h, [43](#)
 primesieve_iterator, [25](#)
 primesieve_iterator.h, [41](#)
 primesieve_free_iterator, [43](#)
 primesieve_init, [43](#)
 primesieve_next_prime, [43](#)
 primesieve_previous_prime, [43](#)
 primesieve_skipto, [43](#)
 primesieve_next_prime
 primesieve_iterator.h, [43](#)
 primesieve_nth_prime
 primesieve.h, [34](#)
 primesieve_parallel_count_primes
 primesieve.h, [35](#)
 primesieve_parallel_count_quadruplets
 primesieve.h, [35](#)
 primesieve_parallel_count_quintuplets
 primesieve.h, [35](#)
 primesieve_parallel_count_sextuplets
 primesieve.h, [35](#)
 primesieve_parallel_count_triplets
 primesieve.h, [35](#)
 primesieve_parallel_count_twins
 primesieve.h, [36](#)
 primesieve_parallel_nth_prime
 primesieve.h, [36](#)
 primesieve_previous_prime
 primesieve_iterator.h, [43](#)
 primesieve_print_primes
 primesieve.h, [36](#)
 primesieve_print_quadruplets
 primesieve.h, [36](#)
 primesieve_print_quintuplets
 primesieve.h, [36](#)
 primesieve_print_sextuplets
 primesieve.h, [37](#)
 primesieve_print_triplets
 primesieve.h, [33](#)

- primesieve.h, [37](#)
- primesieve_print_twins
 - primesieve.h, [37](#)
- primesieve_set_num_threads
 - primesieve.h, [37](#)
- primesieve_set_sieve_size
 - primesieve.h, [37](#)
- primesieve_skipto
 - primesieve_iterator.h, [43](#)
- primesieve_test
 - primesieve, [17](#)
 - primesieve.h, [38](#)
- primesieve_version
 - primesieve.h, [38](#)
- print_primes
 - primesieve, [17](#)
- print_quadruplets
 - primesieve, [17](#)
- print_quintuplets
 - primesieve, [17](#)
- print_sextuplets
 - primesieve, [18](#)
- print_triplets
 - primesieve, [18](#)
- print_twins
 - primesieve, [18](#)
- SHORT_PRIMES
 - primesieve.h, [32](#)
- set_num_threads
 - primesieve, [18](#)
- set_sieve_size
 - primesieve, [18](#)
- skipto
 - primesieve::iterator, [22](#)
- UINT16_PRIMES
 - primesieve.h, [32](#)
- UINT32_PRIMES
 - primesieve.h, [32](#)
- UINT64_PRIMES
 - primesieve.h, [32](#)
- UINT_PRIMES
 - primesieve.h, [32](#)
- ULONG_PRIMES
 - primesieve.h, [32](#)
- ULONGLONG_PRIMES
 - primesieve.h, [32](#)
- USHORT_PRIMES
 - primesieve.h, [32](#)