

Tang

0.1

Generated by Doxygen 1.9.1

1 Tang: A Template Language	1
1.1 Quick Description	1
1.2 Features	1
1.3 License	1
2 Hierarchical Index	3
2.1 Class Hierarchy	3
3 Class Index	5
3.1 Class List	5
4 File Index	7
4.1 File List	7
5 Class Documentation	11
5.1 Tang::AstNode Class Reference	11
5.1.1 Detailed Description	13
5.1.2 Constructor & Destructor Documentation	13
5.1.2.1 AstNode()	13
5.1.3 Member Function Documentation	13
5.1.3.1 collectIdentifiers()	13
5.2 Tang::AstNodeAssign Class Reference	14
5.2.1 Detailed Description	15
5.2.2 Constructor & Destructor Documentation	15
5.2.2.1 AstNodeAssign()	15
5.2.3 Member Function Documentation	15
5.2.3.1 collectIdentifiers()	15
5.3 Tang::AstNodeBinary Class Reference	16
5.3.1 Detailed Description	17
5.3.2 Member Enumeration Documentation	17
5.3.2.1 Operation	17
5.3.3 Constructor & Destructor Documentation	18
5.3.3.1 AstNodeBinary()	18
5.3.4 Member Function Documentation	18
5.3.4.1 collectIdentifiers()	18
5.4 Tang::AstNodeBlock Class Reference	18
5.4.1 Detailed Description	19
5.4.2 Constructor & Destructor Documentation	20
5.4.2.1 AstNodeBlock()	20
5.4.3 Member Function Documentation	20
5.4.3.1 collectIdentifiers()	20
5.5 Tang::AstNodeBoolean Class Reference	20
5.5.1 Detailed Description	21
5.5.2 Constructor & Destructor Documentation	21

5.5.2.1 AstNodeBoolean()	22
5.5.3 Member Function Documentation	22
5.5.3.1 collectIdentifiers()	22
5.6 Tang::AstNodeCast Class Reference	22
5.6.1 Detailed Description	23
5.6.2 Member Enumeration Documentation	24
5.6.2.1 Type	24
5.6.3 Constructor & Destructor Documentation	24
5.6.3.1 AstNodeCast()	24
5.6.4 Member Function Documentation	24
5.6.4.1 collectIdentifiers()	24
5.7 Tang::AstNodeDoWhile Class Reference	25
5.7.1 Detailed Description	26
5.7.2 Constructor & Destructor Documentation	26
5.7.2.1 AstNodeDoWhile()	26
5.7.3 Member Function Documentation	26
5.7.3.1 collectIdentifiers()	26
5.8 Tang::AstNodeFloat Class Reference	27
5.8.1 Detailed Description	28
5.8.2 Constructor & Destructor Documentation	28
5.8.2.1 AstNodeFloat()	28
5.8.3 Member Function Documentation	28
5.8.3.1 collectIdentifiers()	28
5.9 Tang::AstNodeFor Class Reference	29
5.9.1 Detailed Description	30
5.9.2 Constructor & Destructor Documentation	30
5.9.2.1 AstNodeFor()	30
5.9.3 Member Function Documentation	30
5.9.3.1 collectIdentifiers()	30
5.10 Tang::AstNodeIdentifier Class Reference	31
5.10.1 Detailed Description	32
5.10.2 Constructor & Destructor Documentation	32
5.10.2.1 AstNodeIdentifier()	32
5.10.3 Member Function Documentation	32
5.10.3.1 collectIdentifiers()	33
5.11 Tang::AstNodeIfElse Class Reference	33
5.11.1 Detailed Description	34
5.11.2 Constructor & Destructor Documentation	34
5.11.2.1 AstNodeIfElse() [1/2]	34
5.11.2.2 AstNodeIfElse() [2/2]	34
5.11.3 Member Function Documentation	36
5.11.3.1 collectIdentifiers()	36

5.12 Tang::AstNodeInteger Class Reference	36
5.12.1 Detailed Description	37
5.12.2 Constructor & Destructor Documentation	37
5.12.2.1 AstNodeInteger()	37
5.12.3 Member Function Documentation	38
5.12.3.1 collectIdentifiers()	38
5.13 Tang::AstNodePrint Class Reference	38
5.13.1 Detailed Description	39
5.13.2 Member Enumeration Documentation	39
5.13.2.1 Type	39
5.13.3 Constructor & Destructor Documentation	40
5.13.3.1 AstNodePrint()	40
5.13.4 Member Function Documentation	40
5.13.4.1 collectIdentifiers()	40
5.14 Tang::AstNodeString Class Reference	41
5.14.1 Detailed Description	41
5.14.2 Constructor & Destructor Documentation	42
5.14.2.1 AstNodeString()	42
5.14.3 Member Function Documentation	42
5.14.3.1 collectIdentifiers()	42
5.15 Tang::AstNodeUnary Class Reference	42
5.15.1 Detailed Description	43
5.15.2 Member Enumeration Documentation	44
5.15.2.1 Operator	44
5.15.3 Constructor & Destructor Documentation	44
5.15.3.1 AstNodeUnary()	44
5.15.4 Member Function Documentation	44
5.15.4.1 collectIdentifiers()	44
5.16 Tang::AstNodeWhile Class Reference	45
5.16.1 Detailed Description	46
5.16.2 Constructor & Destructor Documentation	46
5.16.2.1 AstNodeWhile()	46
5.16.3 Member Function Documentation	46
5.16.3.1 collectIdentifiers()	46
5.17 Tang::ComputedExpression Class Reference	47
5.17.1 Detailed Description	48
5.17.2 Member Function Documentation	48
5.17.2.1 __add()	48
5.17.2.2 __boolean()	49
5.17.2.3 __divide()	49
5.17.2.4 __equal()	50
5.17.2.5 __float()	50

5.17.2.6 <code>__integer()</code>	50
5.17.2.7 <code>__lessThan()</code>	50
5.17.2.8 <code>__modulo()</code>	51
5.17.2.9 <code>__multiply()</code>	51
5.17.2.10 <code>__negative()</code>	52
5.17.2.11 <code>__not()</code>	52
5.17.2.12 <code>__string()</code>	52
5.17.2.13 <code>__subtract()</code>	52
5.17.2.14 <code>dump()</code>	53
5.17.2.15 <code>is_equal()</code> [1/6]	53
5.17.2.16 <code>is_equal()</code> [2/6]	54
5.17.2.17 <code>is_equal()</code> [3/6]	54
5.17.2.18 <code>is_equal()</code> [4/6]	54
5.17.2.19 <code>is_equal()</code> [5/6]	55
5.17.2.20 <code>is_equal()</code> [6/6]	55
5.17.2.21 <code>makeCopy()</code>	55
5.18 Tang::ComputedExpressionBoolean Class Reference	56
5.18.1 Detailed Description	57
5.18.2 Constructor & Destructor Documentation	58
5.18.2.1 <code>ComputedExpressionBoolean()</code>	58
5.18.3 Member Function Documentation	58
5.18.3.1 <code>__add()</code>	58
5.18.3.2 <code>__boolean()</code>	58
5.18.3.3 <code>__divide()</code>	59
5.18.3.4 <code>__equal()</code>	59
5.18.3.5 <code>__float()</code>	59
5.18.3.6 <code>__integer()</code>	60
5.18.3.7 <code>__lessThan()</code>	60
5.18.3.8 <code>__modulo()</code>	60
5.18.3.9 <code>__multiply()</code>	61
5.18.3.10 <code>__negative()</code>	61
5.18.3.11 <code>__not()</code>	61
5.18.3.12 <code>__string()</code>	62
5.18.3.13 <code>__subtract()</code>	62
5.18.3.14 <code>dump()</code>	62
5.18.3.15 <code>is_equal()</code> [1/6]	62
5.18.3.16 <code>is_equal()</code> [2/6]	63
5.18.3.17 <code>is_equal()</code> [3/6]	63
5.18.3.18 <code>is_equal()</code> [4/6]	64
5.18.3.19 <code>is_equal()</code> [5/6]	64
5.18.3.20 <code>is_equal()</code> [6/6]	64
5.18.3.21 <code>makeCopy()</code>	65

5.19 Tang::ComputedExpressionError Class Reference	65
5.19.1 Detailed Description	67
5.19.2 Constructor & Destructor Documentation	67
5.19.2.1 ComputedExpressionError()	67
5.19.3 Member Function Documentation	67
5.19.3.1 __add()	67
5.19.3.2 __boolean()	68
5.19.3.3 __divide()	68
5.19.3.4 __equal()	68
5.19.3.5 __float()	69
5.19.3.6 __integer()	69
5.19.3.7 __lessThan()	69
5.19.3.8 __modulo()	70
5.19.3.9 __multiply()	70
5.19.3.10 __negative()	71
5.19.3.11 __not()	71
5.19.3.12 __string()	71
5.19.3.13 __subtract()	71
5.19.3.14 dump()	72
5.19.3.15 is_equal() [1/6]	72
5.19.3.16 is_equal() [2/6]	73
5.19.3.17 is_equal() [3/6]	74
5.19.3.18 is_equal() [4/6]	74
5.19.3.19 is_equal() [5/6]	75
5.19.3.20 is_equal() [6/6]	75
5.19.3.21 makeCopy()	75
5.20 Tang::ComputedExpressionFloat Class Reference	76
5.20.1 Detailed Description	77
5.20.2 Constructor & Destructor Documentation	77
5.20.2.1 ComputedExpressionFloat()	77
5.20.3 Member Function Documentation	78
5.20.3.1 __add()	78
5.20.3.2 __boolean()	78
5.20.3.3 __divide()	78
5.20.3.4 __equal()	79
5.20.3.5 __float()	79
5.20.3.6 __integer()	80
5.20.3.7 __lessThan()	80
5.20.3.8 __modulo()	80
5.20.3.9 __multiply()	81
5.20.3.10 __negative()	81
5.20.3.11 __not()	81

5.20.3.12	<code>__string()</code>	82
5.20.3.13	<code>__subtract()</code>	82
5.20.3.14	<code>dump()</code>	82
5.20.3.15	<code>is_equal()</code> [1/6]	83
5.20.3.16	<code>is_equal()</code> [2/6]	83
5.20.3.17	<code>is_equal()</code> [3/6]	83
5.20.3.18	<code>is_equal()</code> [4/6]	84
5.20.3.19	<code>is_equal()</code> [5/6]	84
5.20.3.20	<code>is_equal()</code> [6/6]	85
5.20.3.21	<code>makeCopy()</code>	85
5.21	<code>Tang::ComputedExpressionInteger</code> Class Reference	85
5.21.1	Detailed Description	87
5.21.2	Constructor & Destructor Documentation	87
5.21.2.1	<code>ComputedExpressionInteger()</code>	87
5.21.3	Member Function Documentation	88
5.21.3.1	<code>__add()</code>	88
5.21.3.2	<code>__boolean()</code>	88
5.21.3.3	<code>__divide()</code>	88
5.21.3.4	<code>__equal()</code>	89
5.21.3.5	<code>__float()</code>	89
5.21.3.6	<code>__integer()</code>	90
5.21.3.7	<code>__lessThan()</code>	90
5.21.3.8	<code>__modulo()</code>	90
5.21.3.9	<code>__multiply()</code>	91
5.21.3.10	<code>__negative()</code>	91
5.21.3.11	<code>__not()</code>	91
5.21.3.12	<code>__string()</code>	92
5.21.3.13	<code>__subtract()</code>	92
5.21.3.14	<code>dump()</code>	92
5.21.3.15	<code>is_equal()</code> [1/6]	93
5.21.3.16	<code>is_equal()</code> [2/6]	93
5.21.3.17	<code>is_equal()</code> [3/6]	93
5.21.3.18	<code>is_equal()</code> [4/6]	94
5.21.3.19	<code>is_equal()</code> [5/6]	94
5.21.3.20	<code>is_equal()</code> [6/6]	95
5.21.3.21	<code>makeCopy()</code>	95
5.22	<code>Tang::ComputedExpressionString</code> Class Reference	95
5.22.1	Detailed Description	97
5.22.2	Constructor & Destructor Documentation	97
5.22.2.1	<code>ComputedExpressionString()</code>	97
5.22.3	Member Function Documentation	98
5.22.3.1	<code>__add()</code>	98

5.22.3.2	__boolean()	98
5.22.3.3	__divide()	98
5.22.3.4	__equal()	99
5.22.3.5	__float()	99
5.22.3.6	__integer()	99
5.22.3.7	__lessThan()	100
5.22.3.8	__modulo()	100
5.22.3.9	__multiply()	100
5.22.3.10	__negative()	101
5.22.3.11	__not()	101
5.22.3.12	__string()	101
5.22.3.13	__subtract()	101
5.22.3.14	dump()	102
5.22.3.15	is_equal() [1/6]	102
5.22.3.16	is_equal() [2/6]	102
5.22.3.17	is_equal() [3/6]	103
5.22.3.18	is_equal() [4/6]	103
5.22.3.19	is_equal() [5/6]	104
5.22.3.20	is_equal() [6/6]	104
5.22.3.21	makeCopy()	104
5.23	Tang::Error Class Reference	105
5.23.1	Detailed Description	106
5.23.2	Constructor & Destructor Documentation	106
5.23.2.1	Error() [1/2]	106
5.23.2.2	Error() [2/2]	106
5.23.3	Friends And Related Function Documentation	106
5.23.3.1	operator<<	107
5.24	Tang::GarbageCollected Class Reference	107
5.24.1	Detailed Description	109
5.24.2	Constructor & Destructor Documentation	109
5.24.2.1	GarbageCollected() [1/3]	109
5.24.2.2	GarbageCollected() [2/3]	110
5.24.2.3	~GarbageCollected()	110
5.24.2.4	GarbageCollected() [3/3]	110
5.24.3	Member Function Documentation	110
5.24.3.1	make()	110
5.24.3.2	operator"!()	111
5.24.3.3	operator"!=(())	111
5.24.3.4	operator%()	112
5.24.3.5	operator*() [1/2]	113
5.24.3.6	operator*() [2/2]	113
5.24.3.7	operator+()	113

5.24.3.8 operator-() [1/2]	114
5.24.3.9 operator-() [2/2]	114
5.24.3.10 operator->()	115
5.24.3.11 operator/()	115
5.24.3.12 operator<()	116
5.24.3.13 operator<=()	116
5.24.3.14 operator=() [1/2]	117
5.24.3.15 operator=() [2/2]	117
5.24.3.16 operator==() [1/8]	118
5.24.3.17 operator==() [2/8]	118
5.24.3.18 operator==() [3/8]	119
5.24.3.19 operator==() [4/8]	119
5.24.3.20 operator==() [5/8]	119
5.24.3.21 operator==() [6/8]	120
5.24.3.22 operator==() [7/8]	120
5.24.3.23 operator==() [8/8]	121
5.24.3.24 operator>()	121
5.24.3.25 operator>=()	121
5.24.4 Friends And Related Function Documentation	122
5.24.4.1 operator<<	122
5.25 Tang::location Class Reference	122
5.25.1 Detailed Description	124
5.26 Tang::position Class Reference	124
5.26.1 Detailed Description	125
5.27 Tang::Program Class Reference	125
5.27.1 Detailed Description	127
5.27.2 Member Enumeration Documentation	127
5.27.2.1 CodeType	127
5.27.3 Constructor & Destructor Documentation	127
5.27.3.1 Program()	127
5.27.4 Member Function Documentation	128
5.27.4.1 addBytecode()	128
5.27.4.2 dumpBytecode()	128
5.27.4.3 execute()	128
5.27.4.4 getAst()	129
5.27.4.5 getBytecode()	129
5.27.4.6 getCode()	129
5.27.4.7 getResult()	129
5.27.4.8 setJumpTarget()	129
5.28 Tang::SingletonObjectPool< T > Class Template Reference	130
5.28.1 Detailed Description	130
5.28.2 Member Function Documentation	130

5.28.2.1 get()	131
5.28.2.2 getInstance()	131
5.28.2.3 recycle()	131
5.29 Tang::TangBase Class Reference	131
5.29.1 Detailed Description	132
5.29.2 Constructor & Destructor Documentation	132
5.29.2.1 TangBase()	132
5.29.3 Member Function Documentation	132
5.29.3.1 compileScript()	132
5.30 Tang::TangScanner Class Reference	133
5.30.1 Detailed Description	134
5.30.2 Constructor & Destructor Documentation	134
5.30.2.1 TangScanner()	134
5.30.3 Member Function Documentation	134
5.30.3.1 get_next_token()	134
6 File Documentation	135
6.1 build/generated/location.hh File Reference	135
6.1.1 Detailed Description	136
6.1.2 Function Documentation	136
6.1.2.1 operator<<() [1/2]	136
6.1.2.2 operator<<() [2/2]	137
6.2 include/astNode.hpp File Reference	137
6.2.1 Detailed Description	138
6.3 include/astNodeAssign.hpp File Reference	138
6.3.1 Detailed Description	139
6.4 include/astNodeBinary.hpp File Reference	139
6.4.1 Detailed Description	140
6.5 include/astNodeBlock.hpp File Reference	140
6.5.1 Detailed Description	141
6.6 include/astNodeBoolean.hpp File Reference	141
6.6.1 Detailed Description	142
6.7 include/astNodeCast.hpp File Reference	142
6.7.1 Detailed Description	143
6.8 include/astNodeDoWhile.hpp File Reference	143
6.8.1 Detailed Description	144
6.9 include/astNodeFloat.hpp File Reference	144
6.9.1 Detailed Description	145
6.10 include/astNodeFor.hpp File Reference	145
6.10.1 Detailed Description	146
6.11 include/astNodeIdentifier.hpp File Reference	146
6.11.1 Detailed Description	147

6.12 include/astNodeIfElse.hpp File Reference	147
6.12.1 Detailed Description	148
6.13 include/astNodeInteger.hpp File Reference	148
6.13.1 Detailed Description	149
6.14 include/astNodePrint.hpp File Reference	149
6.14.1 Detailed Description	150
6.15 include/astNodeString.hpp File Reference	150
6.15.1 Detailed Description	151
6.16 include/astNodeUnary.hpp File Reference	151
6.16.1 Detailed Description	152
6.17 include/astNodeWhile.hpp File Reference	152
6.17.1 Detailed Description	153
6.18 include/computedExpression.hpp File Reference	153
6.18.1 Detailed Description	154
6.19 include/computedExpressionBoolean.hpp File Reference	154
6.19.1 Detailed Description	155
6.20 include/computedExpressionError.hpp File Reference	155
6.20.1 Detailed Description	156
6.21 include/computedExpressionFloat.hpp File Reference	156
6.21.1 Detailed Description	156
6.22 include/computedExpressionInteger.hpp File Reference	157
6.22.1 Detailed Description	157
6.23 include/computedExpressionString.hpp File Reference	158
6.23.1 Detailed Description	158
6.24 include/error.hpp File Reference	159
6.24.1 Detailed Description	159
6.25 include/garbageCollected.hpp File Reference	160
6.25.1 Detailed Description	160
6.26 include/macros.hpp File Reference	160
6.26.1 Detailed Description	161
6.26.2 Macro Definition Documentation	161
6.26.2.1 TANG_UNUSED	161
6.27 include/opcode.hpp File Reference	161
6.27.1 Detailed Description	162
6.27.2 Enumeration Type Documentation	162
6.27.2.1 Opcode	162
6.28 include/program.hpp File Reference	163
6.28.1 Detailed Description	163
6.29 include/singletonObjectPool.hpp File Reference	164
6.29.1 Detailed Description	164
6.30 include/tang.hpp File Reference	165
6.30.1 Detailed Description	165

6.31 include/tangBase.hpp File Reference	166
6.31.1 Detailed Description	167
6.32 include/tangScanner.hpp File Reference	167
6.32.1 Detailed Description	168
6.33 src/astNode.cpp File Reference	168
6.33.1 Detailed Description	168
6.34 src/astNodeAssign.cpp File Reference	168
6.34.1 Detailed Description	169
6.35 src/astNodeBinary.cpp File Reference	169
6.35.1 Detailed Description	170
6.36 src/astNodeBlock.cpp File Reference	170
6.36.1 Detailed Description	170
6.37 src/astNodeBoolean.cpp File Reference	170
6.37.1 Detailed Description	171
6.38 src/astNodeCast.cpp File Reference	171
6.38.1 Detailed Description	172
6.39 src/astNodeDoWhile.cpp File Reference	172
6.39.1 Detailed Description	173
6.40 src/astNodeFloat.cpp File Reference	173
6.40.1 Detailed Description	174
6.41 src/astNodeFor.cpp File Reference	174
6.41.1 Detailed Description	174
6.42 src/astNodeIdentifier.cpp File Reference	174
6.42.1 Detailed Description	175
6.43 src/astNodeIfElse.cpp File Reference	175
6.43.1 Detailed Description	176
6.44 src/astNodeInteger.cpp File Reference	176
6.44.1 Detailed Description	177
6.45 src/astNodePrint.cpp File Reference	177
6.45.1 Detailed Description	177
6.46 src/astNodeString.cpp File Reference	177
6.46.1 Detailed Description	178
6.47 src/astNodeUnary.cpp File Reference	178
6.47.1 Detailed Description	179
6.48 src/astNodeWhile.cpp File Reference	179
6.48.1 Detailed Description	180
6.49 src/computedExpression.cpp File Reference	180
6.49.1 Detailed Description	180
6.50 src/computedExpressionBoolean.cpp File Reference	180
6.50.1 Detailed Description	181
6.51 src/computedExpressionError.cpp File Reference	181
6.51.1 Detailed Description	182

6.52 src/computedExpressionFloat.cpp File Reference	182
6.52.1 Detailed Description	182
6.53 src/computedExpressionInteger.cpp File Reference	182
6.53.1 Detailed Description	183
6.54 src/computedExpressionString.cpp File Reference	183
6.54.1 Detailed Description	184
6.55 src/error.cpp File Reference	184
6.55.1 Detailed Description	184
6.55.2 Function Documentation	184
6.55.2.1 operator<<()	184
6.56 src/program-dumpBytecode.cpp File Reference	185
6.56.1 Detailed Description	185
6.56.2 Macro Definition Documentation	186
6.56.2.1 DUMPPROGRAMCHECK	186
6.57 src/program-execute.cpp File Reference	186
6.57.1 Detailed Description	187
6.57.2 Macro Definition Documentation	187
6.57.2.1 EXECUTEPROGRAMCHECK	187
6.57.2.2 STACKCHECK	187
6.58 src/program.cpp File Reference	188
6.58.1 Detailed Description	188
6.59 src/tangBase.cpp File Reference	188
6.59.1 Detailed Description	189
6.60 test/test.cpp File Reference	189
6.60.1 Detailed Description	190
6.61 test/testGarbageCollected.cpp File Reference	190
6.61.1 Detailed Description	191
6.62 test/testSingletonObjectPool.cpp File Reference	191
6.62.1 Detailed Description	192

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

Copyright (c) 2022 Corey Pennycuff

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

Tang::AstNode	11
Tang::AstNodeAssign	14
Tang::AstNodeBinary	16
Tang::AstNodeBlock	18
Tang::AstNodeBoolean	20
Tang::AstNodeCast	22
Tang::AstNodeDoWhile	25
Tang::AstNodeFloat	27
Tang::AstNodeFor	29
Tang::AstNodeIdentifier	31
Tang::AstNodeIfElse	33
Tang::AstNodeInteger	36
Tang::AstNodePrint	38
Tang::AstNodeString	41
Tang::AstNodeUnary	42
Tang::AstNodeWhile	45
Tang::ComputedExpression	47
Tang::ComputedExpressionBoolean	56
Tang::ComputedExpressionError	65
Tang::ComputedExpressionFloat	76
Tang::ComputedExpressionInteger	85
Tang::ComputedExpressionString	95
Tang::Error	105
Tang::GarbageCollected	107
Tang::location	122
Tang::position	124
Tang::Program	125
Tang::SingletonObjectPool< T >	130
Tang::TangBase	131
TangTangFlexLexer	
Tang::TangScanner	133

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)	11
Tang::AstNodeAssign	An AstNode that represents a binary expression	14
Tang::AstNodeBinary	An AstNode that represents a binary expression	16
Tang::AstNodeBlock	An AstNode that represents a code block	18
Tang::AstNodeBoolean	An AstNode that represents a boolean literal	20
Tang::AstNodeCast	An AstNode that represents a typecast of an expression	22
Tang::AstNodeDoWhile	An AstNode that represents a do..while statement	25
Tang::AstNodeFloat	An AstNode that represents an float literal	27
Tang::AstNodeFor	An AstNode that represents an if() statement	29
Tang::AstNodeIdentifier	An AstNode that represents an identifier	31
Tang::AstNodeIfElse	An AstNode that represents an if..else statement	33
Tang::AstNodeInteger	An AstNode that represents an integer literal	36
Tang::AstNodePrint	An AstNode that represents a print typeoperation	38
Tang::AstNodeString	An AstNode that represents a string literal	41
Tang::AstNodeUnary	An AstNode that represents a unary negation	42
Tang::AstNodeWhile	An AstNode that represents a while statement	45
Tang::ComputedExpression	Represents the result of a computation that has been executed	47
Tang::ComputedExpressionBoolean	Represents an Boolean that is the result of a computation	56

Tang::ComputedExpressionError	
Represents a Runtime Error	65
Tang::ComputedExpressionFloat	
Represents a Float that is the result of a computation	76
Tang::ComputedExpressionInteger	
Represents an Integer that is the result of a computation	85
Tang::ComputedExpressionString	
Represents a String that is the result of a computation	95
Tang::Error	
Used to report any error of the system, whether a syntax (parsing) error or a runtime (execution) error	105
Tang::GarbageCollected	
A container that acts as a resource-counting garbage collector for the specified type	107
Tang::location	
Two points in a source file	122
Tang::position	
A point in a source file	124
Tang::Program	
Represents a compiled script or template that may be executed	125
Tang::SingletonObjectPool< T >	
A thread-safe, singleton object pool of the designated type	130
Tang::TangBase	
The base class for the Tang programming language	131
Tang::TangScanner	
The Flex lexer class for the main Tang language	133

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 <code>Tang::location</code> class	135
include/astNode.hpp	
Declare the <code>Tang::AstNode</code> base class	137
include/astNodeAssign.hpp	
Declare the <code>Tang::AstNodeAssign</code> class	138
include/astNodeBinary.hpp	
Declare the <code>Tang::AstNodeBinary</code> class	139
include/astNodeBlock.hpp	
Declare the <code>Tang::AstNodeBlock</code> class	140
include/astNodeBoolean.hpp	
Declare the <code>Tang::AstNodeBoolean</code> class	141
include/astNodeCast.hpp	
Declare the <code>Tang::AstNodeCast</code> class	142
include/astNodeDoWhile.hpp	
Declare the <code>Tang::AstNodeDoWhile</code> class	143
include/astNodeFloat.hpp	
Declare the <code>Tang::AstNodeFloat</code> class	144
include/astNodeFor.hpp	
Declare the <code>Tang::AstNodeFor</code> class	145
include/astNodeIdentifier.hpp	
Declare the <code>Tang::AstNodeIdentifier</code> class	146
include/astNodeIfElse.hpp	
Declare the <code>Tang::AstNodeIfElse</code> class	147
include/astNodeInteger.hpp	
Declare the <code>Tang::AstNodeInteger</code> class	148
include/astNodePrint.hpp	
Declare the <code>Tang::AstNodePrint</code> class	149
include/astNodeString.hpp	
Declare the <code>Tang::AstNodeString</code> class	150
include/astNodeUnary.hpp	
Declare the <code>Tang::AstNodeUnary</code> class	151
include/astNodeWhile.hpp	
Declare the <code>Tang::AstNodeWhile</code> class	152
include/computedExpression.hpp	
Declare the <code>Tang::ComputedExpression</code> base class	153

include/computedExpressionBoolean.hpp	
Declare the Tang::ComputedExpressionBoolean class	154
include/computedExpressionError.hpp	
Declare the Tang::ComputedExpressionError class	155
include/computedExpressionFloat.hpp	
Declare the Tang::ComputedExpressionFloat class	156
include/computedExpressionInteger.hpp	
Declare the Tang::ComputedExpressionInteger class	157
include/computedExpressionString.hpp	
Declare the Tang::ComputedExpressionString class	158
include/error.hpp	
Declare the Tang::Error class used to describe syntax and runtime errors	159
include/garbageCollected.hpp	
Declare the Tang::GarbageCollected class	160
include/macros.hpp	
Contains generic macros	160
include/opcode.hpp	
Declare the Opcodes used in the Bytecode representation of a program	161
include/program.hpp	
Declare the Tang::Program class used to compile and execute source code	163
include/singletonObjectPool.hpp	
Declare the Tang::SingletonObjectPool class	164
include/tang.hpp	
Header file supplied for use by 3rd party code so that they can easily include all necessary headers	165
include/tangBase.hpp	
Declare the Tang::TangBase class used to interact with Tang	166
include/tangScanner.hpp	
Declare the Tang::TangScanner used to tokenize a Tang script	167
src/astNode.cpp	
Define the Tang::AstNode class	168
src/astNodeAssign.cpp	
Define the Tang::AstNodeAssign class	168
src/astNodeBinary.cpp	
Define the Tang::AstNodeBinary class	169
src/astNodeBlock.cpp	
Define the Tang::AstNodeBlock class	170
src/astNodeBoolean.cpp	
Define the Tang::AstNodeBoolean class	170
src/astNodeCast.cpp	
Define the Tang::AstNodeCast class	171
src/astNodeDoWhile.cpp	
Define the Tang::AstNodeDoWhile class	172
src/astNodeFloat.cpp	
Define the Tang::AstNodeFloat class	173
src/astNodeFor.cpp	
Define the Tang::AstNodeFor class	174
src/astNodeIdentifier.cpp	
Define the Tang::AstNodeIdentifier class	174
src/astNodeIfElse.cpp	
Define the Tang::AstNodeIfElse class	175
src/astNodeInteger.cpp	
Define the Tang::AstNodeInteger class	176
src/astNodePrint.cpp	
Define the Tang::AstNodePrint class	177
src/astNodeString.cpp	
Define the Tang::AstNodeString class	177

src/ astNodeUnary.cpp	
Define the Tang::AstNodeUnary class	178
src/ astNodeWhile.cpp	
Define the Tang::AstNodeWhile class	179
src/ computedExpression.cpp	
Define the Tang::ComputedExpression class	180
src/ computedExpressionBoolean.cpp	
Define the Tang::ComputedExpressionBoolean class	180
src/ computedExpressionError.cpp	
Define the Tang::ComputedExpressionError class	181
src/ computedExpressionFloat.cpp	
Define the Tang::ComputedExpressionFloat class	182
src/ computedExpressionInteger.cpp	
Define the Tang::ComputedExpressionInteger class	182
src/ computedExpressionString.cpp	
Define the Tang::ComputedExpressionString class	183
src/ error.cpp	
Define the Tang::Error class	184
src/ program-dumpBytecode.cpp	
Define the Tang::Program::dumpBytecode method	185
src/ program-execute.cpp	
Define the Tang::Program::execute method	186
src/ program.cpp	
Define the Tang::Program class	188
src/ tangBase.cpp	
Define the Tang::TangBase class	188
test/ test.cpp	
Test the general language behaviors	189
test/ testGarbageCollected.cpp	
Test the generic behavior of the Tang::GarbageCollected class	190
test/ testSingletonObjectPool.cpp	
Test the generic behavior of the Tang::SingletonObjectPool class	191

Chapter 5

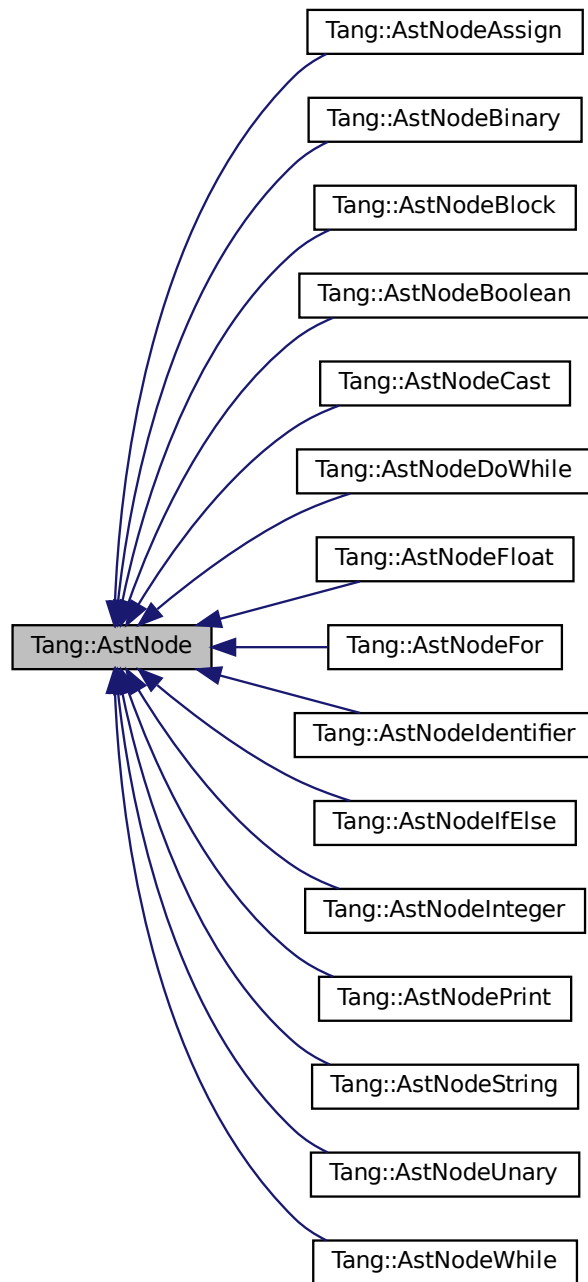
Class Documentation

5.1 Tang::AstNode Class Reference

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

```
#include <astNode.hpp>
```

Inheritance diagram for Tang::AstNode:



Public Member Functions

- [AstNode](#) ([Tang::location](#) [location](#))
The generic constructor.
- 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 void [collectIdentifiers](#) ([Program](#) &program) const

Compile a list of all variables in the scope.

5.1.1 Detailed Description

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

By default, it will represent a NULL value. 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()

```
AstNode::AstNode (
    Tang::location location )
```

The generic constructor.

It should never be called on its own.

Parameters

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

5.1.3 Member Function Documentation

5.1.3.1 collectIdentifiers()

```
void AstNode::collectIdentifiers (
    Program & program ) const [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

Reimplemented in [Tang::AstNodeWhile](#), [Tang::AstNodeUnary](#), [Tang::AstNodePrint](#), [Tang::AstNodeIfElse](#), [Tang::AstNodeIdentifier](#), [Tang::AstNodeFor](#), [Tang::AstNodeDoWhile](#), [Tang::AstNodeBlock](#), [Tang::AstNodeBinary](#), and [Tang::AstNodeAssign](#).

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

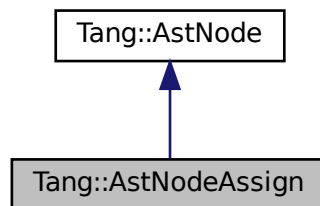
- [include/astNode.hpp](#)
- [src/astNode.cpp](#)

5.2 Tang::AstNodeAssign Class Reference

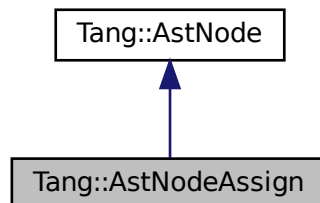
An [AstNode](#) that represents a binary expression.

```
#include <astNodeAssign.hpp>
```

Inheritance diagram for Tang::AstNodeAssign:



Collaboration diagram for Tang::AstNodeAssign:



Public Member Functions

- [AstNodeAssign](#) (std::shared_ptr< [AstNode](#) > lhs, std::shared_ptr< [AstNode](#) > rhs, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.2.1 Detailed Description

An [AstNode](#) that represents a binary expression.

5.2.2 Constructor & Destructor Documentation

5.2.2.1 AstNodeAssign()

```
AstNodeAssign::AstNodeAssign (
    std::shared_ptr< AstNode > lhs,
    std::shared_ptr< AstNode > rhs,
    Tang::location location )
```

The constructor.

Parameters

<i>lhs</i>	The left hand side expression.
<i>rhs</i>	The right hand side expression.
<i>location</i>	The location associated with the expression.

5.2.3 Member Function Documentation

5.2.3.1 collectIdentifiers()

```
void AstNodeAssign::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

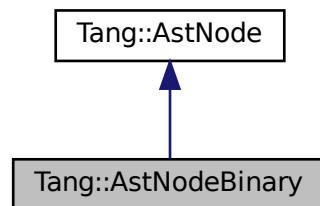
- [include/astNodeAssign.hpp](#)
- [src/astNodeAssign.cpp](#)

5.3 Tang::AstNodeBinary Class Reference

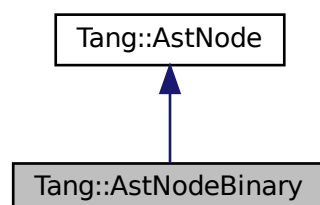
An [AstNode](#) that represents a binary expression.

```
#include <astNodeBinary.hpp>
```

Inheritance diagram for Tang::AstNodeBinary:



Collaboration diagram for Tang::AstNodeBinary:



Public Types

- enum [Operation](#) {
[Add](#) , [Subtract](#) , [Multiply](#) , [Divide](#) ,
[Modulo](#) , [LessThan](#) , [LessThanEqual](#) , [GreaterThan](#) ,
[GreaterThanEqual](#) , [Equal](#) , [NotEqual](#) , [And](#) ,
[Or](#) }

Indicates the type of binary expression that this node represents.

Public Member Functions

- [AstNodeBinary](#) ([Operation](#) op, std::shared_ptr< [AstNode](#) > lhs, std::shared_ptr< [AstNode](#) > rhs, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.3.1 Detailed Description

An [AstNode](#) that represents a binary expression.

5.3.2 Member Enumeration Documentation

5.3.2.1 Operation

enum [Tang::AstNodeBinary::Operation](#)

Indicates the type of binary expression that this node represents.

Enumerator

Add	Indicates lhs + rhs.
Subtract	Indicates lhs - rhs.
Multiply	Indicates lhs * rhs.
Divide	Indicates lhs / rhs.
Modulo	Indicates lhs % rhs.
LessThan	Indicates lhs < rhs.
LessThanEqual	Indicates lhs <= rhs.
GreaterThan	Indicates lhs > rhs.
GreaterThanEqual	Indicates lhs >= rhs.
Equal	Indicates lhs == rhs.
NotEqual	Indicates lhs != rhs.
And	Indicates lhs && rhs with short-circuit evaluation.
Generated by Doxygen Or	Indicates lhs rhs with short-circuit evaluation.

5.3.3 Constructor & Destructor Documentation

5.3.3.1 AstNodeBinary()

```
AstNodeBinary::AstNodeBinary (
    Operation op,
    std::shared_ptr< AstNode > lhs,
    std::shared_ptr< AstNode > rhs,
    Tang::location location )
```

The constructor.

Parameters

<i>op</i>	The Tang::AstNodeBinary::Operation to perform.
<i>lhs</i>	The left hand side expression.
<i>rhs</i>	The right hand side expression.
<i>location</i>	The location associated with the expression.

5.3.4 Member Function Documentation

5.3.4.1 collectIdentifiers()

```
void AstNodeBinary::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

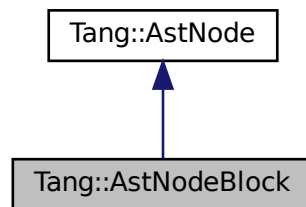
- include/[astNodeBinary.hpp](#)
- src/[astNodeBinary.cpp](#)

5.4 Tang::AstNodeBlock Class Reference

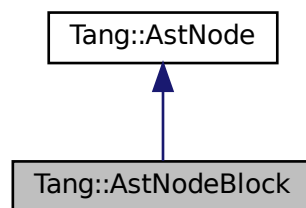
An [AstNode](#) that represents a code block.


```
#include <astNodeBlock.hpp>
```

Inheritance diagram for Tang::AstNodeBlock:



Collaboration diagram for Tang::AstNodeBlock:



Public Member Functions

- [AstNodeBlock](#) (const std::vector< std::shared_ptr< [AstNode](#) >> &statements, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.4.1 Detailed Description

An [AstNode](#) that represents a code block.

5.4.2 Constructor & Destructor Documentation

5.4.2.1 AstNodeBlock()

```
AstNodeBlock::AstNodeBlock (
    const std::vector< std::shared_ptr< AstNode >> & statements,
    Tang::location location )
```

The constructor.

Parameters

<i>statements</i>	The statements of the code block.
<i>location</i>	The location associated with the expression.

5.4.3 Member Function Documentation

5.4.3.1 collectIdentifiers()

```
void AstNodeBlock::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

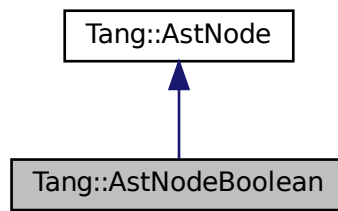
- include/[astNodeBlock.hpp](#)
- src/[astNodeBlock.cpp](#)

5.5 Tang::AstNodeBoolean Class Reference

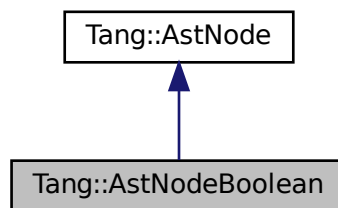
An [AstNode](#) that represents a boolean literal.

```
#include <astNodeBoolean.hpp>
```

Inheritance diagram for Tang::AstNodeBoolean:



Collaboration diagram for Tang::AstNodeBoolean:



Public Member Functions

- [AstNodeBoolean](#) (bool val, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const
Compile a list of all variables in the scope.

5.5.1 Detailed Description

An [AstNode](#) that represents a boolean literal.

5.5.2 Constructor & Destructor Documentation

5.5.2.1 AstNodeBoolean()

```
AstNodeBoolean::AstNodeBoolean (
    bool val,
    Tang::location location )
```

The constructor.

Parameters

<i>val</i>	The boolean to represent.
<i>location</i>	The location associated with the expression.

5.5.3 Member Function Documentation

5.5.3.1 collectIdentifiers()

```
void AstNode::collectIdentifiers (
    Program & program ) const [virtual], [inherited]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

Reimplemented in [Tang::AstNodeWhile](#), [Tang::AstNodeUnary](#), [Tang::AstNodePrint](#), [Tang::AstNodeIfElse](#), [Tang::AstNodeIdentifier](#), [Tang::AstNodeFor](#), [Tang::AstNodeDoWhile](#), [Tang::AstNodeBlock](#), [Tang::AstNodeBinary](#), and [Tang::AstNodeAssign](#).

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

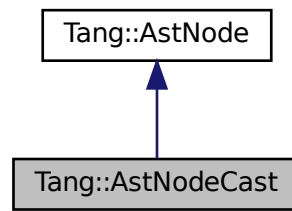
- include/[astNodeBoolean.hpp](#)
- src/[astNodeBoolean.cpp](#)

5.6 Tang::AstNodeCast Class Reference

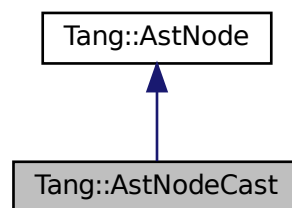
An [AstNode](#) that represents a typecast of an expression.

```
#include <astNodeCast.hpp>
```

Inheritance diagram for Tang::AstNodeCast:



Collaboration diagram for Tang::AstNodeCast:



Public Types

- enum [Type](#) { [Integer](#) , [Float](#) , [Boolean](#) }
- The possible types that can be cast to.*

Public Member Functions

- [AstNodeCast](#) ([Type](#) targetType, shared_ptr< [AstNode](#) > expression, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const
Compile a list of all variables in the scope.

5.6.1 Detailed Description

An [AstNode](#) that represents a typecast of an expression.

5.6.2 Member Enumeration Documentation

5.6.2.1 Type

```
enum Tang::AstNodeCast::Type
```

The possible types that can be cast to.

Enumerator

Integer	Cast to a Tang::ComputedExpressionInteger .
Float	Cast to a Tang::ComputedExpressionFloat .
Boolean	Cast to a Tang::ComputedExpressionBoolean .

5.6.3 Constructor & Destructor Documentation

5.6.3.1 AstNodeCast()

```
AstNodeCast::AstNodeCast (
    Type targetType,
    shared_ptr< AstNode > expression,
    Tang::location location )
```

The constructor.

Parameters

<i>targetType</i>	The target type that the expression will be cast to.
<i>expression</i>	The expression to be typecast.
<i>location</i>	The location associated with this node.

5.6.4 Member Function Documentation

5.6.4.1 collectIdentifiers()

```
void AstNode::collectIdentifiers (
    Program & program ) const [virtual], [inherited]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

Reimplemented in [Tang::AstNodeWhile](#), [Tang::AstNodeUnary](#), [Tang::AstNodePrint](#), [Tang::AstNodeIfElse](#), [Tang::AstNodeIdentifier](#), [Tang::AstNodeFor](#), [Tang::AstNodeDoWhile](#), [Tang::AstNodeBlock](#), [Tang::AstNodeBinary](#), and [Tang::AstNodeAssign](#).

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

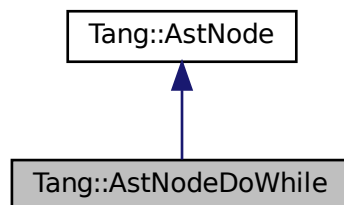
- [include/astNodeCast.hpp](#)
- [src/astNodeCast.cpp](#)

5.7 Tang::AstNodeDoWhile Class Reference

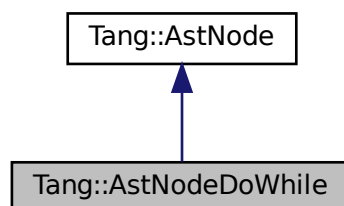
An [AstNode](#) that represents a do..while statement.

```
#include <astNodeDoWhile.hpp>
```

Inheritance diagram for Tang::AstNodeDoWhile:



Collaboration diagram for Tang::AstNodeDoWhile:



Public Member Functions

- [AstNodeDoWhile](#) (shared_ptr< [AstNode](#) > condition, shared_ptr< [AstNode](#) > codeBlock, [Tang::location](#) location)

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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.7.1 Detailed Description

An [AstNode](#) that represents a do..while statement.

5.7.2 Constructor & Destructor Documentation

5.7.2.1 AstNodeDoWhile()

```
AstNodeDoWhile::AstNodeDoWhile (
    shared_ptr< AstNode > condition,
    shared_ptr< AstNode > codeBlock,
    Tang::location location )
```

The constructor.

Parameters

<i>condition</i>	The expression which determines whether the thenBlock or elseBlock is executed.
<i>codeBlock</i>	The statement executed when the condition is true.
<i>location</i>	The location associated with the expression.

5.7.3 Member Function Documentation

5.7.3.1 collectIdentifiers()

```
void AstNodeDoWhile::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

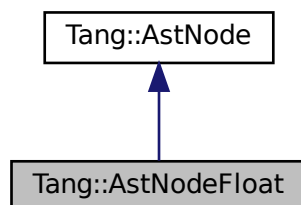
- [include/astNodeDoWhile.hpp](#)
- [src/astNodeDoWhile.cpp](#)

5.8 Tang::AstNodeFloat Class Reference

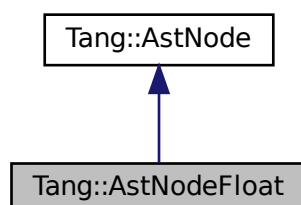
An [AstNode](#) that represents an float literal.

```
#include <astNodeFloat.hpp>
```

Inheritance diagram for Tang::AstNodeFloat:



Collaboration diagram for Tang::AstNodeFloat:



Public Member Functions

- [AstNodeFloat](#) (double number, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const
Compile a list of all variables in the scope.

5.8.1 Detailed Description

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

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

5.8.2 Constructor & Destructor Documentation

5.8.2.1 AstNodeFloat()

```
AstNodeFloat::AstNodeFloat (
    double number,
    Tang::location location )
```

The constructor.

Parameters

<i>number</i>	The number to represent.
<i>location</i>	The location associated with the expression.

5.8.3 Member Function Documentation

5.8.3.1 collectIdentifiers()

```
void AstNode::collectIdentifiers (
    Program & program ) const [virtual], [inherited]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

Reimplemented in [Tang::AstNodeWhile](#), [Tang::AstNodeUnary](#), [Tang::AstNodePrint](#), [Tang::AstNodeIfElse](#), [Tang::AstNodeIdentifier](#), [Tang::AstNodeFor](#), [Tang::AstNodeDoWhile](#), [Tang::AstNodeBlock](#), [Tang::AstNodeBinary](#), and [Tang::AstNodeAssign](#).

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

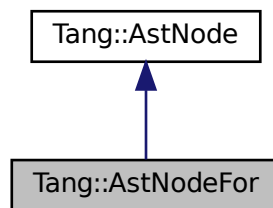
- [include/astNodeFloat.hpp](#)
- [src/astNodeFloat.cpp](#)

5.9 Tang::AstNodeFor Class Reference

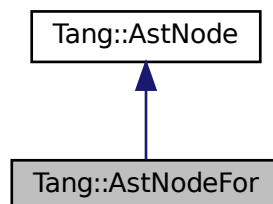
An [AstNode](#) that represents an if() statement.

```
#include <astNodeFor.hpp>
```

Inheritance diagram for Tang::AstNodeFor:



Collaboration diagram for Tang::AstNodeFor:



Public Member Functions

- [AstNodeFor](#) (shared_ptr< [AstNode](#) > initialization, shared_ptr< [AstNode](#) > condition, shared_ptr< [AstNode](#) > increment, shared_ptr< [AstNode](#) > codeBlock, [Tang::location](#) location)

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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.9.1 Detailed Description

An [AstNode](#) that represents an if() statement.

5.9.2 Constructor & Destructor Documentation

5.9.2.1 AstNodeFor()

```
AstNodeFor::AstNodeFor (
    shared_ptr< AstNode > initialization,
    shared_ptr< AstNode > condition,
    shared_ptr< AstNode > increment,
    shared_ptr< AstNode > codeBlock,
    Tang::location location )
```

The constructor.

Parameters

<i>initialization</i>	The expression to be executed first.
<i>condition</i>	The expression which determines whether the codeBlock is executed.
<i>increment</i>	The expression to be executed after each codeBlock.
<i>codeBlock</i>	The statement executed when the condition is true.
<i>location</i>	The location associated with the expression.

5.9.3 Member Function Documentation

5.9.3.1 collectIdentifiers()

```
void AstNodeFor::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

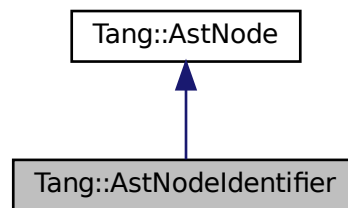
- include/[astNodeFor.hpp](#)
- src/[astNodeFor.cpp](#)

5.10 Tang::AstNodeIdentifier Class Reference

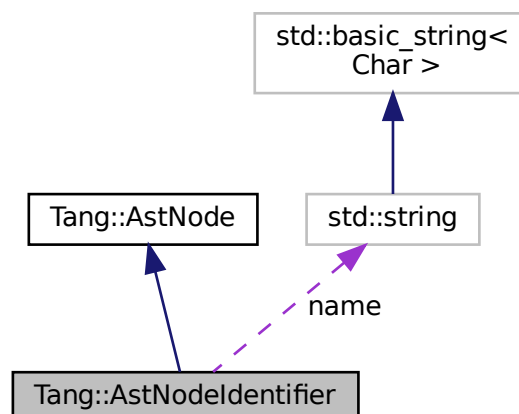
An [AstNode](#) that represents an identifier.

```
#include <astNodeIdentifier.hpp>
```

Inheritance diagram for Tang::AstNodeIdentifier:



Collaboration diagram for Tang::AstNodeIdentifier:



Public Member Functions

- [AstNodeIdentifier](#) (const std::string &name, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

Public Attributes

- std::string [name](#)
The name of the identifier.

5.10.1 Detailed Description

An [AstNode](#) that represents an identifier.

Identifier names are represented by a string.

5.10.2 Constructor & Destructor Documentation

5.10.2.1 AstNodeIdentifier()

```
AstNodeIdentifier::AstNodeIdentifier (
    const std::string & name,
    Tang::location location )
```

The constructor.

Parameters

<i>name</i>	The name of the identifier
<i>location</i>	The location associated with the expression.

5.10.3 Member Function Documentation

5.10.3.1 collectIdentifiers()

```
void AstNodeIdentifier::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

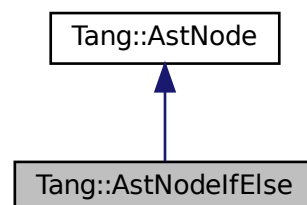
- include/[astNodeIdentifier.hpp](#)
- src/[astNodeIdentifier.cpp](#)

5.11 Tang::AstNodeIfElse Class Reference

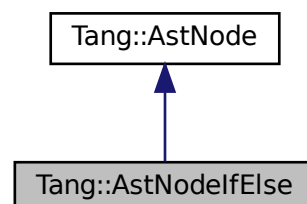
An [AstNode](#) that represents an if..else statement.

```
#include <astNodeIfElse.hpp>
```

Inheritance diagram for Tang::AstNodeIfElse:



Collaboration diagram for Tang::AstNodeIfElse:



Public Member Functions

- [AstNodeIfElse](#) (shared_ptr< [AstNode](#) > condition, shared_ptr< [AstNode](#) > thenBlock, shared_ptr< [AstNode](#) > elseBlock, [Tang::location](#) location)

The constructor.

- [AstNodeIfElse](#) (shared_ptr< [AstNode](#) > condition, shared_ptr< [AstNode](#) > thenBlock, [Tang::location](#) location)

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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.11.1 Detailed Description

An [AstNode](#) that represents an if..else statement.

5.11.2 Constructor & Destructor Documentation

5.11.2.1 AstNodeIfElse() [1/2]

```
AstNodeIfElse::AstNodeIfElse (
    shared_ptr< AstNode > condition,
    shared_ptr< AstNode > thenBlock,
    shared_ptr< AstNode > elseBlock,
    Tang::location location )
```

The constructor.

Parameters

<i>condition</i>	The expression which determines whether the thenBlock or elseBlock is executed.
<i>thenBlock</i>	The statement executed when the condition is true.
<i>elseBlock</i>	The statement executed when the condition is false.
<i>location</i>	The location associated with the expression.

5.11.2.2 AstNodeIfElse() [2/2]

```
AstNodeIfElse::AstNodeIfElse (
    shared_ptr< AstNode > condition,
```



```
shared_ptr< AstNode > thenBlock,  
Tang::location location )
```

The constructor.

Parameters

<i>condition</i>	The expression which determines whether the thenBlock or elseBlock is executed.
<i>thenBlock</i>	The statement executed when the condition is true.
<i>location</i>	The location associated with the expression.

5.11.3 Member Function Documentation

5.11.3.1 collectIdentifiers()

```
void AstNodeIfElse::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

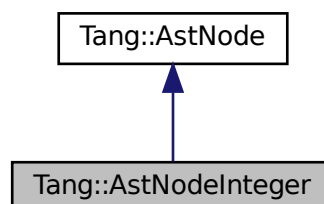
- include/[astNodeIfElse.hpp](#)
- src/[astNodeIfElse.cpp](#)

5.12 Tang::AstNodeInteger Class Reference

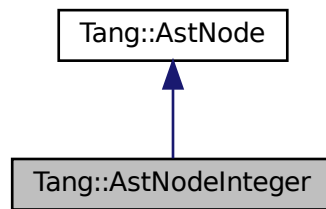
An [AstNode](#) that represents an integer literal.

```
#include <astNodeInteger.hpp>
```

Inheritance diagram for Tang::AstNodeInteger:



Collaboration diagram for Tang::AstNodeInteger:



Public Member Functions

- [AstNodeInteger](#) (int64_t number, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const
Compile a list of all variables in the scope.

5.12.1 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.

5.12.2 Constructor & Destructor Documentation

5.12.2.1 AstNodeInteger()

```

AstNodeInteger::AstNodeInteger (
    int64_t number,
    Tang::location location )
  
```

The constructor.

Parameters

<i>number</i>	The number to represent.
<i>location</i>	The location associated with the expression.

5.12.3 Member Function Documentation

5.12.3.1 collectIdentifiers()

```
void AstNode::collectIdentifiers (
    Program & program ) const [virtual], [inherited]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

Reimplemented in [Tang::AstNodeWhile](#), [Tang::AstNodeUnary](#), [Tang::AstNodePrint](#), [Tang::AstNodeIfElse](#), [Tang::AstNodeIdentifier](#), [Tang::AstNodeFor](#), [Tang::AstNodeDoWhile](#), [Tang::AstNodeBlock](#), [Tang::AstNodeBinary](#), and [Tang::AstNodeAssign](#).

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

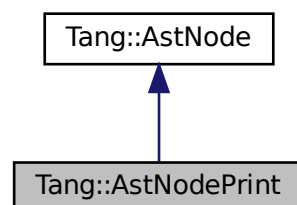
- include/[astNodeInteger.hpp](#)
- src/[astNodeInteger.cpp](#)

5.13 Tang::AstNodePrint Class Reference

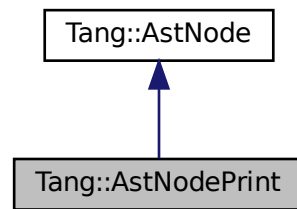
An [AstNode](#) that represents a print typeoperation.

```
#include <astNodePrint.hpp>
```

Inheritance diagram for Tang::AstNodePrint:



Collaboration diagram for Tang::AstNodePrint:



Public Types

- enum [Type](#) { [Default](#) }
The type of print() requested.

Public Member Functions

- [AstNodePrint](#) ([Type](#) type, shared_ptr< [AstNode](#) > expression, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.13.1 Detailed Description

An [AstNode](#) that represents a print typeoperation.

5.13.2 Member Enumeration Documentation

5.13.2.1 Type

```
enum Tang::AstNodePrint::Type
```

The type of print() requested.

Enumerator

Default	Use the default print.
---------	------------------------

5.13.3 Constructor & Destructor Documentation

5.13.3.1 AstNodePrint()

```
AstNodePrint::AstNodePrint (
    Type type,
    shared_ptr< AstNode > expression,
    Tang::location location )
```

The constructor.

Parameters

<i>type</i>	The Tang::AstNodePrint::Type being requested.
<i>expression</i>	The expression to be printed.
<i>location</i>	The location associated with the expression.

5.13.4 Member Function Documentation

5.13.4.1 collectIdentifiers()

```
void AstNodePrint::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

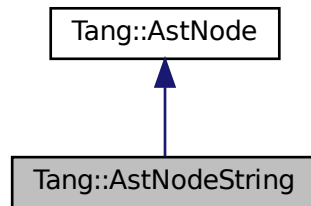
- [include/astNodePrint.hpp](#)
- [src/astNodePrint.cpp](#)

5.14 Tang::AstNodeString Class Reference

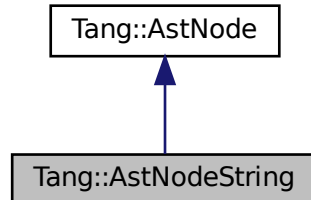
An [AstNode](#) that represents a string literal.

```
#include <astNodeString.hpp>
```

Inheritance diagram for Tang::AstNodeString:



Collaboration diagram for Tang::AstNodeString:



Public Member Functions

- [AstNodeString](#) (const string &text, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const
Compile a list of all variables in the scope.

5.14.1 Detailed Description

An [AstNode](#) that represents a string literal.

5.14.2 Constructor & Destructor Documentation

5.14.2.1 AstNodeString()

```
AstNodeString::AstNodeString (
    const string & text,
    Tang::location location )
```

The constructor.

Parameters

<i>text</i>	The string to represent.
<i>location</i>	The location associated with the expression.

5.14.3 Member Function Documentation

5.14.3.1 collectIdentifiers()

```
void AstNode::collectIdentifiers (
    Program & program ) const [virtual], [inherited]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

Reimplemented in [Tang::AstNodeWhile](#), [Tang::AstNodeUnary](#), [Tang::AstNodePrint](#), [Tang::AstNodeIfElse](#), [Tang::AstNodeIdentifier](#), [Tang::AstNodeFor](#), [Tang::AstNodeDoWhile](#), [Tang::AstNodeBlock](#), [Tang::AstNodeBinary](#), and [Tang::AstNodeAssign](#).

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

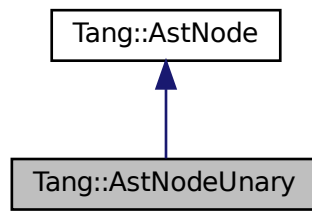
- [include/astNodeString.hpp](#)
- [src/astNodeString.cpp](#)

5.15 Tang::AstNodeUnary Class Reference

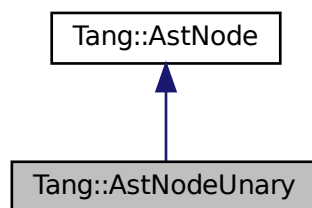
An [AstNode](#) that represents a unary negation.

```
#include <astNodeUnary.hpp>
```


Inheritance diagram for Tang::AstNodeUnary:



Collaboration diagram for Tang::AstNodeUnary:



Public Types

- enum [Operator](#) { [Negative](#) , [Not](#) }
- The type of operation.*

Public Member Functions

- [AstNodeUnary](#) ([Operator](#) op, shared_ptr< [AstNode](#) > operand, [Tang::location](#) location)
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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.15.1 Detailed Description

An [AstNode](#) that represents a unary negation.

5.15.2 Member Enumeration Documentation

5.15.2.1 Operator

```
enum Tang::AstNodeUnary::Operator
```

The type of operation.

Enumerator

Negative	Compute the negative (-).
Not	Compute the logical not (!).

5.15.3 Constructor & Destructor Documentation

5.15.3.1 AstNodeUnary()

```
AstNodeUnary::AstNodeUnary (
    Operator op,
    shared_ptr< AstNode > operand,
    Tang::location location )
```

The constructor.

Parameters

<i>op</i>	The Tang::AstNodeUnary::Operator to apply to the operand.
<i>operand</i>	The expression to be operated on.
<i>location</i>	The location associated with the expression.

5.15.4 Member Function Documentation

5.15.4.1 collectIdentifiers()

```
void AstNodeUnary::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

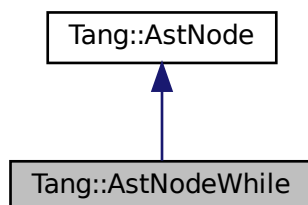
- [include/astNodeUnary.hpp](#)
- [src/astNodeUnary.cpp](#)

5.16 Tang::AstNodeWhile Class Reference

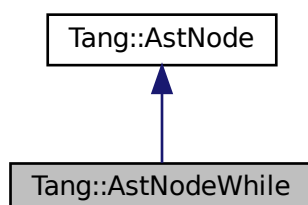
An [AstNode](#) that represents a while statement.

```
#include <astNodeWhile.hpp>
```

Inheritance diagram for Tang::AstNodeWhile:



Collaboration diagram for Tang::AstNodeWhile:



Public Member Functions

- [AstNodeWhile](#) (shared_ptr< [AstNode](#) > condition, shared_ptr< [AstNode](#) > codeBlock, [Tang::location](#) location)

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 void [collectIdentifiers](#) ([Program](#) &program) const override
Compile a list of all variables in the scope.

5.16.1 Detailed Description

An [AstNode](#) that represents a while statement.

5.16.2 Constructor & Destructor Documentation

5.16.2.1 AstNodeWhile()

```
AstNodeWhile::AstNodeWhile (
    shared_ptr< AstNode > condition,
    shared_ptr< AstNode > codeBlock,
    Tang::location location )
```

The constructor.

Parameters

<i>condition</i>	The expression which determines whether the thenBlock or elseBlock is executed.
<i>codeBlock</i>	The statement executed when the condition is true.
<i>location</i>	The location associated with the expression.

5.16.3 Member Function Documentation

5.16.3.1 collectIdentifiers()

```
void AstNodeWhile::collectIdentifiers (
    Program & program ) const [override], [virtual]
```

Compile a list of all variables in the scope.

Parameters

<i>program</i>	The Tang::Program that is being compiled.
----------------	---

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

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

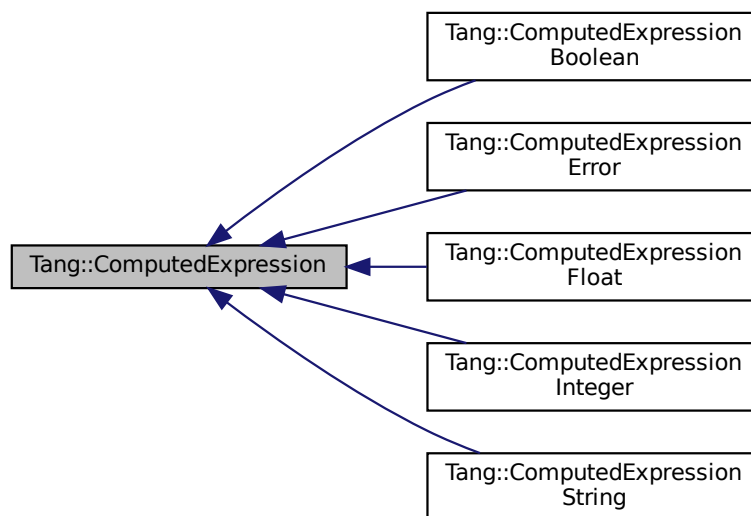
- include/[astNodeWhile.hpp](#)
- src/[astNodeWhile.cpp](#)

5.17 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 [GarbageCollected makeCopy](#) () const
Make a copy of the [ComputedExpression](#) (recursively, if appropriate).
- virtual bool [is_equal](#) (const int &val) const

- Check whether or not the computed expression is equal to another value.*
- virtual bool `is_equal` (const double &val) const
- Check whether or not the computed expression is equal to another value.*
- virtual bool `is_equal` (const bool &val) const
- Check whether or not the computed expression is equal to another value.*
- virtual bool `is_equal` (const string &val) const
- Check whether or not the computed expression is equal to another value.*
- virtual bool `is_equal` (const `Error` &val) const
- Check whether or not the computed expression is equal to another value.*
- virtual bool `is_equal` (const std::nullptr_t &val) const
- Check whether or not the computed expression is equal to another value.*
- virtual `GarbageCollected` `__add` (const `GarbageCollected` &rhs) const
- Compute the result of adding this value and the supplied value.*
- virtual `GarbageCollected` `__subtract` (const `GarbageCollected` &rhs) const
- Compute the result of subtracting this value and the supplied value.*
- virtual `GarbageCollected` `__multiply` (const `GarbageCollected` &rhs) const
- Compute the result of multiplying this value and the supplied value.*
- virtual `GarbageCollected` `__divide` (const `GarbageCollected` &rhs) const
- Compute the result of dividing this value and the supplied value.*
- virtual `GarbageCollected` `__modulo` (const `GarbageCollected` &rhs) const
- Compute the result of moduloing this value and the supplied value.*
- virtual `GarbageCollected` `__negative` () const
- Compute the result of negating this value.*
- virtual `GarbageCollected` `__not` () const
- Compute the logical not of this value.*
- virtual `GarbageCollected` `__lessThan` (const `GarbageCollected` &rhs) const
- Compute the "less than" comparison.*
- virtual `GarbageCollected` `__equal` (const `GarbageCollected` &rhs) const
- Perform an equality test.*
- virtual `GarbageCollected` `__integer` () const
- Perform a type cast to integer.*
- virtual `GarbageCollected` `__float` () const
- Perform a type cast to float.*
- virtual `GarbageCollected` `__boolean` () const
- Perform a type cast to boolean.*
- virtual `GarbageCollected` `__string` () const
- Perform a type cast to string.*

5.17.1 Detailed Description

Represents the result of a computation that has been executed.

By default, it will represent a NULL value.

5.17.2 Member Function Documentation

5.17.2.1 `__add()`

```
GarbageCollected ComputedExpression::__add (
    const GarbageCollected & rhs ) const [virtual]
```

Compute the result of adding this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to add to this.
------------	--

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.17.2.2 `__boolean()`

```
GarbageCollected ComputedExpression::__boolean ( ) const [virtual]
```

Perform a type cast to boolean.

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.17.2.3 `__divide()`

```
GarbageCollected ComputedExpression::__divide (
    const GarbageCollected & rhs ) const [virtual]
```

Compute the result of dividing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to divide this by.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.17.2.4 `__equal()`

```
GarbageCollected ComputedExpression::__equal (
    const GarbageCollected & rhs ) const [virtual]
```

Perform an equalit test.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.17.2.5 `__float()`

```
GarbageCollected ComputedExpression::__float ( ) const [virtual]
```

Perform a type cast to float.

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.17.2.6 `__integer()`

```
GarbageCollected ComputedExpression::__integer ( ) const [virtual]
```

Perform a type cast to integer.

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.17.2.7 `__lessThan()`

```
GarbageCollected ComputedExpression::__lessThan (
    const GarbageCollected & rhs ) const [virtual]
```

Compute the "less than" comparison.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.17.2.8 __modulo()

```
GarbageCollected ComputedExpression::__modulo (
    const GarbageCollected & rhs ) const [virtual]
```

Compute the result of moduloing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to modulo this by.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionError](#).

5.17.2.9 __multiply()

```
GarbageCollected ComputedExpression::__multiply (
    const GarbageCollected & rhs ) const [virtual]
```

Compute the result of multiplying this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to multiply to this.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.17.2.10 `__negative()`

`GarbageCollected` `ComputedExpression::__negative () const [virtual]`

Compute the result of negating this value.

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.17.2.11 `__not()`

`GarbageCollected` `ComputedExpression::__not () const [virtual]`

Compute the logical not of this value.

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.17.2.12 `__string()`

`GarbageCollected` `ComputedExpression::__string () const [virtual]`

Perform a type cast to string.

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.17.2.13 `__subtract()`

`GarbageCollected` `ComputedExpression::__subtract (`
 `const` `GarbageCollected` `& rhs) const [virtual]`

Compute the result of subtracting this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to subtract from this.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.17.2.14 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::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.17.2.15 is_equal() [1/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const bool & val ) const [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionBoolean](#).

5.17.2.16 `is_equal()` [2/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const double & val ) const [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.17.2.17 `is_equal()` [3/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const Error & val ) const [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.17.2.18 `is_equal()` [4/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const int & val ) const [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.17.2.19 is_equal() [5/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const std::nullptr_t & val ) const [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

5.17.2.20 is_equal() [6/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const string & val ) const [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.17.2.21 makeCopy()

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

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

Returns

A [Tang::GarbageCollected](#) value for the new [ComputedExpression](#).

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

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

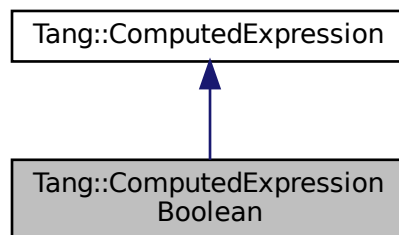
- [include/computedExpression.hpp](#)
- [src/computedExpression.cpp](#)

5.18 Tang::ComputedExpressionBoolean Class Reference

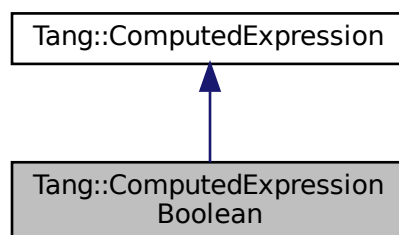
Represents an Boolean that is the result of a computation.

```
#include <computedExpressionBoolean.hpp>
```

Inheritance diagram for Tang::ComputedExpressionBoolean:



Collaboration diagram for Tang::ComputedExpressionBoolean:



Public Member Functions

- [ComputedExpressionBoolean](#) (bool val)
Construct an Boolean result.
- virtual std::string [dump](#) () const override
Output the contents of the [ComputedExpression](#) as a string.
- [GarbageCollected](#) [makeCopy](#) () const override
Make a copy of the [ComputedExpression](#) (recursively, if appropriate).
- virtual bool [is_equal](#) (const bool &val) const override
Check whether or not the computed expression is equal to another value.
- virtual [GarbageCollected](#) [__not](#) () const override
Compute the logical not of this value.
- virtual [GarbageCollected](#) [__equal](#) (const [GarbageCollected](#) &rhs) const override
Perform an equalit test.
- virtual [GarbageCollected](#) [__integer](#) () const override
Perform a type cast to integer.
- virtual [GarbageCollected](#) [__float](#) () const override
Perform a type cast to float.
- virtual [GarbageCollected](#) [__boolean](#) () const override
Perform a type cast to boolean.
- virtual bool [is_equal](#) (const int &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const double &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const string &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const [Error](#) &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const std::nullptr_t &val) const
Check whether or not the computed expression is equal to another value.
- virtual [GarbageCollected](#) [__add](#) (const [GarbageCollected](#) &rhs) const
Compute the result of adding this value and the supplied value.
- virtual [GarbageCollected](#) [__subtract](#) (const [GarbageCollected](#) &rhs) const
Compute the result of subtracting this value and the supplied value.
- virtual [GarbageCollected](#) [__multiply](#) (const [GarbageCollected](#) &rhs) const
Compute the result of multiplying this value and the supplied value.
- virtual [GarbageCollected](#) [__divide](#) (const [GarbageCollected](#) &rhs) const
Compute the result of dividing this value and the supplied value.
- virtual [GarbageCollected](#) [__modulo](#) (const [GarbageCollected](#) &rhs) const
Compute the result of moduloing this value and the supplied value.
- virtual [GarbageCollected](#) [__negative](#) () const
Compute the result of negating this value.
- virtual [GarbageCollected](#) [__lessThan](#) (const [GarbageCollected](#) &rhs) const
Compute the "less than" comparison.
- virtual [GarbageCollected](#) [__string](#) () const
Perform a type cast to string.

5.18.1 Detailed Description

Represents an Boolean that is the result of a computation.

5.18.2 Constructor & Destructor Documentation

5.18.2.1 ComputedExpressionBoolean()

```
ComputedExpressionBoolean::ComputedExpressionBoolean (
    bool val )
```

Construct an Boolean result.

Parameters

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

5.18.3 Member Function Documentation

5.18.3.1 __add()

```
GarbageCollected ComputedExpression::__add (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of adding this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to add to this.
------------	--

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.18.3.2 __boolean()

```
GarbageCollected ComputedExpressionBoolean::__boolean ( ) const [override], [virtual]
```

Perform a type cast to boolean.

Returns

The result of the the operation.

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

5.18.3.3 __divide()

```
GarbageCollected ComputedExpression::__divide (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of dividing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to divide this by.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.18.3.4 __equal()

```
GarbageCollected ComputedExpressionBoolean::__equal (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Perform an equalit test.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.18.3.5 __float()

```
GarbageCollected ComputedExpressionBoolean::__float ( ) const [override], [virtual]
```

Perform a type cast to float.

Returns

The result of the the operation.

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

5.18.3.6 `__integer()`

`GarbageCollected` `ComputedExpressionBoolean::__integer () const [override], [virtual]`

Perform a type cast to integer.

Returns

The result of the the operation.

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

5.18.3.7 `__lessThan()`

`GarbageCollected` `ComputedExpression::__lessThan (`
`const GarbageCollected & rhs) const [virtual], [inherited]`

Compute the "less than" comparison.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.18.3.8 `__modulo()`

`GarbageCollected` `ComputedExpression::__modulo (`
`const GarbageCollected & rhs) const [virtual], [inherited]`

Compute the result of moduloing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to modulo this by.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionError](#).

5.18.3.9 __multiply()

```
GarbageCollected ComputedExpression::__multiply (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of multiplying this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to multiply to this.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.18.3.10 __negative()

```
GarbageCollected ComputedExpression::__negative ( ) const [virtual], [inherited]
```

Compute the result of negating this value.

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.18.3.11 __not()

```
GarbageCollected ComputedExpressionBoolean::__not ( ) const [override], [virtual]
```

Compute the logical not of this value.

Returns

The result of the operation.

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

5.18.3.12 __string()

```
GarbageCollected ComputedExpression::__string ( ) const [virtual], [inherited]
```

Perform a type cast to string.

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.18.3.13 __subtract()

```
GarbageCollected ComputedExpression::__subtract (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of subtracting this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to subtract from this.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.18.3.14 dump()

```
string ComputedExpressionBoolean::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](#).

5.18.3.15 is_equal() [1/6]

```
bool ComputedExpressionBoolean::is_equal (
    const bool & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.18.3.16 is_equal() [2/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const double & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.18.3.17 is_equal() [3/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const Error & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.18.3.18 `is_equal()` [4/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const int & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.18.3.19 `is_equal()` [5/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const std::nullptr_t & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

5.18.3.20 `is_equal()` [6/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const string & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.18.3.21 makeCopy()

```
GarbageCollected ComputedExpressionBoolean::makeCopy ( ) const [override], [virtual]
```

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

Returns

A [Tang::GarbageCollected](#) value for the new [ComputedExpression](#).

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

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

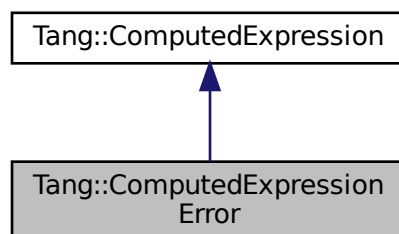
- [include/computedExpressionBoolean.hpp](#)
- [src/computedExpressionBoolean.cpp](#)

5.19 Tang::ComputedExpressionError Class Reference

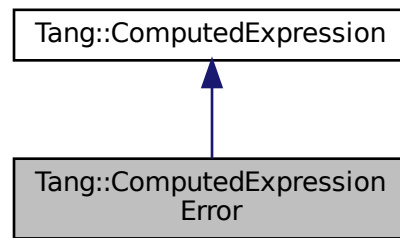
Represents a Runtime [Error](#).

```
#include <computedExpressionError.hpp>
```

Inheritance diagram for Tang::ComputedExpressionError:



Collaboration diagram for Tang::ComputedExpressionError:



Public Member Functions

- `ComputedExpressionError` (`Tang::Error` error)
Construct a Runtime *Error*.
- virtual `std::string dump` () const override
Output the contents of the *ComputedExpression* as a string.
- `GarbageCollected makeCopy` () const override
Make a copy of the *ComputedExpression* (recursively, if appropriate).
- virtual `bool is_equal` (const `Error` &val) const override
Check whether or not the computed expression is equal to another value.
- virtual `GarbageCollected __add` (const `GarbageCollected` &rhs) const override
Compute the result of adding this value and the supplied value.
- virtual `GarbageCollected __subtract` (const `GarbageCollected` &rhs) const override
Compute the result of subtracting this value and the supplied value.
- virtual `GarbageCollected __multiply` (const `GarbageCollected` &rhs) const override
Compute the result of multiplying this value and the supplied value.
- virtual `GarbageCollected __divide` (const `GarbageCollected` &rhs) const override
Compute the result of dividing this value and the supplied value.
- virtual `GarbageCollected __modulo` (const `GarbageCollected` &rhs) const override
Compute the result of moduloing this value and the supplied value.
- virtual `GarbageCollected __negative` () const override
Compute the result of negating this value.
- virtual `GarbageCollected __not` () const override
Compute the logical not of this value.
- virtual `GarbageCollected __lessThan` (const `GarbageCollected` &rhs) const override
Compute the "less than" comparison.
- virtual `GarbageCollected __equal` (const `GarbageCollected` &rhs) const override
Perform an equalit test.
- virtual `GarbageCollected __integer` () const override
Perform a type cast to integer.
- virtual `GarbageCollected __float` () const override
Perform a type cast to float.
- virtual `GarbageCollected __boolean` () const override
Perform a type cast to boolean.

- virtual [GarbageCollected __string](#) () const override
Perform a type cast to string.
- virtual bool [is_equal](#) (const int &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const double &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const bool &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const string &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const std::nullptr_t &val) const
Check whether or not the computed expression is equal to another value.

5.19.1 Detailed Description

Represents a Runtime [Error](#).

5.19.2 Constructor & Destructor Documentation

5.19.2.1 ComputedExpressionError()

```
ComputedExpressionError::ComputedExpressionError (
    Tang::Error error )
```

Construct a Runtime [Error](#).

Parameters

<i>error</i>	The Tang::Error object.
--------------	---

5.19.3 Member Function Documentation

5.19.3.1 __add()

```
GarbageCollected ComputedExpressionError::__add (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of adding this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to add to this.
------------	--

Returns

The result of the operation.

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

5.19.3.2 `__boolean()`

```
GarbageCollected ComputedExpressionError::__boolean ( ) const [override], [virtual]
```

Perform a type cast to boolean.

Returns

The result of the the operation.

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

5.19.3.3 `__divide()`

```
GarbageCollected ComputedExpressionError::__divide (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of dividing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to divide this by.
------------	---

Returns

The result of the operation.

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

5.19.3.4 `__equal()`

```
GarbageCollected ComputedExpressionError::__equal (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Perform an equalit test.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.19.3.5 __float()

[GarbageCollected](#) ComputedExpressionError::__float () const [override], [virtual]

Perform a type cast to float.

Returns

The result of the the operation.

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

5.19.3.6 __integer()

[GarbageCollected](#) ComputedExpressionError::__integer () const [override], [virtual]

Perform a type cast to integer.

Returns

The result of the the operation.

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

5.19.3.7 __lessThan()

[GarbageCollected](#) ComputedExpressionError::__lessThan (
 const [GarbageCollected](#) & *rhs*) const [override], [virtual]

Compute the "less than" comparison.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.19.3.8 __modulo()

```
GarbageCollected ComputedExpressionError::__modulo (  
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of moduloing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to modulo this by.
------------	---

Returns

The result of the operation.

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

5.19.3.9 __multiply()

```
GarbageCollected ComputedExpressionError::__multiply (  
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of multiplying this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to multiply to this.
------------	---

Returns

The result of the operation.

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

5.19.3.10 __negative()

`GarbageCollected` ComputedExpressionError::__negative () const [override], [virtual]

Compute the result of negating this value.

Returns

The result of the operation.

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

5.19.3.11 __not()

`GarbageCollected` ComputedExpressionError::__not () const [override], [virtual]

Compute the logical not of this value.

Returns

The result of the operation.

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

5.19.3.12 __string()

`GarbageCollected` ComputedExpressionError::__string () const [override], [virtual]

Perform a type cast to string.

Returns

The result of the the operation.

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

5.19.3.13 __subtract()

`GarbageCollected` ComputedExpressionError::__subtract (
 const `GarbageCollected` & rhs) const [override], [virtual]

Compute the result of subtracting this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to subtract from this.
------------	---

Returns

The result of the operation.

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

5.19.3.14 dump()

```
std::string ComputedExpressionError::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](#).

5.19.3.15 is_equal() [1/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const bool & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionString](#), [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionBoolean](#).

5.19.3.16 is_equal() [2/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const double & val ) const    [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.19.3.17 is_equal() [3/6]

```
bool ComputedExpressionError::is_equal (
    const Error & val ) const  [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.19.3.18 is_equal() [4/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const int & val ) const  [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.19.3.19 is_equal() [5/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const std::nullptr_t & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

5.19.3.20 is_equal() [6/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const string & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.19.3.21 makeCopy()

```
GarbageCollected ComputedExpressionError::makeCopy ( ) const [override], [virtual]
```

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

Returns

A [Tang::GarbageCollected](#) value for the new [ComputedExpression](#).

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

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

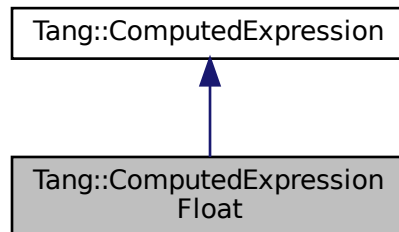
- [include/computedExpressionError.hpp](#)
- [src/computedExpressionError.cpp](#)

5.20 Tang::ComputedExpressionFloat Class Reference

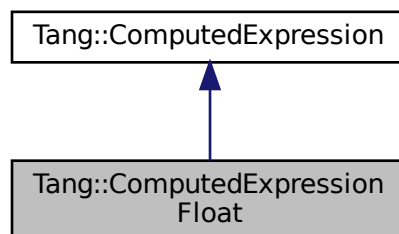
Represents a Float that is the result of a computation.

```
#include <computedExpressionFloat.hpp>
```

Inheritance diagram for Tang::ComputedExpressionFloat:



Collaboration diagram for Tang::ComputedExpressionFloat:



Public Member Functions

- [ComputedExpressionFloat](#) (double val)
Construct a Float result.
- virtual std::string [dump](#) () const override
Output the contents of the [ComputedExpression](#) as a string.
- [GarbageCollected makeCopy](#) () const override
Make a copy of the [ComputedExpression](#) (recursively, if appropriate).
- virtual bool [is_equal](#) (const int &val) const override
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const double &val) const override
Check whether or not the computed expression is equal to another value.

- virtual bool `is_equal` (const bool &val) const override
Check whether or not the computed expression is equal to another value.
- virtual `GarbageCollected __add` (const `GarbageCollected` &rhs) const override
Compute the result of adding this value and the supplied value.
- virtual `GarbageCollected __subtract` (const `GarbageCollected` &rhs) const override
Compute the result of subtracting this value and the supplied value.
- virtual `GarbageCollected __multiply` (const `GarbageCollected` &rhs) const override
Compute the result of multiplying this value and the supplied value.
- virtual `GarbageCollected __divide` (const `GarbageCollected` &rhs) const override
Compute the result of dividing this value and the supplied value.
- virtual `GarbageCollected __negative` () const override
Compute the result of negating this value.
- virtual `GarbageCollected __not` () const override
Compute the logical not of this value.
- virtual `GarbageCollected __lessThan` (const `GarbageCollected` &rhs) const override
Compute the "less than" comparison.
- virtual `GarbageCollected __equal` (const `GarbageCollected` &rhs) const override
Perform an equalit test.
- virtual `GarbageCollected __integer` () const override
Perform a type cast to integer.
- virtual `GarbageCollected __float` () const override
Perform a type cast to float.
- virtual `GarbageCollected __boolean` () const override
Perform a type cast to boolean.
- virtual `GarbageCollected __string` () const override
Perform a type cast to string.
- virtual bool `is_equal` (const string &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const `Error` &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const std::nullptr_t &val) const
Check whether or not the computed expression is equal to another value.
- virtual `GarbageCollected __modulo` (const `GarbageCollected` &rhs) const
Compute the result of moduloing this value and the supplied value.

Friends

- class `ComputedExpressionInteger`

5.20.1 Detailed Description

Represents a Float that is the result of a computation.

5.20.2 Constructor & Destructor Documentation

5.20.2.1 ComputedExpressionFloat()

```
ComputedExpressionFloat::ComputedExpressionFloat (
    double val )
```

Construct a Float result.

Parameters

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

5.20.3 Member Function Documentation

5.20.3.1 `__add()`

```
GarbageCollected ComputedExpressionFloat::__add (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of adding this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to add to this.
------------	--

Returns

The result of the operation.

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

5.20.3.2 `__boolean()`

```
GarbageCollected ComputedExpressionFloat::__boolean ( ) const [override], [virtual]
```

Perform a type cast to boolean.

Returns

The result of the the operation.

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

5.20.3.3 `__divide()`

```
GarbageCollected ComputedExpressionFloat::__divide (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of dividing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to divide this by.
------------	---

Returns

The result of the operation.

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

5.20.3.4 __equal()

```
GarbageCollected ComputedExpressionFloat::__equal (
    const GarbageCollected & rhs ) const  [override], [virtual]
```

Perform an equalit test.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.20.3.5 __float()

```
GarbageCollected ComputedExpressionFloat::__float ( ) const  [override], [virtual]
```

Perform a type cast to float.

Returns

The result of the the operation.

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

5.20.3.6 `__integer()`

`GarbageCollected` `ComputedExpressionFloat::__integer () const [override], [virtual]`

Perform a type cast to integer.

Returns

The result of the the operation.

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

5.20.3.7 `__lessThan()`

`GarbageCollected` `ComputedExpressionFloat::__lessThan (`
`const GarbageCollected & rhs) const [override], [virtual]`

Compute the "less than" comparison.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.20.3.8 `__modulo()`

`GarbageCollected` `ComputedExpression::__modulo (`
`const GarbageCollected & rhs) const [virtual], [inherited]`

Compute the result of moduloing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to modulo this by.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionError](#).

5.20.3.9 __multiply()

```
GarbageCollected ComputedExpressionFloat::__multiply (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of multiplying this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to multiply to this.
------------	---

Returns

The result of the operation.

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

5.20.3.10 __negative()

```
GarbageCollected ComputedExpressionFloat::__negative ( ) const [override], [virtual]
```

Compute the result of negating this value.

Returns

The result of the operation.

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

5.20.3.11 __not()

```
GarbageCollected ComputedExpressionFloat::__not ( ) const [override], [virtual]
```

Compute the logical not of this value.

Returns

The result of the operation.

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

5.20.3.12 `__string()`

```
GarbageCollected ComputedExpressionFloat::__string ( ) const [override], [virtual]
```

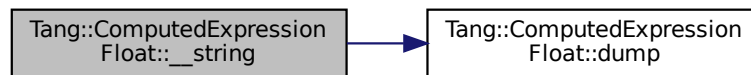
Perform a type cast to string.

Returns

The result of the the operation.

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

Here is the call graph for this function:



5.20.3.13 `__subtract()`

```
GarbageCollected ComputedExpressionFloat::__subtract (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of subtracting this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to subtract from this.
------------	---

Returns

The result of the operation.

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

5.20.3.14 `dump()`

```
string ComputedExpressionFloat::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](#).

5.20.3.15 is_equal() [1/6]

```
bool ComputedExpressionFloat::is_equal (
    const bool & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.20.3.16 is_equal() [2/6]

```
bool ComputedExpressionFloat::is_equal (
    const double & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.20.3.17 is_equal() [3/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const Error & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.20.3.18 is_equal() [4/6]

```
bool ComputedExpressionFloat::is_equal (  
    const int & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.20.3.19 is_equal() [5/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const std::nullptr_t & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

5.20.3.20 is_equal() [6/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const string & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.20.3.21 makeCopy()

```
GarbageCollected ComputedExpressionFloat::makeCopy ( ) const [override], [virtual]
```

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

Returns

A [Tang::GarbageCollected](#) value for the new [ComputedExpression](#).

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

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

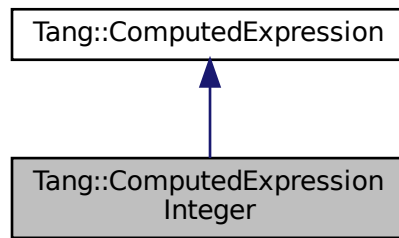
- include/[computedExpressionFloat.hpp](#)
- src/[computedExpressionFloat.cpp](#)

5.21 Tang::ComputedExpressionInteger Class Reference

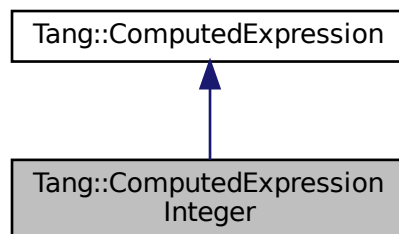
Represents an Integer that is the result of a computation.

```
#include <computedExpressionInteger.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.
- [GarbageCollected makeCopy](#) () const override
Make a copy of the [ComputedExpression](#) (recursively, if appropriate).
- virtual bool [is_equal](#) (const int &val) const override
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const double &val) const override
Check whether or not the computed expression is equal to another value.
- virtual bool [is_equal](#) (const bool &val) const override
Check whether or not the computed expression is equal to another value.
- virtual [GarbageCollected __add](#) (const [GarbageCollected](#) &rhs) const override
Compute the result of adding this value and the supplied value.
- virtual [GarbageCollected __subtract](#) (const [GarbageCollected](#) &rhs) const override
Compute the result of subtracting this value and the supplied value.

- virtual [GarbageCollected](#) `__multiply` (const [GarbageCollected](#) &rhs) const override
Compute the result of multiplying this value and the supplied value.
- virtual [GarbageCollected](#) `__divide` (const [GarbageCollected](#) &rhs) const override
Compute the result of dividing this value and the supplied value.
- virtual [GarbageCollected](#) `__modulo` (const [GarbageCollected](#) &rhs) const override
Compute the result of moduloing this value and the supplied value.
- virtual [GarbageCollected](#) `__negative` () const override
Compute the result of negating this value.
- virtual [GarbageCollected](#) `__not` () const override
Compute the logical not of this value.
- virtual [GarbageCollected](#) `__lessThan` (const [GarbageCollected](#) &rhs) const override
Compute the "less than" comparison.
- virtual [GarbageCollected](#) `__equal` (const [GarbageCollected](#) &rhs) const override
Perform an equalit test.
- virtual [GarbageCollected](#) `__integer` () const override
Perform a type cast to integer.
- virtual [GarbageCollected](#) `__float` () const override
Perform a type cast to float.
- virtual [GarbageCollected](#) `__boolean` () const override
Perform a type cast to boolean.
- virtual [GarbageCollected](#) `__string` () const override
Perform a type cast to string.
- virtual bool `is_equal` (const string &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const [Error](#) &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const std::nullptr_t &val) const
Check whether or not the computed expression is equal to another value.

Friends

- class [ComputedExpressionFloat](#)

5.21.1 Detailed Description

Represents an Integer that is the result of a computation.

5.21.2 Constructor & Destructor Documentation

5.21.2.1 ComputedExpressionInteger()

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

Construct an Integer result.

Parameters

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

5.21.3 Member Function Documentation

5.21.3.1 `__add()`

```
GarbageCollected ComputedExpressionInteger::__add (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of adding this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to add to this.
------------	--

Returns

The result of the operation.

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

5.21.3.2 `__boolean()`

```
GarbageCollected ComputedExpressionInteger::__boolean ( ) const [override], [virtual]
```

Perform a type cast to boolean.

Returns

The result of the the operation.

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

5.21.3.3 `__divide()`

```
GarbageCollected ComputedExpressionInteger::__divide (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of dividing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to divide this by.
------------	---

Returns

The result of the operation.

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

5.21.3.4 `__equal()`

```
GarbageCollected ComputedExpressionInteger::__equal (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Perform an equalit test.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.21.3.5 `__float()`

```
GarbageCollected ComputedExpressionInteger::__float ( ) const [override], [virtual]
```

Perform a type cast to float.

Returns

The result of the the operation.

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

5.21.3.6 `__integer()`

```
GarbageCollected ComputedExpressionInteger::__integer ( ) const [override], [virtual]
```

Perform a type cast to integer.

Returns

The result of the the operation.

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

5.21.3.7 `__lessThan()`

```
GarbageCollected ComputedExpressionInteger::__lessThan (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the "less than" comparison.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.21.3.8 `__modulo()`

```
GarbageCollected ComputedExpressionInteger::__modulo (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of moduloing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to modulo this by.
------------	---

Returns

The result of the operation.

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

5.21.3.9 __multiply()

```
GarbageCollected ComputedExpressionInteger::__multiply (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of multiplying this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to multiply to this.
------------	---

Returns

The result of the operation.

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

5.21.3.10 __negative()

```
GarbageCollected ComputedExpressionInteger::__negative ( ) const [override], [virtual]
```

Compute the result of negating this value.

Returns

The result of the operation.

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

5.21.3.11 __not()

```
GarbageCollected ComputedExpressionInteger::__not ( ) const [override], [virtual]
```

Compute the logical not of this value.

Returns

The result of the operation.

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

5.21.3.12 __string()

```
GarbageCollected ComputedExpressionInteger::__string ( ) const [override], [virtual]
```

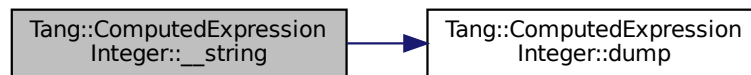
Perform a type cast to string.

Returns

The result of the the operation.

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

Here is the call graph for this function:

**5.21.3.13 __subtract()**

```
GarbageCollected ComputedExpressionInteger::__subtract (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of subtracting this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to subtract from this.
------------	---

Returns

The result of the operation.

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

5.21.3.14 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](#).

5.21.3.15 is_equal() [1/6]

```
bool ComputedExpressionInteger::is_equal (
    const bool & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.21.3.16 is_equal() [2/6]

```
bool ComputedExpressionInteger::is_equal (
    const double & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.21.3.17 is_equal() [3/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const Error & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.21.3.18 is_equal() [4/6]

```
bool ComputedExpressionInteger::is_equal (
    const int & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.21.3.19 is_equal() [5/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const std::nullptr_t & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

5.21.3.20 is_equal() [6/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const string & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.21.3.21 makeCopy()

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

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

Returns

A [Tang::GarbageCollected](#) value for the new [ComputedExpression](#).

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

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

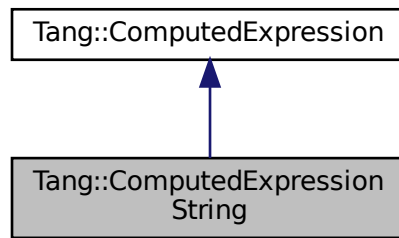
- include/[computedExpressionInteger.hpp](#)
- src/[computedExpressionInteger.cpp](#)

5.22 Tang::ComputedExpressionString Class Reference

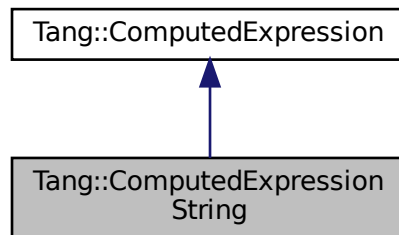
Represents a String that is the result of a computation.

```
#include <computedExpressionString.hpp>
```

Inheritance diagram for Tang::ComputedExpressionString:



Collaboration diagram for Tang::ComputedExpressionString:



Public Member Functions

- `ComputedExpressionString` (std::string val)
Construct a String result.
- virtual std::string `dump` () const override
Output the contents of the `ComputedExpression` as a string.
- `GarbageCollected makeCopy` () const override
Make a copy of the `ComputedExpression` (recursively, if appropriate).
- virtual bool `is_equal` (const bool &val) const override
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const string &val) const override
Check whether or not the computed expression is equal to another value.
- virtual `GarbageCollected __add` (const `GarbageCollected` &rhs) const override
Compute the result of adding this value and the supplied value.
- virtual `GarbageCollected __not` () const override
Compute the logical not of this value.
- virtual `GarbageCollected __lessThan` (const `GarbageCollected` &rhs) const override
Compute the "less than" comparison.

- virtual [GarbageCollected](#) `__equal` (const [GarbageCollected](#) &rhs) const override
Perform an equalit test.
- virtual [GarbageCollected](#) `__boolean` () const override
Perform a type cast to boolean.
- virtual [GarbageCollected](#) `__string` () const override
Perform a type cast to string.
- virtual bool `is_equal` (const int &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const double &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const [Error](#) &val) const
Check whether or not the computed expression is equal to another value.
- virtual bool `is_equal` (const std::nullptr_t &val) const
Check whether or not the computed expression is equal to another value.
- virtual [GarbageCollected](#) `__subtract` (const [GarbageCollected](#) &rhs) const
Compute the result of subtracting this value and the supplied value.
- virtual [GarbageCollected](#) `__multiply` (const [GarbageCollected](#) &rhs) const
Compute the result of multiplying this value and the supplied value.
- virtual [GarbageCollected](#) `__divide` (const [GarbageCollected](#) &rhs) const
Compute the result of dividing this value and the supplied value.
- virtual [GarbageCollected](#) `__modulo` (const [GarbageCollected](#) &rhs) const
Compute the result of moduloing this value and the supplied value.
- virtual [GarbageCollected](#) `__negative` () const
Compute the result of negating this value.
- virtual [GarbageCollected](#) `__integer` () const
Perform a type cast to integer.
- virtual [GarbageCollected](#) `__float` () const
Perform a type cast to float.

5.22.1 Detailed Description

Represents a String that is the result of a computation.

5.22.2 Constructor & Destructor Documentation

5.22.2.1 ComputedExpressionString()

```
ComputedExpressionString::ComputedExpressionString (
    std::string val )
```

Construct a String result.

Parameters

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

5.22.3 Member Function Documentation

5.22.3.1 `__add()`

```
GarbageCollected ComputedExpressionString::__add (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the result of adding this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to add to this.
------------	--

Returns

The result of the operation.

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

5.22.3.2 `__boolean()`

```
GarbageCollected ComputedExpressionString::__boolean ( ) const [override], [virtual]
```

Perform a type cast to boolean.

Returns

The result of the the operation.

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

5.22.3.3 `__divide()`

```
GarbageCollected ComputedExpression::__divide (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of dividing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to divide this by.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.22.3.4 __equal()

```
GarbageCollected ComputedExpressionString::__equal (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Perform an equalit test.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.22.3.5 __float()

```
GarbageCollected ComputedExpression::__float ( ) const [virtual], [inherited]
```

Perform a type cast to float.

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.22.3.6 __integer()

```
GarbageCollected ComputedExpression::__integer ( ) const [virtual], [inherited]
```

Perform a type cast to integer.

Returns

The result of the the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), [Tang::ComputedExpressionError](#), and [Tang::ComputedExpressionBoolean](#).

5.22.3.7 `__lessThan()`

```
GarbageCollected ComputedExpressionString::__lessThan (
    const GarbageCollected & rhs ) const [override], [virtual]
```

Compute the "less than" comparison.

Parameters

<i>rhs</i>	The GarbageCollected value to compare against.
------------	--

Returns

The result of the the operation.

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

5.22.3.8 `__modulo()`

```
GarbageCollected ComputedExpression::__modulo (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of moduloing this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to modulo this by.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionError](#).

5.22.3.9 `__multiply()`

```
GarbageCollected ComputedExpression::__multiply (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of multiplying this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to multiply to this.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.22.3.10 __negative()

```
GarbageCollected ComputedExpression::__negative ( ) const [virtual], [inherited]
```

Compute the result of negating this value.

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.22.3.11 __not()

```
GarbageCollected ComputedExpressionString::__not ( ) const [override], [virtual]
```

Compute the logical not of this value.

Returns

The result of the operation.

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

5.22.3.12 __string()

```
GarbageCollected ComputedExpressionString::__string ( ) const [override], [virtual]
```

Perform a type cast to string.

Returns

The result of the the operation.

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

5.22.3.13 __subtract()

```
GarbageCollected ComputedExpression::__subtract (
    const GarbageCollected & rhs ) const [virtual], [inherited]
```

Compute the result of subtracting this value and the supplied value.

Parameters

<i>rhs</i>	The GarbageCollected value to subtract from this.
------------	---

Returns

The result of the operation.

Reimplemented in [Tang::ComputedExpressionInteger](#), [Tang::ComputedExpressionFloat](#), and [Tang::ComputedExpressionError](#).

5.22.3.14 dump()

```
string ComputedExpressionString::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](#).

5.22.3.15 is_equal() [1/6]

```
bool ComputedExpressionString::is_equal (
    const bool & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.22.3.16 is_equal() [2/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const double & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.22.3.17 is_equal() [3/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const Error & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.22.3.18 is_equal() [4/6]

```
virtual bool Tang::ComputedExpression::is_equal (  
    const int & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

Reimplemented in [Tang::ComputedExpressionInteger](#), and [Tang::ComputedExpressionFloat](#).

5.22.3.19 `is_equal()` [5/6]

```
virtual bool Tang::ComputedExpression::is_equal (
    const std::nullptr_t & val ) const [virtual], [inherited]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

5.22.3.20 `is_equal()` [6/6]

```
bool ComputedExpressionString::is_equal (
    const string & val ) const [override], [virtual]
```

Check whether or not the computed expression is equal to another value.

Parameters

<i>val</i>	The value to compare against.
------------	-------------------------------

Returns

True if equal, false if not.

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

5.22.3.21 `makeCopy()`

```
GarbageCollected ComputedExpressionString::makeCopy ( ) const [override], [virtual]
```

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

Returns

A [Tang::GarbageCollected](#) value for the new [ComputedExpression](#).

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

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

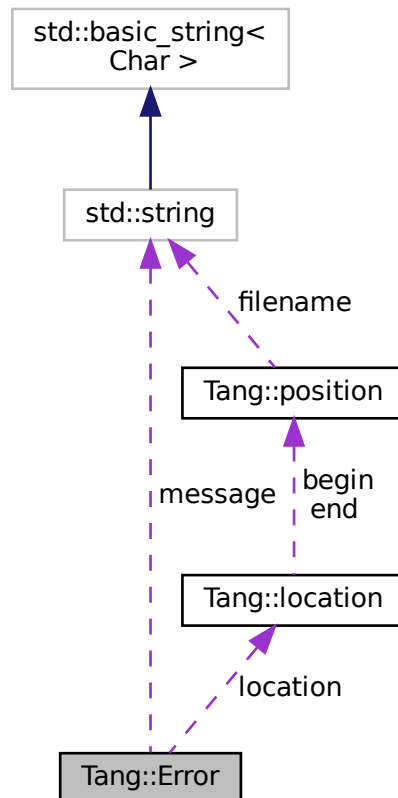
- [include/computedExpressionString.hpp](#)
- [src/computedExpressionString.cpp](#)

5.23 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](#))
Creates an error message using the supplied error string and location.
- [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.

Friends

- `std::ostream & operator<< (std::ostream &out, const Error &error)`
Add friendly output.

5.23.1 Detailed Description

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

5.23.2 Constructor & Destructor Documentation

5.23.2.1 [Error\(\)](#) [1/2]

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

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

Parameters

<i>message</i>	The error message as a string.
----------------	--------------------------------

5.23.2.2 [Error\(\)](#) [2/2]

```
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.

5.23.3 Friends And Related Function Documentation

5.23.3.1 operator<<

```
std::ostream& operator<< (
    std::ostream & out,
    const Error & error ) [friend]
```

Add friendly output.

Parameters

<i>out</i>	The output stream.
<i>error</i>	The Error object.

Returns

The output stream.

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

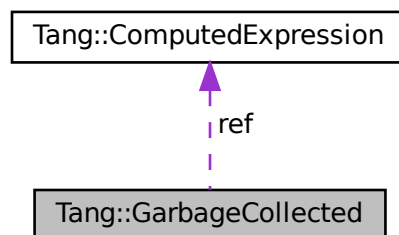
- [include/error.hpp](#)
- [src/error.cpp](#)

5.24 Tang::GarbageCollected Class Reference

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

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

Collaboration diagram for Tang::GarbageCollected:



Public Member Functions

- [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.
- [ComputedExpression](#) * operator-> () const
Access the tracked object as a pointer.
- [ComputedExpression](#) & operator* () const
Access the tracked object.
- bool operator== (const int &val) const
Compare the [GarbageCollected](#) tracked object with a supplied value.
- bool operator== (const double &val) const
Compare the [GarbageCollected](#) tracked object with a supplied value.
- bool operator== (const bool &val) const
Compare the [GarbageCollected](#) tracked object with a supplied value.
- bool operator== (const std::string &val) const
Compare the [GarbageCollected](#) tracked object with a supplied value.
- bool operator== (const char *const &val) const
Compare the [GarbageCollected](#) tracked object with a supplied value.
- bool operator== (const [Error](#) &val) const
Compare the [GarbageCollected](#) tracked object with a supplied value.
- bool operator== (const std::nullptr_t &null) const
Compare the [GarbageCollected](#) tracked object with a supplied value.
- [GarbageCollected](#) operator+ (const [GarbageCollected](#) &rhs) const
Perform an addition between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator- (const [GarbageCollected](#) &rhs) const
Perform a subtraction between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator* (const [GarbageCollected](#) &rhs) const
Perform a multiplication between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator/ (const [GarbageCollected](#) &rhs) const
Perform a division between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator% (const [GarbageCollected](#) &rhs) const
Perform a modulo between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator- () const
Perform a negation on the [GarbageCollected](#) value.
- [GarbageCollected](#) operator! () const
Perform a logical not on the [GarbageCollected](#) value.
- [GarbageCollected](#) operator< (const [GarbageCollected](#) &rhs) const
Perform a < between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator<= (const [GarbageCollected](#) &rhs) const
Perform a <= between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator> (const [GarbageCollected](#) &rhs) const
Perform a > between two [GarbageCollected](#) values.
- [GarbageCollected](#) operator>= (const [GarbageCollected](#) &rhs) const

- Perform a \geq between two *GarbageCollected* values.
- GarbageCollected* operator== (const *GarbageCollected* &rhs) const
Perform a == between two *GarbageCollected* values.
- GarbageCollected* operator!= (const *GarbageCollected* &rhs) const
Perform a != between two *GarbageCollected* values.

Static Public Member Functions

- template<class T, typename... Args>
static *GarbageCollected* make (Args... args)
Creates a garbage-collected object of the specified type.

Protected Member Functions

- GarbageCollected* ()
Constructs a garbage-collected object of the specified type.

Protected Attributes

- size_t * count
The count of references to the tracked object.
- ComputedExpression * ref
A reference to the tracked object.
- std::function< void(void)> recycle
A cleanup function to recycle the object.

Friends

- std::ostream & operator<< (std::ostream &out, const *GarbageCollected* &gc)
Add friendly output.

5.24.1 Detailed Description

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.

5.24.2 Constructor & Destructor Documentation

5.24.2.1 *GarbageCollected*() [1/3]

```
Tang::GarbageCollected::GarbageCollected (
    const GarbageCollected & other ) [inline]
```

Copy Constructor.

Parameters

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

5.24.2.2 [GarbageCollected\(\)](#) [2/3]

```
Tang::GarbageCollected::GarbageCollected (
    GarbageCollected && other ) [inline]
```

Move Constructor.

Parameters

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

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

```
Tang::GarbageCollected::~~GarbageCollected ( ) [inline]
```

Destructor.

Clean up the tracked object, if appropriate.

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

```
Tang::GarbageCollected::GarbageCollected ( ) [inline], [protected]
```

Constructs a garbage-collected object of the specified type.

It is private so that a [GarbageCollected](#) object can only be created using the [GarbageCollected::make\(\)](#) function.

Parameters

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

5.24.3 Member Function Documentation**5.24.3.1 [make\(\)](#)**

```
template<class T , typename... Args>
static GarbageCollected Tang::GarbageCollected::make (
```

```
Args... args ) [inline], [static]
```

Creates a garbage-collected object of the specified type.

Parameters

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

Returns

A [GarbageCollected](#) object.

Here is the call graph for this function:



5.24.3.2 operator"!")()

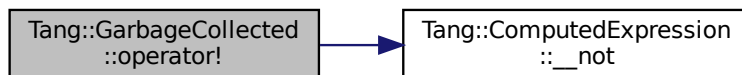
```
GarbageCollected GarbageCollected::operator! ( ) const
```

Perform a logical not on the [GarbageCollected](#) value.

Returns

The result of the operation.

Here is the call graph for this function:



5.24.3.3 operator"!=(())

```
GarbageCollected GarbageCollected::operator!= (
    const GarbageCollected & rhs ) const
```

Perform a `!=` between two [GarbageCollected](#) values.

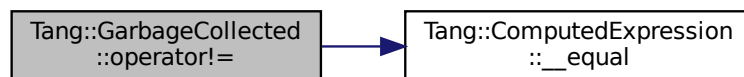
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:

**5.24.3.4 operator%()**

```

GarbageCollected GarbageCollected::operator% (
    const GarbageCollected & rhs ) const
  
```

Perform a modulo between two [GarbageCollected](#) values.

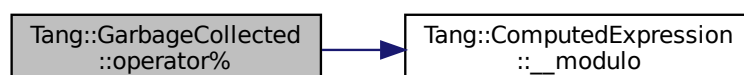
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:



5.24.3.5 operator*() [1/2]

```
ComputedExpression& Tang::GarbageCollected::operator* ( ) const [inline]
```

Access the tracked object.

Returns

A reference to the tracked object.

5.24.3.6 operator*() [2/2]

```
GarbageCollected Tang::GarbageCollected::operator* (
    const GarbageCollected & rhs ) const
```

Perform a multiplication between two [GarbageCollected](#) values.

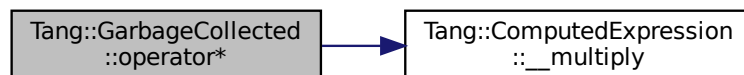
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:

**5.24.3.7 operator+()**

```
GarbageCollected Tang::GarbageCollected::operator+ (
    const GarbageCollected & rhs ) const
```

Perform an addition between two [GarbageCollected](#) values.

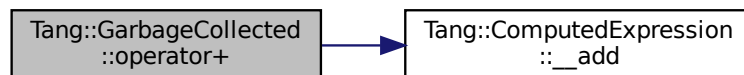
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:

5.24.3.8 `operator-()` [1/2]

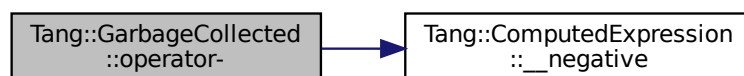
```
GarbageCollected GarbageCollected::operator- ( ) const
```

Perform a negation on the `GarbageCollected` value.

Returns

The result of the operation.

Here is the call graph for this function:

5.24.3.9 `operator-()` [2/2]

```
GarbageCollected GarbageCollected::operator- (
    const GarbageCollected & rhs ) const
```

Perform a subtraction between two `GarbageCollected` values.

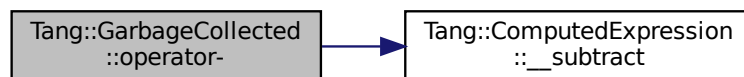
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:



5.24.3.10 operator->()

```
ComputedExpression* Tang::GarbageCollected::operator-> ( ) const [inline]
```

Access the tracked object as a pointer.

Returns

A pointer to the tracked object.

5.24.3.11 operator/()

```
GarbageCollected GarbageCollected::operator/ (
    const GarbageCollected & rhs ) const
```

Perform a division between two [GarbageCollected](#) values.

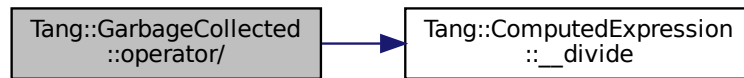
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:



5.24.3.12 `operator<()`

```
GarbageCollected GarbageCollected::operator< (
    const GarbageCollected & rhs ) const
```

Perform a `<` between two `GarbageCollected` values.

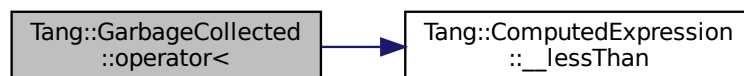
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:



5.24.3.13 `operator<=()`

```
GarbageCollected GarbageCollected::operator<= (
    const GarbageCollected & rhs ) const
```

Perform a `<=` between two `GarbageCollected` values.

Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

5.24.3.14 operator=() [1/2]

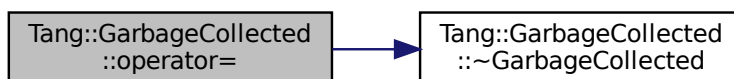
```
GarbageCollected& Tang::GarbageCollected::operator= (  
    const GarbageCollected & other ) [inline]
```

Copy Assignment.

Parameters

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

Here is the call graph for this function:

**5.24.3.15 operator=()** [2/2]

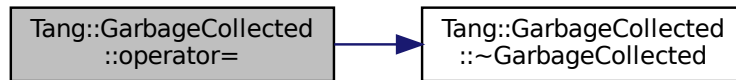
```
GarbageCollected& Tang::GarbageCollected::operator= (  
    GarbageCollected && other ) [inline]
```

Move Assignment.

Parameters

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

Here is the call graph for this function:



5.24.3.16 operator==() [1/8]

```
bool GarbageCollected::operator== (
    const bool & val ) const
```

Compare the [GarbageCollected](#) tracked object with a supplied value.

Parameters

<i>val</i>	The value to compare the tracked object against.
------------	--

Returns

True if they are equal, false otherwise.

5.24.3.17 operator==() [2/8]

```
bool GarbageCollected::operator== (
    const char *const & val ) const
```

Compare the [GarbageCollected](#) tracked object with a supplied value.

Parameters

<i>val</i>	The value to compare the tracked object against.
------------	--

Returns

True if they are equal, false otherwise.

5.24.3.18 operator==() [3/8]

```
bool GarbageCollected::operator== (
    const double & val ) const
```

Compare the [GarbageCollected](#) tracked object with a supplied value.

Parameters

<i>val</i>	The value to compare the tracked object against.
------------	--

Returns

True if they are equal, false otherwise.

5.24.3.19 operator==() [4/8]

```
bool GarbageCollected::operator== (
    const Error & val ) const
```

Compare the [GarbageCollected](#) tracked object with a supplied value.

Parameters

<i>val</i>	The value to compare the tracked object against.
------------	--

Returns

True if they are equal, false otherwise.

5.24.3.20 operator==() [5/8]

```
GarbageCollected GarbageCollected::operator== (
    const GarbageCollected & rhs ) const
```

Perform a == between two [GarbageCollected](#) values.

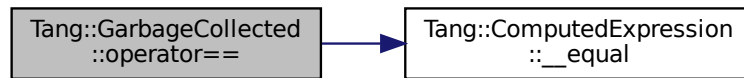
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:



5.24.3.21 operator==() [6/8]

```
bool GarbageCollected::operator== (
    const int & val ) const
```

Compare the [GarbageCollected](#) tracked object with a supplied value.

Parameters

<i>val</i>	The value to compare the tracked object against.
------------	--

Returns

True if they are equal, false otherwise.

5.24.3.22 operator==() [7/8]

```
bool GarbageCollected::operator== (
    const std::nullptr_t & null ) const
```

Compare the [GarbageCollected](#) tracked object with a supplied value.

Parameters

<i>val</i>	The value to compare the tracked object against.
------------	--

Returns

True if they are equal, false otherwise.

5.24.3.23 operator==() [8/8]

```
bool GarbageCollected::operator== (
    const std::string & val ) const
```

Compare the [GarbageCollected](#) tracked object with a supplied value.

Parameters

<i>val</i>	The value to compare the tracked object against.
------------	--

Returns

True if they are equal, false otherwise.

5.24.3.24 operator>()

```
GarbageCollected GarbageCollected::operator> (
    const GarbageCollected & rhs ) const
```

Perform a > between two [GarbageCollected](#) values.

Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

5.24.3.25 operator>=()

```
GarbageCollected GarbageCollected::operator>= (
    const GarbageCollected & rhs ) const
```

Perform a >= between two [GarbageCollected](#) values.

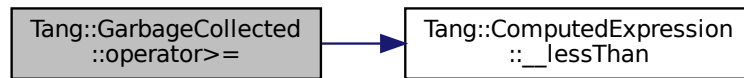
Parameters

<i>rhs</i>	The right hand side operand.
------------	------------------------------

Returns

The result of the operation.

Here is the call graph for this function:



5.24.4 Friends And Related Function Documentation

5.24.4.1 operator<<

```
std::ostream& operator<< (
    std::ostream & out,
    const GarbageCollected & gc ) [friend]
```

Add friendly output.

Parameters

<i>out</i>	The output stream.
<i>gc</i>	The GarbageCollected value.

Returns

The output stream.

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

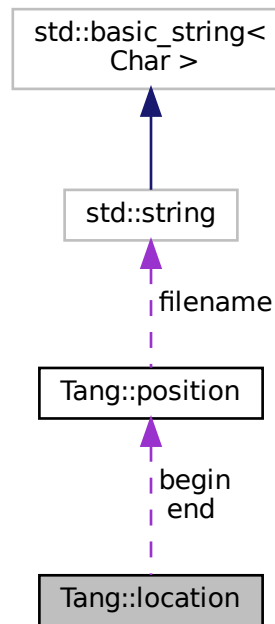
- [include/garbageCollected.hpp](#)
- [src/garbageCollected.cpp](#)

5.25 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.

5.25.1 Detailed Description

Two points in a source file.

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

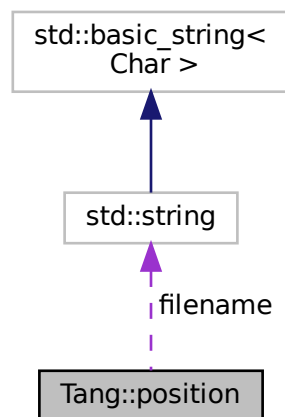
- [build/generated/location.hh](#)

5.26 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.

5.26.1 Detailed Description

A point in a source file.

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

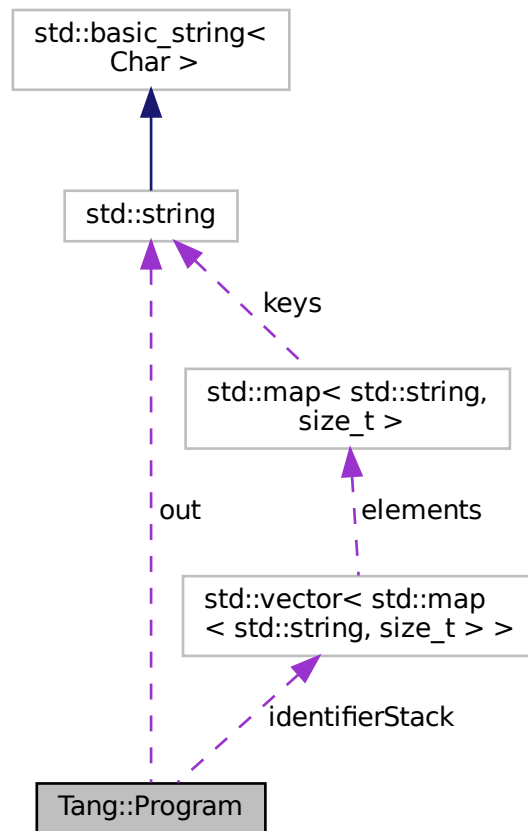
- build/generated/[location.hh](#)

5.27 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 std::shared_ptr< [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 [GarbageCollected](#) > [getResult](#) () const
Get the result of the [Program](#) execution, if it exists.

- `size_t addBytecode (uint64_t)`
Add a uint64_t to the Bytecode.
- `const Bytecode & getBytecode ()`
Get the Bytecode vector.
- `Program & execute ()`
Execute the program's Bytecode, and return the current Program object.
- `bool setJumpTarget (size_t opcodeAddress, uint64_t jumpTarget)`
Set the target address of a Jump opcode.

Public Attributes

- `std::string out`
The output of the program, resulting from the program execution.
- `std::vector< std::map< std::string, size_t > > identifierStack`
Stack of mappings of identifiers to their stack locations.

5.27.1 Detailed Description

Represents a compiled script or template that may be executed.

5.27.2 Member Enumeration Documentation

5.27.2.1 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.

5.27.3 Constructor & Destructor Documentation

5.27.3.1 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 <i>Script</i> or <i>Template</i> .

5.27.4 Member Function Documentation

5.27.4.1 addBytecode()

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

Add a `uint64_t` to the Bytecode.

Parameters

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

Returns

The size of the bytecode structure.

5.27.4.2 dumpBytecode()

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

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

Returns

A string containing the Opcode representation.

5.27.4.3 execute()

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

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

Returns

The current [Program](#) object.

5.27.4.4 getAst()

```
optional< const shared_ptr< 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.

5.27.4.5 getBytecode()

```
const Bytecode & Program::getBytecode ( )
```

Get the Bytecode vector.

Returns

The Bytecode vector.

5.27.4.6 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.

5.27.4.7 getResult()

```
optional< const GarbageCollected > Program::getResult ( ) const
```

Get the result of the `Program` execution, if it exists.

Returns

The result of the `Program` execution, if it exists.

5.27.4.8 setJumpTarget()

```
bool Program::setJumpTarget (
    size_t opcodeAddress,
    uint64_t jumpTarget )
```

Set the target address of a Jump opcode.

Parameters

<i>opcodeAddress</i>	The location of the jump statement.
<i>jumpTarget</i>	The address to jump to.

Returns

Whether or not the jumpTarget was set.

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

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

5.28 Tang::SingletonObjectPool< T > Class Template Reference

A thread-safe, singleton object pool of the designated type.

```
#include <singletonObjectPool.hpp>
```

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.

5.28.1 Detailed Description

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

A thread-safe, singleton object pool of the designated type.

5.28.2 Member Function Documentation

5.28.2.1 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.

5.28.2.2 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.

5.28.2.3 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](#)

5.29 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](#).

5.29.1 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).

5.29.2 Constructor & Destructor Documentation

5.29.2.1 TangBase()

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

The constructor.

Isn't it glorious.

5.29.3 Member Function Documentation

5.29.3.1 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:

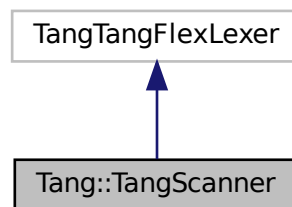
- include/[tangBase.hpp](#)
- src/[tangBase.cpp](#)

5.30 Tang::TangScanner Class Reference

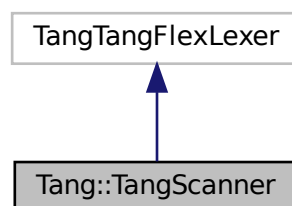
The Flex lexer class for the main Tang language.

```
#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.

5.30.1 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.

5.30.2 Constructor & Destructor Documentation

5.30.2.1 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)

5.30.3 Member Function Documentation

5.30.3.1 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

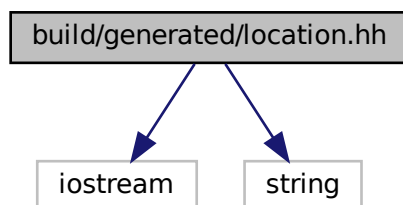
6.1 build/generated/location.hh File Reference

Define the Tang ::location class.

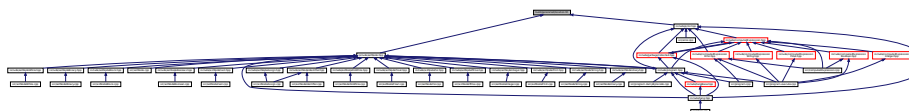
```
#include <iostream>
```

```
#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.

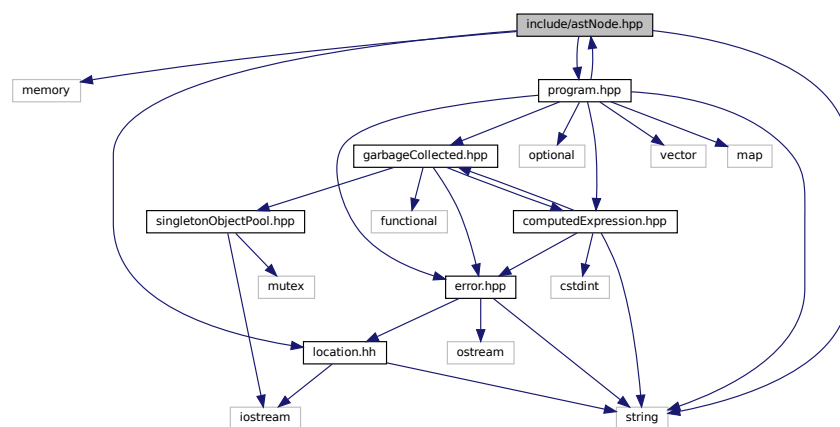
Parameters

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

6.2 include/astNode.hpp File Reference

Declare the [Tang::AstNode](#) base class.

```
#include <memory>
#include <string>
#include "location.hh"
#include "program.hpp"
Include dependency graph for astNode.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).

6.2.1 Detailed Description

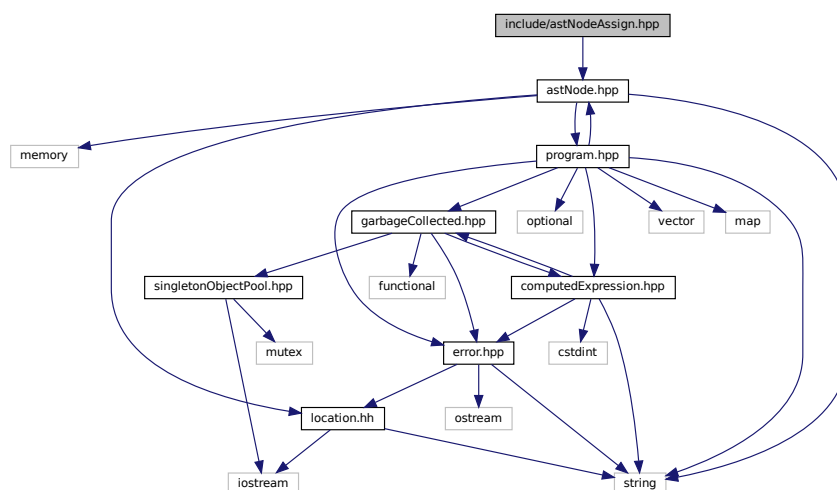
Declare the [Tang::AstNode](#) base class.

6.3 include/astNodeAssign.hpp File Reference

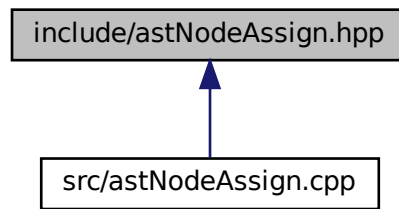
Declare the [Tang::AstNodeAssign](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodeAssign.hpp:



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



Classes

- class [Tang::AstNodeAssign](#)
An [AstNode](#) that represents a binary expression.

6.3.1 Detailed Description

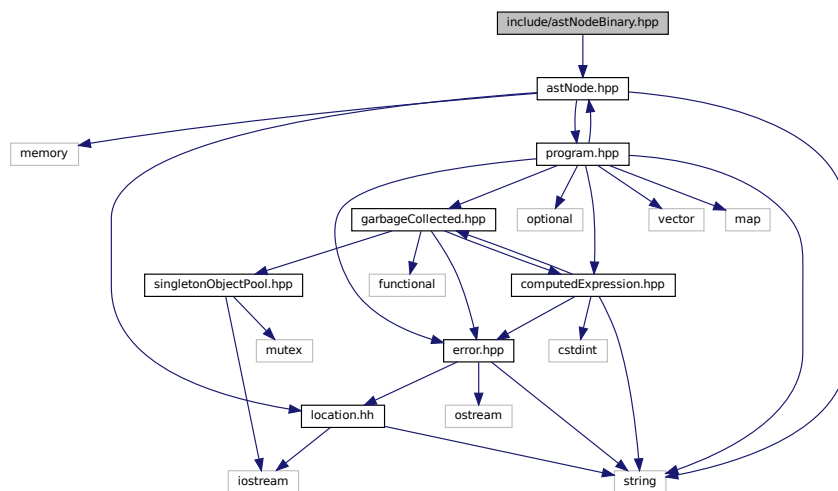
Declare the [Tang::AstNodeAssign](#) class.

6.4 include/astNodeBinary.hpp File Reference

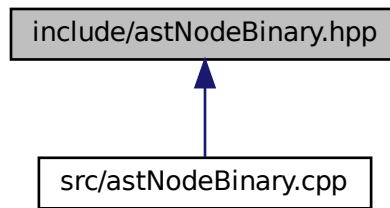
Declare the [Tang::AstNodeBinary](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodeBinary.hpp:



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



Classes

- class [Tang::AstNodeBinary](#)
An [AstNode](#) that represents a binary expression.

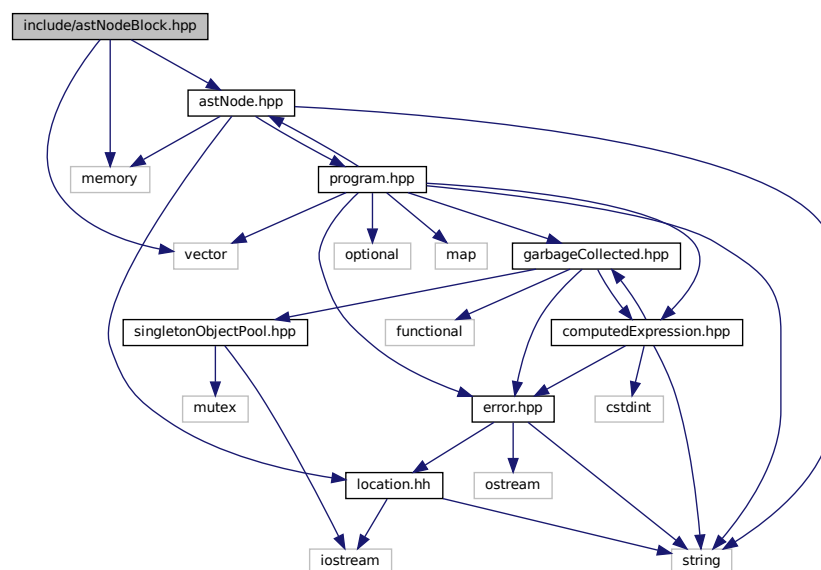
6.4.1 Detailed Description

Declare the [Tang::AstNodeBinary](#) class.

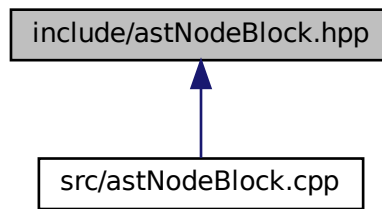
6.5 include/astNodeBlock.hpp File Reference

Declare the [Tang::AstNodeBlock](#) class.

```
#include <vector>
#include <memory>
#include "astNode.hpp"
Include dependency graph for astNodeBlock.hpp:
```



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



Classes

- class [Tang::AstNodeBlock](#)
An [AstNode](#) that represents a code block.

6.5.1 Detailed Description

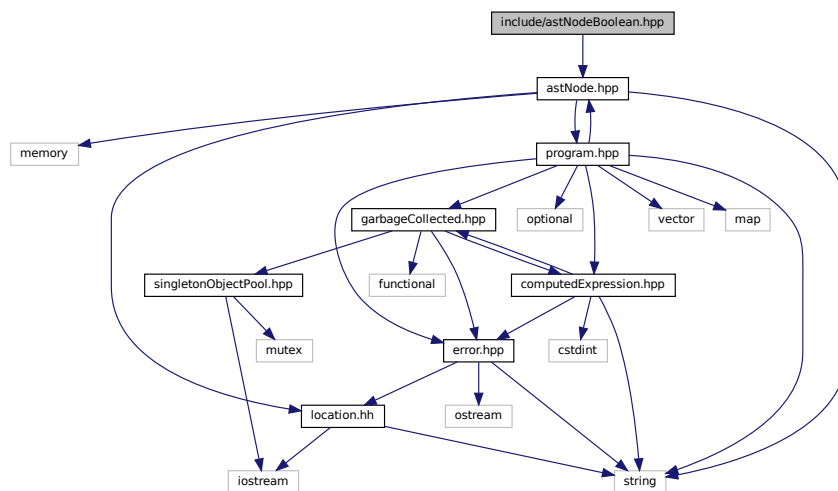
Declare the [Tang::AstNodeBlock](#) class.

6.6 include/astNodeBoolean.hpp File Reference

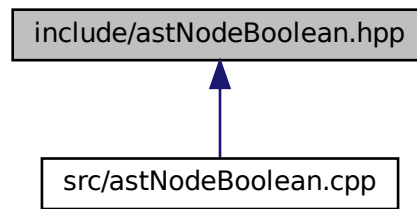
Declare the [Tang::AstNodeBoolean](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodeBoolean.hpp:



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



Classes

- class [Tang::AstNodeBoolean](#)
An [AstNode](#) that represents a boolean literal.

6.6.1 Detailed Description

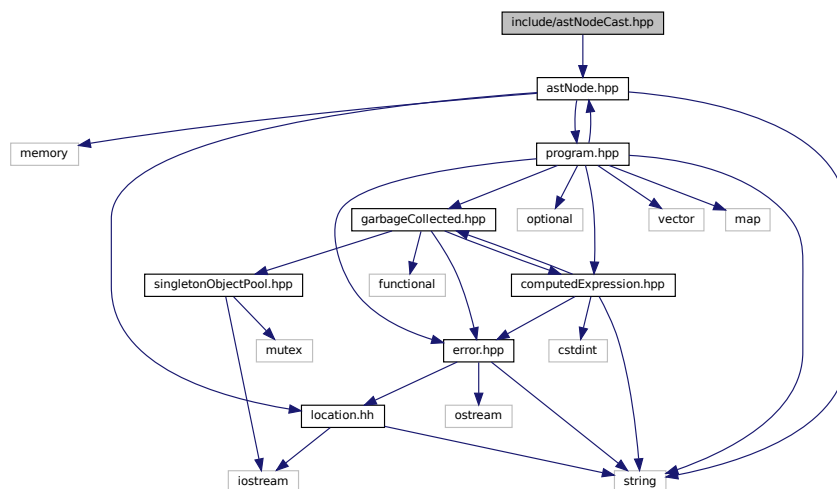
Declare the [Tang::AstNodeBoolean](#) class.

6.7 include/astNodeCast.hpp File Reference

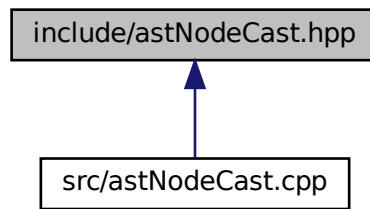
Declare the [Tang::AstNodeCast](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodeCast.hpp:



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



Classes

- class [Tang::AstNodeCast](#)

An [AstNode](#) that represents a typecast of an expression.

6.7.1 Detailed Description

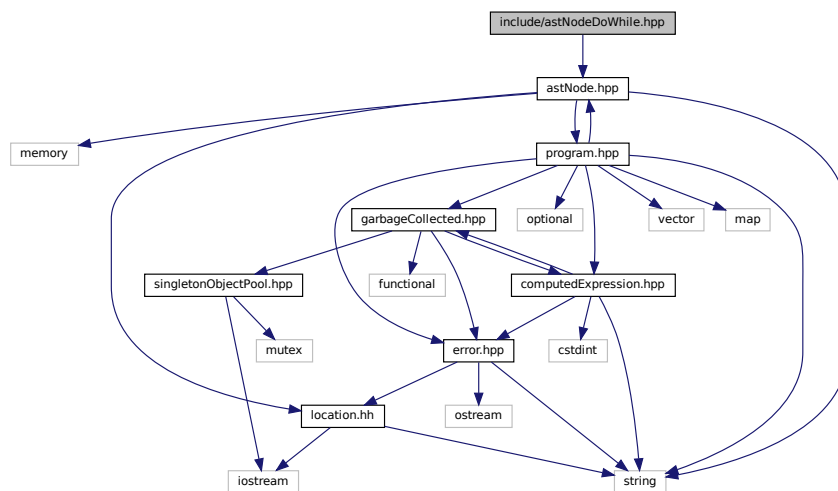
Declare the [Tang::AstNodeCast](#) class.

6.8 include/astNodeDoWhile.hpp File Reference

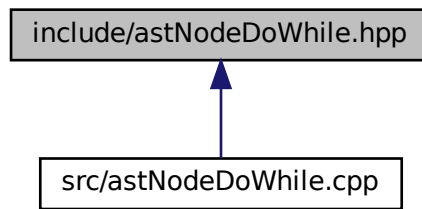
Declare the [Tang::AstNodeDoWhile](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodeDoWhile.hpp:



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



Classes

- class [Tang::AstNodeDoWhile](#)
An [AstNode](#) that represents a `do..while` statement.

6.8.1 Detailed Description

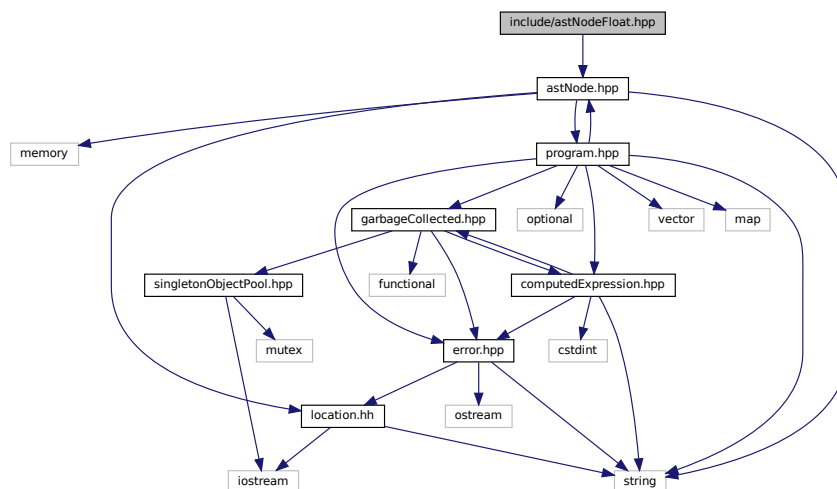
Declare the [Tang::AstNodeDoWhile](#) class.

6.9 include/astNodeFloat.hpp File Reference

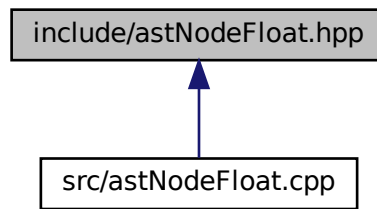
Declare the [Tang::AstNodeFloat](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for `astNodeFloat.hpp`:



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



Classes

- class [Tang::AstNodeFloat](#)
An [AstNode](#) that represents an float literal.

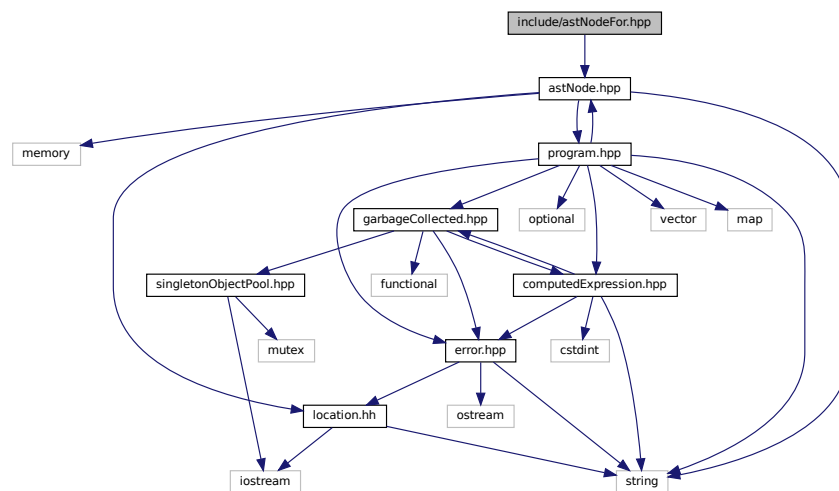
6.9.1 Detailed Description

Declare the [Tang::AstNodeFloat](#) class.

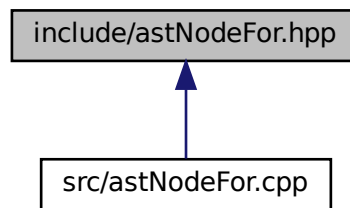
6.10 include/astNodeFor.hpp File Reference

Declare the [Tang::AstNodeFor](#) class.

```
#include "astNode.hpp"
Include dependency graph for astNodeFor.hpp:
```



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



Classes

- class [Tang::AstNodeFor](#)
An [AstNode](#) that represents an if() statement.

6.10.1 Detailed Description

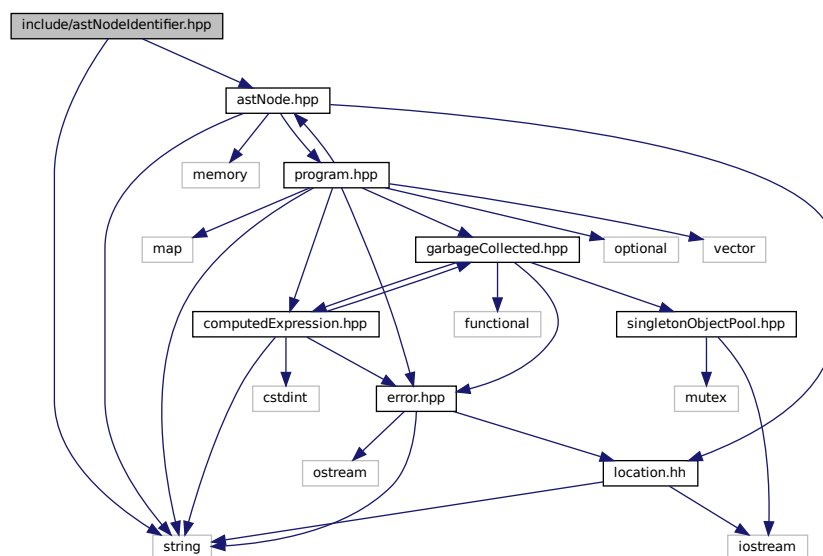
Declare the [Tang::AstNodeFor](#) class.

6.11 include/astNodeIdentifier.hpp File Reference

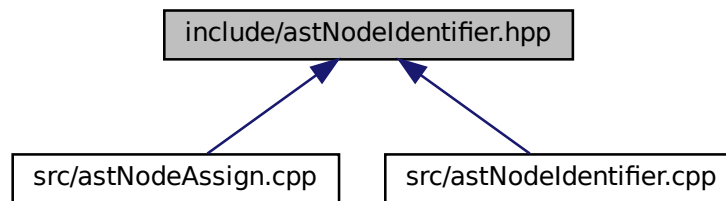
Declare the [Tang::AstNodeIdentifier](#) class.

```
#include <string>
#include "astNode.hpp"
```

Include dependency graph for astNodeIdentifier.hpp:



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



Classes

- class [Tang::AstNodeIdentifier](#)
An [AstNode](#) that represents an identifier.

6.11.1 Detailed Description

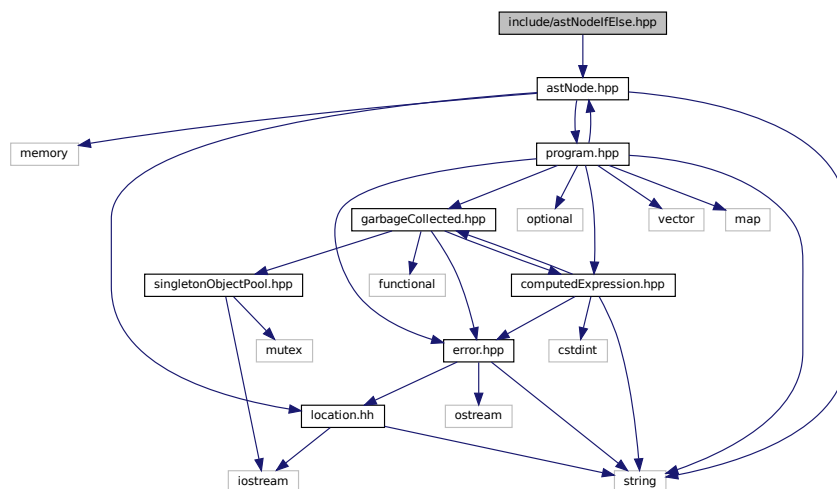
Declare the [Tang::AstNodeIdentifier](#) class.

6.12 include/astNodeIfElse.hpp File Reference

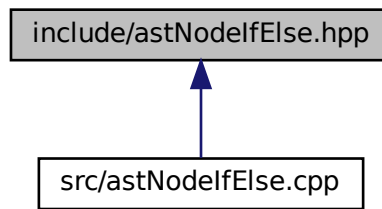
Declare the [Tang::AstNodeIfElse](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for `astNodeIfElse.hpp`:



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



Classes

- class [Tang::AstNodeIfElse](#)
An [AstNode](#) that represents an *if..else* statement.

6.12.1 Detailed Description

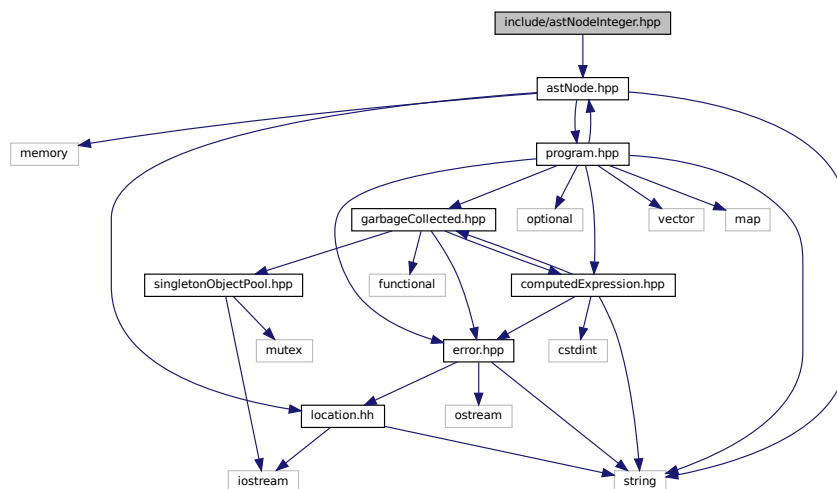
Declare the [Tang::AstNodeIfElse](#) class.

6.13 include/astNodeInteger.hpp File Reference

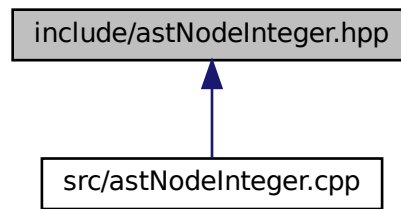
Declare the [Tang::AstNodeInteger](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for `astNodeInteger.hpp`:



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



Classes

- class [Tang::AstNodeInteger](#)
An [AstNode](#) that represents an integer literal.

6.13.1 Detailed Description

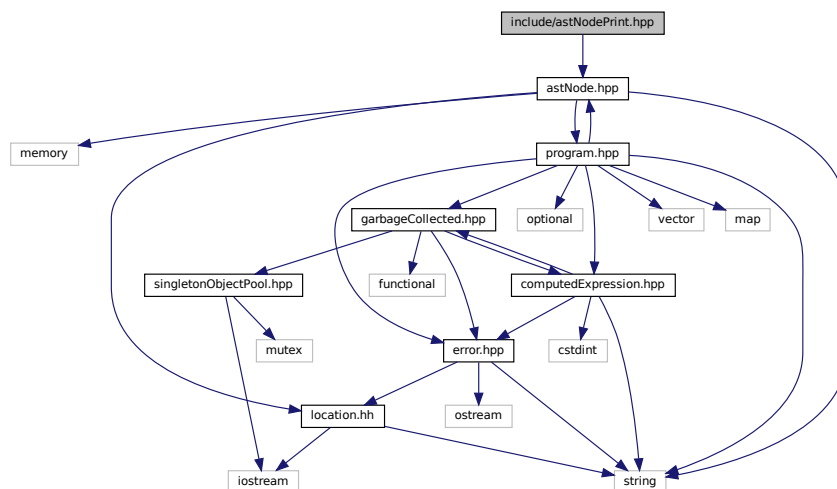
Declare the [Tang::AstNodeInteger](#) class.

6.14 include/astNodePrint.hpp File Reference

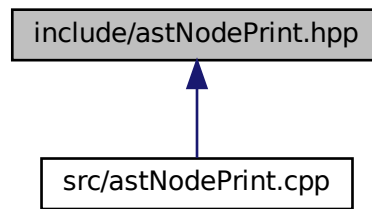
Declare the [Tang::AstNodePrint](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodePrint.hpp:



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



Classes

- class [Tang::AstNodePrint](#)
An [AstNode](#) that represents a print typeoperation.

6.14.1 Detailed Description

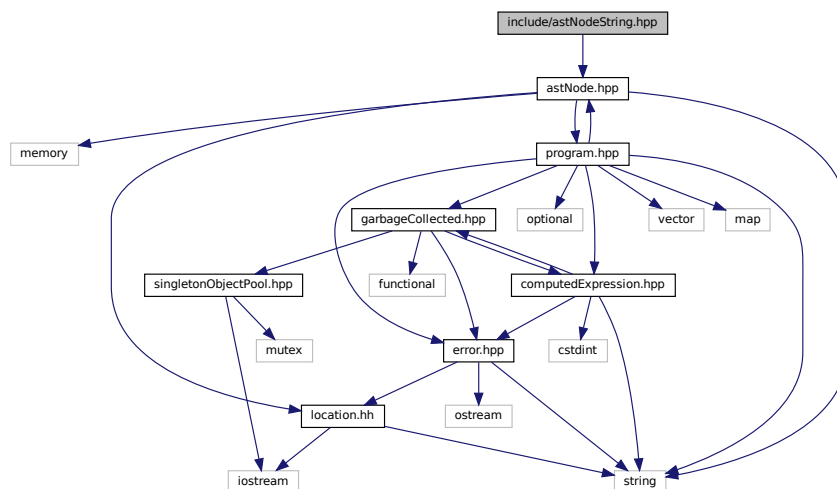
Declare the [Tang::AstNodePrint](#) class.

6.15 include/astNodeString.hpp File Reference

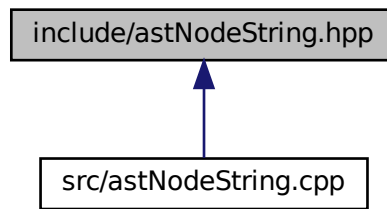
Declare the [Tang::AstNodeString](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodeString.hpp:



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



Classes

- class [Tang::AstNodeString](#)
An [AstNode](#) that represents a string literal.

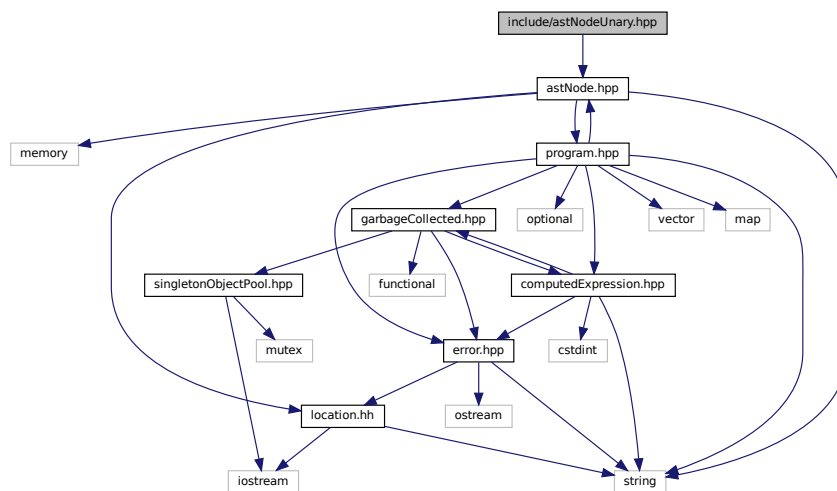
6.15.1 Detailed Description

Declare the [Tang::AstNodeString](#) class.

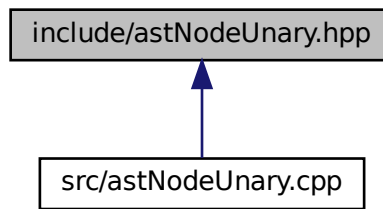
6.16 include/astNodeUnary.hpp File Reference

Declare the [Tang::AstNodeUnary](#) class.

```
#include "astNode.hpp"
Include dependency graph for astNodeUnary.hpp:
```



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



Classes

- class [Tang::AstNodeUnary](#)
An [AstNode](#) that represents a unary negation.

6.16.1 Detailed Description

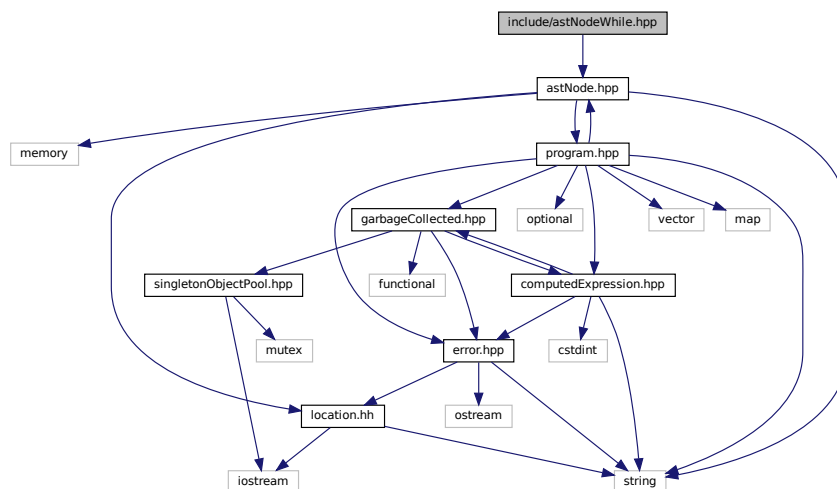
Declare the [Tang::AstNodeUnary](#) class.

6.17 include/astNodeWhile.hpp File Reference

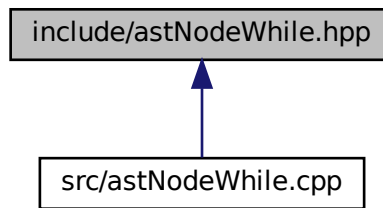
Declare the [Tang::AstNodeWhile](#) class.

```
#include "astNode.hpp"
```

Include dependency graph for astNodeWhile.hpp:



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



Classes

- class [Tang::AstNodeWhile](#)
An [AstNode](#) that represents a while statement.

6.17.1 Detailed Description

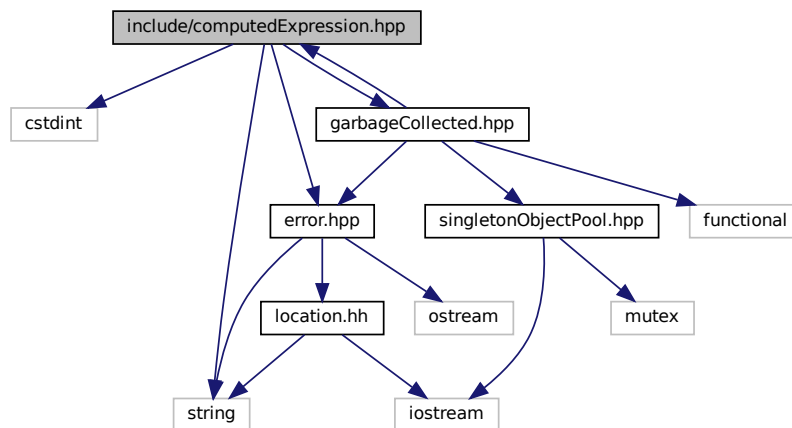
Declare the [Tang::AstNodeWhile](#) class.

6.18 include/computedExpression.hpp File Reference

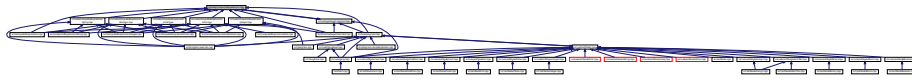
Declare the [Tang::ComputedExpression](#) base class.

```
#include <stdint>
#include <string>
#include "garbageCollected.hpp"
#include "error.hpp"
```

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.

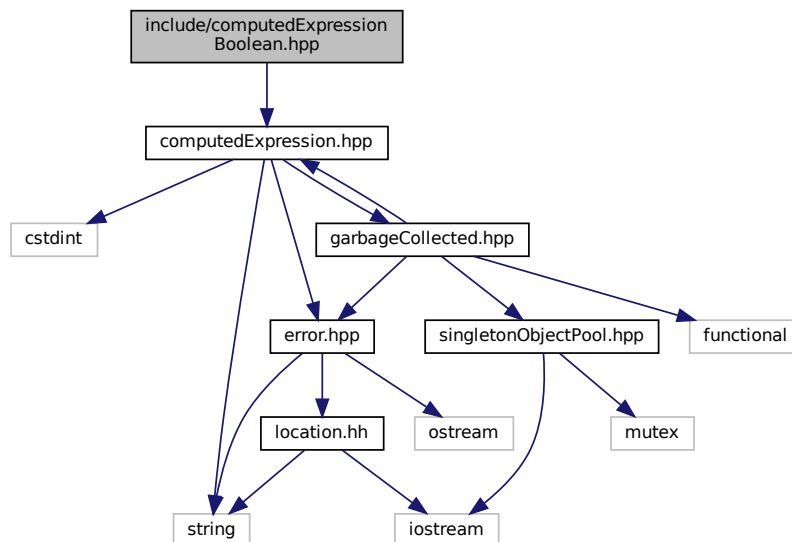
6.18.1 Detailed Description

Declare the [Tang::ComputedExpression](#) base class.

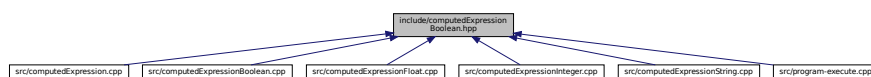
6.19 include/computedExpressionBoolean.hpp File Reference

Declare the [Tang::ComputedExpressionBoolean](#) class.

```
#include "computedExpression.hpp"
Include dependency graph for computedExpressionBoolean.hpp:
```



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



Classes

- class [Tang::ComputedExpressionBoolean](#)
Represents an Boolean that is the result of a computation.

6.19.1 Detailed Description

Declare the [Tang::ComputedExpressionBoolean](#) class.

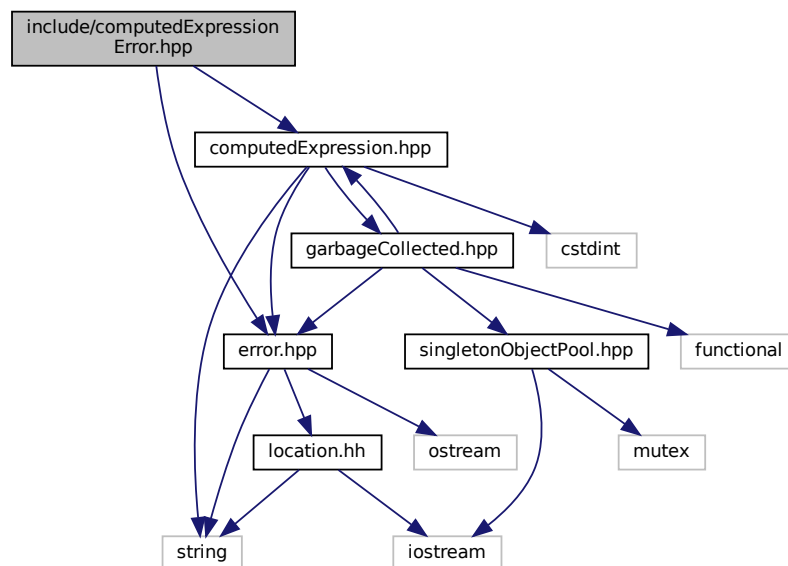
6.20 include/computedExpressionError.hpp File Reference

Declare the [Tang::ComputedExpressionError](#) class.

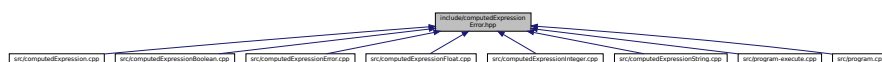
```
#include "computedExpression.hpp"
```

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

Include dependency graph for computedExpressionError.hpp:



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



Classes

- class [Tang::ComputedExpressionError](#)
Represents a Runtime Error.

6.20.1 Detailed Description

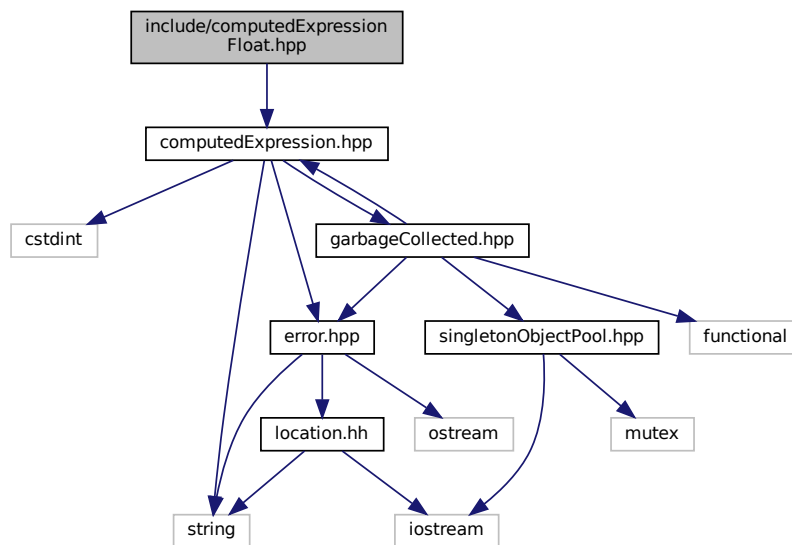
Declare the [Tang::ComputedExpressionError](#) class.

6.21 include/computedExpressionFloat.hpp File Reference

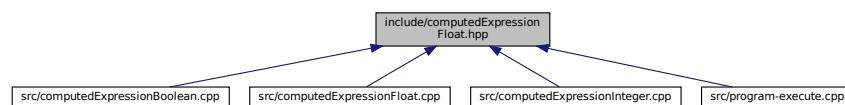
Declare the [Tang::ComputedExpressionFloat](#) class.

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

Include dependency graph for computedExpressionFloat.hpp:



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



Classes

- class [Tang::ComputedExpressionFloat](#)
Represents a Float that is the result of a computation.

6.21.1 Detailed Description

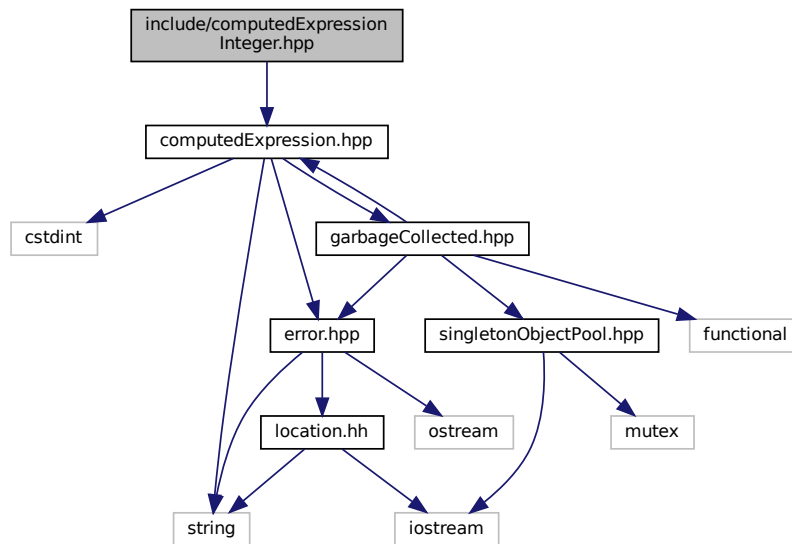
Declare the [Tang::ComputedExpressionFloat](#) class.

6.22 include/computedExpressionInteger.hpp File Reference

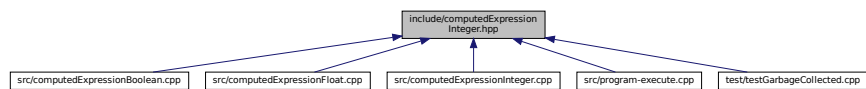
Declare the [Tang::ComputedExpressionInteger](#) class.

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

Include dependency graph for computedExpressionInteger.hpp:



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



Classes

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

6.22.1 Detailed Description

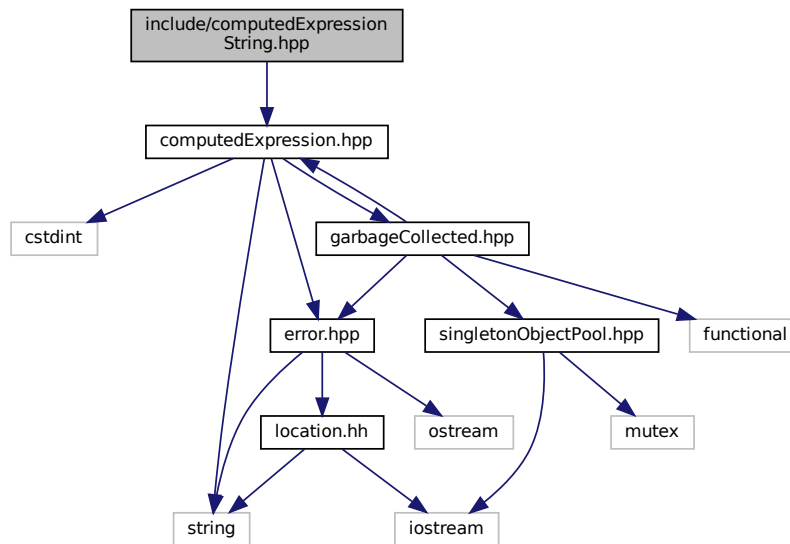
Declare the [Tang::ComputedExpressionInteger](#) class.

6.23 include/computedExpressionString.hpp File Reference

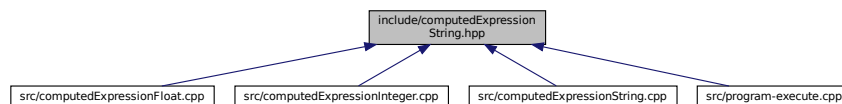
Declare the [Tang::ComputedExpressionString](#) class.

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

Include dependency graph for computedExpressionString.hpp:



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



Classes

- class [Tang::ComputedExpressionString](#)
Represents a String that is the result of a computation.

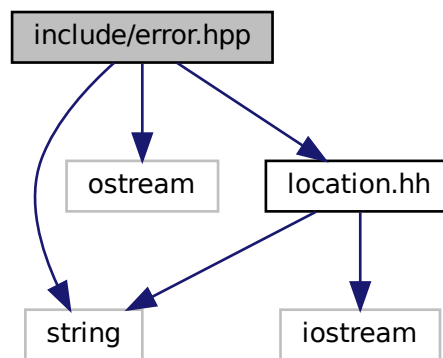
6.23.1 Detailed Description

Declare the [Tang::ComputedExpressionString](#) class.

6.24 include/error.hpp File Reference

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

```
#include <string>
#include <ostream>
#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.

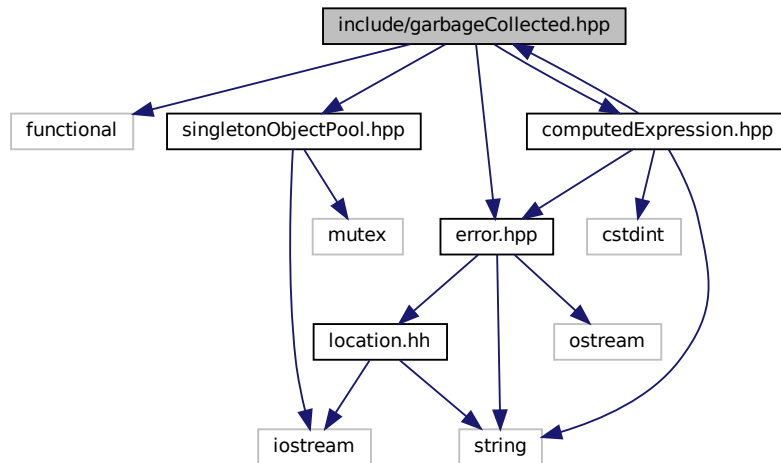
6.24.1 Detailed Description

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

6.25 include/garbageCollected.hpp File Reference

Declare the [Tang::GarbageCollected](#) class.

```
#include <functional>
#include "singletonObjectPool.hpp"
#include "computedExpression.hpp"
#include "error.hpp"
Include dependency graph for garbageCollected.hpp:
```



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



Classes

- class [Tang::GarbageCollected](#)

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

6.25.1 Detailed Description

Declare the [Tang::GarbageCollected](#) class.

6.26 include/macros.hpp File Reference

Contains generic macros.

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.

6.26.1 Detailed Description

Contains generic macros.

6.26.2 Macro Definition Documentation

6.26.2.1 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.
---	-----------------------------

6.27 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` {
`POP`, `PEEK`, `POKE`, `JMP`,
`JMPF`, `JMPF_POP`, `JMPT`, `JMPT_POP`,
`NULLVAL`, `INTEGER`, `FLOAT`, `BOOLEAN`,
`STRING`, `ADD`, `SUBTRACT`, `MULTIPLY`,
`DIVIDE`, `MODULO`, `NEGATIVE`, `NOT`,
`LT`, `LTE`, `GT`, `GTE`,
`EQ`, `NEQ`, `CASTINTEGER`, `CASTFLOAT`,
`CASTBOOLEAN`, `PRINT` }

6.27.1 Detailed Description

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

6.27.2 Enumeration Type Documentation

6.27.2.1 Opcode

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

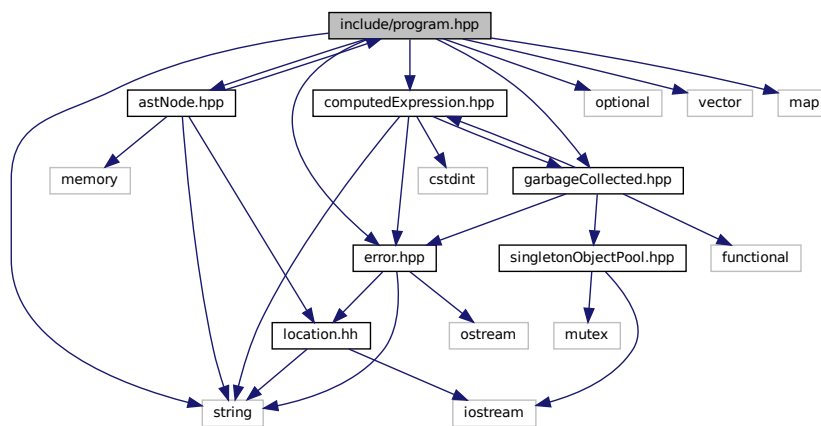
Enumerator

POP	Pop a val.
PEEK	Stack #: (from fp): push val from stack #.
POKE	Stack #: (from fp): Copy a val, store @ stack #.
JMP	PC #: set pc to PC #.
JMPF	PC #: read val, if false, set pc to PC #.
JMPF_POP	PC #: pop val, if false, set pc to PC #.
JMPT	PC #: read val, if true, set pc to PC #.
JMPT_POP	PC #: pop val, if true, set pc to PC #.
NULLVAL	Push a null onto the stack.
INTEGER	Push an integer onto the stack.
FLOAT	Push a floating point number onto the stack.
BOOLEAN	Push a boolean onto the stack.
STRING	Get len, char string: push string.
ADD	Pop rhs, pop lhs, push lhs + rhs.
SUBTRACT	Pop rhs, pop lhs, push lhs - rhs.
MULTIPLY	Pop rhs, pop lhs, push lhs * rhs.
DIVIDE	Pop rhs, pop lhs, push lhs / rhs.
MODULO	Pop rhs, pop lhs, push lhs % rhs.
NEGATIVE	Pop val, push negative val.
NOT	Pop val, push logical not of val.
LT	Pop rhs, pop lhs, push lhs < rhs.
LTE	Pop rhs, pop lhs, push lhs <= rhs.
GT	Pop rhs, pop lhs, push lhs > rhs.
GTE	Pop rhs, pop lhs, push lhs >= rhs.
EQ	Pop rhs, pop lhs, push lhs == rhs.
NEQ	Pop rhs, pop lhs, push lhs != rhs.
CASTINTEGER	Pop a val, typecast to int, push.
CASTFLOAT	Pop a val, typecast to float, push.
CASTBOOLEAN	Pop a val, typecast to boolean, push.
PRINT	Pop val, print(val), push error or NULL.

6.28 include/program.hpp File Reference

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

```
#include <string>
#include <optional>
#include <vector>
#include <map>
#include "astNode.hpp"
#include "error.hpp"
#include "computedExpression.hpp"
#include "garbageCollected.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.

6.28.1 Detailed Description

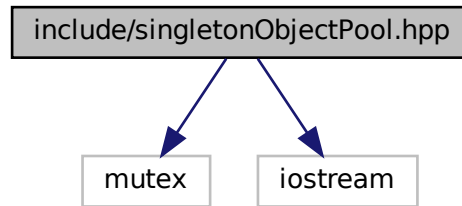
Declare the `Tang::Program` class used to compile and execute source code.

6.29 include/singletonObjectPool.hpp File Reference

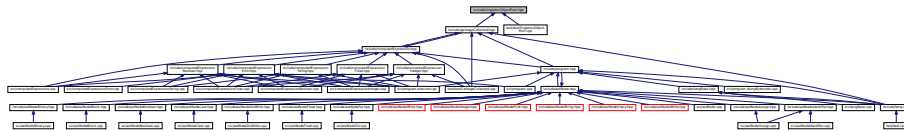
Declare the [Tang::SingletonObjectPool](#) class.

```
#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 >](#)
A thread-safe, singleton object pool of the designated type.

Macros

- #define [GROW](#) 1024
The threshold size to use when allocating blocks of data, measured in the number of instances of the object type.

6.29.1 Detailed Description

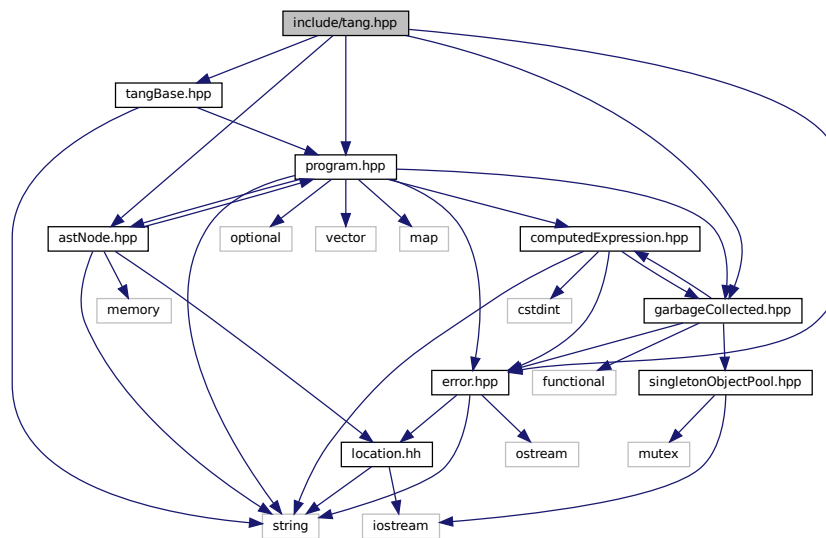
Declare the [Tang::SingletonObjectPool](#) class.

6.30 include/tang.hpp File Reference

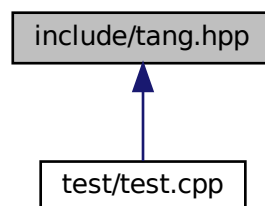
Header file supplied for use by 3rd party code so that they can easily include all necessary headers.

```
#include "tangBase.hpp"
#include "astNode.hpp"
#include "error.hpp"
#include "garbageCollected.hpp"
#include "program.hpp"
```

Include dependency graph for tang.hpp:



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



6.30.1 Detailed Description

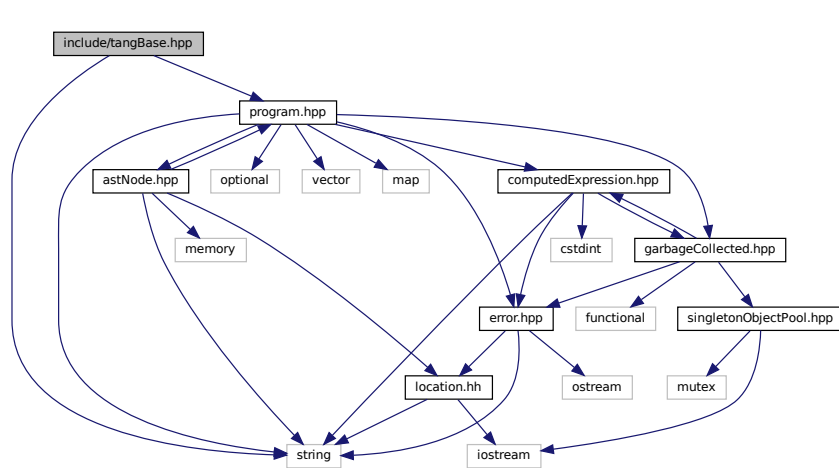
Header file supplied for use by 3rd party code so that they can easily include all necessary headers.

6.31 include/tangBase.hpp File Reference

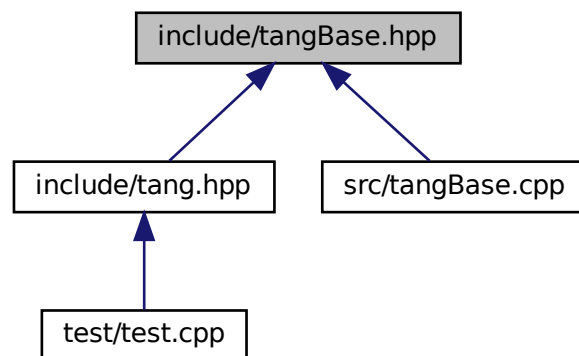
Declare the [Tang::TangBase](#) class used to interact with Tang.

```
#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.

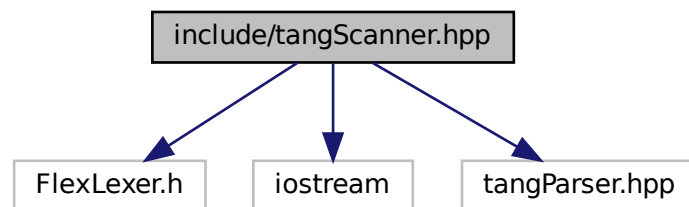
6.31.1 Detailed Description

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

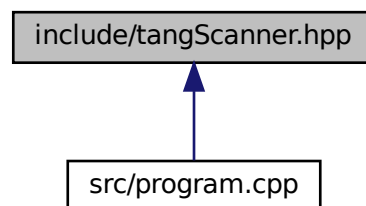
6.32 include/tangScanner.hpp File Reference

Declare 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()`

6.32.1 Detailed Description

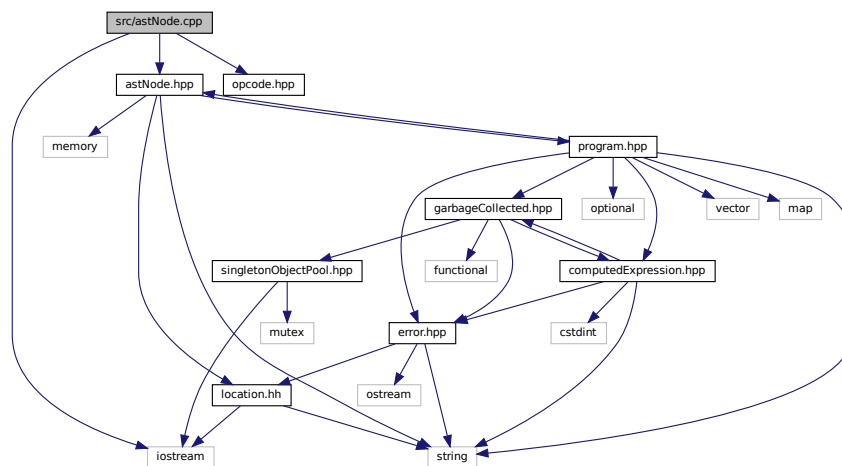
Declare the [Tang::TangScanner](#) used to tokenize a Tang script.

6.33 src/astNode.cpp File Reference

Define the [Tang::AstNode](#) class.

```
#include <iostream>
#include "astNode.hpp"
#include "opcode.hpp"
```

Include dependency graph for astNode.cpp:



6.33.1 Detailed Description

Define the [Tang::AstNode](#) class.

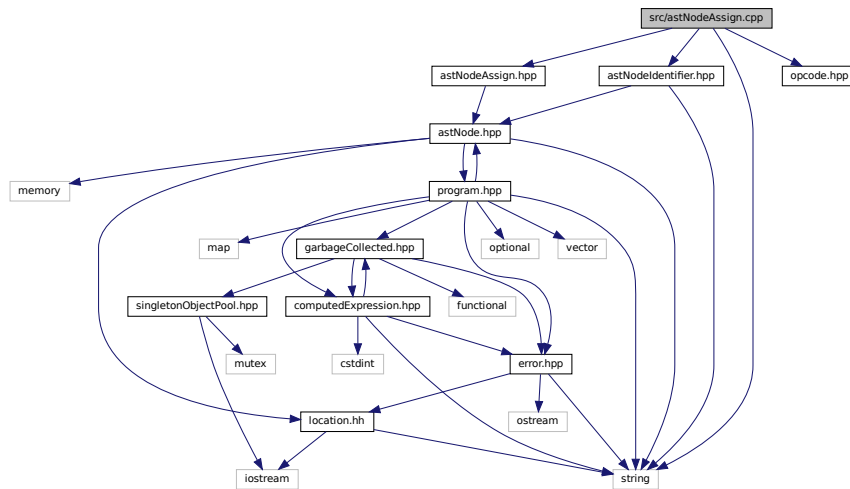
6.34 src/astNodeAssign.cpp File Reference

Define the [Tang::AstNodeAssign](#) class.

```
#include <string>
#include "astNodeAssign.hpp"
#include "astNodeIdentifier.hpp"
```

```
#include "opcode.hpp"
```

Include dependency graph for astNodeAssign.cpp:



6.34.1 Detailed Description

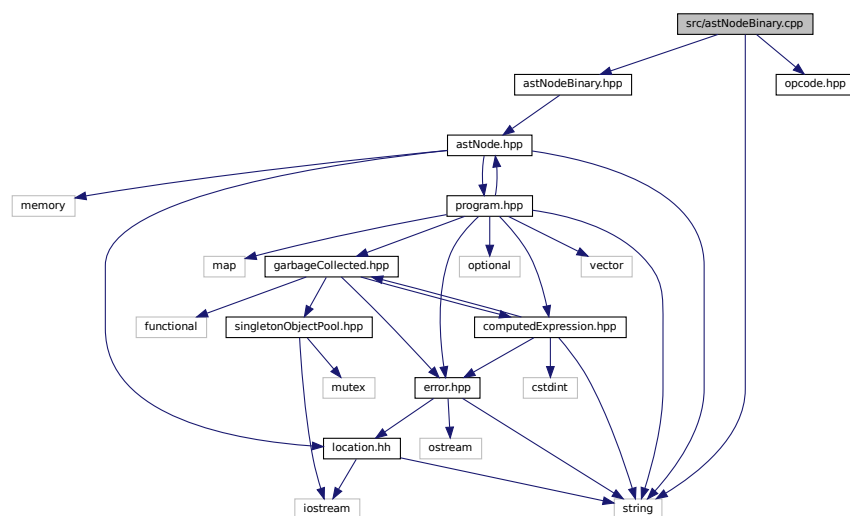
Define the [Tang::AstNodeAssign](#) class.

6.35 src/astNodeBinary.cpp File Reference

Define the [Tang::AstNodeBinary](#) class.

```
#include <string>
#include "astNodeBinary.hpp"
#include "opcode.hpp"
```

Include dependency graph for astNodeBinary.cpp:



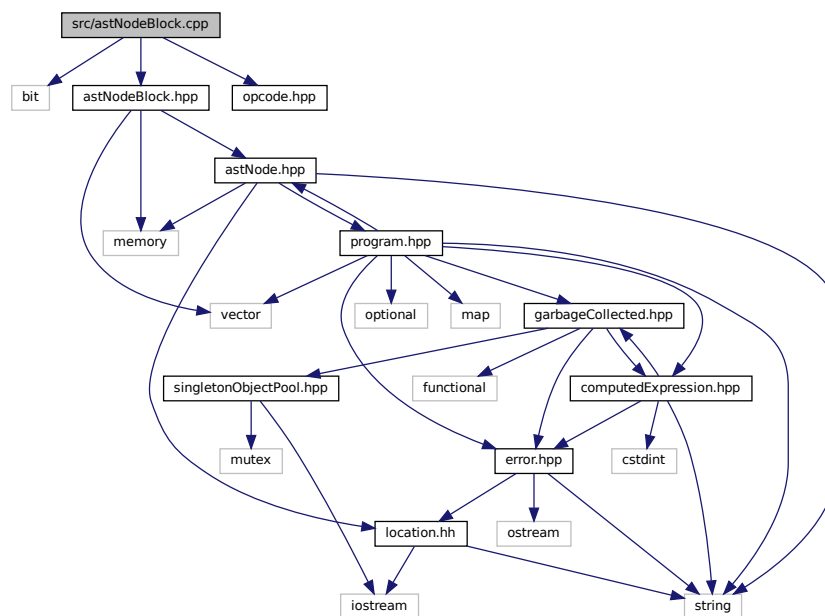
6.35.1 Detailed Description

Define the [Tang::AstNodeBinary](#) class.

6.36 src/astNodeBlock.cpp File Reference

Define the [Tang::AstNodeBlock](#) class.

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



6.36.1 Detailed Description

Define the [Tang::AstNodeBlock](#) class.

6.37 src/astNodeBoolean.cpp File Reference

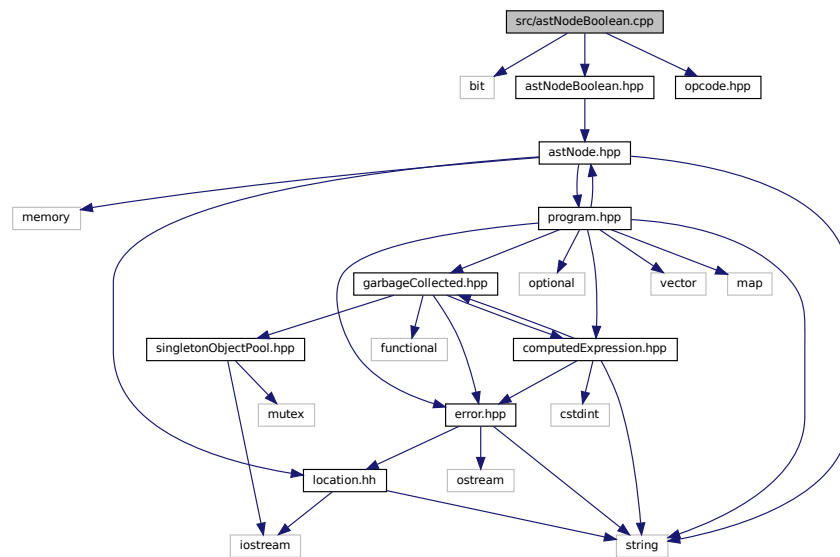
Define the [Tang::AstNodeBoolean](#) class.

```
#include <bit>
#include "astNodeBoolean.hpp"
```



```
#include "opcode.hpp"
```

Include dependency graph for astNodeBoolean.cpp:



6.37.1 Detailed Description

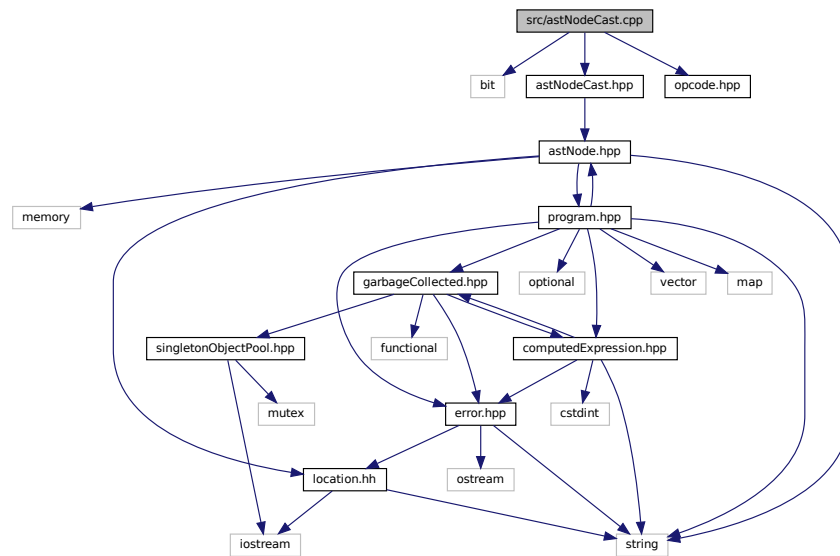
Define the [Tang::AstNodeBoolean](#) class.

6.38 src/astNodeCast.cpp File Reference

Define the [Tang::AstNodeCast](#) class.

```
#include <bit>
#include "astNodeCast.hpp"
#include "opcode.hpp"
```

Include dependency graph for astNodeCast.cpp:



6.38.1 Detailed Description

Define the [Tang::AstNodeCast](#) class.

6.39 src/astNodeDoWhile.cpp File Reference

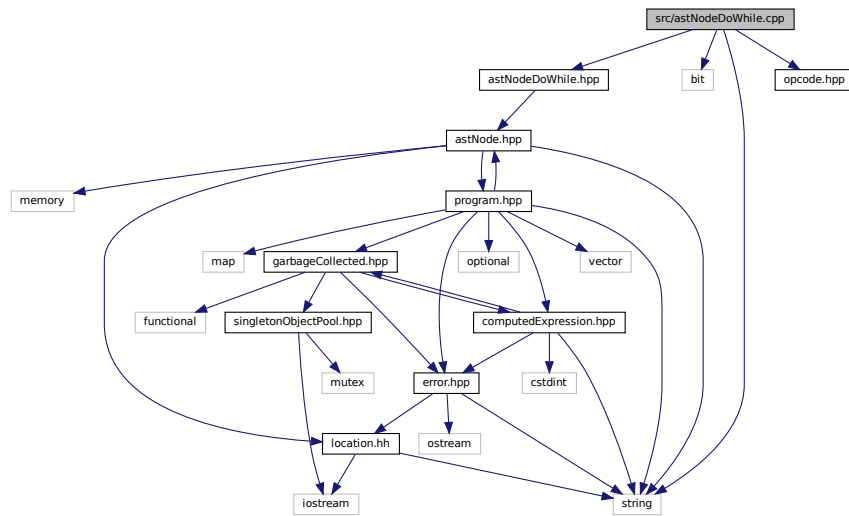
Define the [Tang::AstNodeDoWhile](#) class.

```

#include <string>
#include <bit>
#include "astNodeDoWhile.hpp"
#include "opcode.hpp"

```

Include dependency graph for astNodeDoWhile.cpp:



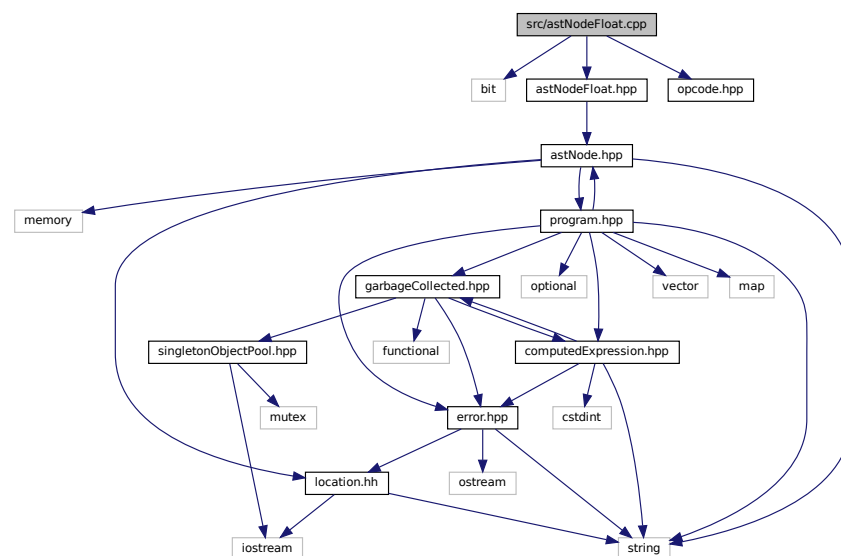
6.39.1 Detailed Description

Define the [Tang::AstNodeDoWhile](#) class.

6.40 src/astNodeFloat.cpp File Reference

Define the [Tang::AstNodeFloat](#) class.

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



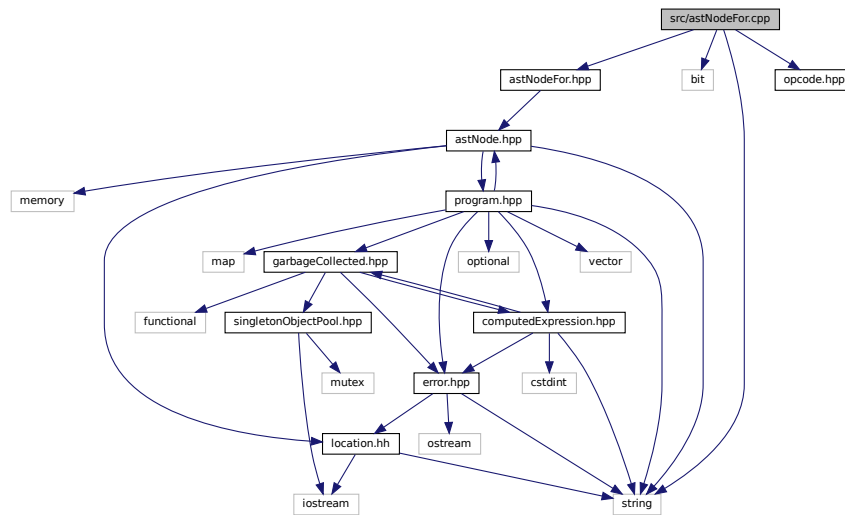
6.40.1 Detailed Description

Define the `Tang::AstNodeFloat` class.

6.41 src/astNodeFor.cpp File Reference

Define the `Tang::AstNodeFor` class.

```
#include <string>
#include <bit>
#include "astNodeFor.hpp"
#include "opcode.hpp"
Include dependency graph for astNodeFor.cpp:
```



6.41.1 Detailed Description

Define the `Tang::AstNodeFor` class.

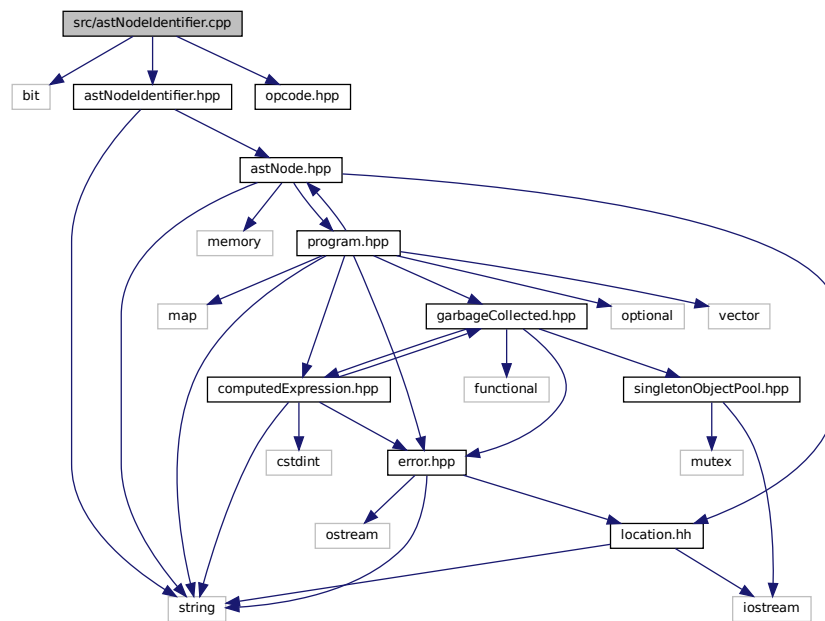
6.42 src/astNodeIdentifier.cpp File Reference

Define the `Tang::AstNodeIdentifier` class.

```
#include <bit>
#include "astNodeIdentifier.hpp"
```

```
#include "opcode.hpp"
```

Include dependency graph for astNodeIdentifier.cpp:



6.42.1 Detailed Description

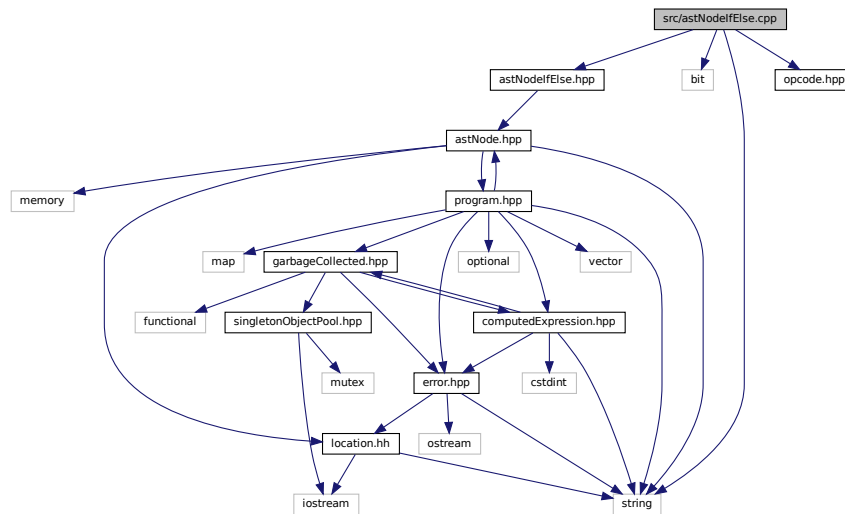
Define the [Tang::AstNodeIdentifier](#) class.

6.43 src/astNodeIfElse.cpp File Reference

Define the [Tang::AstNodeIfElse](#) class.

```
#include <string>
#include <bit>
#include "astNodeIfElse.hpp"
#include "opcode.hpp"
```

Include dependency graph for `astNodeIfElse.cpp`:



6.43.1 Detailed Description

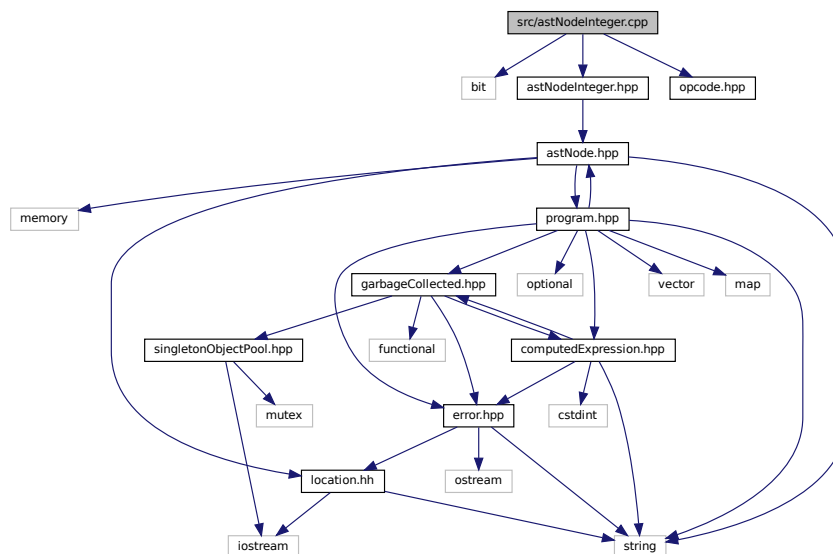
Define the [Tang::AstNodeIfElse](#) class.

6.44 src/astNodeInteger.cpp File Reference

Define the [Tang::AstNodeInteger](#) class.

```
#include <bit>
#include "astNodeInteger.hpp"
#include "opcode.hpp"
```

Include dependency graph for `astNodeInteger.cpp`:



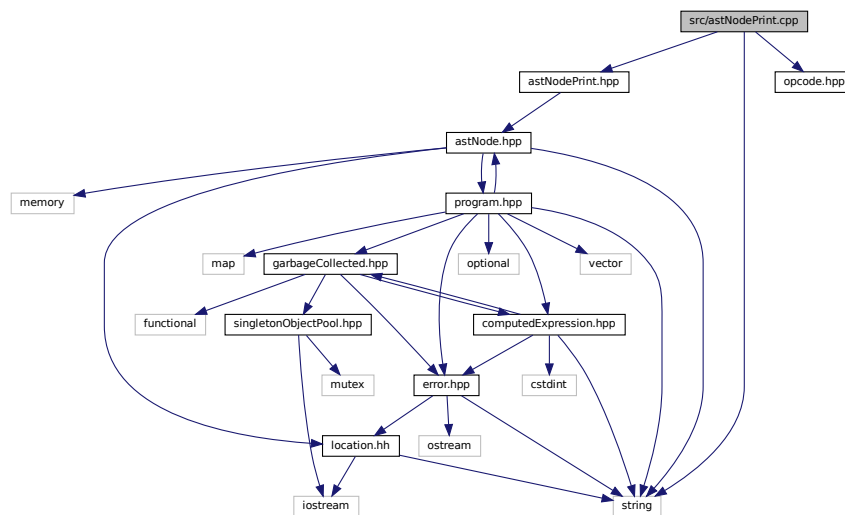
6.44.1 Detailed Description

Define the [Tang::AstNodeInteger](#) class.

6.45 src/astNodePrint.cpp File Reference

Define the [Tang::AstNodePrint](#) class.

```
#include <string>
#include "astNodePrint.hpp"
#include "opcode.hpp"
Include dependency graph for astNodePrint.cpp:
```



6.45.1 Detailed Description

Define the [Tang::AstNodePrint](#) class.

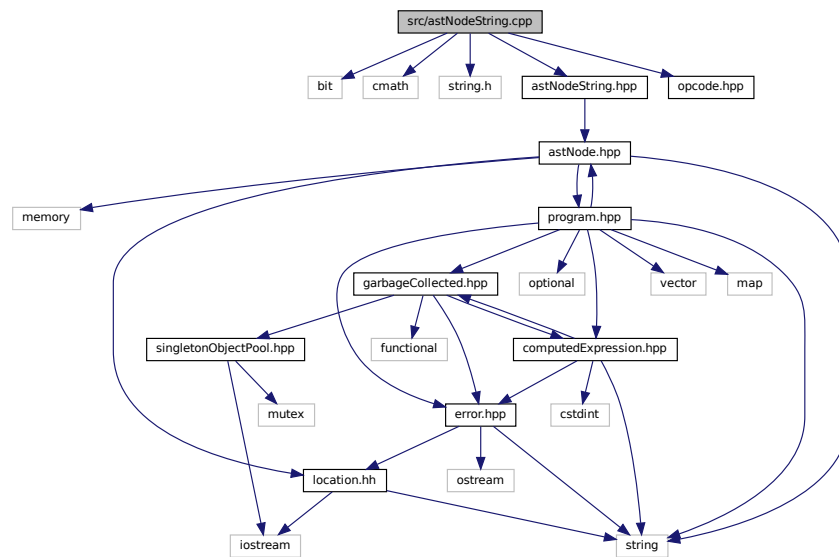
6.46 src/astNodeString.cpp File Reference

Define the [Tang::AstNodeString](#) class.

```
#include <bit>
#include <cmath>
#include <string.h>
#include "astNodeString.hpp"
```

```
#include "opcode.hpp"
```

Include dependency graph for `astNodeString.cpp`:



6.46.1 Detailed Description

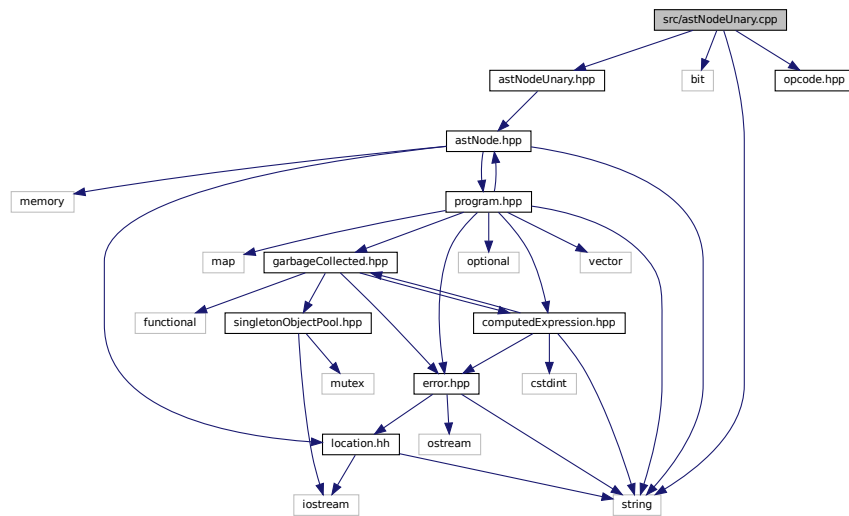
Define the [Tang::AstNodeString](#) class.

6.47 src/astNodeUnary.cpp File Reference

Define the [Tang::AstNodeUnary](#) class.

```
#include <string>
#include <bit>
#include "astNodeUnary.hpp"
#include "opcode.hpp"
```


Include dependency graph for astNodeUnary.cpp:



6.47.1 Detailed Description

Define the [Tang::AstNodeUnary](#) class.

6.48 src/astNodeWhile.cpp File Reference

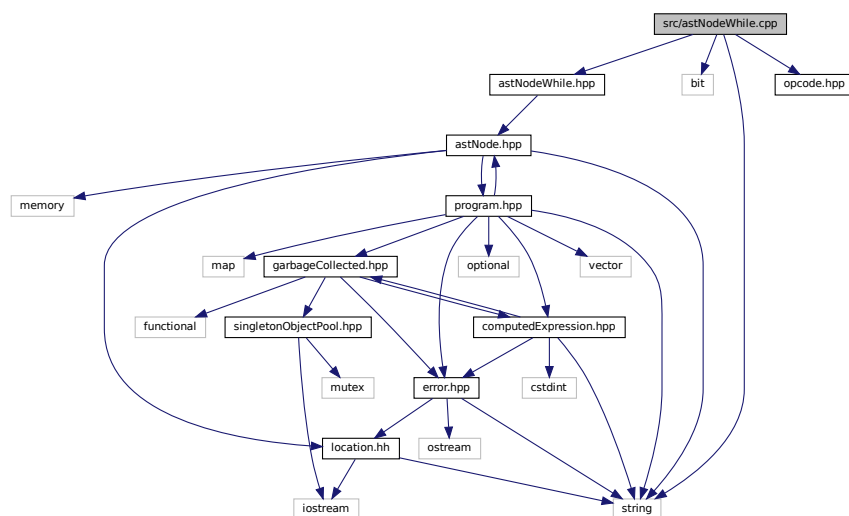
Define the [Tang::AstNodeWhile](#) class.

```

#include <string>
#include <bit>
#include "astNodeWhile.hpp"
#include "opcode.hpp"

```

Include dependency graph for astNodeWhile.cpp:



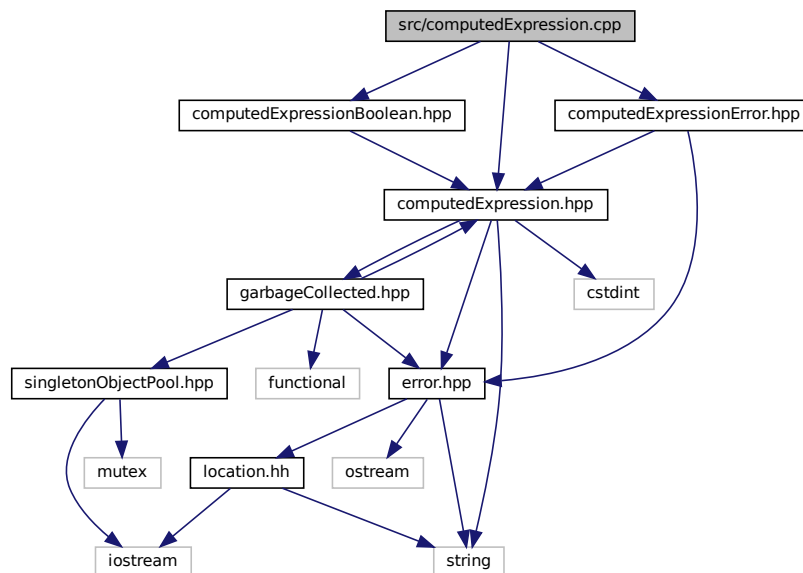
6.48.1 Detailed Description

Define the [Tang::AstNodeWhile](#) class.

6.49 src/computedExpression.cpp File Reference

Define the [Tang::ComputedExpression](#) class.

```
#include "computedExpression.hpp"
#include "computedExpressionBoolean.hpp"
#include "computedExpressionError.hpp"
Include dependency graph for computedExpression.cpp:
```



6.49.1 Detailed Description

Define the [Tang::ComputedExpression](#) class.

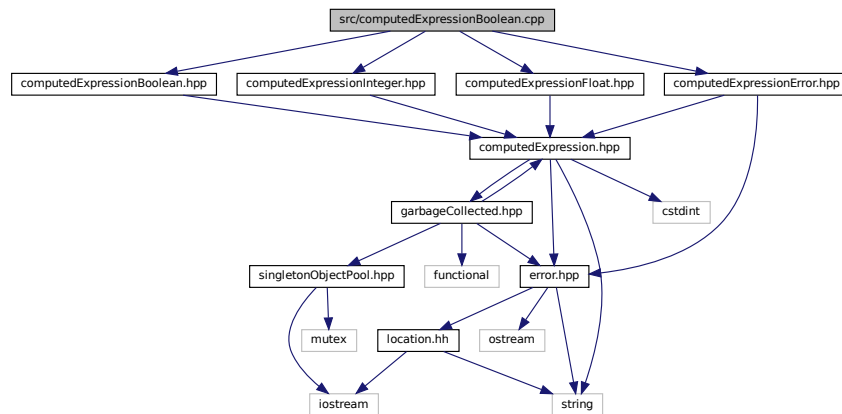
6.50 src/computedExpressionBoolean.cpp File Reference

Define the [Tang::ComputedExpressionBoolean](#) class.

```
#include "computedExpressionBoolean.hpp"
#include "computedExpressionInteger.hpp"
#include "computedExpressionFloat.hpp"
```

```
#include "computedExpressionError.hpp"
```

Include dependency graph for computedExpressionBoolean.cpp:



6.50.1 Detailed Description

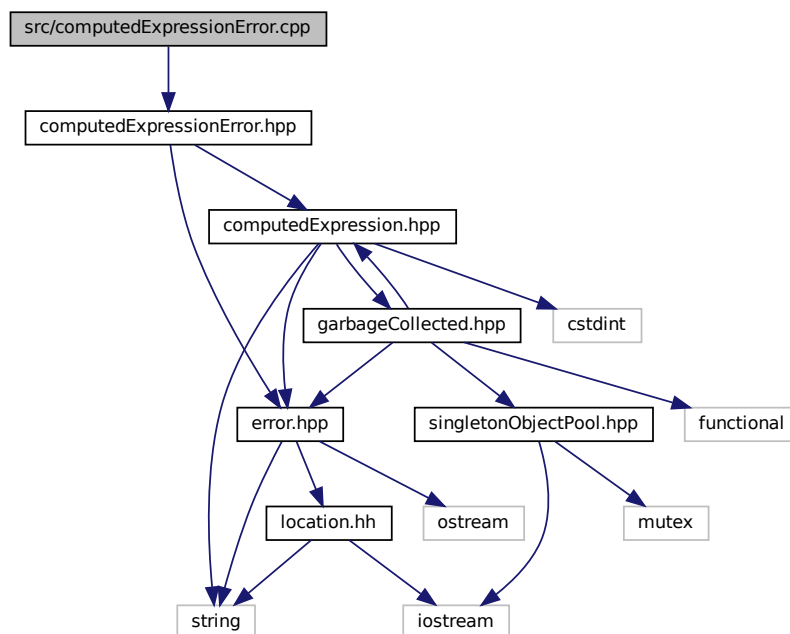
Define the [Tang::ComputedExpressionBoolean](#) class.

6.51 src/computedExpressionError.cpp File Reference

Define the [Tang::ComputedExpressionError](#) class.

```
#include "computedExpressionError.hpp"
```

Include dependency graph for computedExpressionError.cpp:



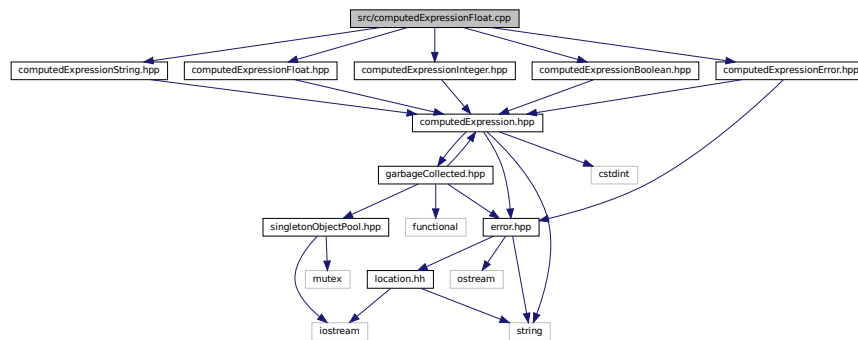
6.51.1 Detailed Description

Define the [Tang::ComputedExpressionError](#) class.

6.52 src/computedExpressionFloat.cpp File Reference

Define the [Tang::ComputedExpressionFloat](#) class.

```
#include "computedExpressionFloat.hpp"
#include "computedExpressionInteger.hpp"
#include "computedExpressionBoolean.hpp"
#include "computedExpressionString.hpp"
#include "computedExpressionError.hpp"
Include dependency graph for computedExpressionFloat.cpp:
```



6.52.1 Detailed Description

Define the [Tang::ComputedExpressionFloat](#) class.

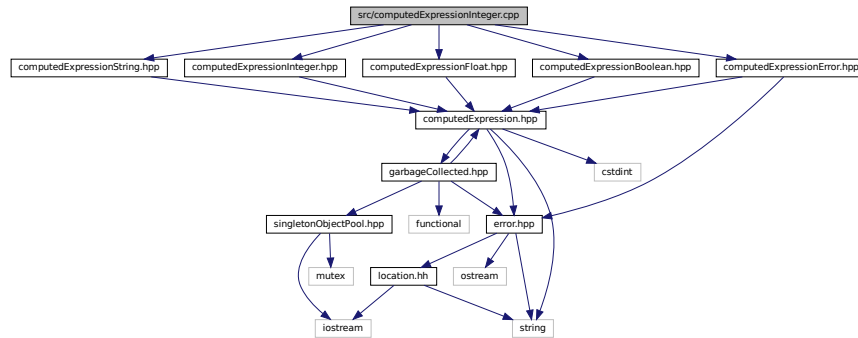
6.53 src/computedExpressionInteger.cpp File Reference

Define the [Tang::ComputedExpressionInteger](#) class.

```
#include "computedExpressionInteger.hpp"
#include "computedExpressionFloat.hpp"
#include "computedExpressionBoolean.hpp"
#include "computedExpressionString.hpp"
```

```
#include "computedExpressionError.hpp"
```

Include dependency graph for computedExpressionInteger.cpp:



6.53.1 Detailed Description

Define the [Tang::ComputedExpressionInteger](#) class.

6.54 src/computedExpressionString.cpp File Reference

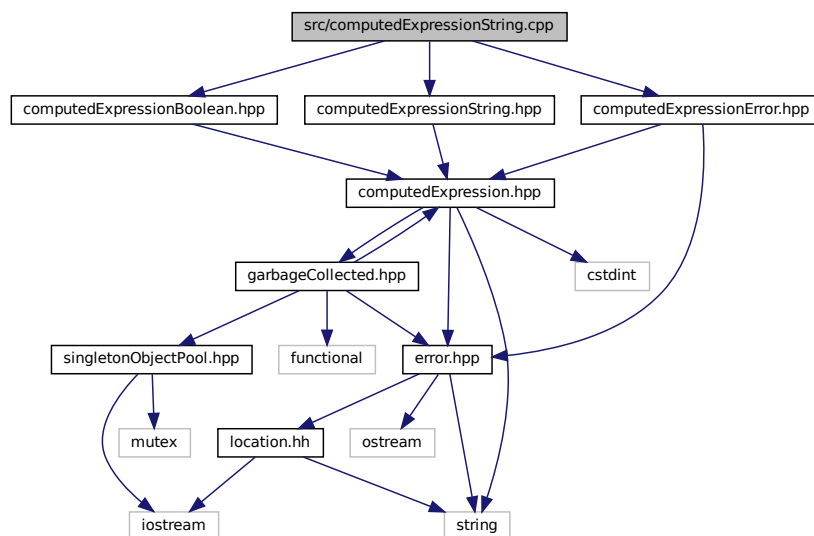
Define the [Tang::ComputedExpressionString](#) class.

```
#include "computedExpressionString.hpp"
```

```
#include "computedExpressionBoolean.hpp"
```

```
#include "computedExpressionError.hpp"
```

Include dependency graph for computedExpressionString.cpp:



6.54.1 Detailed Description

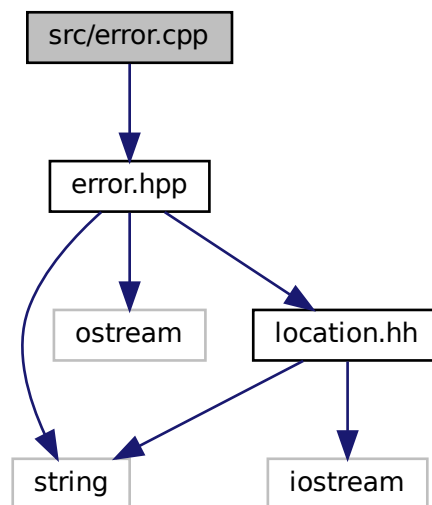
Define the [Tang::ComputedExpressionString](#) class.

6.55 src/error.cpp File Reference

Define the [Tang::Error](#) class.

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

Include dependency graph for error.cpp:



Functions

- `std::ostream & Tang::operator<< (std::ostream &out, const Error &error)`

6.55.1 Detailed Description

Define the [Tang::Error](#) class.

6.55.2 Function Documentation

6.55.2.1 operator<<()

```
std::ostream& Tang::operator<< (
    std::ostream & out,
    const Error & error )
```

Parameters

<i>out</i>	The output stream.
<i>error</i>	The Error object.

Returns

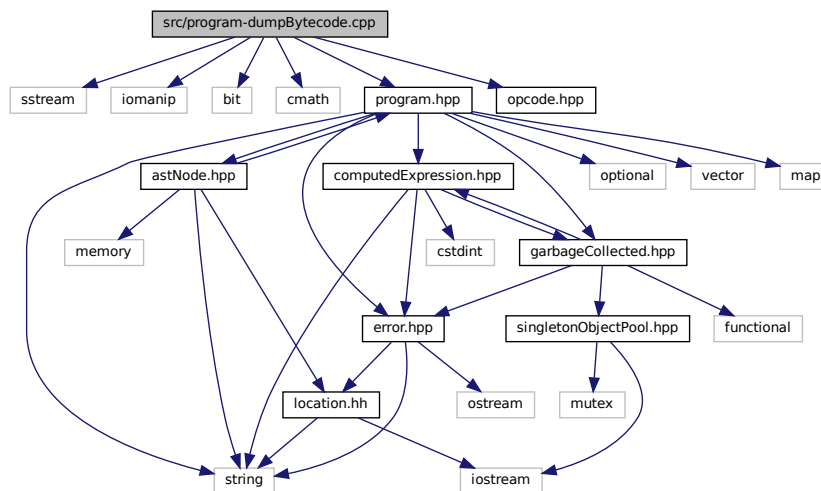
The output stream.

6.56 src/program-dumpBytecode.cpp File Reference

Define the [Tang::Program::dumpBytecode](#) method.

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

Include dependency graph for program-dumpBytecode.cpp:



Macros

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

6.56.1 Detailed Description

Define the [Tang::Program::dumpBytecode](#) method.

6.56.2 Macro Definition Documentation

6.56.2.1 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

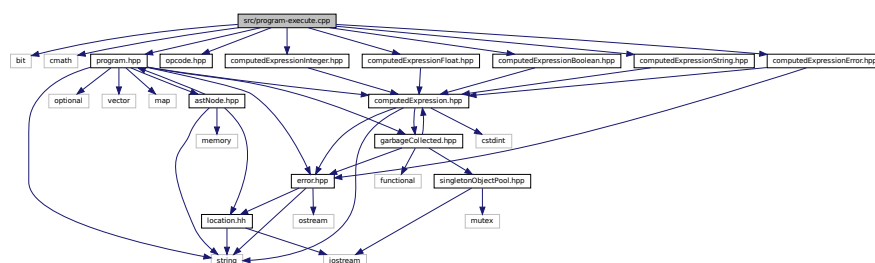
x	The number of additional vector entries that should exist.
---	--

6.57 src/program-execute.cpp File Reference

Define the [Tang::Program::execute](#) method.

```
#include <bit>  
#include <cmath>  
#include "program.hpp"  
#include "opcode.hpp"  
#include "computedExpressionError.hpp"  
#include "computedExpressionInteger.hpp"  
#include "computedExpressionFloat.hpp"  
#include "computedExpressionBoolean.hpp"  
#include "computedExpressionString.hpp"
```

Include dependency graph for program-execute.cpp:



Macros

- `#define EXECUTEPROGRAMCHECK(x)`

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

- `#define STACKCHECK(x)`

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

6.57.1 Detailed Description

Define the `Tang::Program::execute` method.

6.57.2 Macro Definition Documentation

6.57.2.1 EXECUTEPROGRAMCHECK

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

Value:

```
if (this->bytecode.size() < (pc + (x))) { \
    stack.push_back(GarbageCollected::make<ComputedExpressionError>(Error{"Opcode instruction  
truncated."})); \
    pc = this->bytecode.size(); \
    break; \
}
```

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

Parameters

<code>x</code>	The number of additional vector entries that should exist.
----------------	--

6.57.2.2 STACKCHECK

```
#define STACKCHECK(  
    x )
```

Value:

```
if (stack.size() < (fp + (x))) { \
    stack.push_back(GarbageCollected::make<ComputedExpressionError>(Error{"Insufficient stack depth."})); \
    pc = this->bytecode.size(); \
    break; \
}
```

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

Parameters

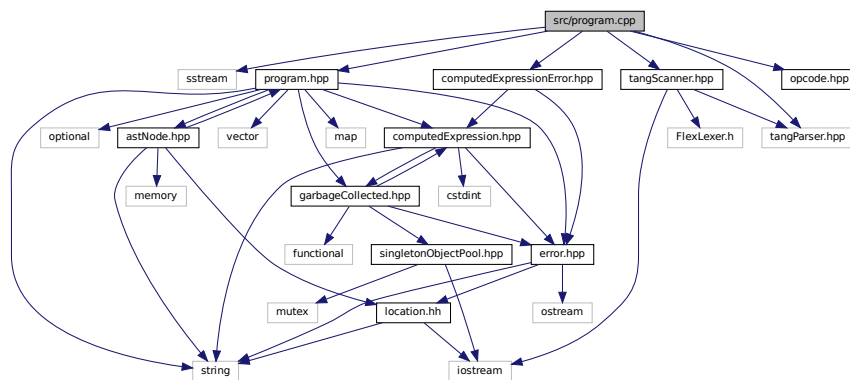
<code>x</code>	The number of entries that should exist in the stack.
----------------	---

6.58 src/program.cpp File Reference

Define the [Tang::Program](#) class.

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

Include dependency graph for program.cpp:



6.58.1 Detailed Description

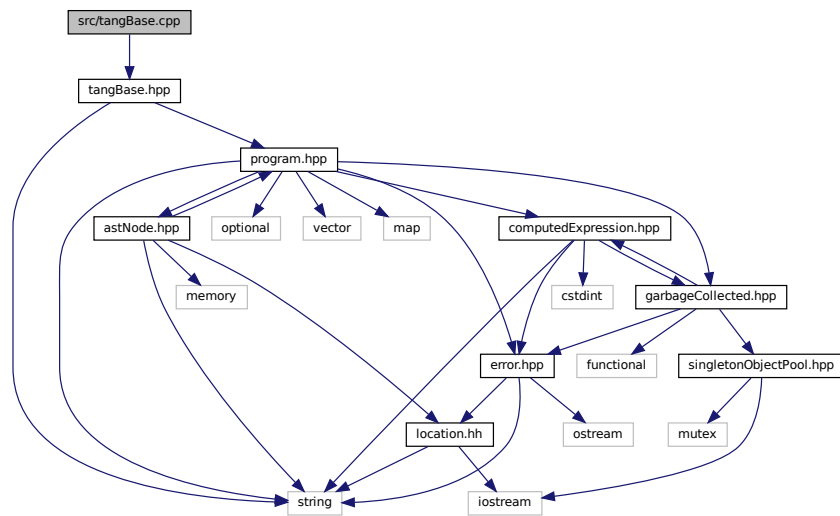
Define the [Tang::Program](#) class.

6.59 src/tangBase.cpp File Reference

Define the [Tang::TangBase](#) class.

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

Include dependency graph for tangBase.cpp:



6.59.1 Detailed Description

Define the [Tang::TangBase](#) class.

6.60 test/test.cpp File Reference

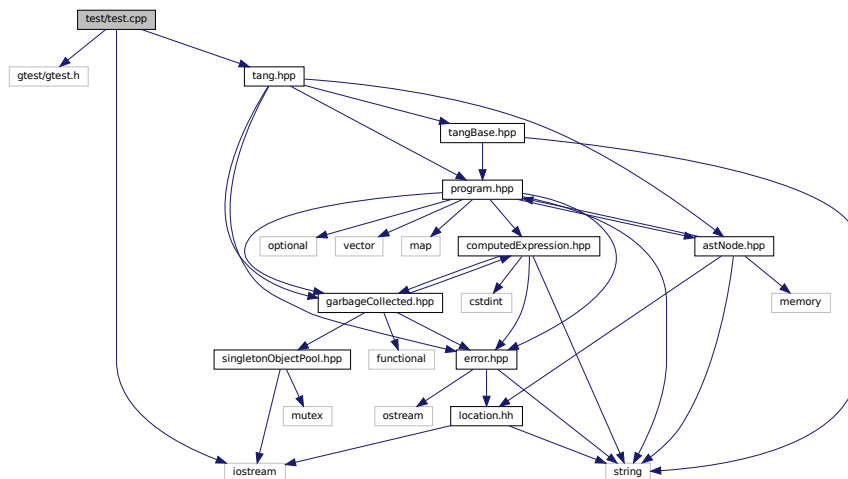
Test the general language behaviors.

```
#include <gtest/gtest.h>
```

```
#include <iostream>
```

```
#include "tang.hpp"
```

Include dependency graph for test.cpp:



Functions

- **TEST** (Declare, Null)
- **TEST** (Declare, Integer)
- **TEST** (Declare, Float)
- **TEST** (Declare, Boolean)
- **TEST** (Declare, String)
- **TEST** (Expression, Add)
- **TEST** (Expression, Subtract)
- **TEST** (Expression, Multiplication)
- **TEST** (Expression, Division)
- **TEST** (Expression, Modulo)
- **TEST** (Expression, UnaryMinus)
- **TEST** (Expression, Parentheses)
- **TEST** (Expression, TypeCast)
- **TEST** (Expression, Not)
- **TEST** (Expression, LessThan)
- **TEST** (Expression, LessThanEqual)
- **TEST** (Expression, GreaterThan)
- **TEST** (Expression, GreaterThanEqual)
- **TEST** (Expression, Equal)
- **TEST** (Expression, NotEqual)
- **TEST** (Expression, And)
- **TEST** (Expression, Or)
- **TEST** (CodeBlock, Statements)
- **TEST** (Assign, Identifier)
- **TEST** (ControlFlow, IfElse)
- **TEST** (ControlFlow, While)
- **TEST** (ControlFlow, DoWhile)
- **TEST** (ControlFlow, For)
- **TEST** (Print, Default)
- `int main (int argc, char **argv)`

6.60.1 Detailed Description

Test the general language behaviors.

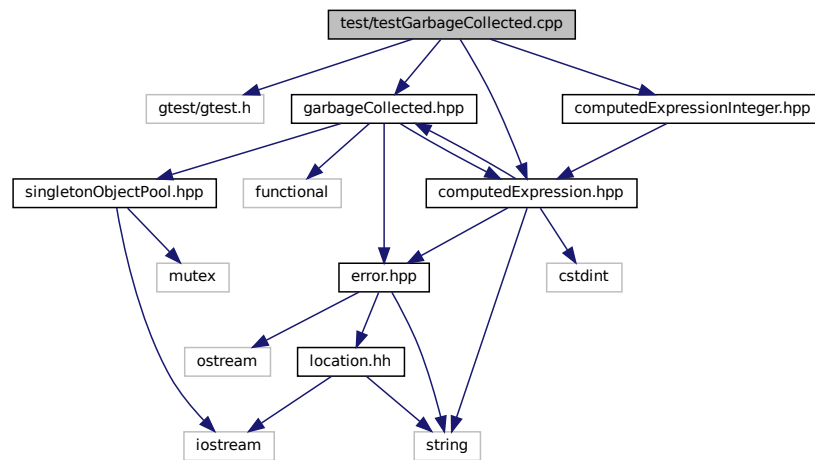
6.61 test/testGarbageCollected.cpp File Reference

Test the generic behavior of the [Tang::GarbageCollected](#) class.

```
#include <gtest/gtest.h>
#include "garbageCollected.hpp"
#include "computedExpression.hpp"
```

```
#include "computedExpressionInteger.hpp"
```

Include dependency graph for testGarbageCollected.cpp:



Functions

- **TEST** (Create, Access)
- **TEST** (RuleOfFive, CopyConstructor)
- **TEST** (Recycle, ObjectIsRecycled)
- **TEST** (Recycle, ObjectIsNotRecycled)
- **int main** (int argc, char **argv)

6.61.1 Detailed Description

Test the generic behavior of the [Tang::GarbageCollected](#) class.

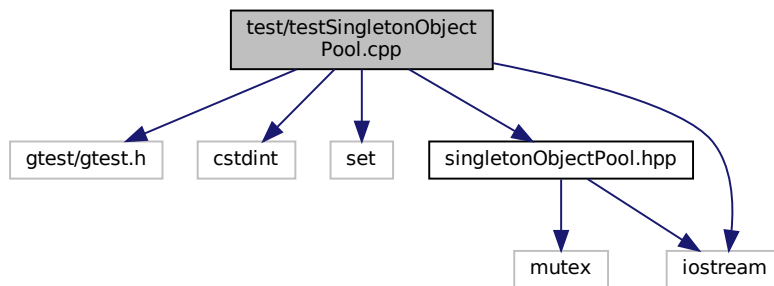
6.62 test/testSingletonObjectPool.cpp File Reference

Test the generic behavior of the [Tang::SingletonObjectPool](#) class.

```
#include <gtest/gtest.h>
#include <cstdint>
#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, RecycledObjectsIsReused)
- **TEST** (Get, SuccessiveCallsAreSequential)
- **TEST** (Get, KeepsGeneratingDifferentPointers)
- **TEST** (Recycle, WorksAfterLargeNumberOfAllocations)
- `int main` (int argc, char **argv)

6.62.1 Detailed Description

Test the generic behavior of the [Tang::SingletonObjectPool](#) class.

Index

- __add
 - Tang::ComputedExpression, [48](#)
 - Tang::ComputedExpressionBoolean, [58](#)
 - Tang::ComputedExpressionError, [67](#)
 - Tang::ComputedExpressionFloat, [78](#)
 - Tang::ComputedExpressionInteger, [88](#)
 - Tang::ComputedExpressionString, [98](#)
- __boolean
 - Tang::ComputedExpression, [49](#)
 - Tang::ComputedExpressionBoolean, [58](#)
 - Tang::ComputedExpressionError, [68](#)
 - Tang::ComputedExpressionFloat, [78](#)
 - Tang::ComputedExpressionInteger, [88](#)
 - Tang::ComputedExpressionString, [98](#)
- __divide
 - Tang::ComputedExpression, [49](#)
 - Tang::ComputedExpressionBoolean, [58](#)
 - Tang::ComputedExpressionError, [68](#)
 - Tang::ComputedExpressionFloat, [78](#)
 - Tang::ComputedExpressionInteger, [88](#)
 - Tang::ComputedExpressionString, [98](#)
- __equal
 - Tang::ComputedExpression, [49](#)
 - Tang::ComputedExpressionBoolean, [59](#)
 - Tang::ComputedExpressionError, [68](#)
 - Tang::ComputedExpressionFloat, [79](#)
 - Tang::ComputedExpressionInteger, [89](#)
 - Tang::ComputedExpressionString, [99](#)
- __float
 - Tang::ComputedExpression, [50](#)
 - Tang::ComputedExpressionBoolean, [59](#)
 - Tang::ComputedExpressionError, [69](#)
 - Tang::ComputedExpressionFloat, [79](#)
 - Tang::ComputedExpressionInteger, [89](#)
 - Tang::ComputedExpressionString, [99](#)
- __integer
 - Tang::ComputedExpression, [50](#)
 - Tang::ComputedExpressionBoolean, [59](#)
 - Tang::ComputedExpressionError, [69](#)
 - Tang::ComputedExpressionFloat, [79](#)
 - Tang::ComputedExpressionInteger, [89](#)
 - Tang::ComputedExpressionString, [99](#)
- __lessThan
 - Tang::ComputedExpression, [50](#)
 - Tang::ComputedExpressionBoolean, [60](#)
 - Tang::ComputedExpressionError, [69](#)
 - Tang::ComputedExpressionFloat, [80](#)
 - Tang::ComputedExpressionInteger, [90](#)
 - Tang::ComputedExpressionString, [99](#)
- __modulo
 - Tang::ComputedExpression, [51](#)
 - Tang::ComputedExpressionBoolean, [60](#)
 - Tang::ComputedExpressionError, [70](#)
 - Tang::ComputedExpressionFloat, [80](#)
 - Tang::ComputedExpressionInteger, [90](#)
 - Tang::ComputedExpressionString, [100](#)
- __multiply
 - Tang::ComputedExpression, [51](#)
 - Tang::ComputedExpressionBoolean, [61](#)
 - Tang::ComputedExpressionError, [70](#)
 - Tang::ComputedExpressionFloat, [80](#)
 - Tang::ComputedExpressionInteger, [90](#)
 - Tang::ComputedExpressionString, [100](#)
- __negative
 - Tang::ComputedExpression, [51](#)
 - Tang::ComputedExpressionBoolean, [61](#)
 - Tang::ComputedExpressionError, [70](#)
 - Tang::ComputedExpressionFloat, [81](#)
 - Tang::ComputedExpressionInteger, [91](#)
 - Tang::ComputedExpressionString, [101](#)
- __not
 - Tang::ComputedExpression, [52](#)
 - Tang::ComputedExpressionBoolean, [61](#)
 - Tang::ComputedExpressionError, [71](#)
 - Tang::ComputedExpressionFloat, [81](#)
 - Tang::ComputedExpressionInteger, [91](#)
 - Tang::ComputedExpressionString, [101](#)
- __string
 - Tang::ComputedExpression, [52](#)
 - Tang::ComputedExpressionBoolean, [61](#)
 - Tang::ComputedExpressionError, [71](#)
 - Tang::ComputedExpressionFloat, [81](#)
 - Tang::ComputedExpressionInteger, [91](#)
 - Tang::ComputedExpressionString, [101](#)
- __subtract
 - Tang::ComputedExpression, [52](#)
 - Tang::ComputedExpressionBoolean, [62](#)
 - Tang::ComputedExpressionError, [71](#)
 - Tang::ComputedExpressionFloat, [82](#)
 - Tang::ComputedExpressionInteger, [92](#)
 - Tang::ComputedExpressionString, [101](#)
- ~GarbageCollected
 - Tang::GarbageCollected, [110](#)
- ADD
 - opcode.hpp, [162](#)
- Add
 - Tang::AstNodeBinary, [17](#)
- addBytecode

- Tang::Program, 128
- And
 - Tang::AstNodeBinary, 17
- AstNode
 - Tang::AstNode, 13
- AstNodeAssign
 - Tang::AstNodeAssign, 15
- AstNodeBinary
 - Tang::AstNodeBinary, 18
- AstNodeBlock
 - Tang::AstNodeBlock, 20
- AstNodeBoolean
 - Tang::AstNodeBoolean, 21
- AstNodeCast
 - Tang::AstNodeCast, 24
- AstNodeDoWhile
 - Tang::AstNodeDoWhile, 26
- AstNodeFloat
 - Tang::AstNodeFloat, 28
- AstNodeFor
 - Tang::AstNodeFor, 30
- AstNodeIdentifier
 - Tang::AstNodeIdentifier, 32
- AstNodeIfElse
 - Tang::AstNodeIfElse, 34
- AstNodeInteger
 - Tang::AstNodeInteger, 37
- AstNodePrint
 - Tang::AstNodePrint, 40
- AstNodeString
 - Tang::AstNodeString, 42
- AstNodeUnary
 - Tang::AstNodeUnary, 44
- AstNodeWhile
 - Tang::AstNodeWhile, 46
- BOOLEAN
 - opcode.hpp, 162
- Boolean
 - Tang::AstNodeCast, 24
- build/generated/location.hh, 135
- CASTBOOLEAN
 - opcode.hpp, 162
- CASTFLOAT
 - opcode.hpp, 162
- CASTINTEGER
 - opcode.hpp, 162
- CodeType
 - Tang::Program, 127
- collectIdentifiers
 - Tang::AstNode, 13
 - Tang::AstNodeAssign, 15
 - Tang::AstNodeBinary, 18
 - Tang::AstNodeBlock, 20
 - Tang::AstNodeBoolean, 22
 - Tang::AstNodeCast, 24
 - Tang::AstNodeDoWhile, 26
 - Tang::AstNodeFloat, 28
 - Tang::AstNodeFor, 30
 - Tang::AstNodeIdentifier, 32
 - Tang::AstNodeIfElse, 34
 - Tang::AstNodeInteger, 37
 - Tang::AstNodePrint, 40
 - Tang::AstNodeString, 42
 - Tang::AstNodeUnary, 44
 - Tang::AstNodeWhile, 46
- compileScript
 - Tang::TangBase, 132
- ComputedExpressionBoolean
 - Tang::ComputedExpressionBoolean, 58
- ComputedExpressionError
 - Tang::ComputedExpressionError, 67
- ComputedExpressionFloat
 - Tang::ComputedExpressionFloat, 77
- ComputedExpressionInteger
 - Tang::ComputedExpressionInteger, 87
- ComputedExpressionString
 - Tang::ComputedExpressionString, 97
- Default
 - Tang::AstNodePrint, 40
- DIVIDE
 - opcode.hpp, 162
- Divide
 - Tang::AstNodeBinary, 17
- dump
 - Tang::ComputedExpression, 53
 - Tang::ComputedExpressionBoolean, 62
 - Tang::ComputedExpressionError, 72
 - Tang::ComputedExpressionFloat, 82
 - Tang::ComputedExpressionInteger, 92
 - Tang::ComputedExpressionString, 102
- dumpBytecode
 - Tang::Program, 128
- DUMPPROGRAMCHECK
 - program-dumpBytecode.cpp, 186
- EQ
 - opcode.hpp, 162
- Equal
 - Tang::AstNodeBinary, 17
- Error
 - Tang::Error, 106
- error.cpp
 - operator<<, 184
- execute
 - Tang::Program, 128
- EXECUTEPROGRAMCHECK
 - program-execute.cpp, 187
- FLOAT
 - opcode.hpp, 162
- Float
 - Tang::AstNodeCast, 24
- GarbageCollected
 - Tang::GarbageCollected, 109, 110

- get
 - Tang::SingletonObjectPool< T >, 130
- get_next_token
 - Tang::TangScanner, 134
- getAst
 - Tang::Program, 128
- getBytecode
 - Tang::Program, 129
- getCode
 - Tang::Program, 129
- getInstance
 - Tang::SingletonObjectPool< T >, 131
- getResult
 - Tang::Program, 129
- GreaterThan
 - Tang::AstNodeBinary, 17
- GreaterThanEqual
 - Tang::AstNodeBinary, 17
- GT
 - opcode.hpp, 162
- GTE
 - opcode.hpp, 162
- include/astNode.hpp, 137
- include/astNodeAssign.hpp, 138
- include/astNodeBinary.hpp, 139
- include/astNodeBlock.hpp, 140
- include/astNodeBoolean.hpp, 141
- include/astNodeCast.hpp, 142
- include/astNodeDoWhile.hpp, 143
- include/astNodeFloat.hpp, 144
- include/astNodeFor.hpp, 145
- include/astNodeIdentifier.hpp, 146
- include/astNodeIfElse.hpp, 147
- include/astNodeInteger.hpp, 148
- include/astNodePrint.hpp, 149
- include/astNodeString.hpp, 150
- include/astNodeUnary.hpp, 151
- include/astNodeWhile.hpp, 152
- include/computedExpression.hpp, 153
- include/computedExpressionBoolean.hpp, 154
- include/computedExpressionError.hpp, 155
- include/computedExpressionFloat.hpp, 156
- include/computedExpressionInteger.hpp, 157
- include/computedExpressionString.hpp, 158
- include/error.hpp, 159
- include/garbageCollected.hpp, 160
- include/macros.hpp, 160
- include/opcode.hpp, 161
- include/program.hpp, 163
- include/singletonObjectPool.hpp, 164
- include/tang.hpp, 165
- include/tangBase.hpp, 166
- include/tangScanner.hpp, 167
- INTEGER
 - opcode.hpp, 162
- Integer
 - Tang::AstNodeCast, 24
- is_equal
 - Tang::ComputedExpression, 53–55
 - Tang::ComputedExpressionBoolean, 62–64
 - Tang::ComputedExpressionError, 72, 74, 75
 - Tang::ComputedExpressionFloat, 83, 84
 - Tang::ComputedExpressionInteger, 93, 94
 - Tang::ComputedExpressionString, 102–104
- JMP
 - opcode.hpp, 162
- JMPF
 - opcode.hpp, 162
- JMPF_POP
 - opcode.hpp, 162
- JMPT
 - opcode.hpp, 162
- JMPT_POP
 - opcode.hpp, 162
- LessThan
 - Tang::AstNodeBinary, 17
- LessThanEqual
 - Tang::AstNodeBinary, 17
- location.hh
 - operator<<, 136, 137
- LT
 - opcode.hpp, 162
- LTE
 - opcode.hpp, 162
- macros.hpp
 - TANG_UNUSED, 161
- make
 - Tang::GarbageCollected, 110
- makeCopy
 - Tang::ComputedExpression, 55
 - Tang::ComputedExpressionBoolean, 65
 - Tang::ComputedExpressionError, 75
 - Tang::ComputedExpressionFloat, 85
 - Tang::ComputedExpressionInteger, 95
 - Tang::ComputedExpressionString, 104
- MODULO
 - opcode.hpp, 162
- Modulo
 - Tang::AstNodeBinary, 17
- MULTIPLY
 - opcode.hpp, 162
- Multiply
 - Tang::AstNodeBinary, 17
- NEGATIVE
 - opcode.hpp, 162
- Negative
 - Tang::AstNodeUnary, 44
- NEQ
 - opcode.hpp, 162
- NOT
 - opcode.hpp, 162
- Not
 - Tang::AstNodeUnary, 44

- NotEqual
 - Tang::AstNodeBinary, 17
- NULLVAL
 - opcode.hpp, 162
- Opcode
 - opcode.hpp, 162
- opcode.hpp
 - ADD, 162
 - BOOLEAN, 162
 - CASTBOOLEAN, 162
 - CASTFLOAT, 162
 - CASTINTEGER, 162
 - DIVIDE, 162
 - EQ, 162
 - FLOAT, 162
 - GT, 162
 - GTE, 162
 - INTEGER, 162
 - JMP, 162
 - JMPF, 162
 - JMPF_POP, 162
 - JMPT, 162
 - JMPT_POP, 162
 - LT, 162
 - LTE, 162
 - MODULO, 162
 - MULTIPLY, 162
 - NEGATIVE, 162
 - NEQ, 162
 - NOT, 162
 - NULLVAL, 162
 - Opcode, 162
 - PEEK, 162
 - POKE, 162
 - POP, 162
 - PRINT, 162
 - STRING, 162
 - SUBTRACT, 162
- Operation
 - Tang::AstNodeBinary, 17
- Operator
 - Tang::AstNodeUnary, 44
- operator!
 - Tang::GarbageCollected, 111
- operator!=
 - Tang::GarbageCollected, 111
- operator<
 - Tang::GarbageCollected, 116
- operator<<
 - error.cpp, 184
 - location.hh, 136, 137
 - Tang::Error, 106
 - Tang::GarbageCollected, 122
- operator<=
 - Tang::GarbageCollected, 116
- operator>
 - Tang::GarbageCollected, 121
- operator>=
 - Tang::GarbageCollected, 121
- operator*
 - Tang::GarbageCollected, 112, 113
- operator+
 - Tang::GarbageCollected, 113
- operator-
 - Tang::GarbageCollected, 114
- operator->
 - Tang::GarbageCollected, 115
- operator/
 - Tang::GarbageCollected, 115
- operator=
 - Tang::GarbageCollected, 117
- operator==
 - Tang::GarbageCollected, 118–120
- operator%
 - Tang::GarbageCollected, 112
- Or
 - Tang::AstNodeBinary, 17
- PEEK
 - opcode.hpp, 162
- POKE
 - opcode.hpp, 162
- POP
 - opcode.hpp, 162
- PRINT
 - opcode.hpp, 162
- Program
 - Tang::Program, 127
- program-dumpBytecode.cpp
 - DUMPPROGRAMCHECK, 186
- program-execute.cpp
 - EXECUTEPROGRAMCHECK, 187
 - STACKCHECK, 187
- recycle
 - Tang::SingletonObjectPool< T >, 131
- Script
 - Tang::Program, 127
- setJumpTarget
 - Tang::Program, 129
- src/astNode.cpp, 168
- src/astNodeAssign.cpp, 168
- src/astNodeBinary.cpp, 169
- src/astNodeBlock.cpp, 170
- src/astNodeBoolean.cpp, 170
- src/astNodeCast.cpp, 171
- src/astNodeDoWhile.cpp, 172
- src/astNodeFloat.cpp, 173
- src/astNodeFor.cpp, 174
- src/astNodeIdentifier.cpp, 174
- src/astNodeIfElse.cpp, 175
- src/astNodeInteger.cpp, 176
- src/astNodePrint.cpp, 177
- src/astNodeString.cpp, 177
- src/astNodeUnary.cpp, 178
- src/astNodeWhile.cpp, 179

- src/computedExpression.cpp, 180
- src/computedExpressionBoolean.cpp, 180
- src/computedExpressionError.cpp, 181
- src/computedExpressionFloat.cpp, 182
- src/computedExpressionInteger.cpp, 182
- src/computedExpressionString.cpp, 183
- src/error.cpp, 184
- src/program-dumpBytecode.cpp, 185
- src/program-execute.cpp, 186
- src/program.cpp, 188
- src/tangBase.cpp, 188
- STACKCHECK
 - program-execute.cpp, 187
- STRING
 - opcode.hpp, 162
- SUBTRACT
 - opcode.hpp, 162
- Subtract
 - Tang::AstNodeBinary, 17
- Tang::AstNode, 11
 - AstNode, 13
 - collectIdentifiers, 13
- Tang::AstNodeAssign, 14
 - AstNodeAssign, 15
 - collectIdentifiers, 15
- Tang::AstNodeBinary, 16
 - Add, 17
 - And, 17
 - AstNodeBinary, 18
 - collectIdentifiers, 18
 - Divide, 17
 - Equal, 17
 - GreaterThan, 17
 - GreaterThanEqual, 17
 - LessThan, 17
 - LessThanEqual, 17
 - Modulo, 17
 - Multiply, 17
 - NotEqual, 17
 - Operation, 17
 - Or, 17
 - Subtract, 17
- Tang::AstNodeBlock, 18
 - AstNodeBlock, 20
 - collectIdentifiers, 20
- Tang::AstNodeBoolean, 20
 - AstNodeBoolean, 21
 - collectIdentifiers, 22
- Tang::AstNodeCast, 22
 - AstNodeCast, 24
 - Boolean, 24
 - collectIdentifiers, 24
 - Float, 24
 - Integer, 24
 - Type, 24
- Tang::AstNodeDoWhile, 25
 - AstNodeDoWhile, 26
 - collectIdentifiers, 26
- Tang::AstNodeFloat, 27
 - AstNodeFloat, 28
 - collectIdentifiers, 28
- Tang::AstNodeFor, 29
 - AstNodeFor, 30
 - collectIdentifiers, 30
- Tang::AstNodeIdentifier, 31
 - AstNodeIdentifier, 32
 - collectIdentifiers, 32
- Tang::AstNodeIfElse, 33
 - AstNodeIfElse, 34
 - collectIdentifiers, 36
- Tang::AstNodeInteger, 36
 - AstNodeInteger, 37
 - collectIdentifiers, 38
- Tang::AstNodePrint, 38
 - AstNodePrint, 40
 - collectIdentifiers, 40
 - Default, 40
 - Type, 39
- Tang::AstNodeString, 41
 - AstNodeString, 42
 - collectIdentifiers, 42
- Tang::AstNodeUnary, 42
 - AstNodeUnary, 44
 - collectIdentifiers, 44
 - Negative, 44
 - Not, 44
 - Operator, 44
- Tang::AstNodeWhile, 45
 - AstNodeWhile, 46
 - collectIdentifiers, 46
- Tang::ComputedExpression, 47
 - __add, 48
 - __boolean, 49
 - __divide, 49
 - __equal, 49
 - __float, 50
 - __integer, 50
 - __lessThan, 50
 - __modulo, 51
 - __multiply, 51
 - __negative, 51
 - __not, 52
 - __string, 52
 - __subtract, 52
 - dump, 53
 - is_equal, 53–55
 - makeCopy, 55
- Tang::ComputedExpressionBoolean, 56
 - __add, 58
 - __boolean, 58
 - __divide, 58
 - __equal, 59
 - __float, 59
 - __integer, 59
 - __lessThan, 60
 - __modulo, 60

- __multiply, 61
- __negative, 61
- __not, 61
- __string, 61
- __subtract, 62
- ComputedExpressionBoolean, 58
- dump, 62
- is_equal, 62–64
- makeCopy, 65
- Tang::ComputedExpressionError, 65
 - __add, 67
 - __boolean, 68
 - __divide, 68
 - __equal, 68
 - __float, 69
 - __integer, 69
 - __lessThan, 69
 - __modulo, 70
 - __multiply, 70
 - __negative, 70
 - __not, 71
 - __string, 71
 - __subtract, 71
 - ComputedExpressionError, 67
 - dump, 72
 - is_equal, 72, 74, 75
 - makeCopy, 75
- Tang::ComputedExpressionFloat, 76
 - __add, 78
 - __boolean, 78
 - __divide, 78
 - __equal, 79
 - __float, 79
 - __integer, 79
 - __lessThan, 80
 - __modulo, 80
 - __multiply, 80
 - __negative, 81
 - __not, 81
 - __string, 81
 - __subtract, 82
 - ComputedExpressionFloat, 77
 - dump, 82
 - is_equal, 83, 84
 - makeCopy, 85
- Tang::ComputedExpressionInteger, 85
 - __add, 88
 - __boolean, 88
 - __divide, 88
 - __equal, 89
 - __float, 89
 - __integer, 89
 - __lessThan, 90
 - __modulo, 90
 - __multiply, 90
 - __negative, 91
 - __not, 91
 - __string, 91
 - __subtract, 92
 - ComputedExpressionInteger, 87
 - dump, 92
 - is_equal, 93, 94
 - makeCopy, 95
- Tang::ComputedExpressionString, 95
 - __add, 98
 - __boolean, 98
 - __divide, 98
 - __equal, 99
 - __float, 99
 - __integer, 99
 - __lessThan, 99
 - __modulo, 100
 - __multiply, 100
 - __negative, 101
 - __not, 101
 - __string, 101
 - __subtract, 101
 - ComputedExpressionString, 97
 - dump, 102
 - is_equal, 102–104
 - makeCopy, 104
- Tang::Error, 105
 - Error, 106
 - operator<<, 106
- Tang::GarbageCollected, 107
 - ~GarbageCollected, 110
 - GarbageCollected, 109, 110
 - make, 110
 - operator!, 111
 - operator!=, 111
 - operator<, 116
 - operator<<, 122
 - operator<=, 116
 - operator>, 121
 - operator>=, 121
 - operator*, 112, 113
 - operator+, 113
 - operator-, 114
 - operator->, 115
 - operator/, 115
 - operator=, 117
 - operator==, 118–120
 - operator%, 112
- Tang::location, 122
- Tang::position, 124
- Tang::Program, 125
 - addBytecode, 128
 - CodeType, 127
 - dumpBytecode, 128
 - execute, 128
 - getAst, 128
 - getBytecode, 129
 - getCode, 129
 - getResult, 129
 - Program, 127
 - Script, 127

- setJumpTarget, [129](#)
- Template, [127](#)
- Tang::SingletonObjectPool< T >, [130](#)
 - get, [130](#)
 - getInstance, [131](#)
 - recycle, [131](#)
- Tang::TangBase, [131](#)
 - compileScript, [132](#)
 - TangBase, [132](#)
- Tang::TangScanner, [133](#)
 - get_next_token, [134](#)
 - TangScanner, [134](#)
- TANG_UNUSED
 - macros.hpp, [161](#)
- TangBase
 - Tang::TangBase, [132](#)
- TangScanner
 - Tang::TangScanner, [134](#)
- Template
 - Tang::Program, [127](#)
- test/test.cpp, [189](#)
- test/testGarbageCollected.cpp, [190](#)
- test/testSingletonObjectPool.cpp, [191](#)
- Type
 - Tang::AstNodeCast, [24](#)
 - Tang::AstNodePrint, [39](#)