O_STM

v0.1

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Contents

Chapter 1

OSTM C++ Software Transactional Memory

1.1 Object Based Software Transactional Memory.

OSTM is a polymorphic solution to store and manage shared memory spaces within c++ programming context. You can store and managed any kind of object in transactional environment as a shared and protected memory space.

1.1.1 Brief. Download the zip file from the provided link in the web-site, that contains the libostm.so, TM.h, TX.h, OSTM.h files.

Unzip the archive file to the desired destination possibly where in you program is stored.

1.1.2 Step 1: Download the archive file.

1.1.3 Step 2: Unzip in the target destination.

1.1.4 Step 3: Copy the shared library (libostm.so) to the operating system folder where the other shared library are stored.

It will be different destination folder on different platforms. (Linux, Windows, Mac OS) `More Information`

1.1.5 Step 4: Achieve the required class hierarchy between the OSTM library and your own class structure.

Details and instruction of class hierarchy requirements can be found on the web-site. www.serversite.info/ostm

1.1.6 Step 5: Create an executable file as you linking together the TM.h, TX.h, OSTM.h files with your own files.

1.1.7 Step 6: Now your application use transactional environment, that guarantees the consistency between object transactions.

1.1.8 Step 7: Run the application.

Abbreviation for bank names used in the test cases:
BOA - Bank of America
ULSTER - Ulster Bank
UNBL - United National Bank Limited
SWBPLC - Scottish Windows Bank PLC
AIB - Allied Irish Bank
BOI - Bank of Ireland

Chapter 2

Class Index

2.1 Class List

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

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

Chapter 4

Class Documentation

4.1 OSTM Class Reference

```
#include <OSTM.h>
```

Public Member Functions

- OSTM ()

  OSTM Constructor.
- OSTM (int _version_number_, int _unique_id_)

  OSTM Custom Constructor.
- virtual ∼OSTM ()

  De-constructor.
- virtual void copy (std::shared_ptr< OSTM > from, std::shared_ptr< OSTM > to)

  OSTM required virtual method for deep copy.
- virtual std::shared_ptr< OSTM > getBaseCopy (std::shared_ptr< OSTM > object)

  OSTM required virtual method for returning a pointer that is copy of the original pointer.
- virtual void toString ()

  OSTM required virtual method for display object.
- void Set_Unique_ID (int uniqueID)

  setter for unique id
- int Get_Unique_ID () const

  getter for unique id
- void Set_Version (int version)

  setter for version number
- int Get_Version () const

  getter for version number
- void increase_VersionNumber ()

  commit time increase version number to child object
- bool Is_Can_Commit () const

  NOT USED YET.
- void Set_Can_Commit (bool canCommit)

  NOT USED YET.
- void Set_Abort_Transaction (bool abortTransaction)

  NOT USED YET.

- bool Is_Abort_Transaction () const

  NOT USED YET.
- void lock_Mutex ()

  object unique lock, locks mutex
- void unlock_Mutex ()

  object unique lock, unlocks mutex
- bool is_Locked ()

  object unique lock, try locks mutex return boolean value depends on the lock state

4.1.1 Detailed Description

Definition at line 17 of file OSTM.h.

4.1.2 Constructor & Destructor Documentation

4.1.2.1 OSTM::OSTM ( )

OSTM Constructor.

Default constructor.

Parameters

version	indicates the version number of the inherited child pointer
uniqueID	is a unique identifier assigned to every object registered in OSTM library
canCommit	NOT USED YET
abort_Transaction	NOT USED YET

Definition at line 20 of file OSTM.cpp.

4.1.2.2 OSTM::OSTM (int *_version_number_*, int *_unique_id_*)

OSTM Custom Constructor.

Custom Constructor Used for copy object.

Parameters

version	indicates the version number of the inherited child pointer
uniqueID	is a unique identifier assigned to every object registered in OSTM library
canCommit	NOT USED YET
abort_Transaction	NOT USED YET

Definition at line 36 of file OSTM.cpp.

4.1.2.3 OSTM::∼OSTM ( ) [virtual]

De-constructor.

De-constructor

Definition at line 48 of file OSTM.cpp.

4.1.3 Member Function Documentation

4.1.3.1 virtual void OSTM::copy (std::shared_ptr< OSTM > *from*, std::shared_ptr< OSTM > *to*) [inline], [virtual]

OSTM required virtual method for deep copy.

Definition at line 34 of file OSTM.h.

4.1.3.2 int OSTM::Get_Unique_ID ( ) const

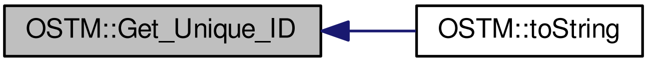
getter for unique id

Parameters

uniqueID	int

Definition at line 73 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.3 int OSTM::Get_Version ( ) const

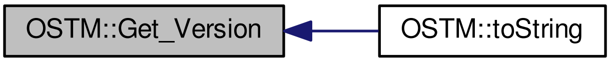
getter for version number

Parameters

version	int

Definition at line 89 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.4 virtual std::shared_ptr<OSTM> OSTM::getBaseCopy (std::shared_ptr< OSTM > *object*) [inline], [virtual]

OSTM required virtual method for returning a pointer that is copy of the original pointer.

Definition at line 38 of file OSTM.h.

4.1.3.5 void OSTM::increase_VersionNumber ( )

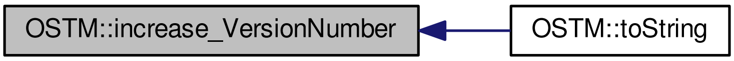
commit time increase version number to child object

Parameters

version	int

Definition at line 97 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.6 bool OSTM::Is_Abort_Transaction ( ) const

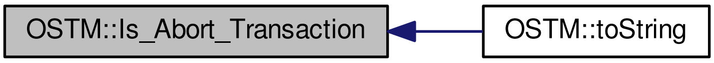
NOT USED YET.

Parameters

abort_Transaction	boolean

Definition at line 126 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.7 bool OSTM::Is_Can_Commit ( ) const

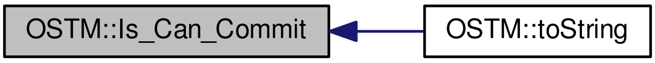
NOT USED YET.

Parameters

canCommit	boolean

Definition at line 112 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.8 bool OSTM::is_Locked ( )

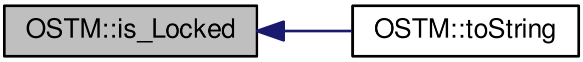
object unique lock, try locks mutex return boolean value depends on the lock state

Parameters

mutex	std::mutex

Definition at line 147 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.9 void OSTM::lock_Mutex ( )

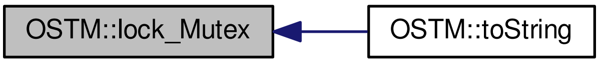
object unique lock, locks mutex

Parameters

mutex	std::mutex

Definition at line 133 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.10 void OSTM::Set_Abort_Transaction (bool *abortTransaction*)

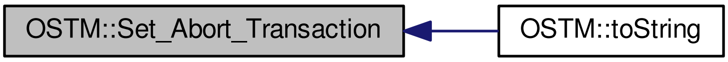
NOT USED YET.

Parameters

abort_Transaction	boolean

Definition at line 119 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.11 void OSTM::Set_Can_Commit (bool *canCommit*)

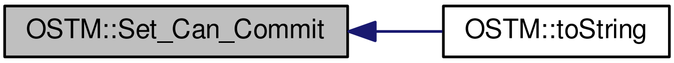
NOT USED YET.

Parameters

canCommit	boolean

Definition at line 105 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.12 void OSTM::Set_Unique_ID (int *uniqueID*)

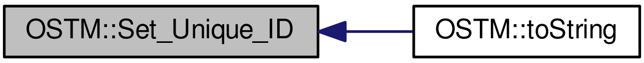
setter for unique id

Parameters

uniqueID	int

Definition at line 66 of file OSTM.cpp.

Here is the caller graph for this function:



4.1.3.13 void OSTM::Set_Version (int *version*)

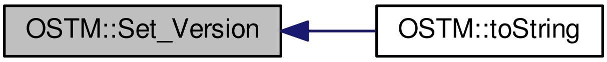
setter for version number

Parameters

version	int

Definition at line 81 of file OSTM.cpp.

Here is the caller graph for this function:

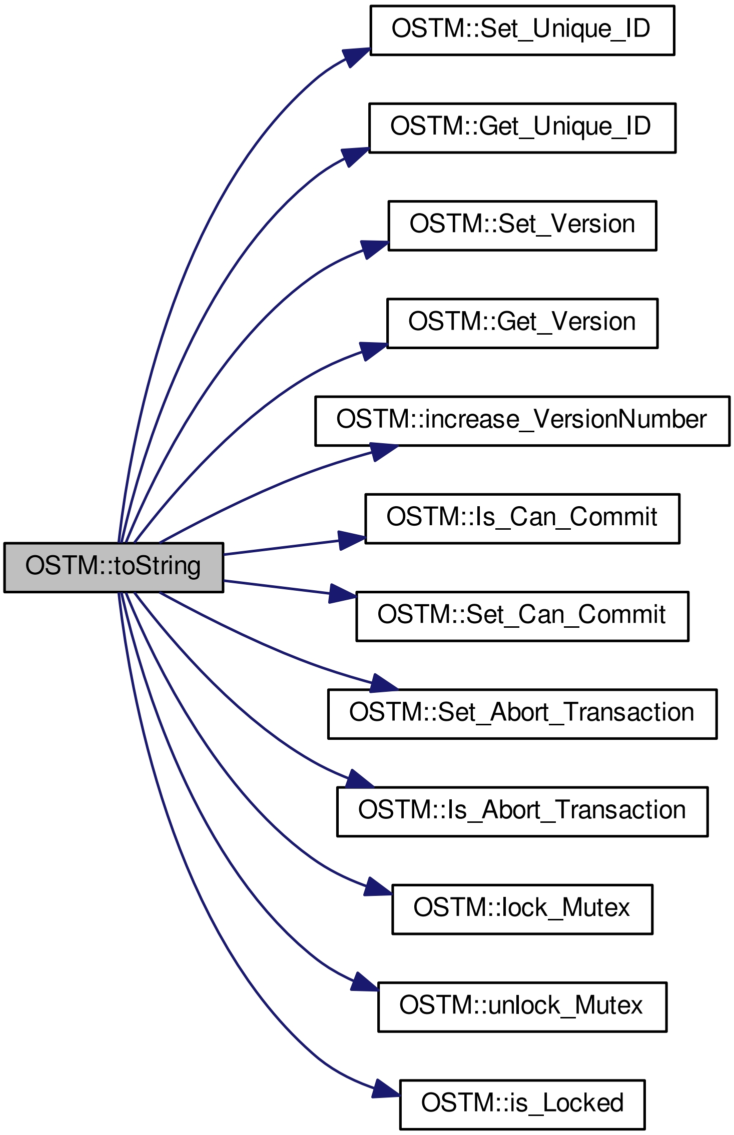


4.1.3.14 virtual void OSTM::toString ( ) [inline], [virtual]

OSTM required virtual method for display object.

Definition at line 42 of file OSTM.h.

Here is the call graph for this function:



4.1.3.15 void OSTM::unlock_Mutex ( )

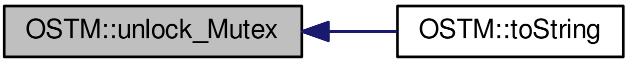
object unique lock, unlocks mutex

Parameters

mutex	std::mutex

Definition at line 140 of file OSTM.cpp.

Here is the caller graph for this function:



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

- /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/OSTM.h
- /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/OSTM.cpp

4.2 TM Class Reference

```
#include <TM.h>
```

Public Member Functions

- std::shared_ptr< TX > const _get_tx ()

    _get_tx std::shared_ptr<TX>, returning a shared pointer with the transaction
- void _TX_EXIT ()

    _TX_EXIT void, the thread calls the ostm_exit function in the transaction, and clear all elements from the shared global collection associated with the main process
- void print_all ()

    ONLY FOR TESTING print_all void, print out all object key from txMAP collection.

Static Public Member Functions

- static TM & Instance ()

    Scott Meyer's Singleton creation, what is thread safe.

4.2.1 Detailed Description

Definition at line 56 of file TM.h.

4.2.2 Member Function Documentation

4.2.2.1 std::shared_ptr< TX > const TM::_get_tx ( )

_get_tx std::shared_ptr<TX>, returning a shared pointer with the transaction

_get_tx std::shared_ptr<TX>, return a shared_ptr with the Transaction object, if TX not exists then create one, else increasing the nesting level std::mutex, protect shared collection from critical section

Parameters

guard	std::lock_guard, locks the register_Lock mutex, unlock automatically when goes out of the scope

Definition at line 77 of file TM.cpp.

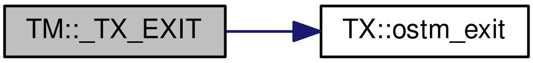
4.2.2.2 void TM::_TX_EXIT ( )

_TX_EXIT void, the thread calls the ostm_exit function in the transaction, and clear all elements from the shared global collection associated with the main process

_TX_EXIT void, the thread calls the ostm_exit function in the transaction, and clear all elements from the shared global collection associated with the main process tx TX, local object to function in transaction

Definition at line 100 of file TM.cpp.

Here is the call graph for this function:



4.2.2.3 TM & TM::Instance ( ) [static]

Scott Meyer's Singleton creation, what is thread safe.

Instance TM, return the same singleton object to any process.

Parameters

_instance	TM, static class reference to the instance of the Transaction Manager class
_instance	ppid, assigning the process id whoever created the Singleton instance

Definition at line 27 of file TM.cpp.

4.2.2.4 void TM::print_all ( )

ONLY FOR TESTING print_all void, print out all object key from txMAP collection.

ONLY FOR TESTING print_all void, prints all object in the txMap

Definition at line 120 of file TM.cpp.

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

- /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/TM.h
- /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/TM.cpp

4.3 TX Class Reference

```
#include <TX.h>
```

Public Member Functions

- TX (std::thread::id id)

  Constructor.
- ∼TX ()

  De-constructor.
- TX (const TX &orig)

  Default copy constructor.
- void ostm_exit ()

  Delete all map entries associated with the main process.
- void _register (std::shared_ptr< OSTM > object)

  Register OSTM pointer into STM library.
- std::shared_ptr< OSTM > load (std::shared_ptr< OSTM > object)

  load std::shared_ptr<OSTM>, returning an std::shared_ptr<OSTM> copy of the original pointer, to work with during transaction life time
- void store (std::shared_ptr< OSTM > object)

  Store transactional changes.
- bool commit ()

  Commit transactional changes.
- void _increase_tx_nesting ()

  Add TX nesting level by one.
- void _decrease_tx_nesting ()

  Remove TX nesting level by one.
- int getTest_counter ()

  getTest_counter TESTING ONLY!!! returning the value of the test_counter stored, number of rollbacks
- void _print_all_tx ()

Static Public Attributes

- static int test_counter = 0

Friends

- class TM

4.3.1 Detailed Description

Definition at line 24 of file TX.h.

4.3.2 Constructor & Destructor Documentation

4.3.2.1 TX::TX (std::thread::id *id*)

Constructor.

Parameters

transaction_Number	int, to store associated thread
_tx_nesting_level	int, to store and indicate nesting level of transactions within transaction

Definition at line 31 of file TX.cpp.

4.3.2.2 TX::∼TX ( )

De-constructor.

Definition at line 38 of file TX.cpp.

4.3.2.3 TX::TX (const TX & *orig*)

Default copy constructor.

Definition at line 44 of file TX.cpp.

4.3.3 Member Function Documentation

4.3.3.1 void TX::_decrease_tx_nesting ( )

Remove TX nesting level by one.

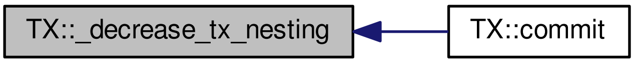
_decrease_tx_nesting decrease the value stored in _tx_nesting_level by one, when outer transactions commiting

Parameters

_tx_nesting_level	int

Definition at line 316 of file TX.cpp.

Here is the caller graph for this function:



4.3.3.2 void TX::_increase_tx_nesting ( )

Add TX nesting level by one.

_increase_tx_nesting increase the value stored in _tx_nesting_level by one, indicate that the transaction nested

Parameters

_tx_nesting_level	int

Definition at line 307 of file TX.cpp.

4.3.3.3 void TX::_print_all_tx ( )

ONLY FOR TESTING CHECK THE MAP AFTER THREAD EXIT AND ALL SHOULD BE DELETED!!!!!!!

Definition at line 346 of file TX.cpp.

4.3.3.4 void TX::_register (std::shared_ptr< OSTM > *object*)

Register OSTM pointer into STM library.

register void, receives an std::shared_ptr<OSTM> that point to the original memory space to protect from reca conditions

Parameters

working_Map_collection	std::map, store all the std::shared_ptr<OSTM> pointer in the transaction
main_Process_Map_collection	std::map, store all std::shared_ptr<OSTM> from all transaction, used to lock and compare the objects
process_map_collection	std::map, store all std::shared_ptr<OSTM> unique ID from all transaction, used to delete all pointers used by the main process, from all transaction before the program exit.
std::lock_guard	use register_Lock(mutex) shared lock between all transaction
ppid	int, store main process number

Definition at line 104 of file TX.cpp.

4.3.3.5 bool TX::commit ( )

Commit transactional changes.

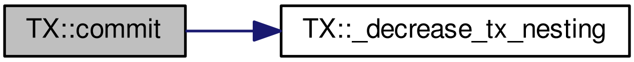
commit bool, returns boolean value TRUE/FALSE depends on the action taken within the function

Parameters

working_Map_collection	std::map, store all the std::shared_ptr<OSTM> pointer in the transaction
main_Process_Map_collection	std::map, store all std::shared_ptr<OSTM> from all transaction, used to lock and compare the objects
can_Commit	bool, helps to make decision that the transaction can commit or rollback

Definition at line 202 of file TX.cpp.

Here is the call graph for this function:



4.3.3.6 int TX::getTest_counter ( )

getTest_counter TESTING ONLY!!! returning the value of the test_counter stored, number of rollbacks

Definition at line 324 of file TX.cpp.

4.3.3.7 std::shared_ptr< OSTM > TX::load (std::shared_ptr< OSTM > *object*)

load std::shared_ptr<OSTM>, returning an std::shared_ptr<OSTM> copy of the original pointer, to work with during transaction life time

Register OSTM pointer into STM library

Parameters

working_Map_collection	std::map, store all the std::shared_ptr<OSTM> pointer in the transaction

Definition at line 155 of file TX.cpp.

4.3.3.8 void TX::ostm_exit ( )

Delete all map entries associated with the main process.

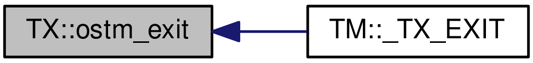
ostm_exit void, clear all elements from the shared global collections associated with the main process

Parameters

main_Process_Map_collection	std::map, store all std::shared_ptr<OSTM> from all transaction shared between multiple processes
process_map_collection	std::map, store all unique id from all transaction within main process DO NOT CALL THIS METHOD EXPLICITLY!!!!!! WILL DELETE ALL PROCESS ASSOCIATED ELEMENTS!!!!

Definition at line 72 of file TX.cpp.

Here is the caller graph for this function:



4.3.3.9 void TX::store (std::shared_ptr< OSTM > *object*)

Store transactional changes.

store void, receive an std::shared_ptr<OSTM> object to store the changes within the transaction, depends the user action

Parameters

working_Map_collection	std::map, store all the std::shared_ptr<OSTM> pointer in the transaction

Definition at line 178 of file TX.cpp.

4.3.4 Friends And Related Function Documentation

4.3.4.1 friend class TM [friend]

Only TM Transaction Manager can create instance of TX Transaction

Definition at line 70 of file TX.h.

4.3.5 Member Data Documentation

4.3.5.1 int TX::test_counter = 0 [static]

Parameters

test_counter	int ONLY FOR TESTING!!!
static	Global counter for rollback

Definition at line 78 of file TX.h.

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

- /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/T↩ X.h

- /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/TX.cpp

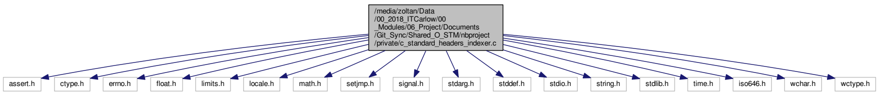
Chapter 5

File Documentation

5.1 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/nbproject/private/c_standard_headers_indexer.c File Reference

```
#include <assert.h>
#include <ctype.h>
#include <errno.h>
#include <float.h>
#include <limits.h>
#include <locale.h>
#include <math.h>
#include <setjmp.h>
#include <signal.h>
#include <stdarg.h>
#include <stddef.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <time.h>
#include <iso646.h>
#include <wchar.h>
#include <wctype.h>
```

Include dependency graph for c_standard_headers_indexer.c:



5.2 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/nbproject/private/cpp_standard_headers_indexer.cpp File Reference

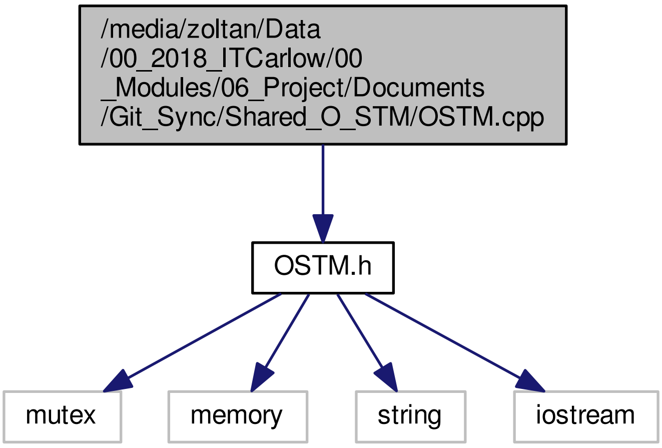
```
#include <cstdlib>
```

```
#include <csignal>
#include <csetjmp>
#include <cstdarg>
#include <typeinfo>
#include <bitset>
#include <functional>
#include <utility>
#include <ctime>
#include <cstddef>
#include <new>
#include <memory>
#include <climits>
#include <cfloat>
#include <limits>
#include <exception>
#include <stdexcept>
#include <cassert>
#include <cerrno>
#include <cctype>
#include <cwctype>
#include <cstring>
#include <cwchar>
#include <string>
#include <vector>
#include <deque>
#include <list>
#include <set>
#include <map>
#include <stack>
#include <queue>
#include <algorithm>
#include <iterator>
#include <cmath>
#include <complex>
#include <valarray>
#include <numeric>
#include <iosfwd>
#include <ios>
#include <istream>
#include <ostream>
#include <iostream>
#include <fstream>
#include <sstream>
#include <strstream>
#include <iomanip>
#include <streambuf>
#include <cstdio>
#include <locale>
#include <clocale>
#include <ciso646>
```

5.3 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/OSTM.cpp File Reference

```
#include "OSTM.h"
```

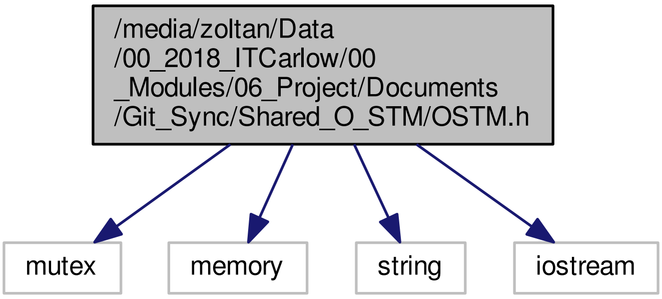
Include dependency graph for OSTM.cpp:



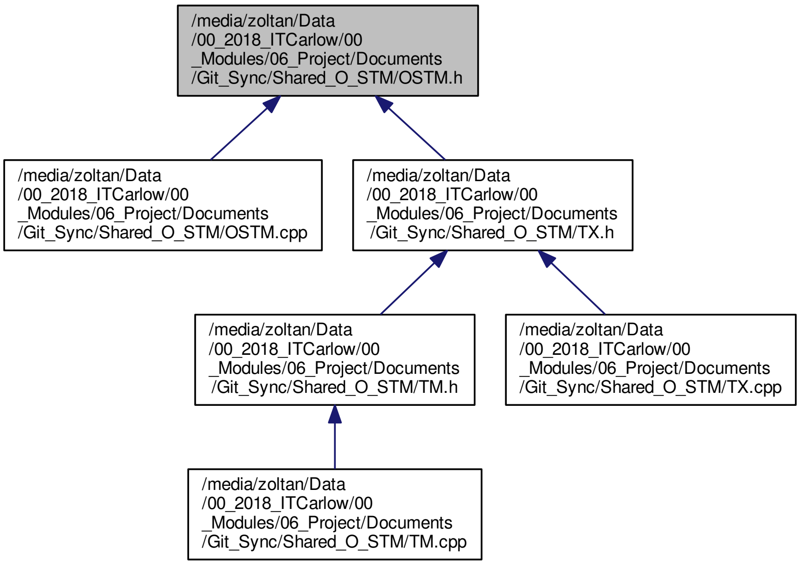
5.4 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/OSTM.h File Reference

```
#include <mutex>
#include <memory>
#include <string>
#include <iostream>
```

Include dependency graph for OSTM.h:



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


/media/zoltan/Data /00_2018_ITCarlow/00 _Modules/06_Project/Documents /Git_Sync/Shared_O_STM/OSTM.h
/media/zoltan/Data /00_2018_ITCarlow/00 _Modules/06_Project/Documents /Git_Sync/Shared_O_STM/OSTM.cpp
/media/zoltan/Data /00_2018_ITCarlow/00 _Modules/06_Project/Documents /Git_Sync/Shared_O_STM/TX.h
/media/zoltan/Data /00_2018_ITCarlow/00 _Modules/06_Project/Documents /Git_Sync/Shared_O_STM/TM.h
/media/zoltan/Data /00_2018_ITCarlow/00 _Modules/06_Project/Documents /Git_Sync/Shared_O_STM/TX.cpp
/media/zoltan/Data /00_2018_ITCarlow/00 _Modules/06_Project/Documents /Git_Sync/Shared_O_STM/TM.cpp

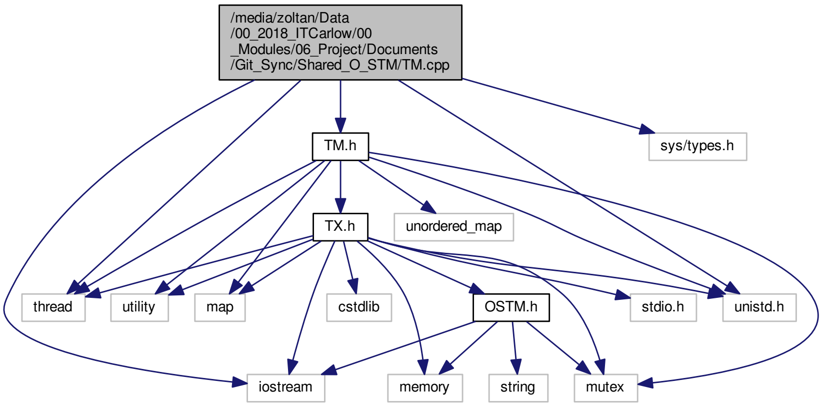
Classes

- class OSTM

5.5 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/TM.cpp File Reference

```
#include "TM.h"
#include <thread>
#include <unistd.h>
#include <sys/types.h>
#include <iostream>
```

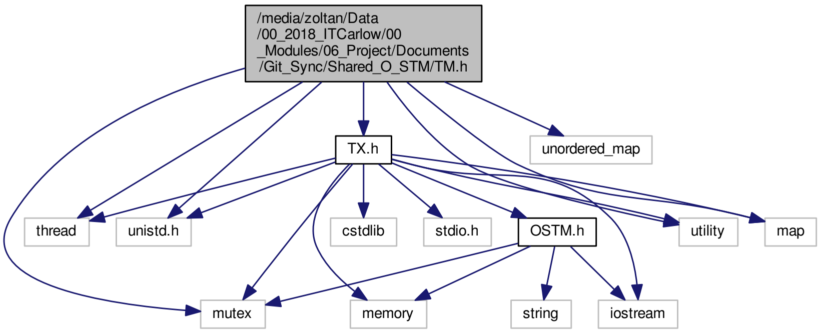
Include dependency graph for TM.cpp:



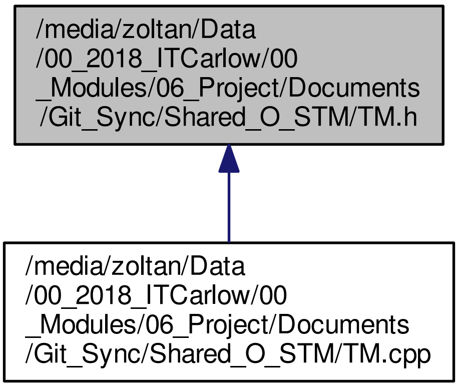
5.6 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/TM.h File Reference

```
#include <thread>
#include <unistd.h>
#include <mutex>
#include <unordered_map>
#include <utility>
#include <map>
#include "TX.h"
```

Include dependency graph for TM.h:



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


/media/zoltan/Data
/00_2018_ITCarlow/00
_Modules/06_Project/Documents
/Git_Sync/Shared_O_STM/TM.h
/media/zoltan/Data
/00_2018_ITCarlow/00
_Modules/06_Project/Documents
/Git_Sync/Shared_O_STM/TM.cpp

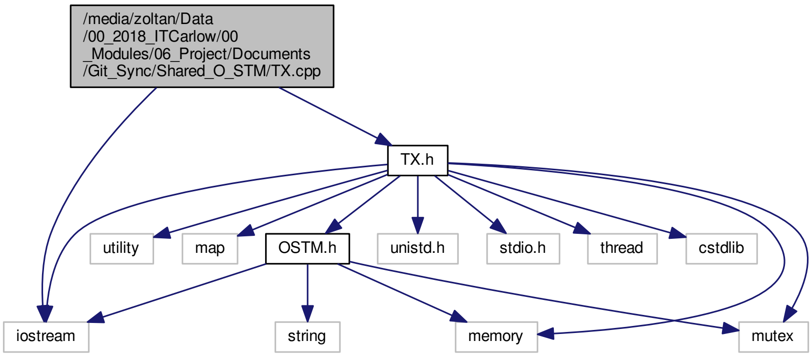
Classes

- class TM

5.7 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/TX.cpp File Reference

```
#include "TX.h"
#include <iostream>
```

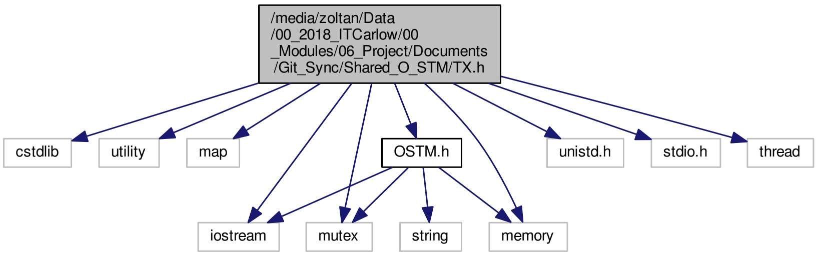
Include dependency graph for TX.cpp:



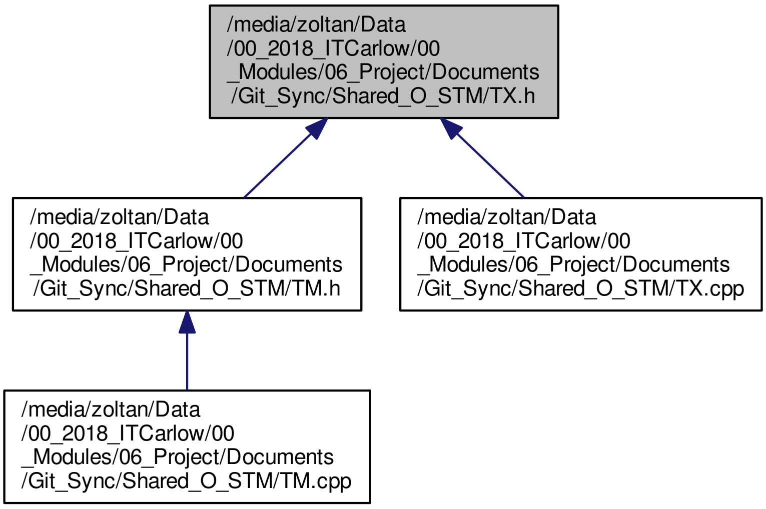
5.8 /media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_↩ Sync/Shared_O_STM/TX.h File Reference

```
#include <cstdlib>
#include <utility>
#include <map>
#include <iostream>
#include <mutex>
#include <unistd.h>
#include <memory>
#include <stdio.h>
#include <thread>
#include "OSTM.h"
```

Include dependency graph for TX.h:



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


/media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/TX.h
/media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/TM.h
/media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/TX.cpp
/media/zoltan/Data/00_2018_ITCarlow/00_Modules/06_Project/Documents/Git_Sync/Shared_O_STM/TM.cpp

Classes

- class TX