

Tang

0.1

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Chapter 1

Tang: A Template Language

1.1 Quick Description

Tang is a C++ Template Language. It takes the form of a library which may be included in other projects. It is under active development, and you can follow its progress here:

- [YouTube playlist](#)
- [GitHub repository](#)

1.2 Features

The following features are planned:

- Native support for Unicode/Utf-8 strings.
- Change from template to script mode using escape tags like PHP.
- Loosely typed, with Python-like indexing and slicing of containers.
- Syntax similar to C/C++/PHP.
- Code compiles to a custom Bytecode and is executed by the Tang VM.
- Fast and thread-safe.

1.3 License

MIT License

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Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

Tang::AstNode	9
Tang::AstNodeInteger	12
Tang::ComputedExpression	15
Tang::ComputedExpressionInteger	16
Tang::Error	18
Tang::GarbageCollected< T >	20
Tang::location	24
Tang::position	26
Tang::Program	27
Tang::SingletonObjectPool< T >	31
Tang::TangBase	32
TangTangFlexLexer	
Tang::TangScanner	34

Chapter 3

Class Index

3.1 Class List

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

Tang::AstNode	Base class for representing nodes of an Abstract Syntax Tree (AST)	9
Tang::AstNodeInteger	An AstNode that represents an integer literal	12
Tang::ComputedExpression	Represents the result of a computation that has been executed	15
Tang::ComputedExpressionInteger	Represents an Integer that is the result of a computation	16
Tang::Error	Used to report any error of the system, whether a syntax (parsing) error or a runtime (execution) error	18
Tang::GarbageCollected< T >	A container that acts as a resource-counting garbage collector for the specified type	20
Tang::location	Two points in a source file	24
Tang::position	A point in a source file	26
Tang::Program	Represents a compiled script or template that may be executed	27
Tang::SingletonObjectPool< T >	31
Tang::TangBase	The base class for the Tang programming language	32
Tang::TangScanner	The Flex lexer class for the main Tang language	34

Chapter 4

File Index

4.1 File List

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

build/generated/location.hh	
Define the Tang ::location class	37
include/ast.hpp	
Define the Tang::AstNode and its associated/derivative classes	39
include/computedExpression.hpp	41
include/error.hpp	
Define the Tang::Error class used to describe syntax and runtime errors	41
include/garbageCollected.hpp	43
include/macros.hpp	
Contains generic macros	43
include/opcode.hpp	
Declare the Opcodes used in the Bytecode representation of a program	44
include/program.hpp	
Define the Tang::Program class used to compile and execute source code	45
include/singletonObjectPool.hpp	46
include/tang.hpp	
Header file supplied for use by 3rd party code so that they can easily include all necessary headers	47
include/tangBase.hpp	
Defines the Tang::TangBase class used to interact with Tang	48
include/tangScanner.hpp	
Defines the Tang::TangScanner used to tokenize a Tang script	49
src/ast.cpp	50
src/computedExpression.cpp	51
src/error.cpp	51
src/program.cpp	52
src/tangBase.cpp	53
test/testSingletonObjectPool.cpp	54

Chapter 5

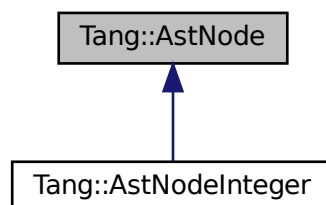
Class Documentation

5.1 Tang::AstNode Class Reference

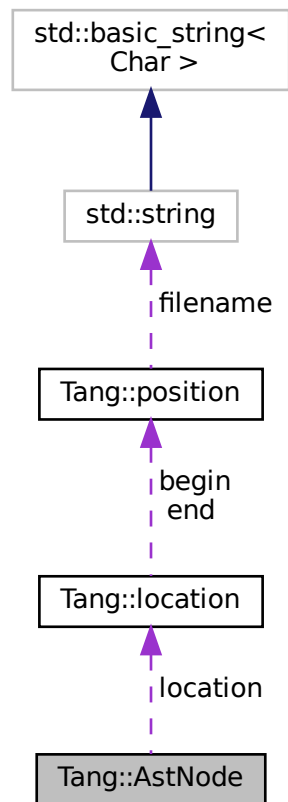
Base class for representing nodes of an Abstract Syntax Tree (AST).

```
#include <ast.hpp>
```

Inheritance diagram for Tang::AstNode:



Collaboration diagram for Tang::AstNode:



Public Member Functions

- virtual `~AstNode` ()
The object destructor.
- virtual `std::string dump` (`std::string indent=""`) const
Return a string that describes the contents of the node.
- virtual void `compile` (`Tang::Program &program`) const
Compile the ast of the provided `Tang::Program`.
- virtual `AstNode * makeCopy` () const
Provide a copy of the `AstNode` (recursively, if appropriate).

Protected Member Functions

- `AstNode` (`Tang::location loc`)
The generic constructor.

Protected Attributes

- [Tang::location location](#)

The location associated with this node.

5.1.1 Detailed Description

Base class for representing nodes of an Abstract Syntax Tree (AST).

There will be *many* derived classes, each one conveying the syntactic meaning of the code that it represents.

5.1.2 Constructor & Destructor Documentation

5.1.2.1 AstNode()

```
Tang::AstNode::AstNode (
    Tang::location loc ) [inline], [protected]
```

The generic constructor.

It should never be called on its own.

Parameters

<i>loc</i>	The location associated with this node.
------------	---

5.1.3 Member Function Documentation

5.1.3.1 makeCopy()

```
AstNode * AstNode::makeCopy ( ) const [virtual]
```

Provide a copy of the [AstNode](#) (recursively, if appropriate).

Returns

A pointer to a new [AstNode](#) that is a copy of the current [AstNode](#).

Reimplemented in [Tang::AstNodeInteger](#).

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

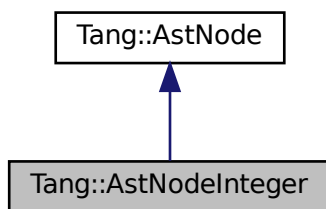
- [include/ast.hpp](#)
- [src/ast.cpp](#)

5.2 Tang::AstNodeInteger Class Reference

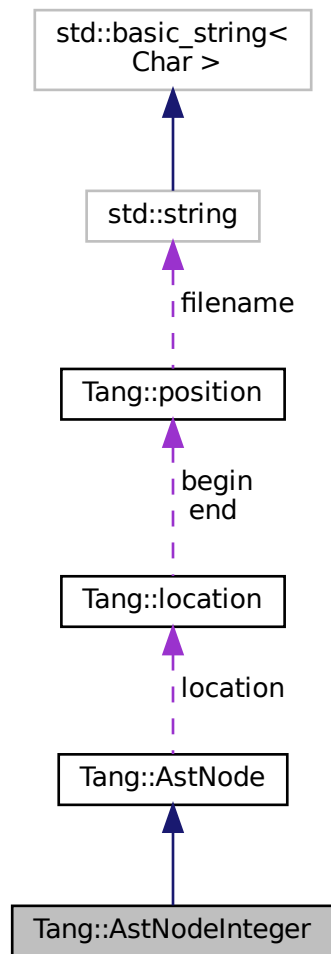
An [AstNode](#) that represents an integer literal.

```
#include <ast.hpp>
```

Inheritance diagram for Tang::AstNodeInteger:



Collaboration diagram for Tang::AstNodeInteger:



Public Member Functions

- [AstNodeInteger](#) (int64_t number, [Tang::location](#) loc)
The constructor.
- virtual std::string [dump](#) (std::string indent="") const override
Return a string that describes the contents of the node.
- virtual void [compile](#) ([Tang::Program](#) &program) const override
Compile the ast of the provided [Tang::Program](#).
- virtual [AstNode](#) * [makeCopy](#) () const override
Provide a copy of the [AstNode](#) (recursively, if appropriate).

Protected Attributes

- [Tang::location](#) location
The location associated with this node.

5.2.1 Detailed Description

An [AstNode](#) that represents an integer literal.

Integers are represented by the `int64_t` type, and so are limited in range by that of the underlying type.

5.2.2 Constructor & Destructor Documentation

5.2.2.1 AstNodeInteger()

```
Tang::AstNodeInteger::AstNodeInteger (
    int64_t number,
    Tang::location loc ) [inline]
```

The constructor.

Parameters

<i>number</i>	The number to represent.
<i>loc</i>	The location associated with the expression. @location The location associated with this node.

5.2.3 Member Function Documentation

5.2.3.1 makeCopy()

```
AstNode * AstNodeInteger::makeCopy ( ) const [override], [virtual]
```

Provide a copy of the [AstNode](#) (recursively, if appropriate).

Returns

A pointer to a new [AstNode](#) that is a copy of the current [AstNode](#).

Reimplemented from [Tang::AstNode](#).

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

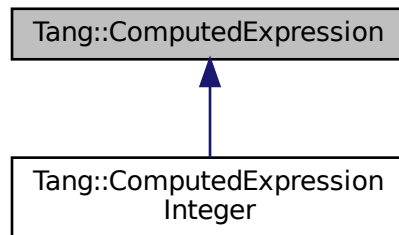
- include/[ast.hpp](#)
- src/[ast.cpp](#)

5.3 Tang::ComputedExpression Class Reference

Represents the result of a computation that has been executed.

```
#include <computedExpression.hpp>
```

Inheritance diagram for Tang::ComputedExpression:



Public Member Functions

- virtual [~ComputedExpression](#) ()
The object destructor.
- virtual std::string [dump](#) () const
Output the contents of the [ComputedExpression](#) as a string.
- virtual [ComputedExpression](#) * [makeCopy](#) () const
Make a copy of the [ComputedExpression](#) (recursively, if appropriate).

5.3.1 Detailed Description

Represents the result of a computation that has been executed.

5.3.2 Member Function Documentation

5.3.2.1 dump()

```
string ComputedExpression::dump ( ) const [virtual]
```

Output the contents of the [ComputedExpression](#) as a string.

Returns

A string representation of the computed expression.

Reimplemented in [Tang::ComputedExpressionInteger](#).

5.3.2.2 makeCopy()

```
ComputedExpression * ComputedExpression::makeCopy ( ) const [virtual]
```

Make a copy of the [ComputedExpression](#) (recursively, if appropriate).

Returns

A pointer to the new [ComputedExpression](#).

Reimplemented in [Tang::ComputedExpressionInteger](#).

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

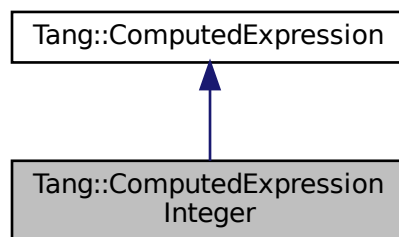
- [include/computedExpression.hpp](#)
- [src/computedExpression.cpp](#)

5.4 Tang::ComputedExpressionInteger Class Reference

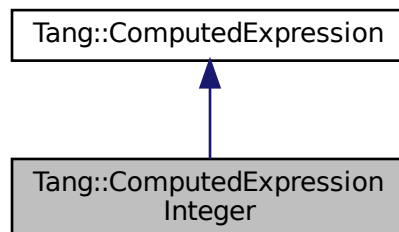
Represents an Integer that is the result of a computation.

```
#include <computedExpression.hpp>
```

Inheritance diagram for Tang::ComputedExpressionInteger:



Collaboration diagram for Tang::ComputedExpressionInteger:



Public Member Functions

- [ComputedExpressionInteger](#) (int64_t val)
Construct an Integer result.
- virtual std::string [dump](#) () const override
Output the contents of the [ComputedExpression](#) as a string.
- [ComputedExpression](#) * [makeCopy](#) () const override
Make a copy of the [ComputedExpression](#) (recursively, if appropriate).

5.4.1 Detailed Description

Represents an Integer that is the result of a computation.

5.4.2 Constructor & Destructor Documentation

5.4.2.1 ComputedExpressionInteger()

```
ComputedExpressionInteger::ComputedExpressionInteger (
    int64_t val )
```

Construct an Integer result.

Parameters

<i>val</i>	The integer value.
------------	--------------------

5.4.3 Member Function Documentation

5.4.3.1 dump()

```
string ComputedExpressionInteger::dump ( ) const [override], [virtual]
```

Output the contents of the [ComputedExpression](#) as a string.

Returns

A string representation of the computed expression.

Reimplemented from [Tang::ComputedExpression](#).

5.4.3.2 makeCopy()

```
ComputedExpression * ComputedExpressionInteger::makeCopy ( ) const [override], [virtual]
```

Make a copy of the [ComputedExpression](#) (recursively, if appropriate).

Returns

A pointer to the new [ComputedExpression](#).

Reimplemented from [Tang::ComputedExpression](#).

Here is the call graph for this function:



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

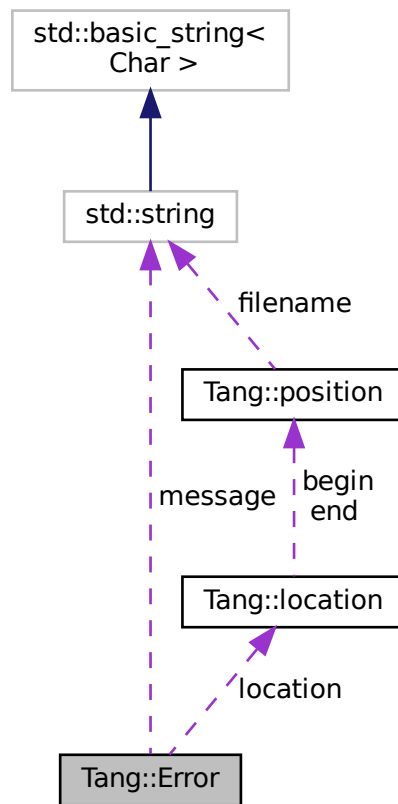
- [include/computedExpression.hpp](#)
- [src/computedExpression.cpp](#)

5.5 Tang::Error Class Reference

The [Error](#) class is used to report any error of the system, whether a syntax (parsing) error or a runtime (execution) error.

```
#include <error.hpp>
```


Collaboration diagram for Tang::Error:



Public Member Functions

- [Error](#) ()
Creates an empty error message.
- [Error](#) (std::string [message](#), [Tang::location](#) [location](#))
Creates an error message using the supplied error string and location.

Public Attributes

- std::string [message](#)
The error message as a string.
- [Tang::location](#) [location](#)
The location of the error.

5.5.1 Detailed Description

The [Error](#) class is used to report any error of the system, whether a syntax (parsing) error or a runtime (execution) error.

5.5.2 Constructor & Destructor Documentation

5.5.2.1 Error()

```
Tang::Error::Error (
    std::string message,
    Tang::location location ) [inline]
```

Creates an error message using the supplied error string and location.

Parameters

<i>message</i>	The error message as a string.
<i>location</i>	The location of the error.

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

- include/error.hpp
- src/error.cpp

5.6 Tang::GarbageCollected< T > Class Template Reference

A container that acts as a resource-counting garbage collector for the specified type.

```
#include <garbageCollected.hpp>
```

Public Member Functions

- template<typename... Args>
 [GarbageCollected](#) (Args... args)
 Constructs a garbage-collected object of the specified type.
- [GarbageCollected](#) (const [GarbageCollected](#) &other)
 Copy Constructor.
- [GarbageCollected](#) ([GarbageCollected](#) &&other)
 Move Constructor.
- [GarbageCollected](#) & operator= (const [GarbageCollected](#) &other)
 Copy Assignment.
- [GarbageCollected](#) & operator= ([GarbageCollected](#) &&other)
 Move Assignment.
- [~GarbageCollected](#) ()
 Destructor.
- T * operator-> () const
 Access the tracked object as a pointer.
- T & operator* () const
 Access the tracked object.

5.6.1 Detailed Description

```
template<class T>
class Tang::GarbageCollected< T >
```

A container that acts as a resource-counting garbage collector for the specified type.

Uses the [SingletonObjectPool](#) to created and recycle object memory. The container is not thread-safe.

5.6.2 Constructor & Destructor Documentation

5.6.2.1 GarbageCollected() [1/3]

```
template<class T >
template<typename... Args>
Tang::GarbageCollected< T >::GarbageCollected (
    Args... args ) [inline]
```

Constructs a garbage-collected object of the specified type.

Parameters

<i>variable</i>	The arguments to pass to the constructor of the specified type.
-----------------	---

Here is the call graph for this function:



5.6.2.2 GarbageCollected() [2/3]

```
template<class T >
Tang::GarbageCollected< T >::GarbageCollected (
    const GarbageCollected< T > & other ) [inline]
```

Copy Constructor.

Parameters

<i>The</i>	other GarbageCollected object to copy.
------------	--

5.6.2.3 [GarbageCollected\(\)](#) [3/3]

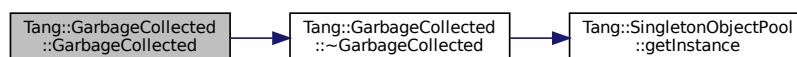
```
template<class T >
Tang::GarbageCollected< T >::GarbageCollected (
    GarbageCollected< T > && other ) [inline]
```

Move Constructor.

Parameters

<i>The</i>	other GarbageCollected object to move.
------------	--

Here is the call graph for this function:

5.6.2.4 [~GarbageCollected\(\)](#)

```
template<class T >
Tang::GarbageCollected< T >::~~GarbageCollected ( ) [inline]
```

Destructor.

Clean up the tracked object, if appropriate. Here is the call graph for this function:



5.6.3 Member Function Documentation

5.6.3.1 operator*()

```
template<class T >
T& Tang::GarbageCollected< T >::operator* ( ) const [inline]
```

Access the tracked object.

Returns

A reference to the tracked object.

5.6.3.2 operator->()

```
template<class T >
T* Tang::GarbageCollected< T >::operator-> ( ) const [inline]
```

Access the tracked object as a pointer.

Returns

A pointer to the tracked object.

5.6.3.3 operator=() [1/2]

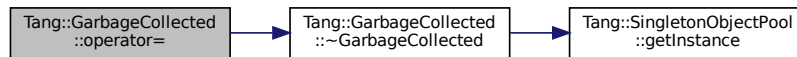
```
template<class T >
GarbageCollected& Tang::GarbageCollected< T >::operator= (
    const GarbageCollected< T > & other ) [inline]
```

Copy Assignment.

Parameters

The	other GarbageCollected object.
-----	--

Here is the call graph for this function:



5.6.3.4 operator=() [2/2]

```

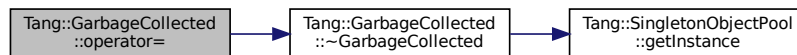
template<class T >
GarbageCollected& Tang::GarbageCollected< T >::operator= (
    GarbageCollected< T > && other ) [inline]
  
```

Move Assignment.

Parameters

<i>The</i>	other GarbageCollected object.
------------	--

Here is the call graph for this function:



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

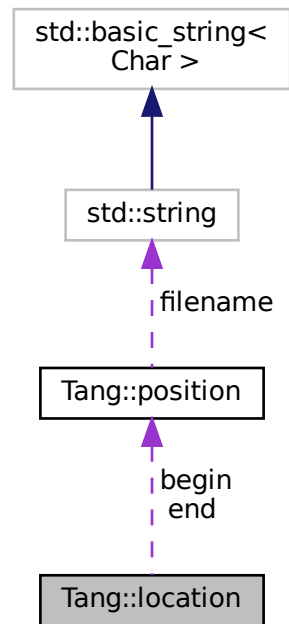
- [include/garbageCollected.hpp](#)

5.7 Tang::location Class Reference

Two points in a source file.

```
#include <location.hh>
```

Collaboration diagram for Tang::location:



Public Types

- typedef `position::filename_type filename_type`
Type for file name.
- typedef `position::counter_type counter_type`
Type for line and column numbers.

Public Member Functions

- `location` (const `position` &b, const `position` &e)
Construct a location from b to e.
- `location` (const `position` &p=`position`())
Construct a 0-width location in p.
- `location` (`filename_type` *f, `counter_type` l=1, `counter_type` c=1)
Construct a 0-width location in f, l, c.
- void `initialize` (`filename_type` *f=((void *) 0), `counter_type` l=1, `counter_type` c=1)
Initialization.

Line and Column related manipulators

- void `step` ()
Reset initial location to final location.
- void `columns` (`counter_type` count=1)
Extend the current location to the COUNT next columns.
- void `lines` (`counter_type` count=1)
Extend the current location to the COUNT next lines.

Public Attributes

- [position begin](#)
Beginning of the located region.
- [position end](#)
End of the located region.

5.7.1 Detailed Description

Two points in a source file.

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

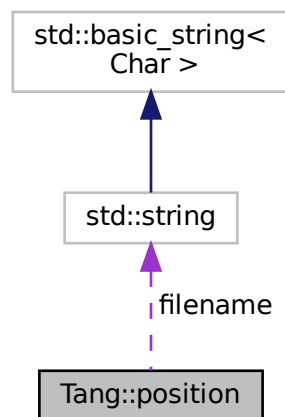
- [build/generated/location.hh](#)

5.8 Tang::position Class Reference

A point in a source file.

```
#include <location.hh>
```

Collaboration diagram for Tang::position:



Public Types

- typedef const std::string [filename_type](#)
Type for file name.
- typedef int [counter_type](#)
Type for line and column numbers.

Public Member Functions

- `position` (`filename_type` *f=((void *) 0), `counter_type` l=1, `counter_type` c=1)
Construct a position.
- `void initialize` (`filename_type` *fn=((void *) 0), `counter_type` l=1, `counter_type` c=1)
Initialization.

Line and Column related manipulators

- `void lines` (`counter_type` count=1)
(line related) Advance to the COUNT next lines.
- `void columns` (`counter_type` count=1)
(column related) Advance to the COUNT next columns.

Public Attributes

- `filename_type` * `filename`
File name to which this position refers.
- `counter_type` `line`
Current line number.
- `counter_type` `column`
Current column number.

5.8.1 Detailed Description

A point in a source file.

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

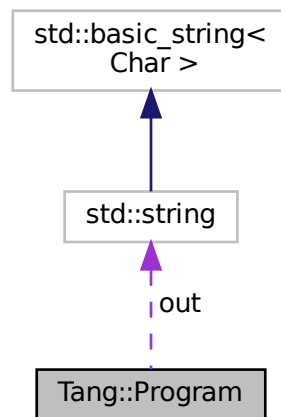
- `build/generated/location.hh`

5.9 Tang::Program Class Reference

Represents a compiled script or template that may be executed.

```
#include <program.hpp>
```

Collaboration diagram for Tang::Program:



Public Types

- enum `CodeType` { `Script` , `Template` }
Indicate the type of code that was supplied to the `Program`.

Public Member Functions

- `Program` (`std::string` code, `CodeType` codeType)
Create a compiled program using the provided code.
- `~Program` ()
The `Program` Destructor.
- `Program` (const `Program` &program)
The Copy Constructor.
- `Program` & `operator=` (const `Program` &program)
The Copy Assignment operator.
- `Program` (`Program` &&program)
The Move Constructor.
- `Program` & `operator=` (`Program` &&program)
The Move Assignment operator.
- `std::string` `getCode` () const
Get the code that was provided when the `Program` was created.
- `std::optional< const AstNode * >` `getAst` () const
Get the AST that was generated by the parser.
- `std::string` `dumpBytecode` () const
Get the Opcodes of the compiled program, formatted like Assembly.
- `std::optional< const ComputedExpression * >` `getResult` () const
Get the result of the `Program` execution, if it exists.
- void `addBytecode` (uint64_t)
Add a `uint64_t` to the Bytecode.
- `Program` & `execute` ()
Execute the program's Bytecode, and return the current `Program` object.

Public Attributes

- `std::string out`

The output of the program, resulting from the program execution.

5.9.1 Detailed Description

Represents a compiled script or template that may be executed.

5.9.2 Member Enumeration Documentation

5.9.2.1 CodeType

```
enum Tang::Program::CodeType
```

Indicate the type of code that was supplied to the [Program](#).

Enumerator

Script	The code is pure Tang script, without any templating.
Template	The code is a template.

5.9.3 Constructor & Destructor Documentation

5.9.3.1 Program()

```
Program::Program (
    std::string code,
    Program::CodeType codeType )
```

Create a compiled program using the provided code.

Parameters

<i>code</i>	The code to be compiled.
<i>codeType</i>	Whether the code is a <code>Script</code> or <code>Template</code> .

5.9.4 Member Function Documentation

5.9.4.1 addBytecode()

```
void Program::addBytecode (
    uint64_t op )
```

Add a uint64_t to the Bytecode.

Parameters

<i>op</i>	The value to add to the Bytecode.
-----------	-----------------------------------

5.9.4.2 dumpBytecode()

```
string Program::dumpBytecode ( ) const
```

Get the Opcodes of the compiled program, formatted like Assembly.

Returns

A string containing the Opcode representation.

5.9.4.3 execute()

```
Program & Program::execute ( )
```

Execute the program's Bytecode, and return the current [Program](#) object.

Returns

The current [Program](#) object.

5.9.4.4 getAst()

```
optional< const AstNode * > Program::getAst ( ) const
```

Get the AST that was generated by the parser.

The parser may have failed, so the return is an `optional<>` type. If the compilation failed, check `Program::error`.

Returns

A pointer to the AST, if it exists.

5.9.4.5 getCode()

```
string Program::getCode ( ) const
```

Get the code that was provided when the [Program](#) was created.

Returns

The source code from which the [Program](#) was created.

5.9.4.6 getResult()

```
optional< const ComputedExpression * > Program::getResult ( ) const
```

Get the result of the [Program](#) execution, if it exists.

Returns

The result of the [Program](#) execution, if it exists.

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

- include/[program.hpp](#)
- src/[program.cpp](#)

5.10 Tang::SingletonObjectPool< T > Class Template Reference

Public Member Functions

- [T * get](#) ()
Request an uninitialized memory location from the pool for an object T.
- [void recycle](#) (T *obj)
Recycle a memory location for an object T.
- [~SingletonObjectPool](#) ()
Destructor.

Static Public Member Functions

- [static SingletonObjectPool< T > & getInstance](#) ()
Get the singleton instance of the object pool.

5.10.1 Member Function Documentation

5.10.1.1 `get()`

```
template<class T >
T* Tang::SingletonObjectPool< T >::get ( ) [inline]
```

Request an uninitialized memory location from the pool for an object T.

Returns

An uninitialized memory location for an object T.

5.10.1.2 `getInstance()`

```
template<class T >
static SingletonObjectPool<T>& Tang::SingletonObjectPool< T >::getInstance ( ) [inline],
[static]
```

Get the singleton instance of the object pool.

Returns

The singleton instance of the object pool.

5.10.1.3 `recycle()`

```
template<class T >
void Tang::SingletonObjectPool< T >::recycle (
    T * obj ) [inline]
```

Recycle a memory location for an object T.

Parameters

<i>obj</i>	The memory location to recycle.
------------	---------------------------------

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

- [include/singletonObjectPool.hpp](#)

5.11 Tang::TangBase Class Reference

The base class for the Tang programming language.

```
#include <tangBase.hpp>
```

Public Member Functions

- [TangBase](#) ()
The constructor.
- [Program compileScript](#) (std::string script)
Compile the provided source code as a script and return a [Program](#).

5.11.1 Detailed Description

The base class for the Tang programming language.

This class is the fundamental starting point to compile and execute a Tang program. It may be considered in three parts:

1. It acts as an extendable interface through which additional "library" functions can be added to the language. It is intentionally designed that each instance of [TangBase](#) will have its own library functions.
2. It provides methods to compile scripts and templates, resulting in a [Program](#) object.
3. The [Program](#) object may then be executed, providing instance-specific context information (*i.e.*, state).

5.11.2 Constructor & Destructor Documentation

5.11.2.1 TangBase()

```
TangBase::TangBase ( )
```

The constructor.

Isn't it glorious.

5.11.3 Member Function Documentation

5.11.3.1 compileScript()

```
Program TangBase::compileScript (
    std::string script )
```

Compile the provided source code as a script and return a [Program](#).

Parameters

<i>script</i>	The Tang script to be compiled.
---------------	---------------------------------

Returns

The [Program](#) object representing the compiled script.

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

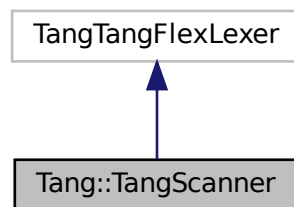
- [include/tangBase.hpp](#)
- [src/tangBase.cpp](#)

5.12 Tang::TangScanner Class Reference

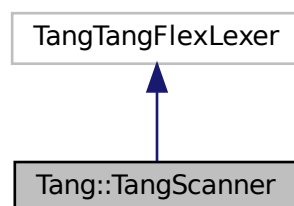
The Flex lexer class for the main Tang language.

```
#include <tangScanner.hpp>
```

Inheritance diagram for Tang::TangScanner:



Collaboration diagram for Tang::TangScanner:



Public Member Functions

- [TangScanner](#) (std::istream &arg_yyin, std::ostream &arg_yyout)
The constructor for the Scanner.
- virtual Tang::TangParser::symbol_type [get_next_token](#) ()
A pass-through function that we supply so that we can provide a Bison 3 token return type instead of the `int` that is returned by the default class configuration.

5.12.1 Detailed Description

The Flex lexer class for the main Tang language.

Flex requires that our lexer class inherit from `yyFlexLexer`, an "intermediate" class whose real name is "`TangTang` ← `FlexLexer`". We are subclassing it so that we can override the return type of `get_next_token()`, for compatibility with Bison 3 tokens.

5.12.2 Constructor & Destructor Documentation

5.12.2.1 TangScanner()

```
Tang::TangScanner::TangScanner (
    std::istream & arg_yyin,
    std::ostream & arg_yyout ) [inline]
```

The constructor for the Scanner.

The design of the Flex lexer is to tokenize the contents of an input stream, and to write any error messages to an output stream. In our implementation, however, errors are returned differently, so the output stream is never used. It's presence is retained, however, in case it is needed in the future.

For now, the general approach should be to supply the input as a string stream, and to use `std::cout` as the output.

Parameters

<i>arg_yyin</i>	The input stream to be tokenized
<i>arg_yyout</i>	The output stream (not currently used)

5.12.3 Member Function Documentation

5.12.3.1 get_next_token()

```
virtual Tang::TangParser::symbol_type Tang::TangScanner::get_next_token ( ) [virtual]
```

A pass-through function that we supply so that we can provide a Bison 3 token return type instead of the `int` that is returned by the default class configuration.

Returns

A Bison 3 token representing the lexeme that was recognized.

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

- [include/tangScanner.hpp](#)

Chapter 6

File Documentation

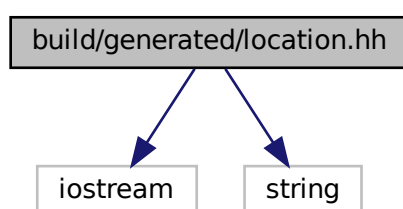
6.1 build/generated/location.hh File Reference

Define the Tang ::location class.

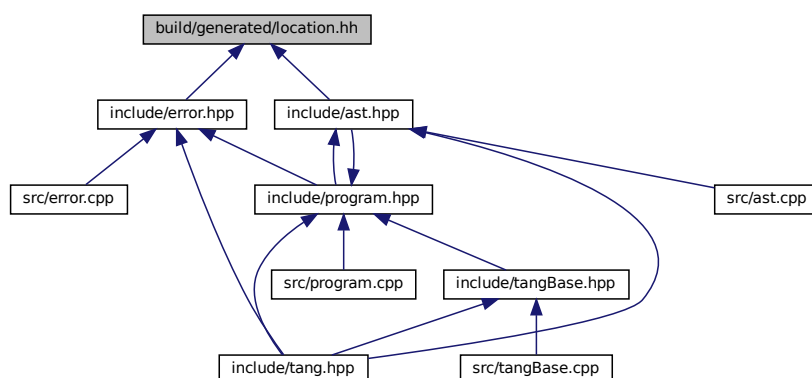
```
#include <iostream>
```

```
#include <string>
```

Include dependency graph for location.hh:



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



Classes

- class [Tang::position](#)
A point in a source file.
- class [Tang::location](#)
Two points in a source file.

Macros

- `#define YY_NULLPTR ((void*)0)`

Functions

- `position & Tang::operator+= (position &res, position::counter_type width)`
Add width columns, in place.
- `position Tang::operator+ (position res, position::counter_type width)`
Add width columns.
- `position & Tang::operator-= (position &res, position::counter_type width)`
Subtract width columns, in place.
- `position Tang::operator- (position res, position::counter_type width)`
Subtract width columns.
- `template<typename YYChar > std::basic_ostream< YYChar > & Tang::operator<< (std::basic_ostream< YYChar > &ostr, const position &pos)`
Intercept output stream redirection.
- `location & Tang::operator+= (location &res, const location &end)`
Join two locations, in place.
- `location Tang::operator+ (location res, const location &end)`
Join two locations.
- `location & Tang::operator+= (location &res, location::counter_type width)`
Add width columns to the end position, in place.
- `location Tang::operator+ (location res, location::counter_type width)`
Add width columns to the end position.
- `location & Tang::operator-= (location &res, location::counter_type width)`
Subtract width columns to the end position, in place.
- `location Tang::operator- (location res, location::counter_type width)`
Subtract width columns to the end position.
- `template<typename YYChar > std::basic_ostream< YYChar > & Tang::operator<< (std::basic_ostream< YYChar > &ostr, const location &loc)`
Intercept output stream redirection.

6.1.1 Detailed Description

Define the Tang ::location class.

6.1.2 Function Documentation

6.1.2.1 operator<<() [1/2]

```
template<typename YYChar >
std::basic_ostream<YYChar>& Tang::operator<< (
    std::basic_ostream< YYChar > & ostr,
    const location & loc )
```

Intercept output stream redirection.

Parameters

<i>ostr</i>	the destination output stream
<i>loc</i>	a reference to the location to redirect

Avoid duplicate information.

6.1.2.2 operator<<() [2/2]

```
template<typename YYChar >
std::basic_ostream<YYChar>& Tang::operator<< (
    std::basic_ostream< YYChar > & ostr,
    const position & pos )
```

Intercept output stream redirection.

Parameters

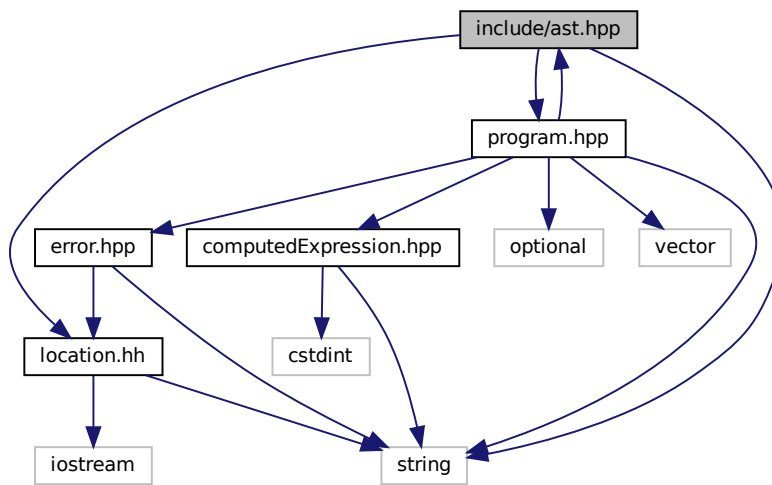
<i>ostr</i>	the destination output stream
<i>pos</i>	a reference to the position to redirect

6.2 include/ast.hpp File Reference

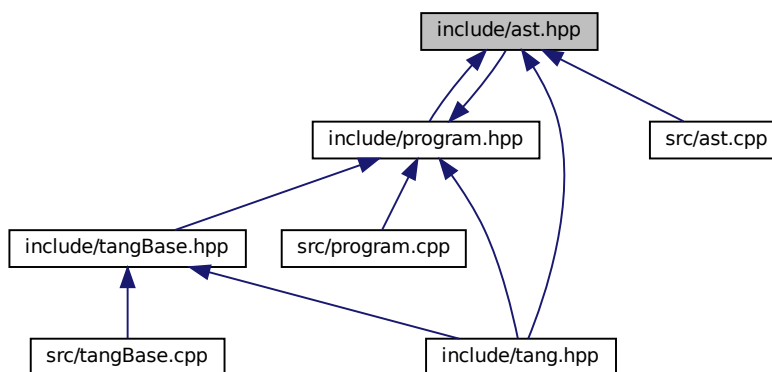
Define the [Tang::AstNode](#) and its associated/derivative classes.

```
#include <string>
#include "location.hh"
#include "program.hpp"
```

Include dependency graph for ast.hpp:



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



Classes

- class [Tang::AstNode](#)
Base class for representing nodes of an Abstract Syntax Tree (AST).
- class [Tang::AstNodeInteger](#)
An [AstNode](#) that represents an integer literal.

6.2.1 Detailed Description

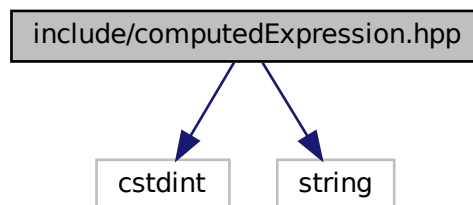
Define the [Tang::AstNode](#) and its associated/derivative classes.

6.3 include/computedExpression.hpp File Reference

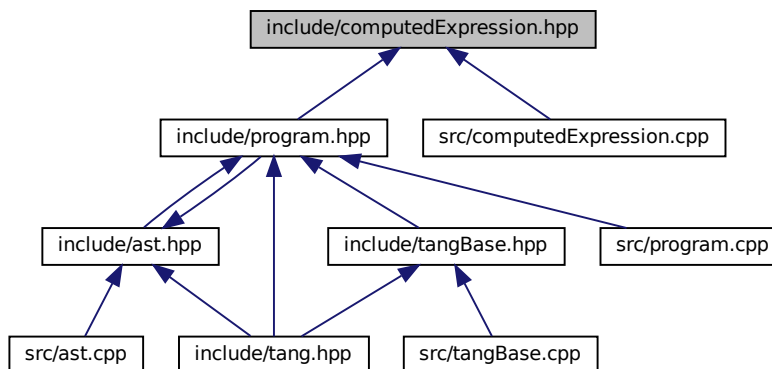
```
#include <stdint>
```

```
#include <string>
```

Include dependency graph for computedExpression.hpp:



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



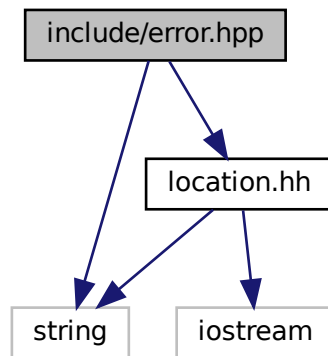
Classes

- class [Tang::ComputedExpression](#)
Represents the result of a computation that has been executed.
- class [Tang::ComputedExpressionInteger](#)
Represents an Integer that is the result of a computation.

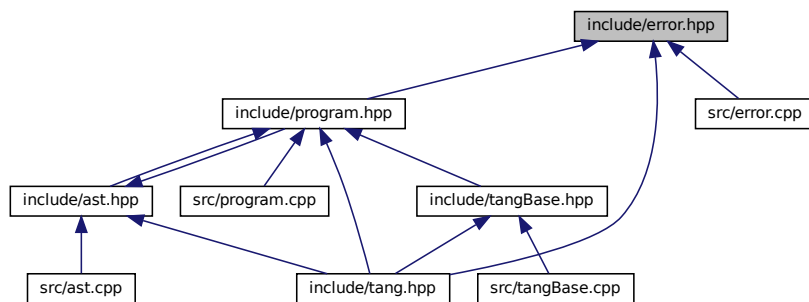
6.4 include/error.hpp File Reference

Define the [Tang::Error](#) class used to describe syntax and runtime errors.

```
#include <string>
#include "location.hh"
Include dependency graph for error.hpp:
```



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



Classes

- class [Tang::Error](#)

The [Error](#) class is used to report any error of the system, whether a syntax (parsing) error or a runtime (execution) error.

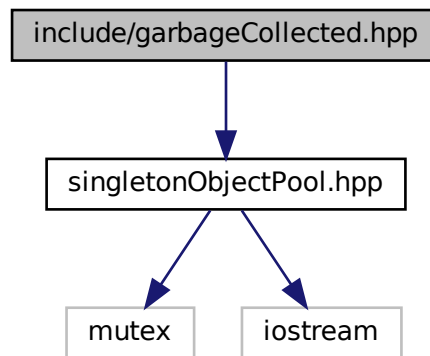
6.4.1 Detailed Description

Define the [Tang::Error](#) class used to describe syntax and runtime errors.

6.5 include/garbageCollected.hpp File Reference

```
#include "singletonObjectPool.hpp"
```

Include dependency graph for garbageCollected.hpp:



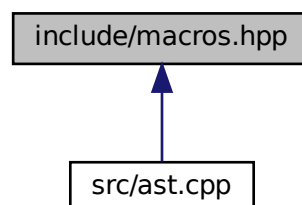
Classes

- class [Tang::GarbageCollected< T >](#)
A container that acts as a resource-counting garbage collector for the specified type.

6.6 include/macros.hpp File Reference

Contains generic macros.

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



Macros

- `#define TANG_UNUSED(x) x`

Instruct the compiler that a function argument will not be used so that it does not generate an error.

6.6.1 Detailed Description

Contains generic macros.

6.6.2 Macro Definition Documentation

6.6.2.1 TANG_UNUSED

```
#define TANG_UNUSED(  
    x ) x
```

Instruct the compiler that a function argument will not be used so that it does not generate an error.

When defining a function, use the `TANG_UNUSED()` macro around any argument which is *not* used in the function, in order to squash any compiler warnings. e.g., `void foo(int TANG_UNUSED(a)) {}`

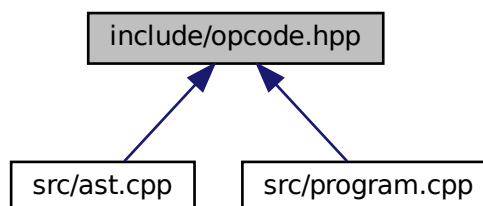
Parameters

x	The argument to be ignored.
---	-----------------------------

6.7 include/opcode.hpp File Reference

Declare the Opcodes used in the Bytecode representation of a program.

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



Enumerations

- enum class [Tang::Opcode](#) { [INTEGER](#) }

6.7.1 Detailed Description

Declare the Opcodes used in the Bytecode representation of a program.

6.7.2 Enumeration Type Documentation

6.7.2.1 Opcode

```
enum Tang::Opcode [strong]
```

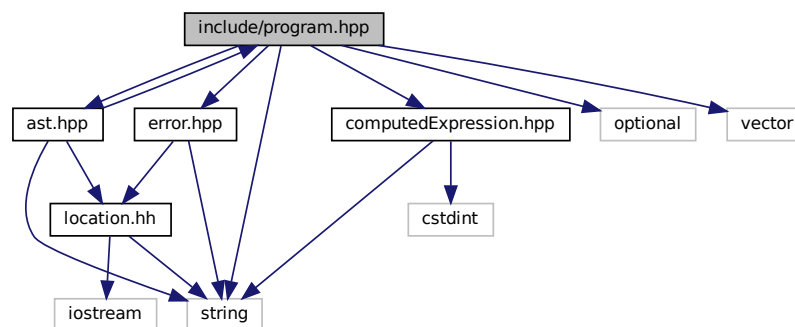
Enumerator

INTEGER	Push an integer onto the stack.
---------	---------------------------------

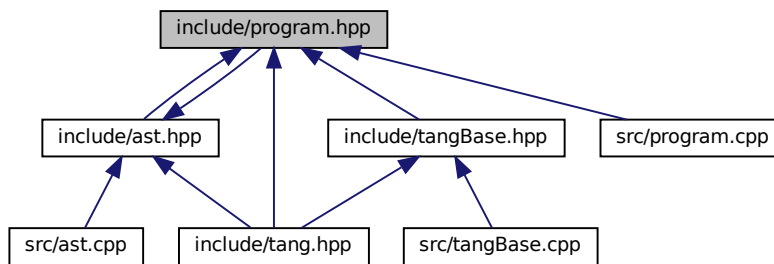
6.8 include/program.hpp File Reference

Define the [Tang::Program](#) class used to compile and execute source code.

```
#include <string>
#include <optional>
#include <vector>
#include "ast.hpp"
#include "error.hpp"
#include "computedExpression.hpp"
Include dependency graph for program.hpp:
```



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



Classes

- class [Tang::Program](#)
Represents a compiled script or template that may be executed.

Typedefs

- using [Tang::Bytecode](#) = `std::vector< uint64_t >`
Contains the Opcodes of a compiled program.

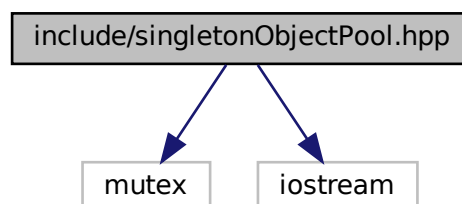
6.8.1 Detailed Description

Define the [Tang::Program](#) class used to compile and execute source code.

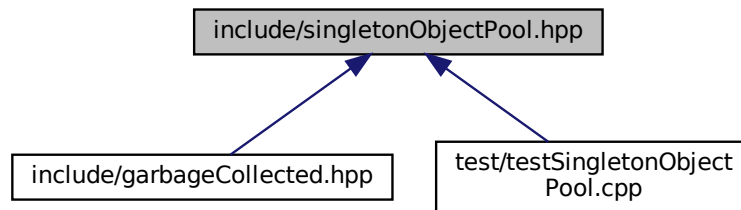
6.9 include/singletonObjectPool.hpp File Reference

```
#include <mutex>
#include <iostream>
```

Include dependency graph for `singletonObjectPool.hpp`:



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



Classes

- class [Tang::SingletonObjectPool< T >](#)

Macros

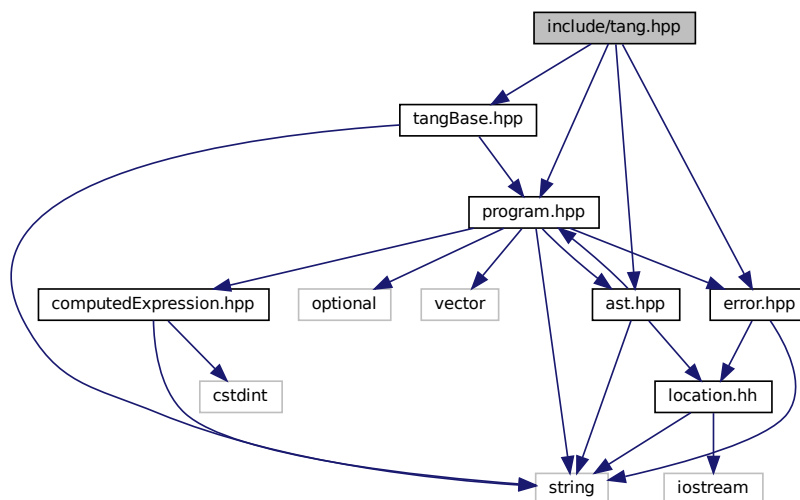
- `#define` [GROW](#) 1024

The threshold size to use when allocating blocks of data, measured in the number of instances of the object type.

6.10 include/tang.hpp File Reference

Header file supplied for use by 3rd party code so that they can easily include all necessary headers.

```
#include "tangBase.hpp"
#include "ast.hpp"
#include "error.hpp"
#include "program.hpp"
Include dependency graph for tang.hpp:
```



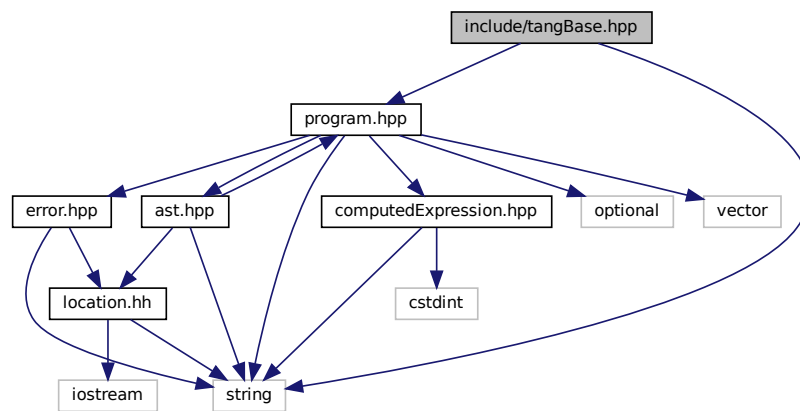
6.10.1 Detailed Description

Header file supplied for use by 3rd party code so that they can easily include all necessary headers.

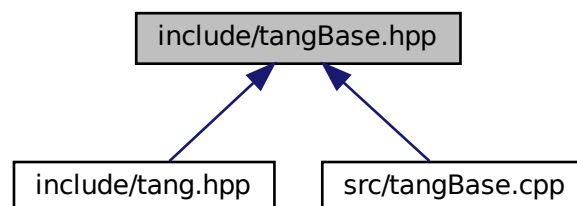
6.11 include/tangBase.hpp File Reference

Defines the [Tang::TangBase](#) class used to interact with Tang.

```
#include <string>
#include "program.hpp"
Include dependency graph for tangBase.hpp:
```



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



Classes

- class [Tang::TangBase](#)

The base class for the Tang programming language.

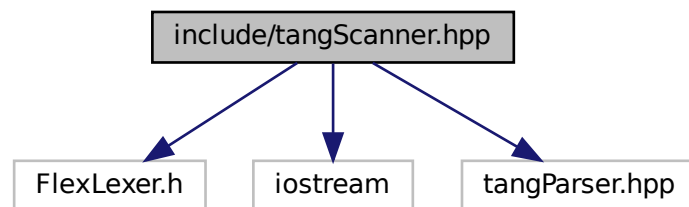
6.11.1 Detailed Description

Defines the [Tang::TangBase](#) class used to interact with Tang.

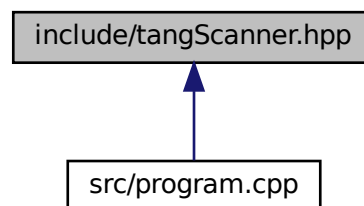
6.12 include/tangScanner.hpp File Reference

Defines the [Tang::TangScanner](#) used to tokenize a Tang script.

```
#include <FlexLexer.h>
#include <iostream>
#include "tangParser.hpp"
Include dependency graph for tangScanner.hpp:
```



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



Classes

- class [Tang::TangScanner](#)

The Flex lexer class for the main Tang language.

Macros

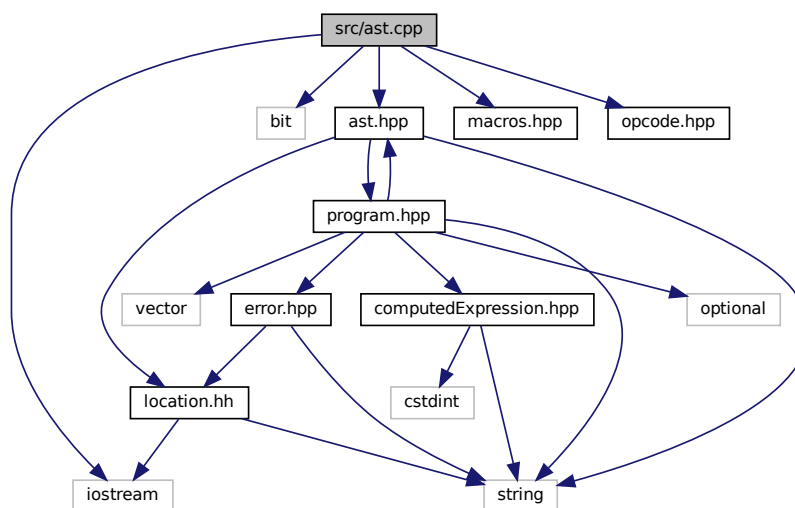
- `#define yyFlexLexer TangTangFlexLexer`
- `#define YY_DECL Tang::TangParser::symbol_type Tang::TangScanner::get_next_token()`

6.12.1 Detailed Description

Defines the [Tang::TangScanner](#) used to tokenize a Tang script.

6.13 src/ast.cpp File Reference

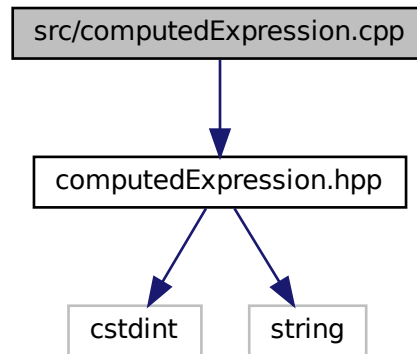
```
#include <iostream>
#include <bit>
#include "ast.hpp"
#include "macros.hpp"
#include "opcode.hpp"
Include dependency graph for ast.cpp:
```



6.14 src/computedExpression.cpp File Reference

```
#include "computedExpression.hpp"
```

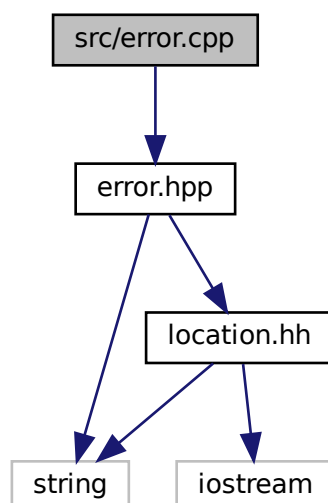
Include dependency graph for computedExpression.cpp:



6.15 src/error.cpp File Reference

```
#include "error.hpp"
```

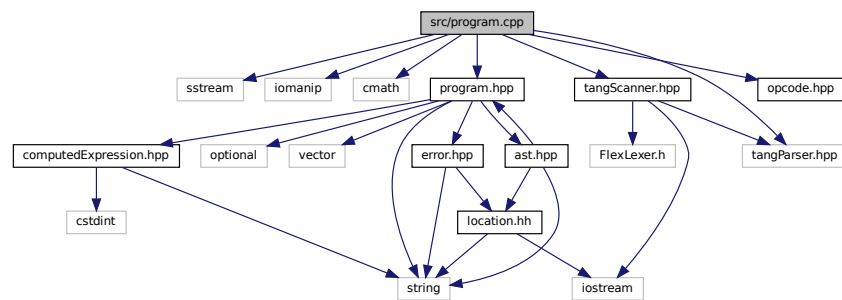
Include dependency graph for error.cpp:



6.16 src/program.cpp File Reference

```
#include <sstream>
#include <iomanip>
#include <cmath>
#include "program.hpp"
#include "tangScanner.hpp"
#include "tangParser.hpp"
#include "opcode.hpp"
```

Include dependency graph for program.cpp:



Macros

- `#define DUMPPROGRAMCHECK(x)`
Verify the size of the Bytecode vector so that it may be safely accessed.
- `#define EXECUTEPROGRAMCHECK(x)`
Verify the size of the Bytecode vector so that it may be safely accessed.

6.16.1 Macro Definition Documentation

6.16.1.1 DUMPPROGRAMCHECK

```
#define DUMPPROGRAMCHECK(  
    x )
```

Value:

```
if (this->bytecode.size() < (pc + (x))) \
    return out.str() + "Error: Opcode truncated\n"
```

Verify the size of the Bytecode vector so that it may be safely accessed.

If the vector is not large enough, an error message is appended to the output string and no further opcodes are printed.

Parameters

x	The number of additional vector entries that should exist.
---	--

6.16.1.2 EXECUTEPROGRAMCHECK

```
#define EXECUTEPROGRAMCHECK(
    x )
```

Value:

```
if (this->bytecode.size() < (pc + (x))) { \
    /* TODO push an error on to the stack! */ \
    pc = this->bytecode.size(); \
    break; \
}
```

Verify the size of the Bytecode vector so that it may be safely accessed.

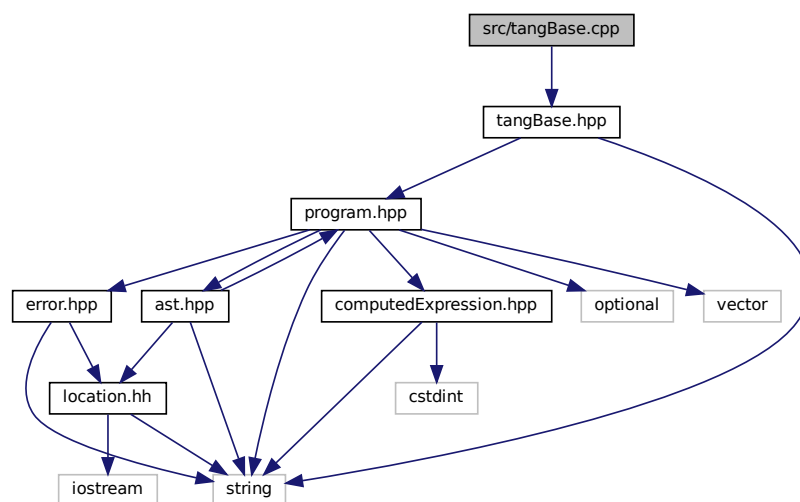
Parameters

x	The number of additional vector entries that should exist.
---	--

6.17 src/tangBase.cpp File Reference

```
#include "tangBase.hpp"
```

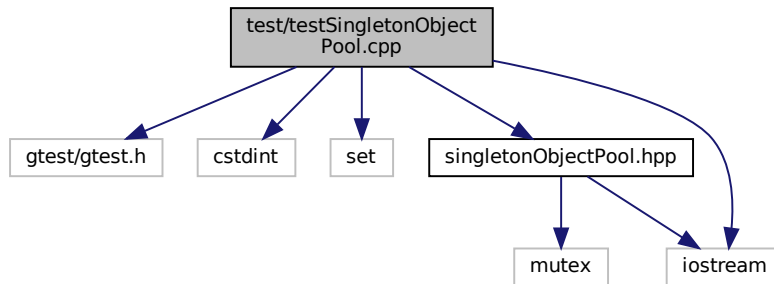
Include dependency graph for tangBase.cpp:



6.18 test/testSingletonObjectPool.cpp File Reference

```
#include <gtest/gtest.h>
#include <stdint>
#include <set>
#include "singletonObjectPool.hpp"
#include <iostream>
```

Include dependency graph for testSingletonObjectPool.cpp:



Functions

- **TEST** (Singleton, SameForSameType)
- **TEST** (Singleton, DifferentForDifferentTypes)
- **TEST** (Get, SuccessiveCallsProduceDifferentMemoryAddresses)
- **TEST** (Recycle, RecycledObjectsAreReused)
- **TEST** (Get, SuccessiveCallsAreSequential)
- **TEST** (Get, KeepsGeneratingDifferentPointers)
- **TEST** (Recycle, WorksAfterLargeNumberOfAllocations)
- `int main` (`int argc`, `char **argv`)

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