Tang

0.1

Generated by Doxygen 1.9.1

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

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

Chapter 3

Class Index

3.1 Class List

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

Chapter 4

File Index

4.1 File List

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

Chapter 5

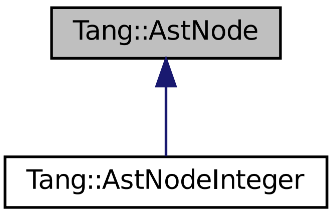
Class Documentation

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:



Public Member Functions

- 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.

Protected Member Functions

- AstNode (Tang::location loc)

  The generic constructor.

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

loc	The location associated with this node.

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

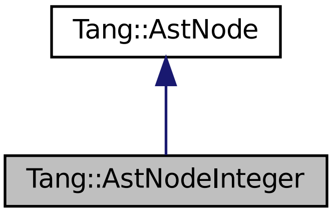
- include/ast.hpp
- src/ast.cpp

5.2 Tang::AstNodeInteger Class Reference

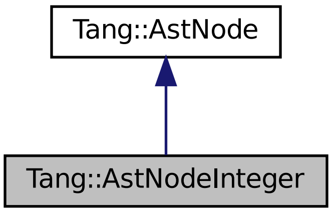
An AstNode that represents an integer literal.

```
#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.

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

number	The number to represent.
loc	The location associated with the expression. @location The location associated with this node.

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

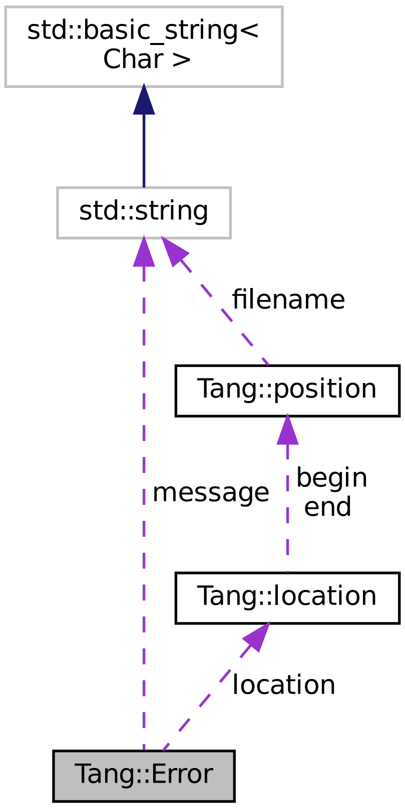
- include/ast.hpp
- src/ast.cpp

5.3 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.

5.3.1 Detailed Description

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

5.3.2 Constructor & Destructor Documentation

5.3.2.1 Error()

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

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

Parameters

message	The error message as a string.
location	The location of the error.

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

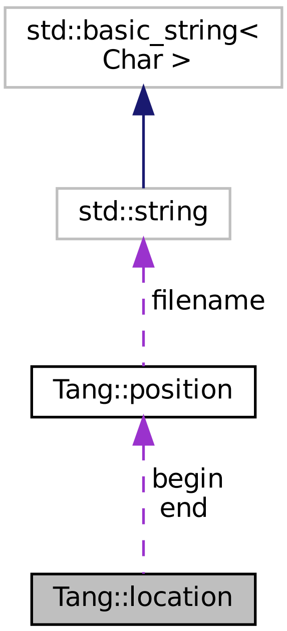
- include/error.hpp
- src/error.cpp

5.4 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.

5.4.1 Detailed Description

Two points in a source file.

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

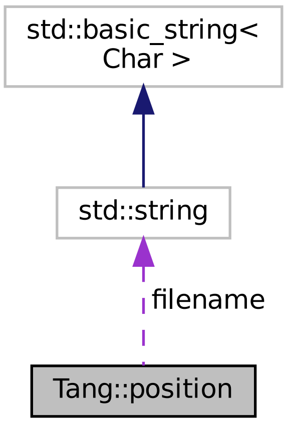
- build/generated/location.hh

5.5 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.

5.5.1 Detailed Description

A point in a source file.

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

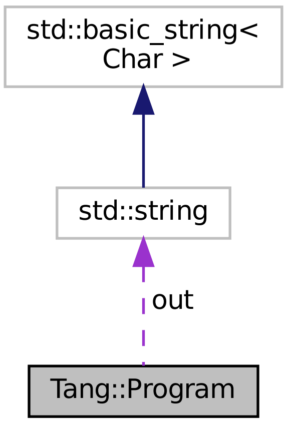
- build/generated/location.hh

5.6 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.
- 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.
- void execute ()

    Execute the program.
- void addBytecode (uint64_t)

    Add a uint64_t to the Bytecode.

Public Attributes

- std::string out

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

5.6.1 Detailed Description

Represents a compiled script or template that may be executed.

5.6.2 Member Enumeration Documentation

5.6.2.1 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.

5.6.3 Constructor & Destructor Documentation

5.6.3.1 Program()

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

Create a compiled program using the provided code.

Parameters

code	The code to be compiled.
codeType	Whether the code is a `Script` or `Template`.

5.6.4 Member Function Documentation

5.6.4.1 addBytecode()

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

Add a uint64_t to the Bytecode.

Parameters

op	The value to add to the Bytecode

5.6.4.2 dumpBytecode()

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

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

Returns

A string containing the Opcode representation.

5.6.4.3 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.

5.6.4.4 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.

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

- include/program.hpp
- src/program.cpp

5.7 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.

5.7.1 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).

5.7.2 Constructor & Destructor Documentation

5.7.2.1 TangBase()

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

The constructor.

Isn't it glorious.

5.7.3 Member Function Documentation

5.7.3.1 compileScript()

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

Compile the provided source code as a script and return a Program.

Parameters

script	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:

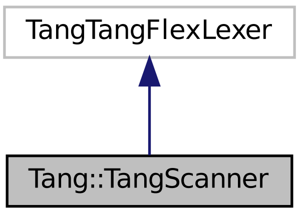
- include/tangBase.hpp
- src/tangBase.cpp

5.8 Tang::TangScanner Class Reference

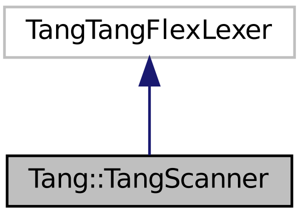
The Flex lexer class for the main Tang language.

```
#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.*

5.8.1 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.

5.8.2 Constructor & Destructor Documentation

5.8.2.1 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

arg_yyin	The input stream to be tokenized
arg_yyout	The output stream (not currently used)

5.8.3 Member Function Documentation

5.8.3.1 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

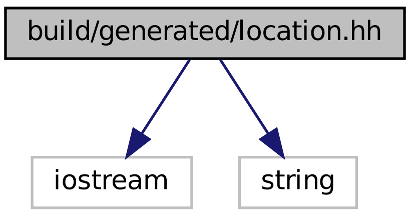
File Documentation

6.1 build/generated/location.hh File Reference

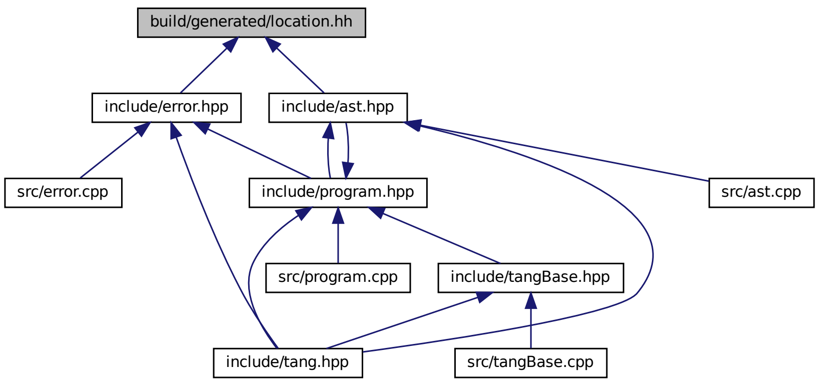
Define the Tang ::location class.

```
#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

ostr	the destination output stream
loc	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

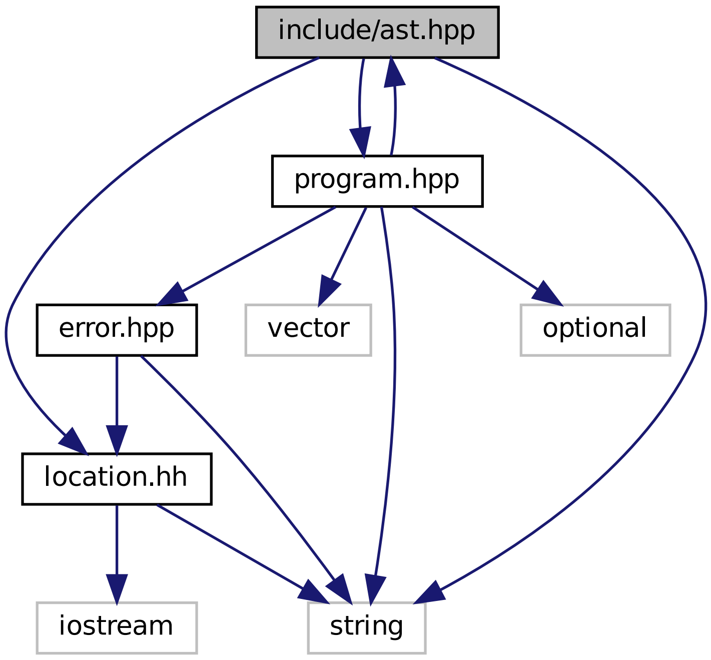
ostr	the destination output stream
pos	a reference to the position to redirect

6.2 include/ast.hpp File Reference

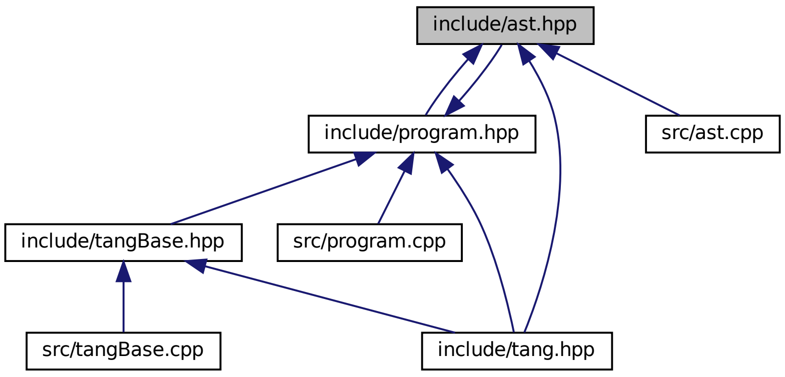
Define the Tang::AstNode and its associated/derivative classes.

```
#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

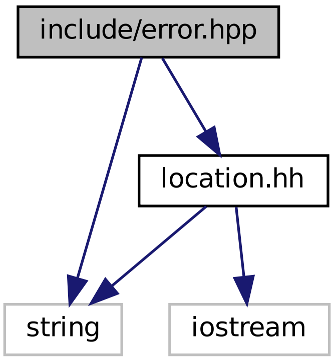
Define the Tang::AstNode and its associated/derivative classes.

6.3 include/error.hpp File Reference

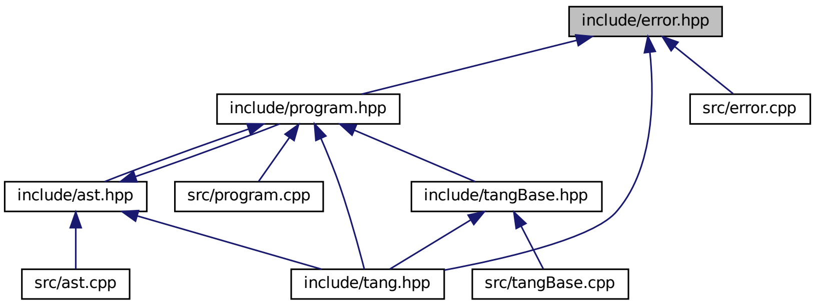
Define the Tang::Error class used to describe syntax and runtime errors.

```
#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.

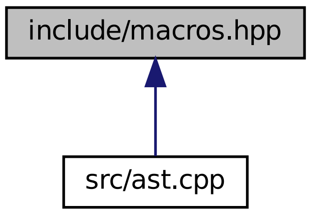
6.3.1 Detailed Description

Define the Tang::Error class used to describe syntax and runtime errors.

6.4 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.

6.4.1 Detailed Description

Contains generic macros.

6.4.2 Macro Definition Documentation

6.4.2.1 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 funcion, 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)) {}

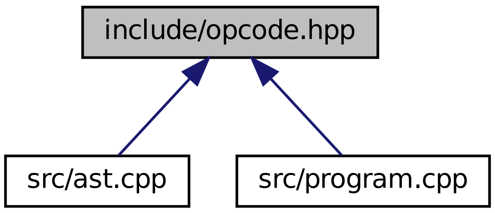
Parameters

x	The argument to be ignored.

6.5 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 { OP_INTEGER }

6.5.1 Detailed Description

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

6.5.2 Enumeration Type Documentation

6.5.2.1 Opcode

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

Enumerator

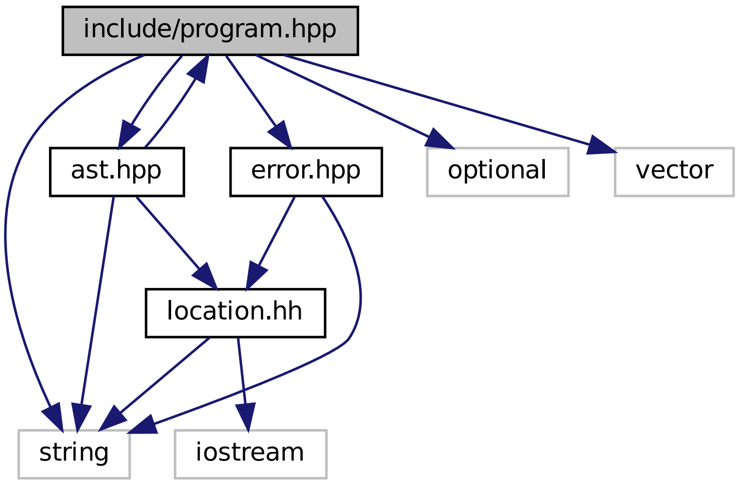
OP_INTEGER	Push an integer onto the stack.

6.6 include/program.hpp File Reference

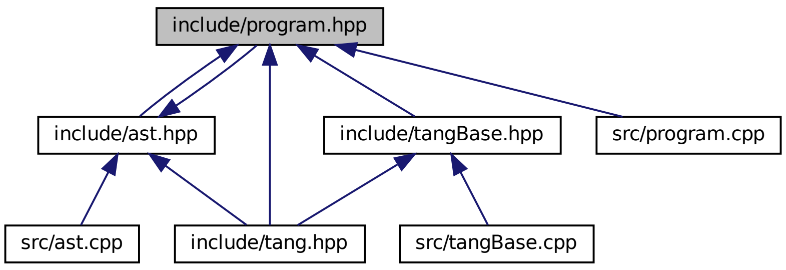
Define the Tang::Program class used to compile and execute source code.

```
#include <string>
#include <optional>
#include <vector>
#include "ast.hpp"
#include "error.hpp"
```

Include 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.

6.6.1 Detailed Description

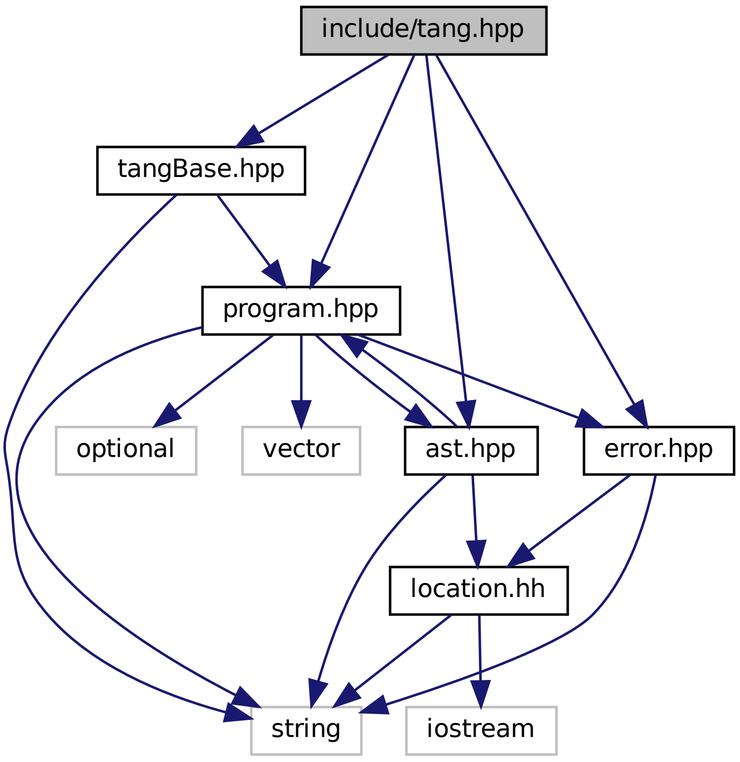
Define the Tang::Program class used to compile and execute source code.

6.7 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:



6.7.1 Detailed Description

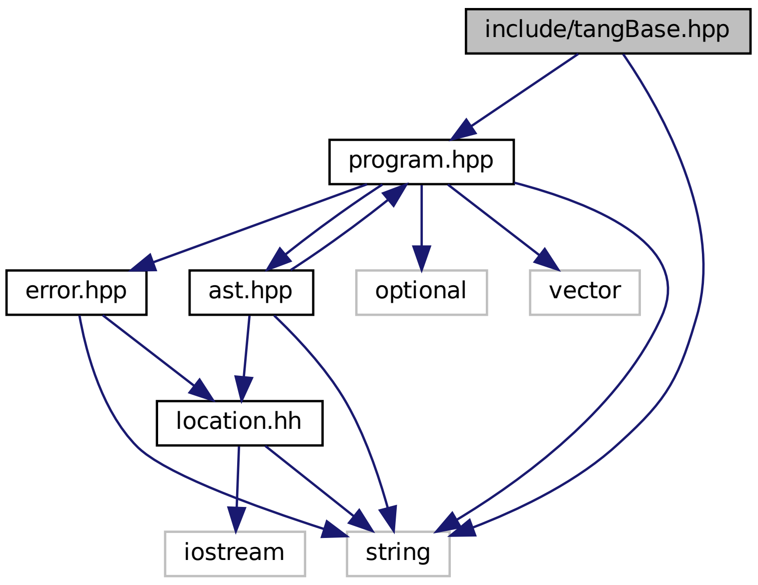
Header file supplied for use by 3rd party code so that they can easily include all necessary headers.

6.8 include/tangBase.hpp File Reference

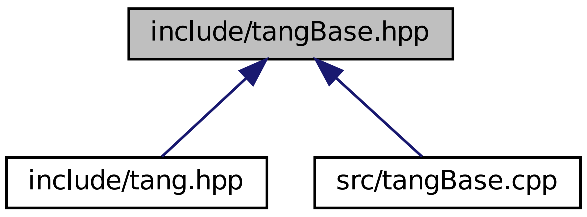
Defines the Tang::TangBase class used to interact with Tang.

```
#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.

6.8.1 Detailed Description

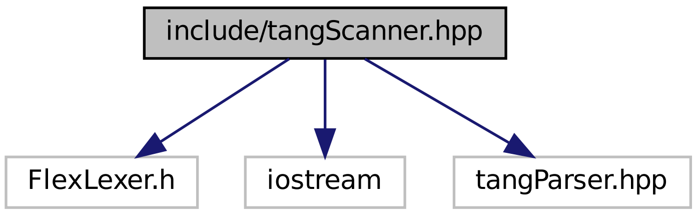
Defines the Tang::TangBase class used to interact with Tang.

6.9 include/tangScanner.hpp File Reference

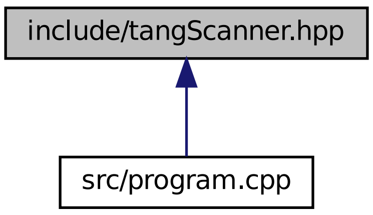
Defines the Tang::TangScanner used to tokenize a Tang script.

```
#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()

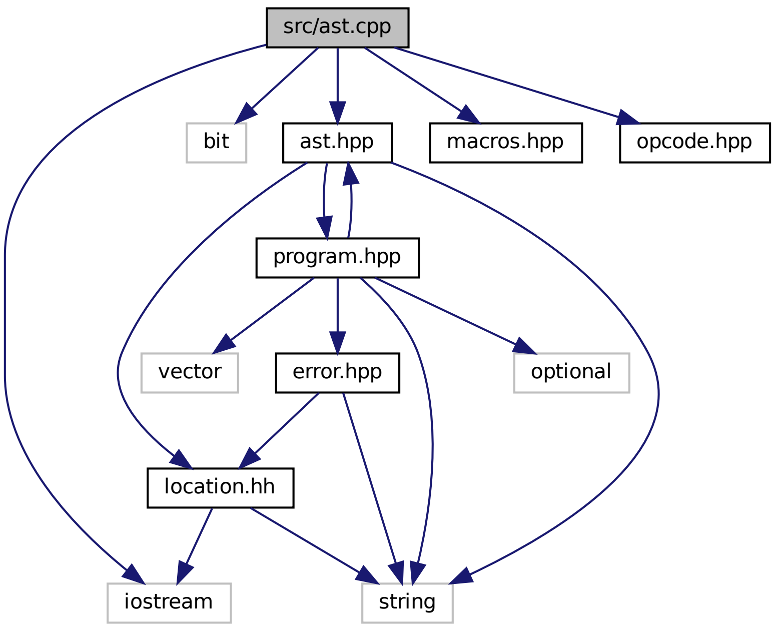
6.9.1 Detailed Description

Defines the Tang::TangScanner used to tokenize a Tang script.

6.10 src/ast.cpp File Reference

```
#include <iostream>
#include <bit>
#include "ast.hpp"
#include "macros.hpp"
#include "opcode.hpp"
```

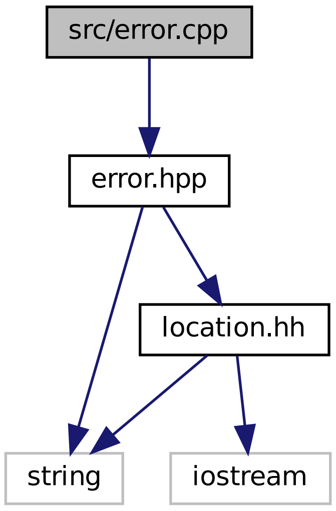
Include dependency graph for ast.cpp:



6.11 src/error.cpp File Reference

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

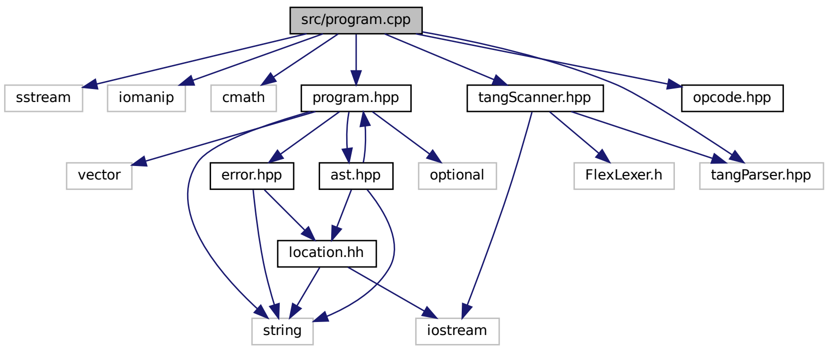
Include dependency graph for error.cpp:



6.12 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.

6.12.1 Macro Definition Documentation

6.12.1.1 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.

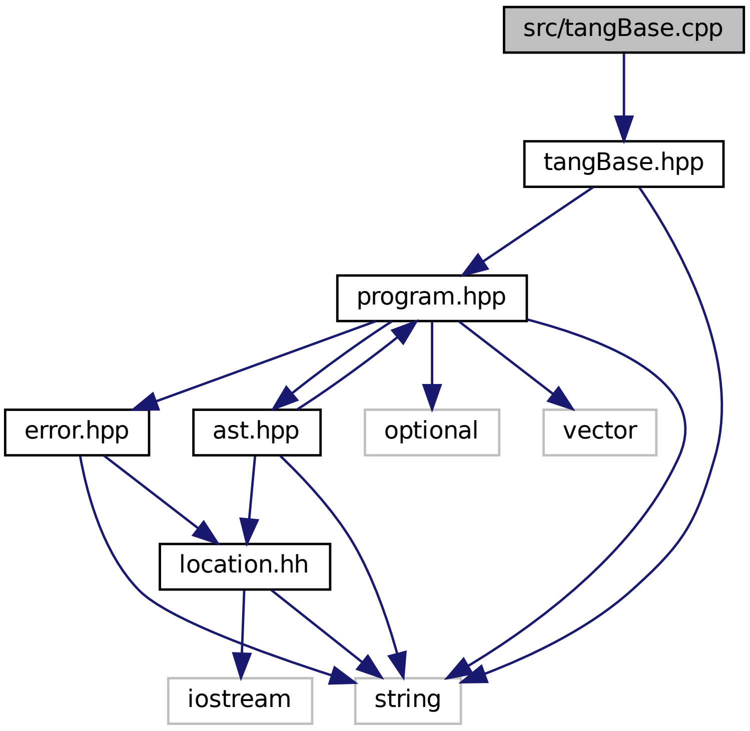
Parameters

x	The number of additional vector entries that should exist.

6.13 src/tangBase.cpp File Reference

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

Include dependency graph for tangBase.cpp:



Index