

Nvwa Reference Manual  
0.8

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# Contents

<b>1</b>	<b>Nvwa Hierarchical Index</b>	<b>1</b>
1.1	Nvwa Class Hierarchy . . . . .	1
<b>2</b>	<b>Nvwa Class Index</b>	<b>3</b>
2.1	Nvwa Class List . . . . .	3
<b>3</b>	<b>Nvwa File Index</b>	<b>5</b>
3.1	Nvwa File List . . . . .	5
<b>4</b>	<b>Nvwa Class Documentation</b>	<b>7</b>
4.1	__debug_new_counter Class Reference . . . . .	7
4.2	__debug_new_recorder Class Reference . . . . .	9
4.3	__nvwa_compile_time_error< true > Struct Template Reference . . . . .	10
4.4	bool_array Class Reference . . . . .	11
4.5	class_level_lock< _Host, _RealLock > Class Template Reference . . . . .	15
4.6	class_level_lock< _Host, _RealLock >::lock Class Reference . . . . .	17
4.7	delete_object Struct Reference . . . . .	18
4.8	dereference Struct Reference . . . . .	19
4.9	dereference_less Struct Reference . . . . .	20
4.10	fast_mutex Class Reference . . . . .	21
4.11	fast_mutex_autolock Class Reference . . . . .	22
4.12	fixed_mem_pool< _Tp > Class Template Reference . . . . .	23
4.13	mem_pool_base Class Reference . . . . .	26
4.14	mem_pool_base::_Block_list Struct Reference . . . . .	28
4.15	new_ptr_list_t Struct Reference . . . . .	29
4.16	object_level_lock< _Host > Class Template Reference . . . . .	31
4.17	object_level_lock< _Host >::lock Class Reference . . . . .	33
4.18	output_object< _OutputStrm, _StringType > Struct Template Reference . . . . .	34
4.19	static_mem_pool< _Sz, _Gid > Class Template Reference . . . . .	35

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4.20	static_mem_pool_set Class Reference . . . . .	38
<b>5</b>	<b>Nvwa File Documentation</b>	<b>41</b>
5.1	bool_array.cpp File Reference . . . . .	41
5.2	bool_array.h File Reference . . . . .	42
5.3	class_level_lock.h File Reference . . . . .	44
5.4	cont_ptr_utils.h File Reference . . . . .	45
5.5	debug_new.cpp File Reference . . . . .	46
5.6	debug_new.h File Reference . . . . .	55
5.7	fast_mutex.h File Reference . . . . .	59
5.8	fixed_mem_pool.h File Reference . . . . .	61
5.9	mem_pool_base.cpp File Reference . . . . .	64
5.10	mem_pool_base.h File Reference . . . . .	65
5.11	object_level_lock.h File Reference . . . . .	66
5.12	pctimer.h File Reference . . . . .	67
5.13	set_assign.h File Reference . . . . .	68
5.14	static_assert.h File Reference . . . . .	69
5.15	static_mem_pool.cpp File Reference . . . . .	70
5.16	static_mem_pool.h File Reference . . . . .	71

# Chapter 1

## Nvwa Hierarchical Index

### 1.1 Nvwa Class Hierarchy

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

__debug_new_counter . . . . .	7
__debug_new_recorder . . . . .	9
__nvwa_compile_time_error< true > . . . . .	10
bool_array . . . . .	11
class_level_lock< _Host, _RealLock > . . . . .	15
class_level_lock< _Host, _RealLock >::lock . . . . .	17
delete_object . . . . .	18
dereference . . . . .	19
dereference_less . . . . .	20
fast_mutex . . . . .	21
fast_mutex_autolock . . . . .	22
fixed_mem_pool< _Tp > . . . . .	23
mem_pool_base . . . . .	26
static_mem_pool< _Sz, _Gid > . . . . .	35
mem_pool_base::_Block_list . . . . .	28
new_ptr_list_t . . . . .	29
object_level_lock< _Host > . . . . .	31
object_level_lock< _Host >::lock . . . . .	33
output_object< _OutputStrm, _StringType > . . . . .	34
static_mem_pool_set . . . . .	38



# Chapter 2

## Nvwa Class Index

### 2.1 Nvwa Class List

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

<code>__debug_new_counter</code> (Counter class for on-exit leakage check ) . . . . .	7
<code>__debug_new_recorder</code> (Recorder class to remember the call context ) . . . . .	9
<code>__nvwa_compile_time_error&lt; true &gt;</code> . . . . .	10
<code>bool_array</code> (Class to represent a packed boolean array ) . . . . .	11
<code>class_level_lock&lt; _Host, _RealLock &gt;</code> (Helper class for class-level locking ) . . . . .	15
<code>class_level_lock&lt; _Host, _RealLock &gt;::lock</code> (Type that provides locking/unlocking semantics ) . . . . .	17
<code>delete_object</code> (Functor to delete objects pointed by a container of pointers ) . . . . .	18
<code>dereference</code> (Functor to return objects pointed by a container of pointers ) . . . . .	19
<code>dereference_less</code> (Functor to compare objects pointed by a container of pointers ) . . . . .	20
<code>fast_mutex</code> (Class for non-reentrant fast mutexes ) . . . . .	21
<code>fast_mutex_autolock</code> (An acquisition-on-initialization lock class based on <code>fast_mutex</code> ) . . . . .	22
<code>fixed_mem_pool&lt; _Tp &gt;</code> (Class template to manipulate a fixed-size memory pool ) . . . . .	23
<code>mem_pool_base</code> (Base class for memory pools ) . . . . .	26
<code>mem_pool_base::_Block_list</code> (Structure to store the next available memory block ) . . . . .	28
<code>new_ptr_list_t</code> (Structure to store the position information where <code>new</code> occurs ) . . . . .	29
<code>object_level_lock&lt; _Host &gt;</code> (Helper class for class-level locking ) . . . . .	31
<code>object_level_lock&lt; _Host &gt;::lock</code> (Type that provides locking/unlocking semantics ) . . . . .	33
<code>output_object&lt; _OutputStrm, _StringType &gt;</code> (Functor to output objects pointed by a container of pointers ) . . . . .	34
<code>static_mem_pool&lt; _Sz, _Gid &gt;</code> (Singleton class template to manage the allocation/deallocation of memory blocks of one specific size ) . . . . .	35
<code>static_mem_pool_set</code> (Singleton class to maintain a set of existing instantiations of <code>static_mem_pool</code> ) . . . . .	38





# Chapter 3

## Nvwa File Index

### 3.1 Nvwa File List

Here is a list of all files with brief descriptions:

<a href="#">bool_array.cpp</a> (Code for class <a href="#">bool_array</a> (packed boolean array) ) . . . . .	41
<a href="#">bool_array.h</a> (Header file for class <a href="#">bool_array</a> (packed boolean array) ) . . . . .	42
<a href="#">class_level_lock.h</a> (In essence Loki <a href="#">ClassLevelLockable</a> re-engineered to use a <a href="#">fast_mutex</a> class ) . . . . .	44
<a href="#">cont_ptr_utils.h</a> (Utility functors for containers of pointers (adapted from Scott Meyers' <i>Effective STL</i> ) ) . . . . .	45
<a href="#">debug_new.cpp</a> (Implementation of debug versions of new and delete to check leakage )	46
<a href="#">debug_new.h</a> (Header file for checking leaks caused by unmatched new/delete ) . . . . .	55
<a href="#">fast_mutex.h</a> (A fast mutex implementation for POSIX and Win32 ) . . . . .	59
<a href="#">fixed_mem_pool.h</a> (Definition of a fixed-size memory pool template for structs/classes )	61
<a href="#">mem_pool_base.cpp</a> (Implementation for the memory pool base ) . . . . .	64
<a href="#">mem_pool_base.h</a> (Header file for the memory pool base ) . . . . .	65
<a href="#">object_level_lock.h</a> (In essence Loki <a href="#">ObjectLevelLockable</a> re-engineered to use a <a href="#">fast_mutex</a> class ) . . . . .	66
<a href="#">pctimer.h</a> (Function to get a high-resolution timer for Win32/Cygwin/Unix ) . . . . .	67
<a href="#">set_assign.h</a> (Definition of template functions <a href="#">set_assign_union</a> and <a href="#">set_assign_difference</a> ) . . . . .	68
<a href="#">static_assert.h</a> (Template class to check validity during compile time (adapted from Loki) )	69
<a href="#">static_mem_pool.cpp</a> (Non-template and non-inline code for the 'static' memory pool )	70
<a href="#">static_mem_pool.h</a> (Header file for the 'static' memory pool ) . . . . .	71



# Chapter 4

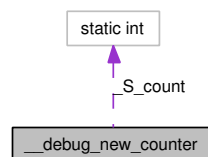
## Nvwa Class Documentation

### 4.1 `__debug_new_counter` Class Reference

Counter class for on-exit leakage check.

```
#include <debug_new.h>
```

Collaboration diagram for `__debug_new_counter`:



#### Public Member Functions

- `__debug_new_counter ()`  
*Constructor to increment the count.*
- `~__debug_new_counter ()`  
*Destructor to decrement the count.*

#### 4.1.1 Detailed Description

Counter class for on-exit leakage check.

This technique is learnt from *The C++ Programming Language* by Bjarne Stroustrup.

#### 4.1.2 Constructor & Destructor Documentation

##### 4.1.2.1 `__debug_new_counter::__debug_new_counter ()`

Constructor to increment the count.

#### 4.1.2.2 `__debug_new_counter::~~__debug_new_counter ()`

Destructor to decrement the count.

When the count is zero, [check\\_leaks](#) will be called.

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

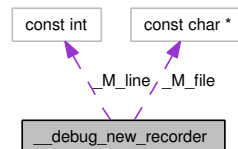
- [debug\\_new.h](#)
- [debug\\_new.cpp](#)

## 4.2 `__debug_new_recorder` Class Reference

Recorder class to remember the call context.

```
#include <debug_new.h>
```

Collaboration diagram for `__debug_new_recorder`:



### Public Member Functions

- `__debug_new_recorder` (`const char *file`, `int line`)  
*Constructor to remember the call context.*
- `template<class _Tp> _Tp * operator → * (_Tp *pointer)`  
*Operator to write the context information to memory.*

#### 4.2.1 Detailed Description

Recorder class to remember the call context.

The idea comes from [Greg Herlihy's post](#) in `comp.lang.c++.moderated`.

#### 4.2.2 Constructor & Destructor Documentation

##### 4.2.2.1 `__debug_new_recorder::__debug_new_recorder` (`const char * file`, `int line`) `[inline]`

Constructor to remember the call context.

The information will be used in `__debug_new_recorder::operator → *`.

#### 4.2.3 Member Function Documentation

##### 4.2.3.1 `template<class _Tp> _Tp* __debug_new_recorder::operator → * (_Tp * pointer)` `[inline]`

Operator to write the context information to memory.

`operator → *` is chosen because it has the right precedence, it is rarely used, and it looks good: so people can tell the special usage more quickly.

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

- [debug\\_new.h](#)
- [debug\\_new.cpp](#)

### 4.3 `__nvwa_compile_time_error< true >` Struct Template Reference

```
#include <static_assert.h>
```

```
template<> struct __nvwa_compile_time_error< true >
```

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

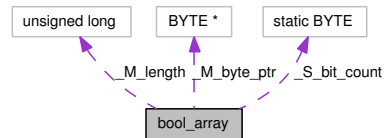
- [static\\_assert.h](#)

## 4.4 bool\_array Class Reference

Class to represent a packed boolean array.

```
#include <bool_array.h>
```

Collaboration diagram for bool\_array:



### Public Member Functions

- [bool\\_array](#) ()
- [bool\\_array](#) (unsigned long \_\_size)  
*Constructs the packed boolean array with a specific size.*
- [~bool\\_array](#) ()
- [bool create](#) (unsigned long \_\_size)  
*Creates the packed boolean array with a specific size.*
- void [initialize](#) (bool \_\_value)  
*Initializes all array elements to a specific value optimally.*
- [\\_Element operator\[\]](#) (unsigned long \_\_idx)  
*Creates a reference to an array element.*
- [bool at](#) (unsigned long \_\_idx) const  
*Reads the boolean value of an array element via an index.*
- void [reset](#) (unsigned long \_\_idx)  
*Resets an array element to **false** via an index.*
- void [set](#) (unsigned long \_\_idx)  
*Sets an array element to **true** via an index.*
- unsigned long [size](#) () const
- unsigned long [count](#) () const  
*Counts elements with a **true** value.*
- unsigned long [count](#) (unsigned long \_\_beg, unsigned long \_\_end) const  
*Counts elements with a **true** value in a specified range.*
- void [flip](#) ()  
*Changes all **true** elements to **false**, and **false** ones to **true**.*

## Classes

- class `_Element`

*Class to represent a reference to an array element.*

### 4.4.1 Detailed Description

Class to represent a packed boolean array.

This was first written in April 1995, before I knew of any existing implementation of this kind of classes. Of course, the C++ Standard Template Library now demands an implementation of packed boolean array as `'vector<bool>'`, but the code here should still be useful for the following three reasons: (1) STL support of MSVC 6 did not implement this specialization (nor did it have a `'bit_vector'`); (2) I incorporated some useful member functions from the STL bitset into this `'bool_array'`, including `'reset'`, `'set'`, `'flip'`, and `'count'`; (3) In my tests under MSVC 6 and GCC 2.95.3/3.2.3 my code is really FASTER than `vector<bool>` or the normal boolean array.

### 4.4.2 Constructor & Destructor Documentation

4.4.2.1 `bool_array::bool_array ()` [inline]

4.4.2.2 `bool_array::bool_array (unsigned long __size)` [inline, explicit]

Constructs the packed boolean array with a specific size.

#### Parameters:

`__size` size of the array

#### Exceptions:

`std::out_of_range` if `__size` equals 0

`std::bad_alloc` if memory is insufficient

4.4.2.3 `bool_array::~~bool_array ()` [inline]

### 4.4.3 Member Function Documentation

4.4.3.1 `bool bool_array::create (unsigned long __size)`

Creates the packed boolean array with a specific size.

#### Parameters:

`__size` size of the array

#### Returns:

`false` if `__size` equals 0 or is too big, or if memory is insufficient; `true` if `__size` has a suitable value and memory allocation is successful.



#### 4.4.3.2 void bool\_array::initialize (bool \_\_value)

Initializes all array elements to a specific value optimally.

**Parameters:**

\_\_value the boolean value to assign to all elements

#### 4.4.3.3 bool\_array::\_Element bool\_array::operator[] (unsigned long \_\_idx) [inline]

Creates a reference to an array element.

**Parameters:**

\_\_idx index of the array element to access

#### 4.4.3.4 bool bool\_array::at (unsigned long \_\_idx) const [inline]

Reads the boolean value of an array element via an index.

**Parameters:**

\_\_idx index of the array element to access

**Returns:**

the boolean value of the accessed array element

**Exceptions:**

*std::out\_of\_range* when the index is too big

#### 4.4.3.5 void bool\_array::reset (unsigned long \_\_idx) [inline]

Resets an array element to `false` via an index.

**Parameters:**

\_\_idx index of the array element to access

**Exceptions:**

*std::out\_of\_range* when the index is too big

#### 4.4.3.6 void bool\_array::set (unsigned long \_\_idx) [inline]

Sets an array element to `true` via an index.

**Parameters:**

\_\_idx index of the array element to access

**Exceptions:**

*std::out\_of\_range* when the index is too big

**4.4.3.7 unsigned long bool\_array::size () const [inline]****4.4.3.8 unsigned long bool\_array::count () const**

Counts elements with a `true` value.

**Returns:**

the count of `true` elements

**4.4.3.9 unsigned long bool\_array::count (unsigned long \_\_beg, unsigned long \_\_end) const**

Counts elements with a `true` value in a specified range.

**Parameters:**

`__beg` beginning of the range  
`__end` end of the range (exclusive)

**Returns:**

the count of `true` elements

**4.4.3.10 void bool\_array::flip ()**

Changes all `true` elements to `false`, and `false` ones to `true`.

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

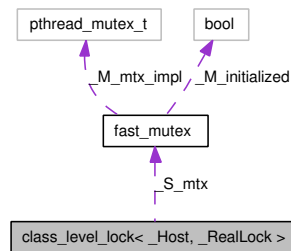
- [bool\\_array.h](#)
- [bool\\_array.cpp](#)

## 4.5 class\_level\_lock< \_Host, \_RealLock > Class Template Reference

Helper class for class-level locking.

```
#include <class_level_lock.h>
```

Collaboration diagram for class\_level\_lock< \_Host, \_RealLock >:



### Public Types

- typedef volatile \_Host [volatile\\_type](#)

### Friends

- class [lock](#)

### Classes

- class [lock](#)

*Type that provides locking/unlocking semantics.*

#### 4.5.1 Detailed Description

```
template<class _Host, bool _RealLock = true> class class_level_lock< _Host, _RealLock >
```

Helper class for class-level locking.

This is the multi-threaded implementation. The main departure from Loki ClassLevelLockable is that there is an additional template parameter which can make the lock not lock at all even in multi-threaded environments. See [static\\_mem\\_pool.h](#) for real usage.

## 4.5.2 Member Typedef Documentation

4.5.2.1 `template<class _Host, bool _RealLock = true> typedef volatile _Host  
class _level_lock< _Host, _RealLock >::volatile_type`

## 4.5.3 Friends And Related Function Documentation

4.5.3.1 `template<class _Host, bool _RealLock = true> friend class lock [friend]`

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

- [class\\_level\\_lock.h](#)

## 4.6 class \_level\_lock< \_Host, \_RealLock >::lock Class Reference

Type that provides locking/unlocking semantics.

```
#include <class_level_lock.h>
```

### Public Member Functions

- [lock \(\)](#)
- [~lock \(\)](#)

#### 4.6.1 Detailed Description

```
template<class _Host, bool _RealLock = true> class class_level_lock< _Host, _RealLock >::lock
```

Type that provides locking/unlocking semantics.

#### 4.6.2 Constructor & Destructor Documentation

4.6.2.1 `template<class _Host, bool _RealLock = true> class\_level\_lock< \_Host, \_RealLock >::lock::lock \(\) [inline]`

4.6.2.2 `template<class _Host, bool _RealLock = true> class\_level\_lock< \_Host, \_RealLock >::lock::~~lock \(\) [inline]`

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

- [class\\_level\\_lock.h](#)

## 4.7 delete\_object Struct Reference

Functor to delete objects pointed by a container of pointers.

```
#include <cont_ptr_utils.h>
```

### Public Member Functions

- `template<typename _Pointer> void operator() (_Pointer __ptr) const`

#### 4.7.1 Detailed Description

Functor to delete objects pointed by a container of pointers.

A typical usage might be like:

```
list<Object*> l;  
...  
for_each(l.begin(), l.end(), delete_object());
```

#### 4.7.2 Member Function Documentation

##### 4.7.2.1 `template<typename _Pointer> void delete_object::operator() (_Pointer __ptr) const` [inline]

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

- [cont\\_ptr\\_utils.h](#)

## 4.8 dereference Struct Reference

Functor to return objects pointed by a container of pointers.

```
#include <cont_ptr_utils.h>
```

### Public Member Functions

- `template<typename _Tp> const _Tp & operator() (const _Tp * __ptr) const`

#### 4.8.1 Detailed Description

Functor to return objects pointed by a container of pointers.

A typical usage might be like:

```
vector<Object*> v;  
...  
transform(v.begin(), v.end(),  
          ostream_iterator<Object>(cout, " "),  
          dereference());
```

#### 4.8.2 Member Function Documentation

- ##### 4.8.2.1 `template<typename _Tp> const _Tp& dereference::operator() (const _Tp * __ptr) const [inline]`

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

- [cont\\_ptr\\_utils.h](#)

## 4.9 dereference\_less Struct Reference

Functor to compare objects pointed by a container of pointers.

```
#include <cont_ptr_utils.h>
```

### Public Member Functions

- `template<typename _Pointer> bool operator() (_Pointer __ptr1, _Pointer __ptr2) const`

#### 4.9.1 Detailed Description

Functor to compare objects pointed by a container of pointers.

```
vector<Object*> v;  
...  
sort(v.begin(), v.end(), dereference_less());
```

or

```
set<Object*, dereference_less> s;
```

#### 4.9.2 Member Function Documentation

##### 4.9.2.1 `template<typename _Pointer> bool dereference_less::operator() (_Pointer __ptr1, _Pointer __ptr2) const [inline]`

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

- [cont\\_ptr\\_utils.h](#)

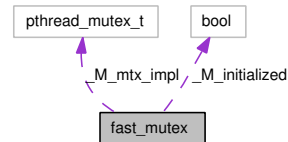


## 4.10 fast\_mutex Class Reference

Class for non-reentrant fast mutexes.

```
#include <fast_mutex.h>
```

Collaboration diagram for fast\_mutex:



### Public Member Functions

- [fast\\_mutex \(\)](#)
- [~fast\\_mutex \(\)](#)
- void [lock \(\)](#)
- void [unlock \(\)](#)

#### 4.10.1 Detailed Description

Class for non-reentrant fast mutexes.

This is the implementation for POSIX threads.

#### 4.10.2 Constructor & Destructor Documentation

4.10.2.1 [fast\\_mutex::fast\\_mutex \(\)](#) [inline]

4.10.2.2 [fast\\_mutex::~~fast\\_mutex \(\)](#) [inline]

#### 4.10.3 Member Function Documentation

4.10.3.1 [void fast\\_mutex::lock \(\)](#) [inline]

4.10.3.2 [void fast\\_mutex::unlock \(\)](#) [inline]

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

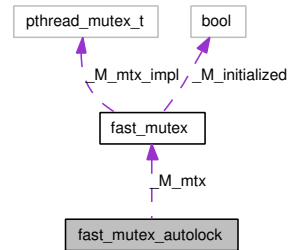
- [fast\\_mutex.h](#)

## 4.11 fast\_mutex\_autolock Class Reference

An acquisition-on-initialization lock class based on [fast\\_mutex](#).

```
#include <fast_mutex.h>
```

Collaboration diagram for fast\_mutex\_autolock:



### Public Member Functions

- [fast\\_mutex\\_autolock](#) ([fast\\_mutex](#) & \_\_mtx)
- [~fast\\_mutex\\_autolock](#) ()

#### 4.11.1 Detailed Description

An acquisition-on-initialization lock class based on [fast\\_mutex](#).

#### 4.11.2 Constructor & Destructor Documentation

4.11.2.1 [fast\\_mutex\\_autolock::fast\\_mutex\\_autolock](#) ([fast\\_mutex](#) & \_\_mtx) [inline, explicit]

4.11.2.2 [fast\\_mutex\\_autolock::~~fast\\_mutex\\_autolock](#) () [inline]

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

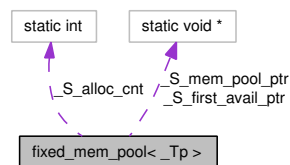
- [fast\\_mutex.h](#)

## 4.12 `fixed_mem_pool< _Tp >` Class Template Reference

Class template to manipulate a fixed-size memory pool.

```
#include <fixed_mem_pool.h>
```

Collaboration diagram for `fixed_mem_pool< _Tp >`:



### Public Types

- typedef `class_level_lock< fixed_mem_pool< _Tp >::lock lock`

### Static Public Member Functions

- static void \* `allocate ()`  
*Allocates a memory block from the memory pool.*
- static void `deallocate (void *)`  
*Deallocates a memory block and returns it to the memory pool.*
- static bool `initialize (size_t __size)`  
*Initializes the memory pool.*
- static int `deinitialize ()`  
*Deinitializes the memory pool.*
- static int `get_alloc_count ()`  
*Gets the allocation count.*
- static bool `is_initialized ()`  
*Is the memory pool initialized?*

### Static Protected Member Functions

- static bool `bad_alloc_handler ()`  
*Bad allocation handler.*

### 4.12.1 Detailed Description

```
template<class _Tp> class fixed_mem_pool< _Tp >
```

Class template to manipulate a fixed-size memory pool.

Please notice that only allocate and deallocate are protected by a lock.

#### Parameters:

`_Tp` class to use the `fixed_mem_pool`

### 4.12.2 Member Typedef Documentation

4.12.2.1 `template<class _Tp> typedef class_level_lock<fixed_mem_pool<_Tp>>::lock fixed_mem_pool< _Tp >::lock`

### 4.12.3 Member Function Documentation

4.12.3.1 `template<class _Tp> void * fixed_mem_pool< _Tp >::allocate ()`  
`[inline, static]`

Allocates a memory block from the memory pool.

#### Returns:

pointer to the allocated memory block

4.12.3.2 `template<class _Tp> void fixed_mem_pool< _Tp >::deallocate (void *`  
`__block_ptr) [inline, static]`

Deallocates a memory block and returns it to the memory pool.

#### Parameters:

`__block_ptr` pointer to the memory block to return

4.12.3.3 `template<class _Tp> bool fixed_mem_pool< _Tp >::initialize (size_t`  
`__size) [static]`

Initializes the memory pool.

#### Parameters:

`__size` number of memory blocks to put in the memory pool

#### Returns:

`true` if successful; `false` if memory insufficient

4.12.3.4 `template<class _Tp> int fixed_mem_pool< _Tp >::deinitialize ()`  
[static]

Deinitializes the memory pool.

**Returns:**

0 if all memory blocks are returned and the memory pool successfully freed; or a non-zero value indicating number of memory blocks still in allocation

4.12.3.5 `template<class _Tp> int fixed_mem_pool< _Tp >::get_alloc_count ()`  
[inline, static]

Gets the allocation count.

**Returns:**

the number of memory blocks still in allocation

4.12.3.6 `template<class _Tp> bool fixed_mem_pool< _Tp >::is_initialized ()`  
[inline, static]

Is the memory pool initialized?

**Returns:**

`true` if it is successfully initialized; `false` otherwise

4.12.3.7 `template<class _Tp> bool fixed_mem_pool< _Tp >::bad_alloc_handler ()`  
[static, protected]

Bad allocation handler.

Called when there are no memory blocks available in the memory pool. If this function returns `false` (default behaviour if not explicitly specialized), it indicates that it can do nothing and `allocate()` should return `NULL`; if this function returns `true`, it indicates that it has freed some memory blocks and `allocate()` should try allocating again.

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

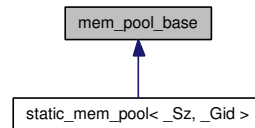
- [fixed\\_mem\\_pool.h](#)

## 4.13 mem\_pool\_base Class Reference

Base class for memory pools.

```
#include <mem_pool_base.h>
```

Inheritance diagram for mem\_pool\_base:



### Public Member Functions

- virtual [~mem\\_pool\\_base](#) ()
- virtual void [recycle](#) ()=0

### Static Public Member Functions

- static void \* [alloc\\_sys](#) (size\_t \_\_size)
- static void [dealloc\\_sys](#) (void \* \_\_ptr)

### Classes

- struct [\\_Block\\_list](#)  
*Structure to store the next available memory block.*

#### 4.13.1 Detailed Description

Base class for memory pools.

#### 4.13.2 Constructor & Destructor Documentation

4.13.2.1 [mem\\_pool\\_base::~mem\\_pool\\_base](#) () [virtual]

#### 4.13.3 Member Function Documentation

4.13.3.1 [virtual void mem\\_pool\\_base::recycle](#) () [pure virtual]

Implemented in [static\\_mem\\_pool<\\_Sz, \\_Gid>](#).

4.13.3.2 [void \\* mem\\_pool\\_base::alloc\\_sys](#) (size\_t \_\_size) [static]

4.13.3.3 [void mem\\_pool\\_base::dealloc\\_sys](#) (void \* \_\_ptr) [static]

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

- [mem\\_pool\\_base.h](#)
- [mem\\_pool\\_base.cpp](#)

## 4.14 mem\_pool\_base::\_Block\_list Struct Reference

Structure to store the next available memory block.

```
#include <mem_pool_base.h>
```

Collaboration diagram for mem\_pool\_base::\_Block\_list:



### Public Attributes

- [\\_Block\\_list \\* \\_M\\_next](#)

#### 4.14.1 Detailed Description

Structure to store the next available memory block.

#### 4.14.2 Member Data Documentation

##### 4.14.2.1 [\\_Block\\_list\\*](#) [mem\\_pool\\_base::\\_Block\\_list::\\_M\\_next](#)

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

- [mem\\_pool\\_base.h](#)



## 4.15 new\_ptr\_list\_t Struct Reference

Structure to store the position information where `new` occurs.

Collaboration diagram for `new_ptr_list_t`:



### Public Attributes

- `new_ptr_list_t * next`
- `new_ptr_list_t * prev`
- `size_t size`
- union {
  - char `file` [`_DEBUG_NEW_FILENAME_LEN`]
  - void \* `addr`
};
- unsigned `line`:31
- unsigned `is_array`:1
- unsigned `magic`

#### 4.15.1 Detailed Description

Structure to store the position information where `new` occurs.

## 4.15.2 Member Data Documentation

4.15.2.1 [new\\_ptr\\_list\\_t\\* new\\_ptr\\_list\\_t::next](#)

4.15.2.2 [new\\_ptr\\_list\\_t\\* new\\_ptr\\_list\\_t::prev](#)

4.15.2.3 [size\\_t new\\_ptr\\_list\\_t::size](#)

4.15.2.4 [char new\\_ptr\\_list\\_t::file\[\\_DEBUG\\_NEW\\_FILENAME\\_LEN\]](#)

4.15.2.5 [void\\* new\\_ptr\\_list\\_t::addr](#)

4.15.2.6 [union { ... }](#)

4.15.2.7 [unsigned new\\_ptr\\_list\\_t::line](#)

4.15.2.8 [unsigned new\\_ptr\\_list\\_t::is\\_array](#)

4.15.2.9 [unsigned new\\_ptr\\_list\\_t::magic](#)

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

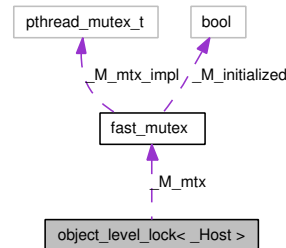
- [debug\\_new.cpp](#)

## 4.16 `object_level_lock< _Host >` Class Template Reference

Helper class for class-level locking.

```
#include <object_level_lock.h>
```

Collaboration diagram for `object_level_lock< _Host >`:



### Public Types

- typedef volatile `_Host` `volatile_type`

### Friends

- class `lock`

### Classes

- class `lock`

*Type that provides locking/unlocking semantics.*

#### 4.16.1 Detailed Description

```
template<class _Host> class object_level_lock< _Host >
```

Helper class for class-level locking.

This is the multi-threaded implementation.

#### 4.16.2 Member Typedef Documentation

4.16.2.1 `template<class _Host> typedef volatile _Host object_level_lock< _Host >::volatile_type`

#### 4.16.3 Friends And Related Function Documentation

4.16.3.1 `template<class _Host> friend class lock [friend]`

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

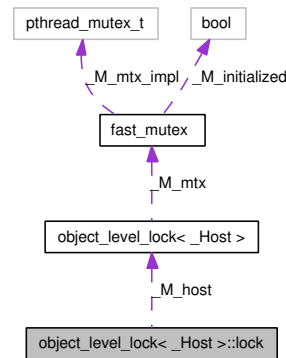
- [object\\_level\\_lock.h](#)

## 4.17 `object_level_lock< _Host >::lock` Class Reference

Type that provides locking/unlocking semantics.

```
#include <object_level_lock.h>
```

Collaboration diagram for `object_level_lock< _Host >::lock`:



### Public Member Functions

- `lock` (`const object_level_lock & __host`)
- `~lock` ()
- `const object_level_lock * get_locked_object` () `const`

#### 4.17.1 Detailed Description

```
template<class _Host> class object_level_lock< _Host >::lock
```

Type that provides locking/unlocking semantics.

#### 4.17.2 Constructor & Destructor Documentation

4.17.2.1 `template<class _Host> object_level_lock< _Host >::lock::lock` (`const object_level_lock & __host`) [`inline`, `explicit`]

4.17.2.2 `template<class _Host> object_level_lock< _Host >::lock::~~lock` () [`inline`]

#### 4.17.3 Member Function Documentation

4.17.3.1 `template<class _Host> const object_level_lock* object_level_lock< _Host >::lock::get_locked_object` () `const` [`inline`]

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

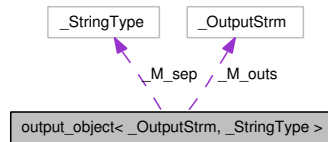
- `object_level_lock.h`

## 4.18 `output_object< _OutputStrm, _StringType >` Struct Template Reference

Functor to output objects pointed by a container of pointers.

```
#include <cont_ptr_utils.h>
```

Collaboration diagram for `output_object< _OutputStrm, _StringType >`:



### Public Member Functions

- `output_object` (`_OutputStrm & __outs`, `const _StringType & __sep`)
- `template<typename _Tp> void operator()` (`const _Tp * __ptr`) `const`

#### 4.18.1 Detailed Description

```
template<typename _OutputStrm, typename _StringType = const char*> struct
output_object< _OutputStrm, _StringType >
```

Functor to output objects pointed by a container of pointers.

A typical usage might be like:

```
list<Object*> l;
...
for_each(l.begin(), l.end(), output_object<ostream>(cout, " "));
```

#### 4.18.2 Constructor & Destructor Documentation

- 4.18.2.1 `template<typename _OutputStrm, typename _StringType = const char*> output_object< _OutputStrm, _StringType >::output_object` (`_OutputStrm & __outs`, `const _StringType & __sep`) [`inline`]

#### 4.18.3 Member Function Documentation

- 4.18.3.1 `template<typename _OutputStrm, typename _StringType = const char*> template<typename _Tp> void output_object< _OutputStrm, _StringType >::operator()` (`const _Tp * __ptr`) `const` [`inline`]

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

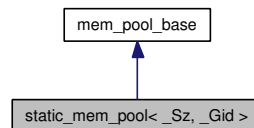
- `cont_ptr_utils.h`

## 4.19 static\_mem\_pool< \_Sz, \_Gid > Class Template Reference

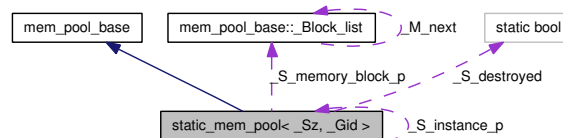
Singleton class template to manage the allocation/deallocation of memory blocks of one specific size.

```
#include <static_mem_pool.h>
```

Inheritance diagram for static\_mem\_pool< \_Sz, \_Gid >:



Collaboration diagram for static\_mem\_pool< \_Sz, \_Gid >:



### Public Member Functions

- void \* [allocate](#) ()  
*Allocates memory and returns its pointer.*
- void [deallocate](#) (void \* \_\_ptr)  
*Deallocates memory by putting the memory block into the pool.*
- virtual void [recycle](#) ()  
*Recycles half of the free memory blocks in the memory pool to the system.*

### Static Public Member Functions

- static [static\\_mem\\_pool & instance](#) ()  
*Gets the instance of the static memory pool.*
- static [static\\_mem\\_pool & instance\\_known](#) ()  
*Gets the known instance of the static memory pool.*

### 4.19.1 Detailed Description

```
template<size_t _Sz, int _Gid = -1> class static_mem_pool< _Sz, _Gid >
```

Singleton class template to manage the allocation/deallocation of memory blocks of one specific size.

**Parameters:**

- `_Sz` size of elements in the `static_mem_pool`
- `_Gid` group id of a `static_mem_pool`: if it is negative, simultaneous accesses to this `static_mem_pool` will be protected from each other; otherwise no protection is given

### 4.19.2 Member Function Documentation

```
4.19.2.1 template<size_t _Sz, int _Gid = -1> static static_mem_pool&
static_mem_pool< _Sz, _Gid >::instance () [inline, static]
```

Gets the instance of the static memory pool.

It will create the instance if it does not already exist. Generally this function is now not needed.

**Returns:**

reference to the instance of the static memory pool

**See also:**

[instance\\_known](#)

```
4.19.2.2 template<size_t _Sz, int _Gid = -1> static static_mem_pool&
static_mem_pool< _Sz, _Gid >::instance_known () [inline, static]
```

Gets the known instance of the static memory pool.

The instance must already exist. Generally the static initializer of the template guarantees it.

**Returns:**

reference to the instance of the static memory pool

```
4.19.2.3 template<size_t _Sz, int _Gid = -1> void* static_mem_pool< _Sz,
_Gid >::allocate () [inline]
```

Allocates memory and returns its pointer.

The template will try to get it from the memory pool first, and request memory from the system if there is no free memory in the pool.

**Returns:**

pointer to allocated memory if successful; NULL otherwise



4.19.2.4 `template<size_t _Sz, int _Gid = -1> void static_mem_pool< _Sz, _Gid >::deallocate (void * __ptr) [inline]`

Deallocates memory by putting the memory block into the pool.

**Parameters:**

`__ptr` pointer to memory to be deallocated

4.19.2.5 `template<size_t _Sz, int _Gid> void static_mem_pool< _Sz, _Gid >::recycle () [virtual]`

Recycles half of the free memory blocks in the memory pool to the system.

It is called when a memory request to the system (in other instances of the static memory pool) fails.

Implements [mem\\_pool\\_base](#).

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

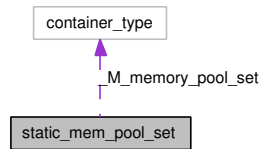
- [static\\_mem\\_pool.h](#)

## 4.20 static\_mem\_pool\_set Class Reference

Singleton class to maintain a set of existing instantiations of [static\\_mem\\_pool](#).

```
#include <static_mem_pool.h>
```

Collaboration diagram for `static_mem_pool_set`:



### Public Types

- typedef `class_level_lock< static_mem_pool_set >::lock lock`

### Public Member Functions

- void `recycle ()`  
*Asks all static memory pools to recycle unused memory blocks back to the system.*
- void `add (mem_pool_base * __memory_pool_p)`  
*Adds a new memory pool to `static_mem_pool_set`.*

### Static Public Member Functions

- static `static_mem_pool_set & instance ()`  
*Creates the singleton instance of `static_mem_pool_set`.*

#### 4.20.1 Detailed Description

Singleton class to maintain a set of existing instantiations of [static\\_mem\\_pool](#).

#### 4.20.2 Member Typedef Documentation

- 4.20.2.1 typedef `class_level_lock<static_mem_pool_set>::lock static_mem_pool_set::lock`

#### 4.20.3 Member Function Documentation

- 4.20.3.1 `static_mem_pool_set & static_mem_pool_set::instance ()` [static]

Creates the singleton instance of `static_mem_pool_set`.

**Returns:**

reference to the instance of `static_mem_pool_set`

**4.20.3.2 void `static_mem_pool_set::recycle` ()**

Asks all static memory pools to recycle unused memory blocks back to the system.

The caller should get the lock to prevent other operations to `static_mem_pool_set` during its execution.

**4.20.3.3 void `static_mem_pool_set::add` (`mem_pool_base * __memory_pool_p`)**

Adds a new memory pool to `static_mem_pool_set`.

**Parameters:**

`__memory_pool_p` pointer to the memory pool to add

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

- `static_mem_pool.h`
- `static_mem_pool.cpp`



## Chapter 5

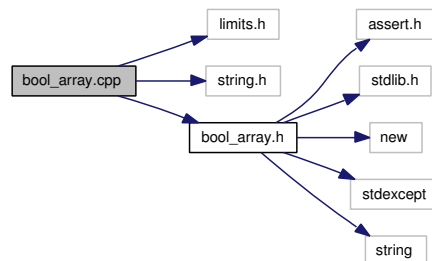
# Nvwa File Documentation

### 5.1 bool\_array.cpp File Reference

Code for class `bool_array` (packed boolean array).

```
#include <limits.h>
#include <string.h>
#include "bool_array.h"
```

Include dependency graph for `bool_array.cpp`:



#### 5.1.1 Detailed Description

Code for class `bool_array` (packed boolean array).

**Version:**

3.1, 2005/08/25

**Author:**

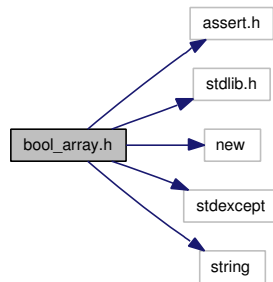
Wu Yongwei

## 5.2 bool\_array.h File Reference

Header file for class `bool_array` (packed boolean array).

```
#include <assert.h>
#include <stdlib.h>
#include <new>
#include <stdexcept>
#include <string>
```

Include dependency graph for `bool_array.h`:



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



### Classes

- class `bool_array`  
*Class to represent a packed boolean array.*
- class `bool_array::_Element`  
*Class to represent a reference to an array element.*

### Typedefs

- typedef unsigned char `BYTE`

#### 5.2.1 Detailed Description

Header file for class `bool_array` (packed boolean array).

#### Version:

3.1, 2005/08/25

**Author:**

Wu Yongwei

## 5.2.2 Typedef Documentation

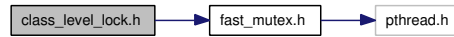
### 5.2.2.1 typedef unsigned char **BYTE**

## 5.3 class\_level\_lock.h File Reference

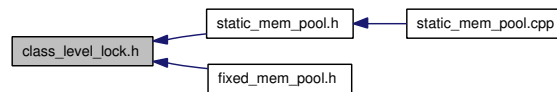
In essence Loki ClassLevelLockable re-engineered to use a [fast\\_mutex](#) class.

```
#include "fast_mutex.h"
```

Include dependency graph for class\_level\_lock.h:



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



### Classes

- class [class\\_level\\_lock< \\_Host, \\_RealLock >](#)  
*Helper class for class-level locking.*
- class [class\\_level\\_lock< \\_Host, \\_RealLock >::lock](#)  
*Type that provides locking/unlocking semantics.*

### 5.3.1 Detailed Description

In essence Loki ClassLevelLockable re-engineered to use a [fast\\_mutex](#) class.

#### Version:

1.13, 2007/12/30

#### Author:

Wu Yongwei



## 5.4 `cont_ptr_utils.h` File Reference

Utility functors for containers of pointers (adapted from Scott Meyers' *Effective STL*).

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



### Classes

- struct [derefence](#)  
*Functor to return objects pointed by a container of pointers.*
- struct [derefence\\_less](#)  
*Functor to compare objects pointed by a container of pointers.*
- struct [delete\\_object](#)  
*Functor to delete objects pointed by a container of pointers.*
- struct [output\\_object](#)< [\\_OutputStrm](#), [\\_StringType](#) >  
*Functor to output objects pointed by a container of pointers.*

### 5.4.1 Detailed Description

Utility functors for containers of pointers (adapted from Scott Meyers' *Effective STL*).

**Version:**

1.4, 2007/09/12

**Author:**

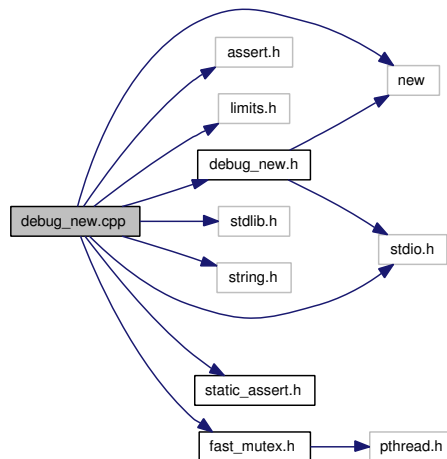
Wu Yongwei

## 5.5 debug\_new.cpp File Reference

Implementation of debug versions of new and delete to check leakage.

```
#include <new>
#include <assert.h>
#include <limits.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include "fast_mutex.h"
#include "static_assert.h"
#include "debug_new.h"
```

Include dependency graph for debug\_new.cpp:



### Classes

- struct `new_ptr_list_t`  
*Structure to store the position information where `new` occurs.*

### Defines

- `#define _DEBUG_NEW_ALIGNMENT 16`  
*The alignment requirement of allocated memory blocks.*
- `#define _DEBUG_NEW_CALLER_ADDRESS __builtin_return_address(0)`  
*The expression to return the caller address.*
- `#define _DEBUG_NEW_ERROR_ACTION abort()`

*The action to take when an error occurs.*

- `#define _DEBUG_NEW_FILENAME_LEN 44`  
*The length of file name stored if greater than zero.*
- `#define _DEBUG_NEW_PROGNAME NULL`  
*The program (executable) name to be set at compile time.*
- `#define _DEBUG_NEW_STD_OPER_NEW 1`  
*Macro to indicate whether the standard-conformant behaviour of operator new is wanted.*
- `#define _DEBUG_NEW_TAILCHECK 0`  
*Macro to indicate whether a writing-past-end check will be performed.*
- `#define _DEBUG_NEW_TAILCHECK_CHAR 0xCC`  
*Value of the padding bytes at the end of a memory block.*
- `#define _DEBUG_NEW_USE_ADDR2LINE 1`  
*Whether to use addr2line to convert a caller address to file/line information.*
- `#define _DEBUG_NEW_REDEFINE_NEW 0`  
*Macro to indicate whether redefinition of new is wanted.*
- `#define align(s) (((s) + _DEBUG_NEW_ALIGNMENT - 1) & ~(_DEBUG_NEW_ALIGNMENT - 1))`  
*Gets the aligned value of memory block size.*

## Functions

- static bool `print_position_from_addr` (const void \*addr)  
*Tries printing the position information from an instruction address.*
- static void `print_position` (const void \*ptr, int line)  
*Prints the position information of a memory operation point.*
- static bool `check_tail` (new\_ptr\_list\_t \*ptr)  
*Checks whether the padding bytes at the end of a memory block is tampered with.*
- static void \* `alloc_mem` (size\_t size, const char \*file, int line, bool is\_array)  
*Allocates memory and initializes control data.*
- static void `free_pointer` (void \*pointer, void \*addr, bool is\_array)  
*Frees memory and adjusts pointers.*
- int `check_leaks` ()  
*Checks for memory leaks.*
- int `check_mem_corruption` ()  
*Checks for heap corruption.*

- void \* `operator new` (size\_t size, const char \*file, int line)
- void \* `operator new[]` (size\_t size, const char \*file, int line)
- void \* `operator new` (size\_t size) throw (std::bad\_alloc)
- void \* `operator new[]` (size\_t size) throw (std::bad\_alloc)
- void \* `operator new` (size\_t size, const std::nothrow\_t &) throw ()
- void \* `operator new[]` (size\_t size, const std::nothrow\_t &) throw ()
- void `operator delete` (void \*pointer) throw ()
- void `operator delete[]` (void \*pointer) throw ()
- void `operator delete` (void \*pointer, const char \*file, int line) throw ()
- void `operator delete[]` (void \*pointer, const char \*file, int line) throw ()
- void `operator delete` (void \*pointer, const std::nothrow\_t &) throw ()
- void `operator delete[]` (void \*pointer, const std::nothrow\_t &) throw ()

## Variables

- const unsigned `MAGIC` = 0x4442474E  
*Magic number for error detection.*
- const int `ALIGNED_LIST_ITEM_SIZE` = align(sizeof(`new_ptr_list_t`))  
*The extra memory allocated by `operator new`.*
- static `new_ptr_list_t new_ptr_list`  
*List of all new'd pointers.*
- static `fast_mutex new_ptr_lock`  
*The mutex guard to protect simultaneous access to the pointer list.*
- static `fast_mutex new_output_lock`  
*The mutex guard to protect simultaneous output to `new_output_fp`.*
- static size\_t `total_mem_alloc` = 0  
*Total memory allocated in bytes.*
- bool `new_autocheck_flag` = true  
*Flag to control whether `check_leaks` will be automatically called on program exit.*
- bool `new_verbose_flag` = false  
*Flag to control whether verbose messages are output.*
- FILE \* `new_output_fp` = stderr  
*Pointer to the output stream.*
- const char \* `new_progname` = `__DEBUG_NEW_PROGNAME`  
*Pointer to the program name.*

## 5.5.1 Detailed Description

Implementation of debug versions of new and delete to check leakage.

**Version:**

4.12, 2007/12/31

**Author:**

Wu Yongwei

## 5.5.2 Define Documentation

### 5.5.2.1 `#define _DEBUG_NEW_ALIGNMENT 16`

The alignment requirement of allocated memory blocks.

It must be a power of two.

### 5.5.2.2 `#define _DEBUG_NEW_CALLER_ADDRESS __builtin_return_address(0)`

The expression to return the caller address.

`print_position` will later on use this address to print the position information of memory operation points.

### 5.5.2.3 `#define _DEBUG_NEW_ERROR_ACTION abort()`

The action to take when an error occurs.

The default behaviour is to call `abort`, unless `_DEBUG_NEW_ERROR_CRASH` is defined, in which case a segmentation fault will be triggered instead (which can be useful on platforms like Windows that do not generate a core dump when `abort` is called).

### 5.5.2.4 `#define _DEBUG_NEW_FILENAME_LEN 44`

The length of file name stored if greater than zero.

If it is zero, only a const char pointer will be stored. Currently the default behaviour is to copy the file name, because I found that the exit leakage check cannot access the address of the file name sometimes (in my case, a core dump will occur when trying to access the file name in a shared library after a SIGINT). The current default value makes the size of `new_ptr_list_t` 64 on 32-bit platforms.

### 5.5.2.5 `#define _DEBUG_NEW_PROGNAME NULL`

The program (executable) name to be set at compile time.

It is better to assign the full program path to `new_progname` in `main` (at run time) than to use this (compile-time) macro, but this macro serves well as a quick hack. Note also that double quotation marks need to be used around the program name, i.e., one should specify a command-line option like `-D_DEBUG_NEW_PROGNAME=\"a.out\"` in `bash`, or `-D_DEBUG_NEW_PROGNAME=\"a.exe\"` in the Windows command prompt.

**5.5.2.6 #define \_DEBUG\_NEW\_REDEFINE\_NEW 0**

Macro to indicate whether redefinition of `new` is wanted.

Here it is defined to 0 to disable the redefinition of `new`.

**5.5.2.7 #define \_DEBUG\_NEW\_STD\_OPER\_NEW 1**

Macro to indicate whether the standard-conformant behaviour of operator `new` is wanted.

It is on by default now, but the user may set it to 0 to revert to the old behaviour.

**5.5.2.8 #define \_DEBUG\_NEW\_TAILCHECK 0**

Macro to indicate whether a writing-past-end check will be performed.

Define it to a positive integer as the number of padding bytes at the end of a memory block for checking.

**5.5.2.9 #define \_DEBUG\_NEW\_TAILCHECK\_CHAR 0xCC**

Value of the padding bytes at the end of a memory block.

**5.5.2.10 #define \_DEBUG\_NEW\_USE\_ADDR2LINE 1**

Whether to use `addr2line` to convert a caller address to file/line information.

Defining it to a non-zero value will enable the conversion (automatically done if GCC is detected). Defining it to zero will disable the conversion.

**5.5.2.11 #define align(s) (((s) + \_DEBUG\_NEW\_ALIGNMENT - 1) & ~(\_DEBUG\_NEW\_ALIGNMENT - 1))**

Gets the aligned value of memory block size.

**5.5.3 Function Documentation****5.5.3.1 static void\* alloc\_mem (size\_t size, const char \* file, int line, bool is\_array) [static]**

Allocates memory and initializes control data.

**Parameters:**

*size* size of the required memory block

*file* null-terminated string of the file name

*line* line number

*is\_array* boolean value whether this is an array operation

**Returns:**

pointer to the user-requested memory area; NULL if memory allocation is not successful

### 5.5.3.2 int check\_leaks ()

Checks for memory leaks.

**Returns:**

zero if no leakage is found; the number of leaks otherwise

### 5.5.3.3 int check\_mem\_corruption ()

Checks for heap corruption.

**Returns:**

zero if no problem is found; the number of found memory corruptions otherwise

### 5.5.3.4 static bool check\_tail (new\_ptr\_list\_t \* ptr) [static]

Checks whether the padding bytes at the end of a memory block is tampered with.

**Parameters:**

*ptr* pointer to a `new_ptr_list_t` struct

**Returns:**

true if the padding bytes are untouched; false otherwise

### 5.5.3.5 static void free\_pointer (void \* pointer, void \* addr, bool is\_array) [static]

Frees memory and adjusts pointers.

**Parameters:**

*pointer* pointer to delete

*addr* pointer to the caller

*is\_array* flag indicating whether it is invoked by a `delete[]` call

- 5.5.3.6 void operator delete (void \* *pointer*, const std::nothrow\_t &) throw ()
- 5.5.3.7 void operator delete (void \* *pointer*, const char \* *file*, int *line*) throw ()
- 5.5.3.8 void operator delete (void \* *pointer*) throw ()
- 5.5.3.9 void operator delete[] (void \* *pointer*, const std::nothrow\_t &) throw ()
- 5.5.3.10 void operator delete[] (void \* *pointer*, const char \* *file*, int *line*) throw ()
- 5.5.3.11 void operator delete[] (void \* *pointer*) throw ()
- 5.5.3.12 void\* operator new (size\_t *size*, const std::nothrow\_t &) throw ()
- 5.5.3.13 void\* operator new (size\_t *size*) throw (std::bad\_alloc)
- 5.5.3.14 void\* operator new (size\_t *size*, const char \* *file*, int *line*)
- 5.5.3.15 void\* operator new[] (size\_t *size*, const std::nothrow\_t &) throw ()
- 5.5.3.16 void\* operator new[] (size\_t *size*) throw (std::bad\_alloc)
- 5.5.3.17 void\* operator new[] (size\_t *size*, const char \* *file*, int *line*)
- 5.5.3.18 static void print\_position (const void \* *ptr*, int *line*) [static]

Prints the position information of a memory operation point.

When `_DEBUG_NEW_USE_ADDR2LINE` is defined to a non-zero value, this function will try to convert a given caller address to file/line information with *addr2line*.

**Parameters:**

*ptr* source file name if *line* is non-zero; caller address otherwise

*line* source line number if non-zero; indication that *ptr* is the caller address otherwise

- 5.5.3.19 static bool print\_position\_from\_addr (const void \* *addr*) [static]

Tries printing the position information from an instruction address.

This is the version that uses *addr2line*.

**Parameters:**

*addr* the instruction address to convert and print

**Returns:**

`true` if the address is converted successfully (and the result is printed); `false` if no useful information is got (and nothing is printed)



## 5.5.4 Variable Documentation

**5.5.4.1** `const int ALIGNED\_LIST\_ITEM\_SIZE = align(sizeof(new\_ptr\_list\_t))`

The extra memory allocated by operator `new`.

**5.5.4.2** `const unsigned MAGIC = 0x4442474E`

Magic number for error detection.

**5.5.4.3** `bool new\_autocheck\_flag = true`

Flag to control whether `check_leaks` will be automatically called on program exit.

**5.5.4.4** `FILE* new\_output\_fp = stderr`

Pointer to the output stream.

The default output is `stderr`, and one may change it to a user stream if needed (say, `new_verbose_flag` is `true` and there are a lot of (de)allocations).

**5.5.4.5** `fast_mutex new\_output\_lock [static]`

The mutex guard to protect simultaneous output to `new_output_fp`.

**5.5.4.6** `const char* new\_progname = _DEBUG_NEW_PROGNAME`

Pointer to the program name.

Its initial value is the macro `_DEBUG_NEW_PROGNAME`. You should try to assign the program path to it early in your application. Assigning `argv[0]` to it in `main` is one way. If you use `bash` or `ksh` (or similar), the following statement is probably what you want: `'new_progname = getenv("_");'`.

**5.5.4.7** `new\_ptr\_list\_t new\_ptr\_list [static]`

**Initial value:**

```
{
    &new_ptr_list,
    &new_ptr_list,
    0,
    {

        ""

    },
    0,
    0,
    MAGIC
}
```

List of all new'd pointers.

**5.5.4.8** `fast_mutex new_ptr_lock` [static]

The mutex guard to protect simultaneous access to the pointer list.

**5.5.4.9** `bool new_verbose_flag` = false

Flag to control whether verbose messages are output.

**5.5.4.10** `size_t total_mem_alloc` = 0 [static]

Total memory allocated in bytes.

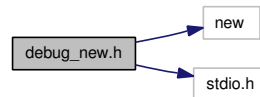
## 5.6 debug\_new.h File Reference

Header file for checking leaks caused by unmatched new/delete.

```
#include <new>
```

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

Include dependency graph for debug\_new.h:



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



### Classes

- class [\\_\\_debug\\_new\\_recorder](#)  
*Recorder class to remember the call context.*
- class [\\_\\_debug\\_new\\_counter](#)  
*Counter class for on-exit leakage check.*

### Defines

- #define [HAVE\\_PLACEMENT\\_DELETE](#) 1  
*Macro to indicate whether placement delete operators are supported on a certain compiler.*
- #define [\\_DEBUG\\_NEW\\_REDEFINE\\_NEW](#) 1  
*Macro to indicate whether redefinition of new is wanted.*
- #define [DEBUG\\_NEW](#) [\\_\\_debug\\_new\\_recorder](#)([\\_\\_FILE\\_\\_](#), [\\_\\_LINE\\_\\_](#)) → \* new  
*Macro to catch file/line information on allocation.*
- #define [new](#) [DEBUG\\_NEW](#)

### Functions

- int [check\\_leaks](#) ()  
*Checks for memory leaks.*
- int [check\\_mem\\_corruption](#) ()  
*Checks for heap corruption.*

- void \* `operator new` (size\_t size, const char \*file, int line)
- void \* `operator new[]` (size\_t size, const char \*file, int line)
- void `operator delete` (void \*pointer, const char \*file, int line) throw ()
- void `operator delete[]` (void \*pointer, const char \*file, int line) throw ()

## Variables

- bool `new_autocheck_flag`  
*Flag to control whether `check_leaks` will be automatically called on program exit.*
- bool `new_verbose_flag`  
*Flag to control whether verbose messages are output.*
- FILE \* `new_output_fp`  
*Pointer to the output stream.*
- const char \* `new_progname`  
*Pointer to the program name.*
- static `__debug_new_counter __debug_new_count`  
*Counting object for each file including `debug_new.h`.*

### 5.6.1 Detailed Description

Header file for checking leaks caused by unmatched new/delete.

#### Version:

4.4, 2007/12/31

#### Author:

Wu Yongwei

### 5.6.2 Define Documentation

#### 5.6.2.1 `#define _DEBUG_NEW_REDEFINE_NEW 1`

Macro to indicate whether redefinition of `new` is wanted.

If one wants to define one's own `operator new`, to call `operator new` directly, or to call placement `new`, it should be defined to 0 to alter the default behaviour. Unless, of course, one is willing to take the trouble to write something like:

```
# ifdef new
#   define _NEW_REDEFINED
#   undef new
# endif

// Code that uses new is here

# ifdef _NEW_REDEFINED
```

```
# ifdef DEBUG_NEW
#   define new DEBUG_NEW
# endif
# undef _NEW_REDEFINED
# endif
```

### 5.6.2.2 `#define DEBUG_NEW __debug_new_recorder(__FILE__, __LINE__) → * new`

Macro to catch file/line information on allocation.

If `_DEBUG_NEW_REDEFINE_NEW` is 0, one can use this macro directly; otherwise `new` will be defined to it, and one must use `new` instead.

### 5.6.2.3 `#define HAVE_PLACEMENT_DELETE 1`

Macro to indicate whether placement delete operators are supported on a certain compiler.

Some compilers, like Borland C++ Compiler 5.5.1 and Digital Mars Compiler 8.42, do not support them, and the user must define this macro to 0 to make the program compile. Also note that in that case memory leakage will occur if an exception is thrown in the initialization (constructor) of a dynamically created object.

### 5.6.2.4 `#define new DEBUG_NEW`

## 5.6.3 Function Documentation

### 5.6.3.1 `int check_leaks ()`

Checks for memory leaks.

#### Returns:

zero if no leakage is found; the number of leaks otherwise

### 5.6.3.2 `int check_mem_corruption ()`

Checks for heap corruption.

#### Returns:

zero if no problem is found; the number of found memory corruptions otherwise

5.6.3.3 void operator delete (void \* *pointer*, const char \* *file*, int *line*) throw ()

5.6.3.4 void operator delete[] (void \* *pointer*, const char \* *file*, int *line*) throw ()

5.6.3.5 void\* operator new (size\_t *size*, const char \* *file*, int *line*)

5.6.3.6 void\* operator new[] (size\_t *size*, const char \* *file*, int *line*)

## 5.6.4 Variable Documentation

5.6.4.1 `__debug_new_counter __debug_new_count` [static]

Counting object for each file including `debug_new.h`.

5.6.4.2 bool `new_autocheck_flag`

Flag to control whether `check_leaks` will be automatically called on program exit.

5.6.4.3 FILE\* `new_output_fp`

Pointer to the output stream.

The default output is `stderr`, and one may change it to a user stream if needed (say, `new_verbose_flag` is true and there are a lot of (de)allocations).

5.6.4.4 const char\* `new_progname`

Pointer to the program name.

Its initial value is the macro `_DEBUG_NEW_PROGNAME`. You should try to assign the program path to it early in your application. Assigning `argv[0]` to it in `main` is one way. If you use `bash` or `ksh` (or similar), the following statement is probably what you want: `'new_progname = getenv("_");'`.

5.6.4.5 bool `new_verbose_flag`

Flag to control whether verbose messages are output.

## 5.7 fast\_mutex.h File Reference

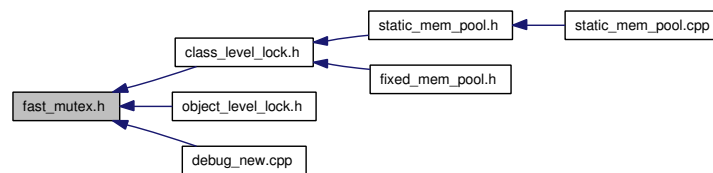
A fast mutex implementation for POSIX and Win32.

```
#include <pthread.h>
```

Include dependency graph for fast\_mutex.h:



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



### Classes

- class [fast\\_mutex](#)  
*Class for non-reentrant fast mutexes.*
- class [fast\\_mutex\\_autolock](#)  
*An acquisition-on-initialization lock class based on [fast\\_mutex](#).*

### Defines

- `#define _FAST_MUTEX_CHECK_INITIALIZATION 1`  
*Macro to control whether to check for initialization status for each lock/unlock operation.*
- `#define _FAST_MUTEX_ASSERT(_Expr, _Msg) ((void)0)`  
*Macro for [fast\\_mutex](#) assertions.*
- `#define __VOLATILE volatile`  
*Macro alias to 'volatile' semantics.*

#### 5.7.1 Detailed Description

A fast mutex implementation for POSIX and Win32.

##### Version:

1.18, 2005/05/06

##### Author:

Wu Yongwei

## 5.7.2 Define Documentation

### 5.7.2.1 `#define __VOLATILE volatile`

Macro alias to 'volatile' semantics.

Here it is truly volatile since it is in a multi-threaded (POSIX threads) environment.

### 5.7.2.2 `#define _FAST_MUTEX_ASSERT(_Expr, _Msg) ((void)0)`

Macro for `fast_mutex` assertions.

Fake version (for release mode).

### 5.7.2.3 `#define _FAST_MUTEX_CHECK_INITIALIZATION 1`

Macro to control whether to check for initialization status for each lock/unlock operation.

Defining it to a non-zero value will enable the check, so that the construction/destruction of a static object using a static `fast_mutex` not yet constructed or already destroyed will work (with lock/unlock operations ignored). Defining it to zero will disable to check.

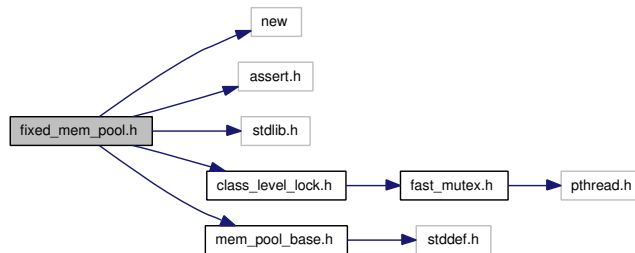


## 5.8 fixed\_mem\_pool.h File Reference

Definition of a fixed-size memory pool template for structs/classes.

```
#include <new>
#include <assert.h>
#include <stdlib.h>
#include "class_level_lock.h"
#include "mem_pool_base.h"
```

Include dependency graph for fixed\_mem\_pool.h:



### Classes

- class [fixed\\_mem\\_pool< \\_Tp >](#)  
*Class template to manipulate a fixed-size memory pool.*

### Defines

- `#define` [MEM\\_POOL\\_ALIGNMENT](#) 4  
*Defines the alignment of memory blocks.*
- `#define` [DECLARE\\_FIXED\\_MEM\\_POOL\(\\_Cls\)](#)  
*Declares the normal (exceptionable) overload of **operator new** and **operator delete**.*
- `#define` [DECLARE\\_FIXED\\_MEM\\_POOL\\_\\_NOTHROW\(\\_Cls\)](#)  
*Declares the non-exceptionable overload of **operator new** and **operator delete**.*
- `#define` [DECLARE\\_FIXED\\_MEM\\_POOL\\_\\_THROW\\_NOCHECK\(\\_Cls\)](#)  
*Declares the exceptionable, non-checking overload of **operator new** and **operator delete**.*

### 5.8.1 Detailed Description

Definition of a fixed-size memory pool template for structs/classes.

This is a easy-to-use class template for pre-allocated memory pools. The client side needs to do the following things:

- Use one of the macros [DECLARE\\_FIXED\\_MEM\\_POOL](#), [DECLARE\\_FIXED\\_MEM\\_POOL\\_\\_NOTHROW](#), and [DECLARE\\_FIXED\\_MEM\\_POOL\\_\\_THROW\\_NOCHECK](#) at the end of the class (say, `class _Cls`) definitions
- Call `fixed_mem_pool<_Cls>::initialize` at the beginning of the program
- Optionally, specialize `fixed_mem_pool<_Cls>::bad_alloc_handler` to change the behaviour when all memory blocks are allocated
- Optionally, call `fixed_mem_pool<_Cls>::deinitialize` at exit of the program to check for memory leaks
- Optionally, call `fixed_mem_pool<_Cls>::get_alloc_count` to check memory usage when the program is running

**Version:**

1.14, 2005/09/19

**Author:**

Wu Yongwei

## 5.8.2 Define Documentation

### 5.8.2.1 #define DECLARE\_FIXED\_MEM\_POOL(\_Cls)

**Value:**

```
public: \
    static void* operator new(size_t __size) \
    { \
        assert(__size == sizeof(_Cls)); \
        if (void* __ptr = fixed_mem_pool<_Cls>::allocate()) \
            return __ptr; \
        else \
            throw std::bad_alloc(); \
    } \
    static void operator delete(void* __ptr) \
    { \
        if (__ptr != NULL) \
            fixed_mem_pool<_Cls>::deallocate(__ptr); \
    }
```

Declares the normal (exceptionable) overload of **operator new** and **operator delete**.

**Parameters:**

`_Cls` class to use the [fixed\\_mem\\_pool](#)

**See also:**

[DECLARE\\_FIXED\\_MEM\\_POOL\\_\\_THROW\\_NOCHECK](#), which, too, defines an **operator new** that will never return NULL, but requires more discipline on the programmer's side.

### 5.8.2.2 #define DECLARE\_FIXED\_MEM\_POOL\_\_NOTHROW(\_Cls)

**Value:**

```
public: \
    static void* operator new(size_t __size) throw() \
    { \
        assert(__size == sizeof(_Cls)); \
        return fixed_mem_pool<_Cls>::allocate(); \
    } \
    static void operator delete(void* __ptr) \
    { \
        if (__ptr != NULL) \
            fixed_mem_pool<_Cls>::deallocate(__ptr); \
    }
```

Declares the non-exceptionable overload of **operator new** and **operator delete**.

**Parameters:**

`_Cls` class to use the [fixed\\_mem\\_pool](#)

### 5.8.2.3 #define DECLARE\_FIXED\_MEM\_POOL\_\_THROW\_\_NOCHECK(\_Cls)

**Value:**

```
public: \
    static void* operator new(size_t __size) \
    { \
        assert(__size == sizeof(_Cls)); \
        return fixed_mem_pool<_Cls>::allocate(); \
    } \
    static void operator delete(void* __ptr) \
    { \
        if (__ptr != NULL) \
            fixed_mem_pool<_Cls>::deallocate(__ptr); \
    }
```

Declares the exceptionable, non-checking overload of **operator new** and **operator delete**.

N.B. Using this macro *requires* users to explicitly specialize [fixed\\_mem\\_pool::bad\\_alloc\\_handler](#) so that it shall never return **false** (it may throw exceptions, say, `std::bad_alloc`, or simply abort). Otherwise a segmentation fault might occur (instead of returning a NULL pointer).

**Parameters:**

`_Cls` class to use the [fixed\\_mem\\_pool](#)

### 5.8.2.4 #define MEM\_POOL\_ALIGNMENT 4

Defines the alignment of memory blocks.

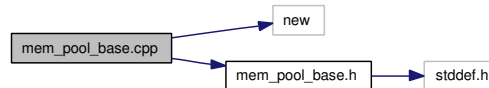
## 5.9 mem\_pool\_base.cpp File Reference

Implementation for the memory pool base.

```
#include <new>
```

```
#include "mem_pool_base.h"
```

Include dependency graph for mem\_pool\_base.cpp:



### Defines

- `#define _MEM_POOL_ALLOCATE(_Sz) ::operator new((_Sz), std::nothrow)`
- `#define _MEM_POOL_DEALLOCATE(_Ptr) ::operator delete(_Ptr)`

### 5.9.1 Detailed Description

Implementation for the memory pool base.

#### Version:

1.2, 2004/07/26

#### Author:

Wu Yongwei

### 5.9.2 Define Documentation

**5.9.2.1** `#define _MEM_POOL_ALLOCATE(_Sz) ::operator new((_Sz), std::nothrow)`

**5.9.2.2** `#define _MEM_POOL_DEALLOCATE(_Ptr) ::operator delete(_Ptr)`

## 5.10 mem\_pool\_base.h File Reference

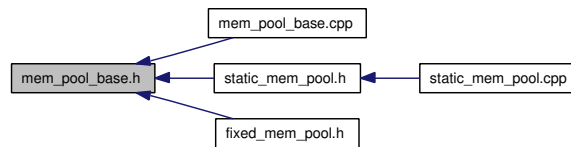
Header file for the memory pool base.

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

Include dependency graph for mem\_pool\_base.h:



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



### Classes

- class [mem\\_pool\\_base](#)  
*Base class for memory pools.*
- struct [mem\\_pool\\_base::\\_Block\\_list](#)  
*Structure to store the next available memory block.*

### 5.10.1 Detailed Description

Header file for the memory pool base.

#### Version:

1.1, 2004/07/26

#### Author:

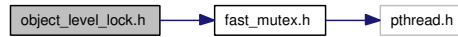
Wu Yongwei

## 5.11 object\_level\_lock.h File Reference

In essence Loki ObjectLevelLockable re-engineered to use a [fast\\_mutex](#) class.

```
#include "fast_mutex.h"
```

Include dependency graph for object\_level\_lock.h:



### Classes

- class [object\\_level\\_lock< \\_Host >](#)  
*Helper class for class-level locking.*
- class [object\\_level\\_lock< \\_Host >::lock](#)  
*Type that provides locking/unlocking semantics.*

#### 5.11.1 Detailed Description

In essence Loki ObjectLevelLockable re-engineered to use a [fast\\_mutex](#) class.

Check also Andrei Alexandrescu's article "[Multithreading and the C++ Type System](#)" for the ideas behind.

#### Version:

1.4, 2004/05/09

#### Author:

Wu Yongwei

## 5.12 `pctimer.h` File Reference

Function to get a high-resolution timer for Win32/Cygwin/Unix.

```
#include <sys/time.h>
```

Include dependency graph for `pctimer.h`:



### Typedefs

- typedef double [pctimer\\_t](#)

### Functions

- `__inline` [pctimer\\_t](#) `pctimer` (void)

#### 5.12.1 Detailed Description

Function to get a high-resolution timer for Win32/Cygwin/Unix.

##### Version:

1.6, 2004/08/02

##### Author:

Wu Yongwei

#### 5.12.2 Typedef Documentation

##### 5.12.2.1 typedef double [pctimer\\_t](#)

#### 5.12.3 Function Documentation

##### 5.12.3.1 `__inline` [pctimer\\_t](#) `pctimer` (void)

## 5.13 set\_assign.h File Reference

Definition of template functions `set_assign_union` and `set_assign_difference`.

```
#include <algorithm>
```

Include dependency graph for `set_assign.h`:



### Functions

- `template<class _Container, class _InputIter> _Container & set_assign_union (_Container & __dest, _InputIter __first, _InputIter __last)`
- `template<class _Container, class _InputIter, class _Compare> _Container & set_assign_union (_Container & __dest, _InputIter __first, _InputIter __last, _Compare __comp)`
- `template<class _Container, class _InputIter> _Container & set_assign_difference (_Container & __dest, _InputIter __first, _InputIter __last)`
- `template<class _Container, class _InputIter, class _Compare> _Container & set_assign_difference (_Container & __dest, _InputIter __first, _InputIter __last, _Compare __comp)`

#### 5.13.1 Detailed Description

Definition of template functions `set_assign_union` and `set_assign_difference`.

##### Version:

1.5, 2004/07/26

##### Author:

Wu Yongwei

#### 5.13.2 Function Documentation

- 5.13.2.1 `template<class _Container, class _InputIter, class _Compare> _Container& set_assign_difference (_Container & __dest, _InputIter __first, _InputIter __last, _Compare __comp)`
- 5.13.2.2 `template<class _Container, class _InputIter> _Container& set_assign_difference (_Container & __dest, _InputIter __first, _InputIter __last)`
- 5.13.2.3 `template<class _Container, class _InputIter, class _Compare> _Container& set_assign_union (_Container & __dest, _InputIter __first, _InputIter __last, _Compare __comp)`
- 5.13.2.4 `template<class _Container, class _InputIter> _Container& set_assign_union (_Container & __dest, _InputIter __first, _InputIter __last)`



## 5.14 static\_assert.h File Reference

Template class to check validity during compile time (adapted from Loki).

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



### Classes

- struct [\\_\\_nvwa\\_compile\\_time\\_error< true >](#)

### Defines

- `#define` [STATIC\\_ASSERT](#)(\_Expr, \_Msg)

#### 5.14.1 Detailed Description

Template class to check validity during compile time (adapted from Loki).

#### Version:

1.2, 2005/11/22

#### Author:

Wu Yongwei

#### 5.14.2 Define Documentation

##### 5.14.2.1 `#define` [STATIC\\_ASSERT](#)(\_Expr, \_Msg)

#### Value:

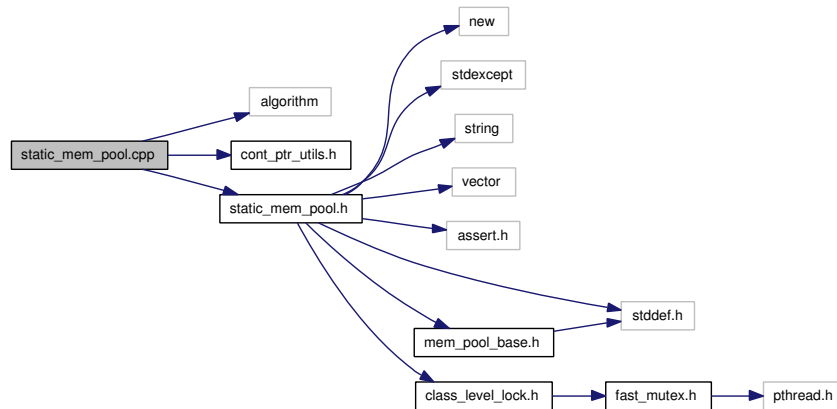
```
{ \
    __nvwa_compile_time_error<((__Expr) != 0)> ERROR_##_Msg; \
    (void)ERROR_##_Msg; \
}
```

## 5.15 static\_mem\_pool.cpp File Reference

Non-template and non-inline code for the ‘static’ memory pool.

```
#include <algorithm>
#include "cont_ptr_utils.h"
#include "static_mem_pool.h"
```

Include dependency graph for static\_mem\_pool.cpp:



### 5.15.1 Detailed Description

Non-template and non-inline code for the ‘static’ memory pool.

**Version:**

1.7, 2006/08/26

**Author:**

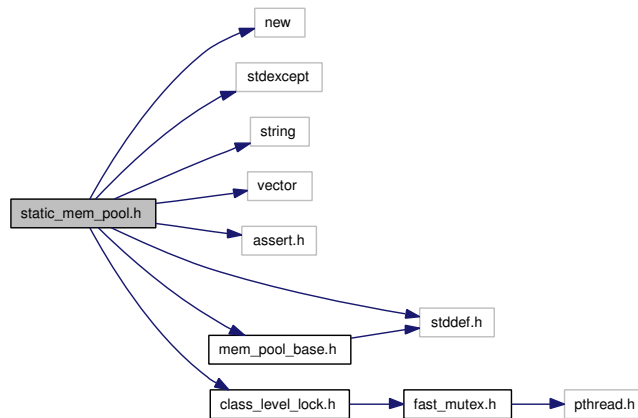
Wu Yongwei

## 5.16 static\_mem\_pool.h File Reference

Header file for the 'static' memory pool.

```
#include <new>
#include <stdexcept>
#include <string>
#include <vector>
#include <assert.h>
#include <stddef.h>
#include "class_level_lock.h"
#include "mem_pool_base.h"
```

Include dependency graph for static\_mem\_pool.h:



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



### Classes

- class [static\\_mem\\_pool\\_set](#)  
*Singleton class to maintain a set of existing instantiations of [static\\_mem\\_pool](#).*
- class [static\\_mem\\_pool< \\_Sz, \\_Gid >](#)  
*Singleton class template to manage the allocation/deallocation of memory blocks of one specific size.*

### Defines

- `#define \_\_PRIVATE private`

- `#define _STATIC_MEM_POOL_TRACE(_Lck, _Msg) ((void)0)`
- `#define DECLARE_STATIC_MEM_POOL(_Cls)`
- `#define DECLARE_STATIC_MEM_POOL__NOTHROW(_Cls)`
- `#define DECLARE_STATIC_MEM_POOL_GROUPED(_Cls, _Gid)`
- `#define DECLARE_STATIC_MEM_POOL_GROUPED__NOTHROW(_Cls, _Gid)`
- `#define PREPARE_STATIC_MEM_POOL(_Cls) std::cerr << "PREPARE_STATIC_MEM_POOL is obsolete!\n";`
- `#define PREPARE_STATIC_MEM_POOL_GROUPED(_Cls, _Gid) std::cerr << "PREPARE_STATIC_MEM_POOL_GROUPED is obsolete!\n";`

### 5.16.1 Detailed Description

Header file for the 'static' memory pool.

#### Version:

1.20, 2007/10/20

#### Author:

Wu Yongwei

### 5.16.2 Define Documentation

#### 5.16.2.1 `#define __PRIVATE private`

#### 5.16.2.2 `#define _STATIC_MEM_POOL_TRACE(_Lck, _Msg) ((void)0)`

#### 5.16.2.3 `#define DECLARE_STATIC_MEM_POOL(_Cls)`

#### Value:

```
public: \
    static void* operator new(size_t __size) \
    { \
        assert(__size == sizeof(_Cls)); \
        void* __ptr; \
        __ptr = static_mem_pool<sizeof(_Cls)>:: \
            instance_known().allocate(); \
        if (__ptr == NULL) \
            throw std::bad_alloc(); \
        return __ptr; \
    } \
    static void operator delete(void* __ptr) \
    { \
        if (__ptr) \
            static_mem_pool<sizeof(_Cls)>:: \
                instance_known().deallocate(__ptr); \
    }
```

#### 5.16.2.4 `#define DECLARE_STATIC_MEM_POOL__NOTHROW(_Cls)`

#### Value:

```

public: \
    static void* operator new(size_t __size) throw() \
    { \
        assert(__size == sizeof(_Cls)); \
        return static_mem_pool<sizeof(_Cls)>:: \
            instance_known().allocate(); \
    } \
    static void operator delete(void* __ptr) \
    { \
        if (__ptr) \
            static_mem_pool<sizeof(_Cls)>:: \
                instance_known().deallocate(__ptr); \
    }

```

#### 5.16.2.5 #define DECLARE\_STATIC\_MEM\_POOL\_GROUPED(\_Cls, \_Gid)

Value:

```

public: \
    static void* operator new(size_t __size) \
    { \
        assert(__size == sizeof(_Cls)); \
        void* __ptr; \
        __ptr = static_mem_pool<sizeof(_Cls), (_Gid)>:: \
            instance_known().allocate(); \
        if (__ptr == NULL) \
            throw std::bad_alloc(); \
        return __ptr; \
    } \
    static void operator delete(void* __ptr) \
    { \
        if (__ptr) \
            static_mem_pool<sizeof(_Cls), (_Gid)>:: \
                instance_known().deallocate(__ptr); \
    }

```

#### 5.16.2.6 #define DECLARE\_STATIC\_MEM\_POOL\_GROUPED\_\_\_NOTHROW(\_Cls, \_Gid)

Value:

```

public: \
    static void* operator new(size_t __size) throw() \
    { \
        assert(__size == sizeof(_Cls)); \
        return static_mem_pool<sizeof(_Cls), (_Gid)>:: \
            instance_known().allocate(); \
    } \
    static void operator delete(void* __ptr) \
    { \
        if (__ptr) \
            static_mem_pool<sizeof(_Cls), (_Gid)>:: \
                instance_known().deallocate(__ptr); \
    }

```

5.16.2.7 `#define PREPARE_STATIC_MEM_POOL(_Cls) std::cerr << "PREPARE_STATIC_MEM_POOL is obsolete!\n";`

5.16.2.8 `#define PREPARE_STATIC_MEM_POOL_GROUPED(_Cls, _Gid) std::cerr << "PREPARE_STATIC_MEM_POOL_GROUPED is obsolete!\n";`

# Index

- ~\_\_debug\_new\_counter
  - \_\_debug\_new\_counter, 7
- ~bool\_array
  - bool\_array, 12
- ~fast\_mutex
  - fast\_mutex, 21
- ~fast\_mutex\_autolock
  - fast\_mutex\_autolock, 22
- ~lock
  - class\_level\_lock::lock, 17
  - object\_level\_lock::lock, 33
- ~mem\_pool\_base
  - mem\_pool\_base, 26
- \_DEBUG\_NEW\_ALIGNMENT
  - debug\_new.cpp, 49
- \_DEBUG\_NEW\_CALLER\_ADDRESS
  - debug\_new.cpp, 49
- \_DEBUG\_NEW\_ERROR\_ACTION
  - debug\_new.cpp, 49
- \_DEBUG\_NEW\_FILENAME\_LEN
  - debug\_new.cpp, 49
- \_DEBUG\_NEW\_PROGNAME
  - debug\_new.cpp, 49
- \_DEBUG\_NEW\_REDEFINE\_NEW
  - debug\_new.cpp, 49
  - debug\_new.h, 56
- \_DEBUG\_NEW\_STD\_OPER\_NEW
  - debug\_new.cpp, 50
- \_DEBUG\_NEW\_TAILCHECK
  - debug\_new.cpp, 50
- \_DEBUG\_NEW\_TAILCHECK\_CHAR
  - debug\_new.cpp, 50
- \_DEBUG\_NEW\_USE\_ADDR2LINE
  - debug\_new.cpp, 50
- \_FAST\_MUTEX\_ASSERT
  - fast\_mutex.h, 60
- \_FAST\_MUTEX\_CHECK\_-  
INITIALIZATION
  - fast\_mutex.h, 60
- \_MEM\_POOL\_ALLOCATE
  - mem\_pool\_base.cpp, 64
- \_MEM\_POOL\_DEALLOCATE
  - mem\_pool\_base.cpp, 64
- \_M\_next
  - mem\_pool\_base::\_Block\_list, 28
- \_STATIC\_MEM\_POOL\_TRACE
  - static\_mem\_pool.h, 72
- \_\_PRIVATE
  - static\_mem\_pool.h, 72
- \_\_VOLATILE
  - fast\_mutex.h, 60
- \_\_debug\_new\_count
  - debug\_new.h, 58
- \_\_debug\_new\_counter, 7
  - ~\_\_debug\_new\_counter, 7
  - \_\_debug\_new\_counter, 7
- \_\_debug\_new\_recorder, 9
  - \_\_debug\_new\_recorder, 9
  - operator-> \*, 9
- \_\_nvwa\_compile\_time\_error< true >, 10
- add
  - static\_mem\_pool\_set, 39
- addr
  - new\_ptr\_list\_t, 30
- align
  - debug\_new.cpp, 50
- ALIGNED\_LIST\_ITEM\_SIZE
  - debug\_new.cpp, 53
- alloc\_mem
  - debug\_new.cpp, 50
- alloc\_sys
  - mem\_pool\_base, 26
- allocate
  - fixed\_mem\_pool, 24
  - static\_mem\_pool, 36
- at
  - bool\_array, 13
- bad\_alloc\_handler
  - fixed\_mem\_pool, 25
- bool\_array, 11
  - ~bool\_array, 12
  - at, 13
  - bool\_array, 12
  - count, 14
  - create, 12
  - flip, 14
  - initialize, 12
  - operator[], 13

- reset, 13
- set, 13
- size, 14
- bool\_array.cpp, 41
- bool\_array.h, 42
  - BYTE, 43
- BYTE
  - bool\_array.h, 43
- check\_leaks
  - debug\_new.cpp, 50
  - debug\_new.h, 57
- check\_mem\_corruption
  - debug\_new.cpp, 51
  - debug\_new.h, 57
- check\_tail
  - debug\_new.cpp, 51
- class\_level\_lock, 15
  - lock, 16
  - volatile\_type, 16
- class\_level\_lock.h, 44
- class\_level\_lock::lock, 17
  - ~lock, 17
  - lock, 17
- cont\_ptr\_utils.h, 45
- count
  - bool\_array, 14
- create
  - bool\_array, 12
- dealloc\_sys
  - mem\_pool\_base, 26
- deallocate
  - fixed\_mem\_pool, 24
  - static\_mem\_pool, 36
- DEBUG\_NEW
  - debug\_new.h, 57
- debug\_new.cpp, 46
  - \_DEBUG\_NEW\_ALIGNMENT, 49
  - \_DEBUG\_NEW\_CALLER\_ADDRESS, 49
  - \_DEBUG\_NEW\_ERROR\_ACTION, 49
  - \_DEBUG\_NEW\_FILENAME\_LEN, 49
  - \_DEBUG\_NEW\_PROGNAME, 49
  - \_DEBUG\_NEW\_REDEFINE\_NEW, 49
  - \_DEBUG\_NEW\_STD\_OPER\_NEW, 50
  - \_DEBUG\_NEW\_TAILCHECK, 50
  - \_DEBUG\_NEW\_TAILCHECK\_CHAR, 50
  - \_DEBUG\_NEW\_USE\_ADDR2LINE, 50
- align, 50
- ALIGNED\_LIST\_ITEM\_SIZE, 53
- alloc\_mem, 50
  - check\_leaks, 50
  - check\_mem\_corruption, 51
  - check\_tail, 51
  - free\_pointer, 51
  - MAGIC, 53
  - new\_autocheck\_flag, 53
  - new\_output\_fp, 53
  - new\_output\_lock, 53
  - new\_progname, 53
  - new\_ptr\_list, 53
  - new\_ptr\_lock, 54
  - new\_verbose\_flag, 54
  - operator delete, 51, 52
  - operator delete[], 52
  - operator new, 52
  - operator new[], 52
  - print\_position, 52
  - print\_position\_from\_addr, 52
  - total\_mem\_alloc, 54
- debug\_new.h, 55
  - \_DEBUG\_NEW\_REDEFINE\_NEW, 56
  - \_debug\_new\_count, 58
  - check\_leaks, 57
  - check\_mem\_corruption, 57
  - DEBUG\_NEW, 57
  - HAVE\_PLACEMENT\_DELETE, 57
  - new, 57
  - new\_autocheck\_flag, 58
  - new\_output\_fp, 58
  - new\_progname, 58
  - new\_verbose\_flag, 58
  - operator delete, 57
  - operator delete[], 58
  - operator new, 58
  - operator new[], 58
- DECLARE\_FIXED\_MEM\_POOL
  - fixed\_mem\_pool.h, 62
- DECLARE\_FIXED\_MEM\_POOL\_\_ - NOTHROW
  - fixed\_mem\_pool.h, 62
- DECLARE\_FIXED\_MEM\_POOL\_\_ - THROW\_NOCHECK
  - fixed\_mem\_pool.h, 63
- DECLARE\_STATIC\_MEM\_POOL
  - static\_mem\_pool.h, 72
- DECLARE\_STATIC\_MEM\_POOL\_\_ - NOTHROW
  - static\_mem\_pool.h, 72
- DECLARE\_STATIC\_MEM\_POOL\_\_ - GROUPED
  - static\_mem\_pool.h, 73
- DECLARE\_STATIC\_MEM\_POOL\_\_ - GROUPED\_\_ NOTHROW
  - static\_mem\_pool.h, 73



- deinitialize
  - fixed\_mem\_pool, 24
- delete\_object, 18
  - operator(), 18
- dereference, 19
  - operator(), 19
- dereference\_less, 20
  - operator(), 20
- fast\_mutex, 21
  - ~fast\_mutex, 21
  - fast\_mutex, 21
  - lock, 21
  - unlock, 21
- fast\_mutex.h, 59
  - \_FAST\_MUTEX\_ASSERT, 60
  - \_FAST\_MUTEX\_CHECK\_ -  
INITIALIZATION, 60
  - \_\_VOLATILE, 60
- fast\_mutex\_autolock, 22
  - ~fast\_mutex\_autolock, 22
  - fast\_mutex\_autolock, 22
- file
  - new\_ptr\_list\_t, 30
- fixed\_mem\_pool, 23
  - allocate, 24
  - bad\_alloc\_handler, 25
  - deallocate, 24
  - deinitialize, 24
  - get\_alloc\_count, 25
  - initialize, 24
  - is\_initialized, 25
  - lock, 24
- fixed\_mem\_pool.h, 61
  - DECLARE\_FIXED\_MEM\_POOL, 62
  - DECLARE\_FIXED\_MEM\_POOL\_\_ -  
NOTHROW, 62
  - DECLARE\_FIXED\_MEM\_POOL\_\_ -  
THROW\_NOCHECK, 63
  - MEM\_POOL\_ALIGNMENT, 63
- flip
  - bool\_array, 14
- free\_pointer
  - debug\_new.cpp, 51
- get\_alloc\_count
  - fixed\_mem\_pool, 25
- get\_locked\_object
  - object\_level\_lock::lock, 33
- HAVE\_PLACEMENT\_DELETE
  - debug\_new.h, 57
- initialize
  - bool\_array, 12
  - fixed\_mem\_pool, 24
- instance
  - static\_mem\_pool, 36
  - static\_mem\_pool\_set, 38
- instance\_known
  - static\_mem\_pool, 36
- is\_array
  - new\_ptr\_list\_t, 30
- is\_initialized
  - fixed\_mem\_pool, 25
- line
  - new\_ptr\_list\_t, 30
- lock
  - class\_level\_lock, 16
  - class\_level\_lock::lock, 17
  - fast\_mutex, 21
  - fixed\_mem\_pool, 24
  - object\_level\_lock, 31
  - object\_level\_lock::lock, 33
  - static\_mem\_pool\_set, 38
- MAGIC
  - debug\_new.cpp, 53
- magic
  - new\_ptr\_list\_t, 30
- MEM\_POOL\_ALIGNMENT
  - fixed\_mem\_pool.h, 63
- mem\_pool\_base, 26
  - ~mem\_pool\_base, 26
  - alloc\_sys, 26
  - dealloc\_sys, 26
  - recycle, 26
- mem\_pool\_base.cpp, 64
  - \_MEM\_POOL\_ALLOCATE, 64
  - \_MEM\_POOL\_DEALLOCATE, 64
- mem\_pool\_base.h, 65
- mem\_pool\_base::\_Block\_list, 28
  - \_M\_next, 28
- new
  - debug\_new.h, 57
- new\_autocheck\_flag
  - debug\_new.cpp, 53
  - debug\_new.h, 58
- new\_output\_fp
  - debug\_new.cpp, 53
  - debug\_new.h, 58
- new\_output\_lock
  - debug\_new.cpp, 53
- new\_progname
  - debug\_new.cpp, 53
  - debug\_new.h, 58

- new\_ptr\_list
  - debug\_new.cpp, 53
- new\_ptr\_list\_t, 29
  - addr, 30
  - file, 30
  - is\_array, 30
  - line, 30
  - magic, 30
  - next, 30
  - prev, 30
  - size, 30
- new\_ptr\_lock
  - debug\_new.cpp, 54
- new\_verbose\_flag
  - debug\_new.cpp, 54
  - debug\_new.h, 58
- next
  - new\_ptr\_list\_t, 30
- object\_level\_lock, 31
  - lock, 31
  - volatile\_type, 31
- object\_level\_lock.h, 66
- object\_level\_lock::lock, 33
  - ~lock, 33
  - get\_locked\_object, 33
  - lock, 33
- operator delete
  - debug\_new.cpp, 51, 52
  - debug\_new.h, 57
- operator delete[]
  - debug\_new.cpp, 52
  - debug\_new.h, 58
- operator new
  - debug\_new.cpp, 52
  - debug\_new.h, 58
- operator new[]
  - debug\_new.cpp, 52
  - debug\_new.h, 58
- operator()
  - delete\_object, 18
  - dereference, 19
  - dereference\_less, 20
  - output\_object, 34
- operator-> \*
  - \_\_debug\_new\_recorder, 9
- operator[]
  - bool\_array, 13
- output\_object, 34
  - operator(), 34
  - output\_object, 34
- pctimer
  - pctimer.h, 67
- pctimer.h, 67
  - pctimer, 67
  - pctimer\_t, 67
- pctimer\_t
  - pctimer.h, 67
- PREPARE\_STATIC\_MEM\_POOL
  - static\_mem\_pool.h, 73
- PREPARE\_STATIC\_MEM\_POOL\_-
  - GROUPED
    - static\_mem\_pool.h, 74
- prev
  - new\_ptr\_list\_t, 30
- print\_position
  - debug\_new.cpp, 52
- print\_position\_from\_addr
  - debug\_new.cpp, 52
- recycle
  - mem\_pool\_base, 26
  - static\_mem\_pool, 37
  - static\_mem\_pool\_set, 39
- reset
  - bool\_array, 13
- set
  - bool\_array, 13
- set\_assign.h, 68
  - set\_assign\_difference, 68
  - set\_assign\_union, 68
- set\_assign\_difference
  - set\_assign.h, 68
- set\_assign\_union
  - set\_assign.h, 68
- size
  - bool\_array, 14
  - new\_ptr\_list\_t, 30
- STATIC\_ASSERT
  - static\_assert.h, 69
- static\_assert.h, 69
  - STATIC\_ASSERT, 69
- static\_mem\_pool, 35
  - allocate, 36
  - deallocate, 36
  - instance, 36
  - instance\_known, 36
  - recycle, 37
- static\_mem\_pool.cpp, 70
- static\_mem\_pool.h, 71
  - STATIC\_MEM\_POOL\_TRACE, 72
  - PRIVATE, 72
  - DECLARE\_STATIC\_MEM\_POOL, 72
  - DECLARE\_STATIC\_MEM\_POOL\_-
    - NOTHROW, 72

---

- DECLARE\_STATIC\_MEM\_POOL\_-  
GROUPED, [73](#)
- DECLARE\_STATIC\_MEM\_POOL\_-  
GROUPED\_\_NÖTHROW, [73](#)
- PREPARE\_STATIC\_MEM\_POOL, [73](#)
- PREPARE\_STATIC\_MEM\_POOL\_-  
GROUPED, [74](#)
- static\_mem\_pool\_set, [38](#)
  - add, [39](#)
  - instance, [38](#)
  - lock, [38](#)
  - recycle, [39](#)
- total\_mem\_alloc
  - debug\_new.cpp, [54](#)
- unlock
  - fast\_mutex, [21](#)
- volatile\_type
  - class\_level\_lock, [16](#)
  - object\_level\_lock, [31](#)