Assignment 2: Dataflow Framework

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Chapter 1

Namespace Index

1.1 Namespace List

Here is a list of all namespaces with brief descriptions:

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

Chapter 3

Class Index

3.1 Class List

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

Chapter 4

File Index

4.1 File List

Here is a list of all files with brief descriptions:

Chapter 5

Namespace Documentation

5.1 anonymous_namespace{available.cpp} Namespace Reference

Classes

- class AvailableExpressions
- class KillGenEval

Functions

- RegisterPass< AvailableExpressions > X ("available", "ECE 5984 Available Expressions")

5.1.1 Function Documentation

5.1.1.1 X()

```
RegisterPass<AvailableExpressions> anonymous_namespace{available.cpp}::X (
            "available" ,
            "ECE 5984 Available Expressions"  )
```

5.2 anonymous_namespace{liveness.cpp} Namespace Reference

Classes

- class KillGenLive
- class Liveness

Functions

- RegisterPass< Liveness > X ("liveness", "ECE 5984 Liveness")

5.2.1 Function Documentation

5.2.1.1 X()

```
RegisterPass<Liveness> anonymous_namespace{liveness.cpp}::X (
            "liveness" ,
            "ECE 5984 Liveness"  )
```

5.3 llvm Namespace Reference

Classes

- class BaseTransferFunction

  Holds the base implementation of a transfer function, to be extended later if we require additional steps to be added to the transfer function.
- class BBInOutBits
- class DataflowFramework
- class Expression
- class KillGen

Functions

- void printSet (std::vector< Expression > *x)
- std::string getShortValueName (Value *v)

5.3.1 Function Documentation

5.3.1.1 getShortValueName()

```
std::string llvm::getShortValueName (
            Value * v )
```

5.3.1.2 printSet()

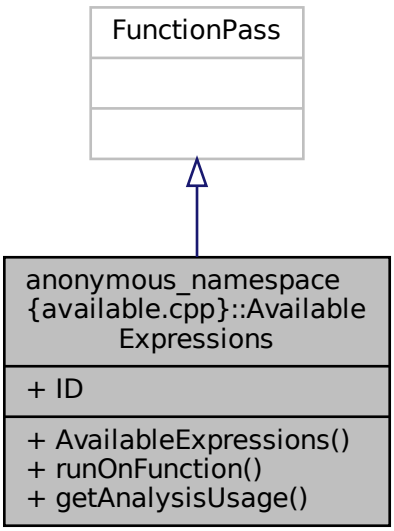
```
void llvm::printSet (
            std::vector< Expression > * x )
```

Chapter 6

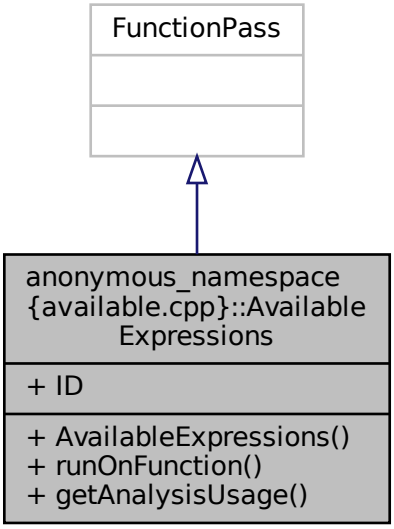
Class Documentation

6.1 anonymous_namespace{available.cpp}::AvailableExpressions Class Reference

Inheritance diagram for anonymous_namespace{available.cpp}::AvailableExpressions:



Collaboration diagram for anonymous_namespace{available.cpp}::AvailableExpressions:



Public Member Functions

- AvailableExpressions ()
- virtual bool runOnFunction (Function &F)
- virtual void getAnalysisUsage (AnalysisUsage &AU) const

Static Public Attributes

- static char ID = 0

6.1.1 Constructor & Destructor Documentation

6.1.1.1 AvailableExpressions()

```
anonymous_namespace{available.cpp}::AvailableExpressions::AvailableExpressions ( )  [inline]
```

6.1.2 Member Function Documentation

6.1.2.1 getAnalysisUsage()

```
virtual void anonymous_namespace{available.cpp}::AvailableExpressions::getAnalysisUsage (
            AnalysisUsage & AU ) const  [inline], [virtual]
```

6.1.2.2 runOnFunction()

```
virtual bool anonymous_namespace{available.cpp}::AvailableExpressions::runOnFunction (
            Function & F )  [inline], [virtual]
```

6.1.3 Member Data Documentation

6.1.3.1 ID

```
char anonymous_namespace{available.cpp}::AvailableExpressions::ID = 0  [static]
```

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

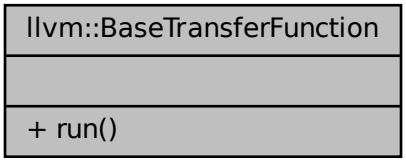
- available.cpp

6.2 llvm::BaseTransferFunction Class Reference

Holds the base implementation of a transfer function, to be extended later if we require additional steps to be added to the transfer function.

```
#include <BaseTransferFunction.h>
```

Collaboration diagram for llvm::BaseTransferFunction:



Public Member Functions

- virtual std::bitset< MAX_BITS_SIZE > run (const std::bitset< MAX_BITS_SIZE > &input, const std::bitset< MAX_BITS_SIZE > &genSet, const std::bitset< MAX_BITS_SIZE > &killSet)

  General base transfer function main method. Takes in 3 const set references, gen, kill, and input(IN for forward, OUT for backward analysis) General form is [Gen U (In - Kill)]. To mimic the (In - Kill) without doing a borrow operation, we flip the kill set and perform bitwise AND. Truth table is 0-0 = 0; 0-1 = 0; 1-0 = 1; 1-1 = 0. Next, Union operation is synonymous to bitwise OR. Truth table is 0 U 0 = 0; 0 U 1 = 1; 1 U 0 = 1; 1 U 1 = 1.

6.2.1 Detailed Description

Holds the base implementation of a transfer function, to be extended later if we require additional steps to be added to the transfer function.

6.2.2 Member Function Documentation

6.2.2.1 run()

```
std::bitset< MAX_BITS_SIZE > llvm::BaseTransferFunction::run (
            const std::bitset< MAX_BITS_SIZE > & input,
            const std::bitset< MAX_BITS_SIZE > & genSet,
            const std::bitset< MAX_BITS_SIZE > & killSet )  [virtual]
```

General base transfer function main method. Takes in 3 const set references, gen, kill, and input(IN for forward, OUT for backward analysis) General form is [Gen U (In - Kill)]. To mimic the (In - Kill) without doing a borrow operation, we flip the kill set and perform bitwise AND. Truth table is 0-0 = 0; 0-1 = 0; 1-0 = 1; 1-1 = 0. Next, Union operation is synonymous to bitwise OR. Truth table is 0 U 0 = 0; 0 U 1 = 1; 1 U 0 = 1; 1 U 1 = 1.

Parameters

input	Input into function, can be IN or OUT depending on direction
genSet	Gen set
killSet	Kill set

Returns

Copy out the bitset.

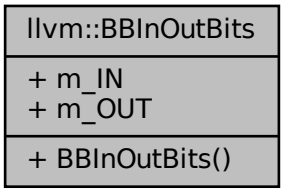
The documentation for this class was generated from the following files:

- DataflowFramework/include/BaseTransferFunction.h
- DataflowFramework/BaseTransferFunction.cpp

6.3 llvm::BBInOutBits Class Reference

`#include <dataflow.h>`

Collaboration diagram for llvm::BBInOutBits:



Public Member Functions

- BBInOutBits (BitsVal inval, BitsVal outval)

Public Attributes

- std::bitset< MAX_BITS_SIZE > m_IN
- std::bitset< MAX_BITS_SIZE > m_OUT

6.3.1 Constructor & Destructor Documentation

6.3.1.1 BBInOutBits()

```
llvm::BBInOutBits::BBInOutBits (
            BitsVal inval,
            BitsVal outval )  [inline]
```

6.3.2 Member Data Documentation

6.3.2.1 m_IN

```
std::bitset<MAX_BITS_SIZE> llvm::BBInOutBits::m_IN
```

6.3.2.2 m_OUT

```
std::bitset<MAX_BITS_SIZE> llvm::BBInOutBits::m_OUT
```

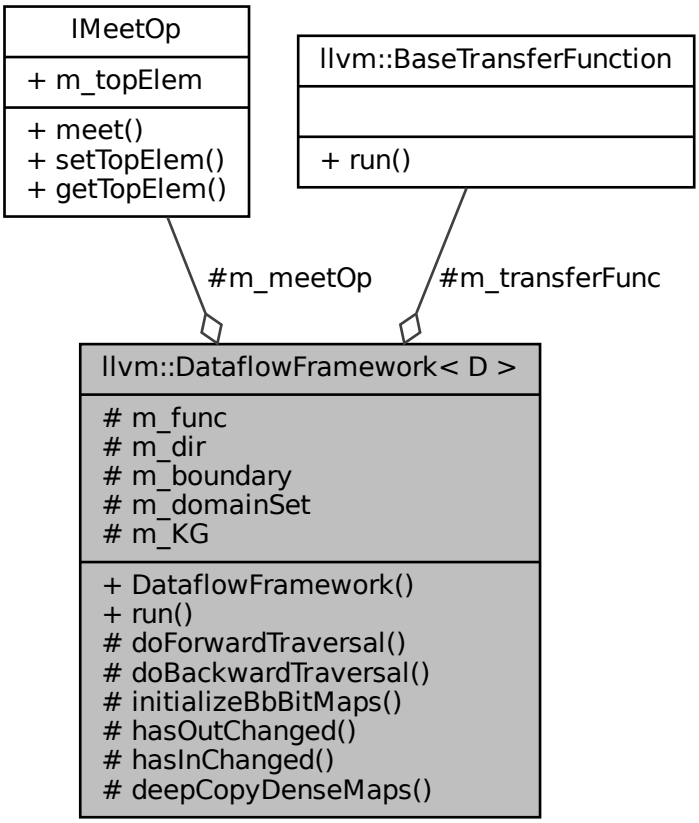
The documentation for this class was generated from the following file:

- DataflowFramework/include/dataflow.h

6.4 llvm::DataflowFramework< D > Class Template Reference

```
#include <dataflow.h>
```

Collaboration diagram for llvm::DataflowFramework< D >:



Public Member Functions

- DataflowFramework (IMeetOp &meetOp, FlowDirection direction, BoundaryCondition boundary, Function &function, std::vector< D > &domainset, KillGen< D > &KillGenImp, BaseTransferFunction &transfer)
- std::vector< D > & run ()

Protected Member Functions

- void doForwardTraversal (llvm::DenseMap< BasicBlock *, BBInOutBits * > &currentInOutMap, llvm::DenseMap< BasicBlock *, BBInOutBits * > &previousInOutMap)
- void doBackwardTraversal (llvm::DenseMap< BasicBlock *, BBInOutBits * > &currentInOutMap, llvm::DenseMap< BasicBlock *, BBInOutBits * > &previousInOutMap)
- void initializeBbBitMaps (Function &F, llvm::DenseMap< BasicBlock *, BBInOutBits * > &map)

  Initializes the basic block bitmaps for in and out. In charge of creating the bit vectors and associating them with the basic blocks.
- bool hasOutChanged (llvm::DenseMap< BasicBlock *, BBInOutBits * > &currentMap, llvm::DenseMap< BasicBlock *, BBInOutBits * > &previousMap)

  Checks if any of the OUT's of any basic blocks has changed, if it has, return true, else return false.
- bool hasInChanged (llvm::DenseMap< BasicBlock *, BBInOutBits * > &currentMap, llvm::DenseMap< BasicBlock *, BBInOutBits * > &previousMap)

  Checks if any of the IN's of any basic blocks has changed, if it has, return true, else return false.
- void deepCopyDenseMaps (llvm::DenseMap< BasicBlock *, BBInOutBits * > &currentMap, llvm::DenseMap< BasicBlock *, BBInOutBits * > &previousMap)

Protected Attributes

- IMeetOp & m_meetOp
- Function & m_func
- FlowDirection m_dir
- BoundaryCondition m_boundary
- std::vector< D > & m_domainSet
- KillGen< D > & m_KG
- BaseTransferFunction & m_transferFunc

6.4.1 Constructor & Destructor Documentation

6.4.1.1 DataflowFramework()

```
template<typename D >
llvm::DataflowFramework< D >::DataflowFramework (
            IMeetOp & meetOp,
            FlowDirection direction,
            BoundaryCondition boundary,
            Function & function,
            std::vector< D > & domainset,
            KillGen< D > & KillGenImp,
            BaseTransferFunction & transfer )
```

6.4.2 Member Function Documentation

6.4.2.1 deepCopyDenseMaps()

```
template<typename D >
void llvm::DataflowFramework< D >::deepCopyDenseMaps (
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & currentMap,
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & previousMap )  [protected]
```

6.4.2.2 doBackwardTraversal()

```
template<typename D >
void llvm::DataflowFramework< D >::doBackwardTraversal (
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & currentInOutMap,
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & previousInOutMap )  [protected]
```

6.4.2.3 doForwardTraversal()

```
template<typename D >
void llvm::DataflowFramework< D >::doForwardTraversal (
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & currentInOutMap,
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & previousInOutMap )  [protected]
```

6.4.2.4 hasInChanged()

```
template<typename D >
bool llvm::DataflowFramework< D >::hasInChanged (
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & currentMap,
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & previousMap )  [protected]
```

Checks if any of the IN's of any basic blocks has changed, if it has, return true, else return false.

Template Parameters

D	Domain we operate on

Parameters

currentMap	Current bitmap reference
previousMap	Previous bitmap reference from previous iteration

Returns

6.4.2.5 hasOutChanged()

```
template<typename D >
bool llvm::DataflowFramework< D >::hasOutChanged (
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & currentMap,
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & previousMap )  [protected]
```

Checks if any of the OUT's of any basic blocks has changed, if it has, return true, else return false.

Template Parameters

D	Domain we operate on

Parameters

currentMap	Current bitmap reference
previousMap	Previous bitmap reference from previous iteration

Returns

6.4.2.6 initializeBbBitMaps()

```
template<typename D >
void llvm::DataflowFramework< D >::initializeBbBitMaps (
            Function & F,
            llvm::DenseMap< BasicBlock *, BBInOutBits * > & map )  [protected]
```

Initializes the basic block bitmaps for in and out. In charge of creating the bit vectors and associating them with the basic blocks.

Template Parameters

D	Domain we operate on

Parameters

F	Function reference we're operating on
currentMap	Map reference for basic block pointer to IN OUT bitmap mapping

6.4.2.7 run()

```
template<typename D >
std::vector< D > & llvm::DataflowFramework< D >::run
```

6.4.3 Member Data Documentation

6.4.3.1 m_boundary

```
template<typename D >
BoundaryCondition llvm::DataflowFramework< D >::m_boundary  [protected]
```

6.4.3.2 m_dir

```
template<typename D >
FlowDirection llvm::DataflowFramework< D >::m_dir  [protected]
```

6.4.3.3 m_domainSet

```
template<typename D >
std::vector<D>& llvm::DataflowFramework< D >::m_domainSet  [protected]
```

6.4.3.4 m_func

```
template<typename D >
Function& llvm::DataflowFramework< D >::m_func  [protected]
```

6.4.3.5 m_KG

```
template<typename D >
KillGen<D>& llvm::DataflowFramework< D >::m_KG  [protected]
```

6.4.3.6 m_meetOp

```
template<typename D >
IMeetOp& llvm::DataflowFramework< D >::m_meetOp  [protected]
```

6.4.3.7 m_transferFunc

```
template<typename D >
BaseTransferFunction& llvm::DataflowFramework< D >::m_transferFunc  [protected]
```

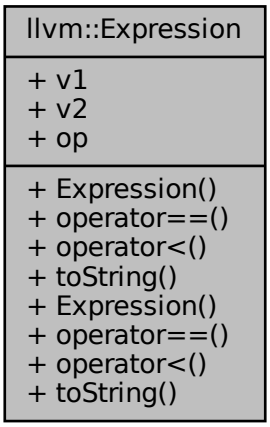
The documentation for this class was generated from the following file:

- DataflowFramework/include/dataflow.h

6.5 llvm::Expression Class Reference

```
#include <available-support.h>
```

Collaboration diagram for llvm::Expression:



Public Member Functions

- Expression (Instruction *I)
- bool operator== (const Expression &e2) const
- bool operator< (const Expression &e2) const
- std::string toString () const
- Expression (Instruction *I)
- bool operator== (const Expression &e2) const
- bool operator< (const Expression &e2) const
- std::string toString () const

Public Attributes

- Value * v1
- Value * v2
- Instruction::BinaryOps op

6.5.1 Constructor & Destructor Documentation

6.5.1.1 Expression() [1/2]

```
llvm::Expression::Expression (
            Instruction * I )
```

6.5.1.2 Expression() [2/2]

```
llvm::Expression::Expression (
            Instruction * I )
```

6.5.2 Member Function Documentation

6.5.2.1 operator<() [1/2]

```
bool llvm::Expression::operator< (
            const Expression & e2 ) const
```

6.5.2.2 operator<() [2/2]

```
bool llvm::Expression::operator< (
            const Expression & e2 ) const
```

6.5.2.3 operator==() [1/2]

```
bool llvm::Expression::operator== (
            const Expression & e2 ) const
```

6.5.2.4 operator==() [2/2]

```
bool llvm::Expression::operator== (
            const Expression & e2 ) const
```

6.5.2.5 toString() [1/2]

```
std::string llvm::Expression::toString ( ) const
```

6.5.2.6 toString() [2/2]

```
std::string llvm::Expression::toString ( ) const
```

6.5.3 Member Data Documentation

6.5.3.1 op

```
Instruction::BinaryOps llvm::Expression::op
```

6.5.3.2 v1

```
Value * llvm::Expression::v1
```

6.5.3.3 v2

```
Value * llvm::Expression::v2
```

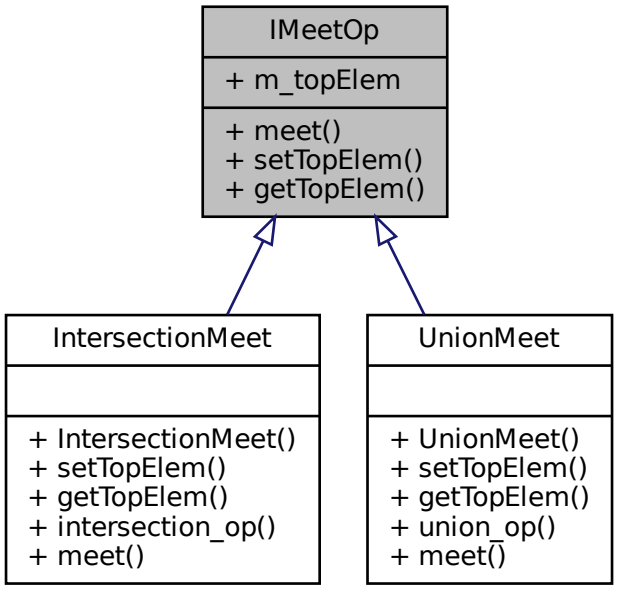
The documentation for this class was generated from the following files:

- available-support.h
- liveness-support.h
- available-support.cpp
- liveness-support.cpp

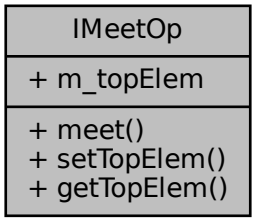
6.6 IMeetOp Class Reference

`#include <MeetOpInterface.h>`

Inheritance diagram for IMeetOp:



Collaboration diagram for IMeetOp:



Public Member Functions

- virtual std::bitset< MAX_BITS_SIZE > meet (std::bitset< MAX_BITS_SIZE > input1, std::bitset< MAX_BITS_SIZE > input2)=0
- virtual void setTopElem (BitsVal val)=0
- virtual BitsVal getTopElem ()=0

Public Attributes

- BitsVal m_topElem

6.6.1 Member Function Documentation

6.6.1.1 getTopElem()

```
virtual BitsVal IMeetOp::getTopElem ( )  [pure virtual]
```

Implemented in IntersectionMeet, and UnionMeet.

6.6.1.2 meet()

```
virtual std::bitset<MAX_BITS_SIZE> IMeetOp::meet (
            std::bitset< MAX_BITS_SIZE > input1,
            std::bitset< MAX_BITS_SIZE > input2 )  [pure virtual]
```

Implemented in IntersectionMeet, and UnionMeet.

6.6.1.3 setTopElem()

```
virtual void IMeetOp::setTopElem (
            BitsVal val )  [pure virtual]
```

Implemented in IntersectionMeet, and UnionMeet.

6.6.2 Member Data Documentation

6.6.2.1 m_topElem

```
BitsVal IMeetOp::m_topElem
```

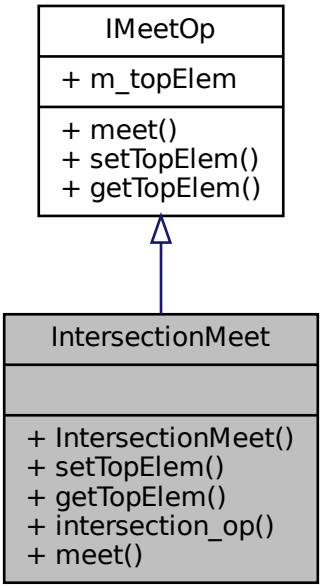
The documentation for this class was generated from the following file:

- DataflowFramework/include/MeetOpInterface.h

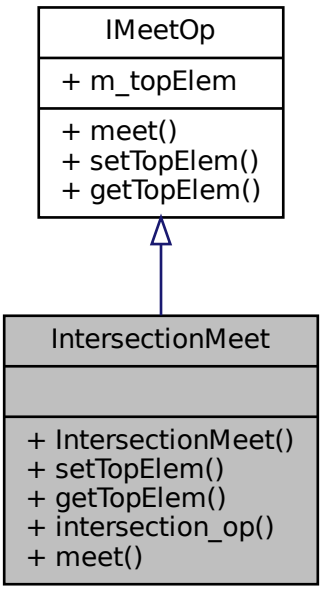
6.7 IntersectionMeet Class Reference

`#include <IntersectionMeet.h>`

Inheritance diagram for IntersectionMeet:



Collaboration diagram for IntersectionMeet:



Public Member Functions

- IntersectionMeet ()
- void setTopElem (BitsVal val) override
- BitsVal getTopElem () override
- std::bitset< MAX_BITS_SIZE > intersection_op (std::bitset< MAX_BITS_SIZE > ip1, std::bitset< MAX_BITS_SIZE > ip2)
- std::bitset< MAX_BITS_SIZE > meet (std::bitset< MAX_BITS_SIZE > input1, std::bitset< MAX_BITS_SIZE > input2) override

Additional Inherited Members

6.7.1 Constructor & Destructor Documentation

6.7.1.1 IntersectionMeet()

```
IntersectionMeet::IntersectionMeet ( )
```

6.7.2 Member Function Documentation

6.7.2.1 getTopElem()

```
BitsVal IntersectionMeet::getTopElem ( )  [override], [virtual]
```

Implements IMeetOp.

6.7.2.2 intersection_op()

```
std::bitset< MAX_BITS_SIZE > IntersectionMeet::intersection_op (
            std::bitset< MAX_BITS_SIZE > ip1,
            std::bitset< MAX_BITS_SIZE > ip2 )
```

6.7.2.3 meet()

```
std::bitset< MAX_BITS_SIZE > IntersectionMeet::meet (
            std::bitset< MAX_BITS_SIZE > input1,
            std::bitset< MAX_BITS_SIZE > input2 )  [override], [virtual]
```

Implements IMeetOp.

6.7.2.4 setTopElem()

```
void IntersectionMeet::setTopElem (
            BitsVal val )  [override], [virtual]
```

Implements IMeetOp.

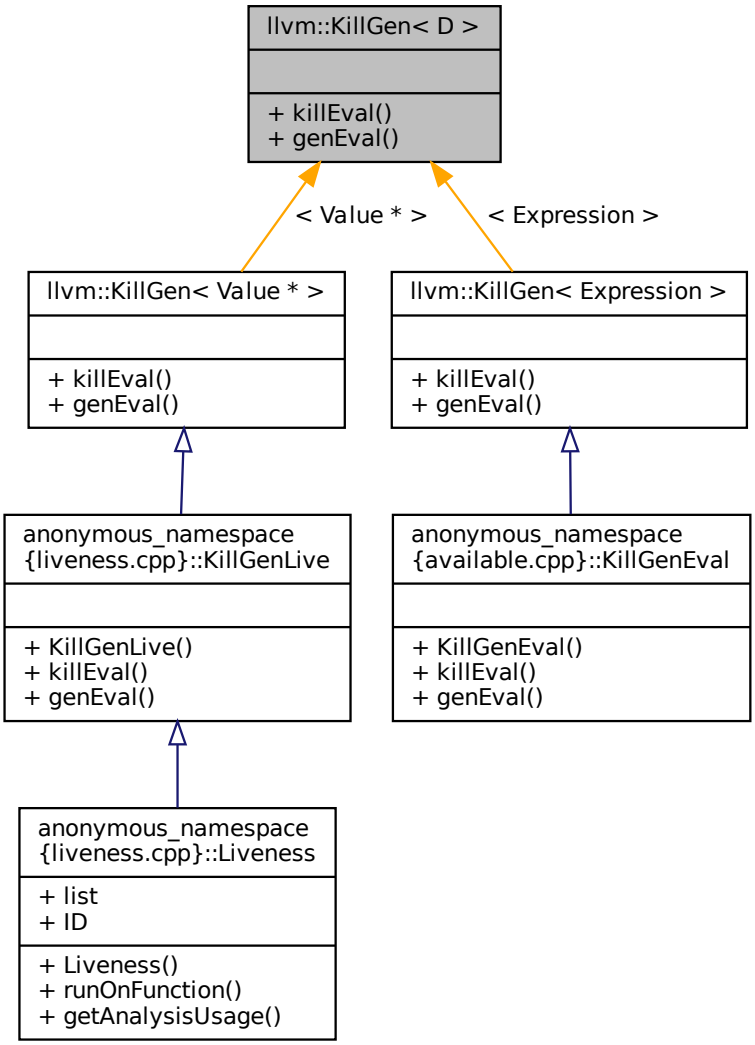
The documentation for this class was generated from the following files:

- DataflowFramework/include/IntersectionMeet.h
- DataflowFramework/IntersectionMeet.cpp

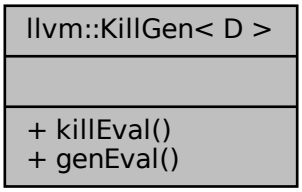
6.8 llvm::KillGen< D > Class Template Reference

`#include <KillGen.h>`

Inheritance diagram for llvm::KillGen< D >:



Collaboration diagram for llvm::KillGen< D >:



Public Member Functions

- virtual std::bitset< MAX_BITS_SIZE > killEval (llvm::BasicBlock *BB, std::bitset< MAX_BITS_SIZE > &meet_res, std::vector< D > &domainset)=0
- virtual std::bitset< MAX_BITS_SIZE > genEval (llvm::BasicBlock *BB, std::bitset< MAX_BITS_SIZE > &meet_res, std::vector< D > &domainset)=0

6.8.1 Member Function Documentation

6.8.1.1 genEval()

```
template<typename D >
virtual std::bitset<MAX_BITS_SIZE> llvm::KillGen< D >::genEval (
            llvm::BasicBlock * BB,
            std::bitset< MAX_BITS_SIZE > & meet_res,
            std::vector< D > & domainset )  [pure virtual]
```

Implemented in anonymous_namespace{liveness.cpp}::KillGenLive, and anonymous_namespace{available.cpp}::KillGenEval.

6.8.1.2 killEval()

```
template<typename D >
virtual std::bitset<MAX_BITS_SIZE> llvm::KillGen< D >::killEval (
            llvm::BasicBlock * BB,
            std::bitset< MAX_BITS_SIZE > & meet_res,
            std::vector< D > & domainset )  [pure virtual]
```

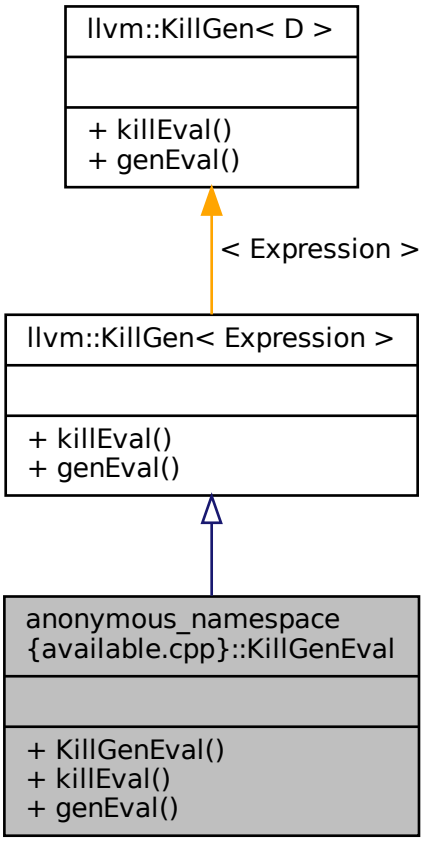
Implemented in anonymous_namespace{liveness.cpp}::KillGenLive, and anonymous_namespace{available.cpp}::KillGenEval.

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

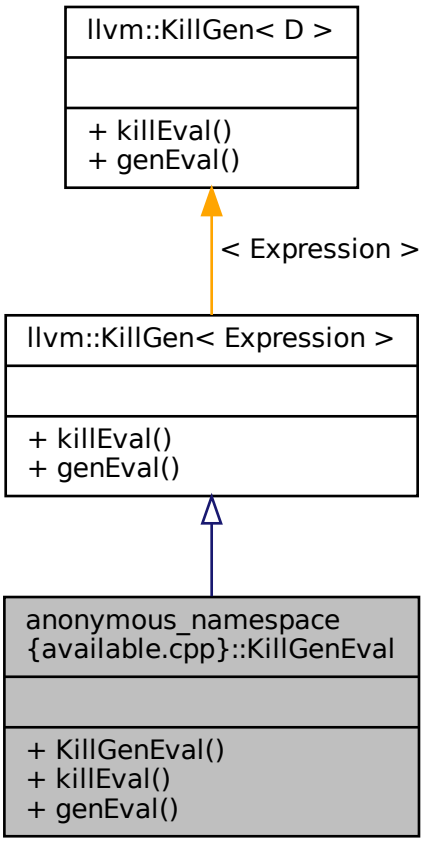
- DataflowFramework/include/KillGen.h

6.9 anonymous_namespace{available.cpp}::KillGenEval Class Reference

Inheritance diagram for anonymous_namespace{available.cpp}::KillGenEval:



Collaboration diagram for anonymous_namespace{available.cpp}::KillGenEval:



Public Member Functions

- KillGenEval ()
- std::bitset< MAX_BITS_SIZE > killEval (llvm::BasicBlock *BB, std::bitset< MAX_BITS_SIZE > &meet_res, std::vector< Expression > &domainset) override
- std::bitset< MAX_BITS_SIZE > genEval (llvm::BasicBlock *BB, std::bitset< MAX_BITS_SIZE > &meet_res, std::vector< Expression > &domainset) override

6.9.1 Constructor & Destructor Documentation

6.9.1.1 KillGenEval()

```
anonymous_namespace{available.cpp}::KillGenEval::KillGenEval ( )  [inline]
```

6.9.2 Member Function Documentation

6.9.2.1 genEval()

```
std::bitset<MAX_BITS_SIZE> anonymous_namespace{available.cpp}::KillGenEval::genEval (
            llvm::BasicBlock * BB,
            std::bitset< MAX_BITS_SIZE > & meet_res,
            std::vector< Expression > & domainset )  [inline], [override], [virtual]
```

Implements llvm::KillGen< Expression >.

6.9.2.2 killEval()

```
std::bitset<MAX_BITS_SIZE> anonymous_namespace{available.cpp}::KillGenEval::killEval (
            llvm::BasicBlock * BB,
            std::bitset< MAX_BITS_SIZE > & meet_res,
            std::vector< Expression > & domainset )  [inline], [override], [virtual]
```

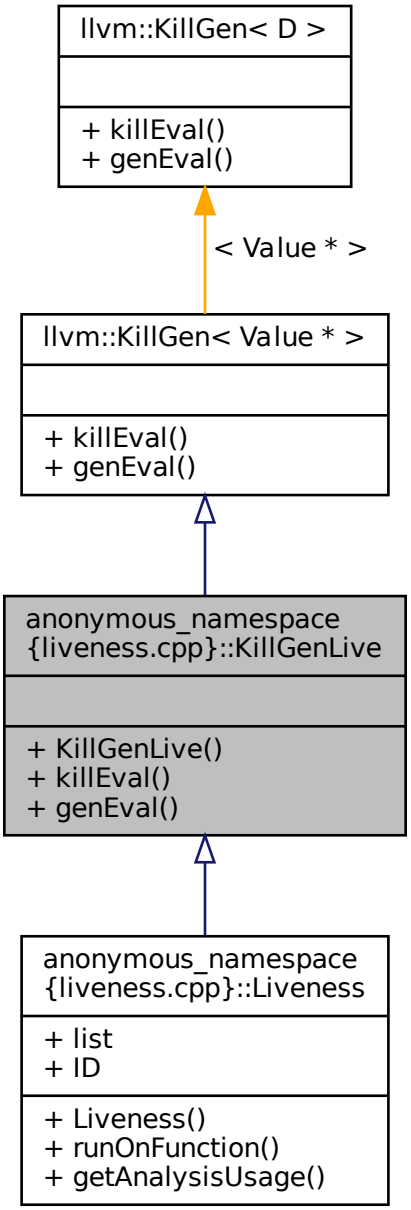
Implements llvm::KillGen< Expression >.

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

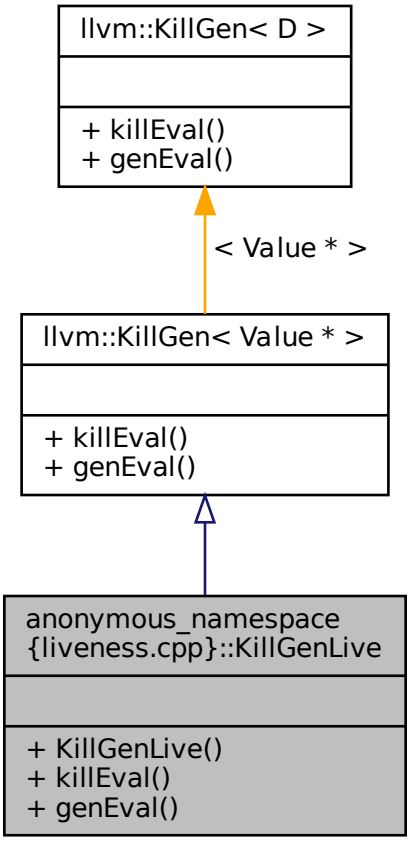
- available.cpp

6.10 anonymous_namespace{liveness.cpp}::KillGenLive Class Reference

Inheritance diagram for anonymous_namespace{liveness.cpp}::KillGenLive:



Collaboration diagram for anonymous_namespace{liveness.cpp}::KillGenLive:



Public Member Functions

- KillGenLive ()
- std::bitset< MAX_BITS_SIZE > killEval (llvm::BasicBlock *BB, std::bitset< MAX_BITS_SIZE > &meet_res, std::vector< Value * > &domainset) override
- std::bitset< MAX_BITS_SIZE > genEval (llvm::BasicBlock *BB, std::bitset< MAX_BITS_SIZE > &meet_res, std::vector< Value * > &domainset) override

6.10.1 Constructor & Destructor Documentation

6.10.1.1 KillGenLive()

```
anonymous_namespace{liveness.cpp}::KillGenLive::KillGenLive ( )  [inline]
```

6.10.2 Member Function Documentation

6.10.2.1 genEval()

```
std::bitset<MAX_BITS_SIZE> anonymous_namespace{liveness.cpp}::KillGenLive::genEval (
            llvm::BasicBlock * BB,
            std::bitset< MAX_BITS_SIZE > & meet_res,
            std::vector< Value * > & domainset )  [inline], [override], [virtual]
```

Implements llvm::KillGen< Value * >.

6.10.2.2 killEval()

```
std::bitset<MAX_BITS_SIZE> anonymous_namespace{liveness.cpp}::KillGenLive::killEval (
            llvm::BasicBlock * BB,
            std::bitset< MAX_BITS_SIZE > & meet_res,
            std::vector< Value * > & domainset )  [inline], [override], [virtual]
```

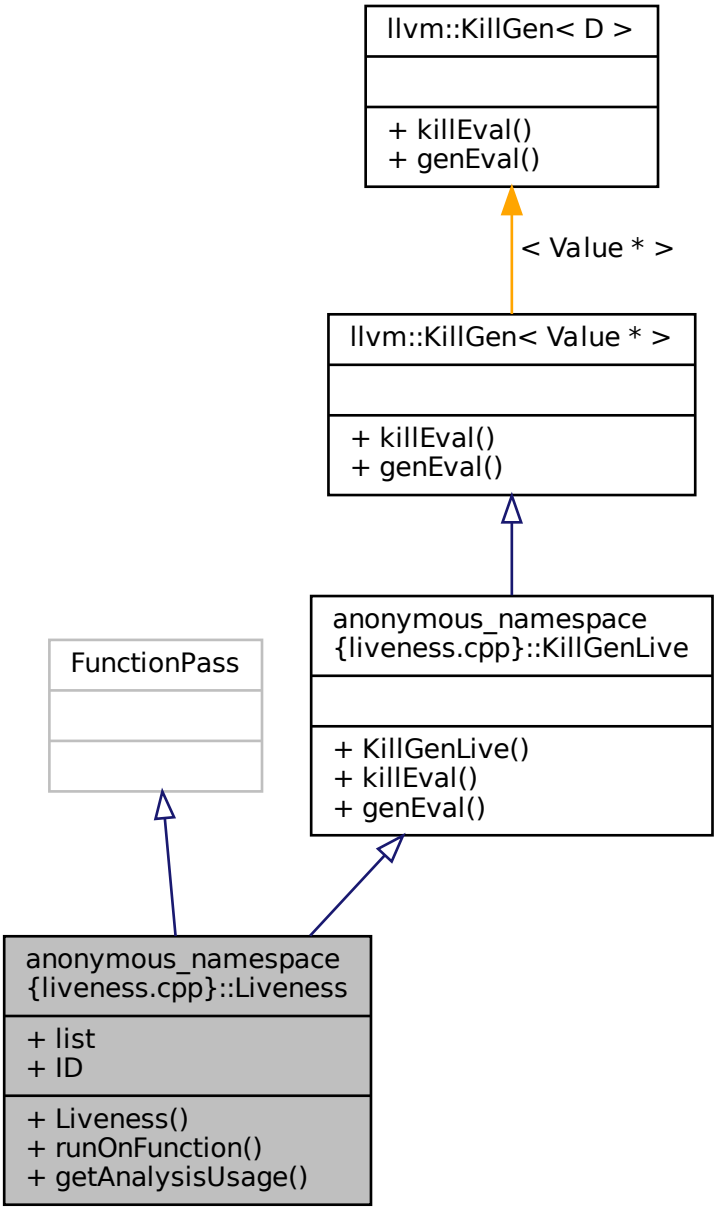
Implements llvm::KillGen< Value * >.

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

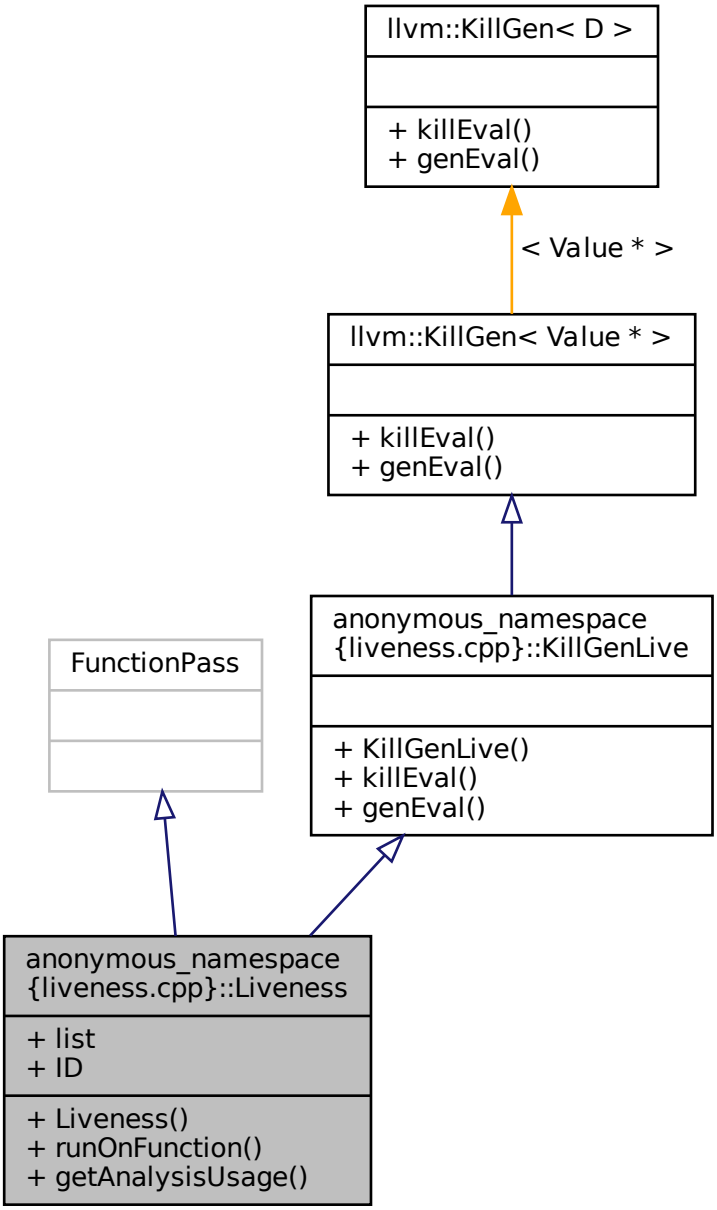
- liveness.cpp

6.11 anonymous_namespace{liveness.cpp}::Liveness Class Reference

Inheritance diagram for anonymous_namespace{liveness.cpp}::Liveness:



Collaboration diagram for anonymous_namespace{liveness.cpp}::Liveness:



Public Member Functions

- Liveness ()
- virtual bool runOnFunction (Function &F)
- virtual void getAnalysisUsage (AnalysisUsage &AU) const

Public Attributes

- std::vector< Value * > list

Static Public Attributes

- static char ID = 0

6.11.1 Constructor & Destructor Documentation

6.11.1.1 Liveness()

```
anonymous_namespace{liveness.cpp}::Liveness::Liveness ( )  [inline]
```

6.11.2 Member Function Documentation

6.11.2.1 getAnalysisUsage()

```
virtual void anonymous_namespace{liveness.cpp}::Liveness::getAnalysisUsage (
            AnalysisUsage & AU ) const  [inline], [virtual]
```

6.11.2.2 runOnFunction()

```
virtual bool anonymous_namespace{liveness.cpp}::Liveness::runOnFunction (
            Function & F )  [inline], [virtual]
```

6.11.3 Member Data Documentation

6.11.3.1 ID

```
char anonymous_namespace{liveness.cpp}::Liveness::ID = 0  [static]
```

6.11.3.2 list

```
std::vector<Value *> anonymous_namespace{liveness.cpp}::Liveness::list
```

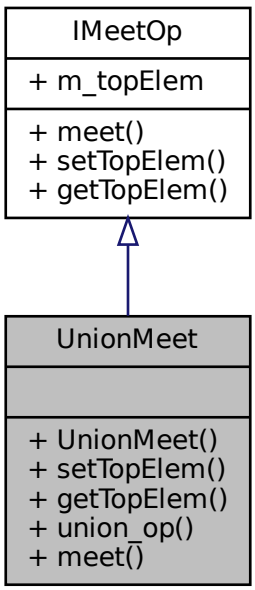
The documentation for this class was generated from the following file:

- liveness.cpp

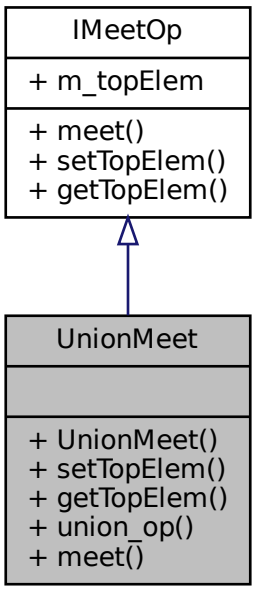
6.12 UnionMeet Class Reference

`#include <UnionMeet.h>`

Inheritance diagram for UnionMeet:



Collaboration diagram for UnionMeet:



Public Member Functions

- UnionMeet ()
- void setTopElem (BitsVal val) override
- BitsVal getTopElem () override
- std::bitset< MAX_BITS_SIZE > union_op (std::bitset< MAX_BITS_SIZE > ip1, std::bitset< MAX_BITS_SIZE > ip2)
- std::bitset< MAX_BITS_SIZE > meet (std::bitset< MAX_BITS_SIZE > input1, std::bitset< MAX_BITS_SIZE > input2) override

Additional Inherited Members

6.12.1 Constructor & Destructor Documentation

6.12.1.1 UnionMeet()

```
UnionMeet::UnionMeet ( )
```

6.12.2 Member Function Documentation

6.12.2.1 getTopElem()

```
BitsVal UnionMeet::getTopElem ( )  [override], [virtual]
```

Implements IMeetOp.

6.12.2.2 meet()

```
std::bitset< MAX_BITS_SIZE > UnionMeet::meet (
            std::bitset< MAX_BITS_SIZE > input1,
            std::bitset< MAX_BITS_SIZE > input2 )  [override], [virtual]
```

Implements IMeetOp.

6.12.2.3 setTopElem()

```
void UnionMeet::setTopElem (
            BitsVal val )  [override], [virtual]
```

Implements IMeetOp.

6.12.2.4 union_op()

```
std::bitset< MAX_BITS_SIZE > UnionMeet::union_op (
            std::bitset< MAX_BITS_SIZE > ip1,
            std::bitset< MAX_BITS_SIZE > ip2 )
```

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

- DataflowFramework/include/UnionMeet.h
- DataflowFramework/UnionMeet.cpp

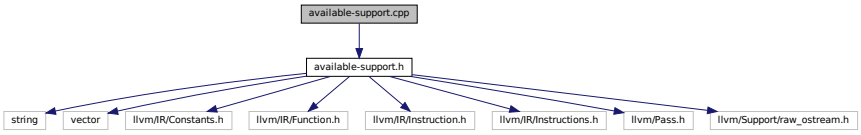
Chapter 7

File Documentation

7.1 available-support.cpp File Reference

```
#include "available-support.h"
```

Include dependency graph for available-support.cpp:



Namespaces

- llvm

Functions

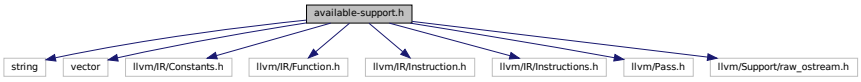
- void llvm::printSet (std::vector< Expression > *x)
- std::string llvm::getShortValueName (Value *v)

7.2 available-support.h File Reference

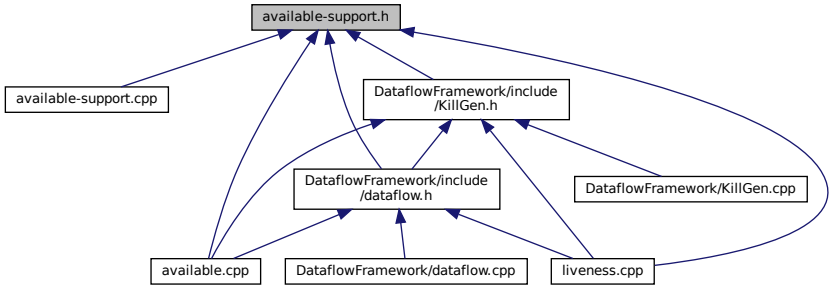
```
#include <string>
#include <vector>
#include "llvm/IR/Constants.h"
#include "llvm/IR/Function.h"
#include "llvm/IR/Instruction.h"
#include "llvm/IR/Instructions.h"
#include "llvm/Pass.h"
```

```
#include "llvm/Support/raw_ostream.h"
```

Include dependency graph for available-support.h:



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



Classes

- class llvm::Expression

Namespaces

- llvm

Functions

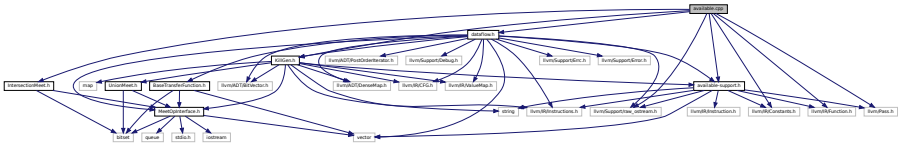
- std::string llvm::getShortValueName (Value *v)
- void llvm::printSet (std::vector< Expression > *x)

7.3 available.cpp File Reference

```
#include "available-support.h"
#include "llvm/IR/Constants.h"
#include "llvm/IR/Function.h"
#include "llvm/Pass.h"
#include "llvm/Support/raw_ostream.h"
#include <IntersectionMeet.h>
#include <KillGen.h>
```

```
#include <dataflow.h>
```

Include dependency graph for available.cpp:



Classes

- class anonymous_namespace{available.cpp}::KillGenEval
- class anonymous_namespace{available.cpp}::AvailableExpressions

Namespaces

- anonymous_namespace{available.cpp}

Macros

- #define DEBUG_TYPE "dataflow_framework"

Functions

- RegisterPass< AvailableExpressions > anonymous_namespace{available.cpp}::X ("available", "ECE 5984 Available Expressions")

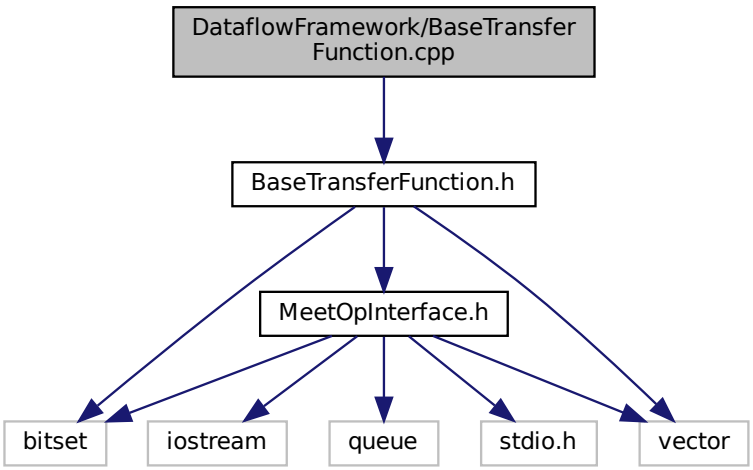
7.3.1 Macro Definition Documentation

7.3.1.1 DEBUG_TYPE

```
#define DEBUG_TYPE "dataflow_framework"
```

7.4 DataflowFramework/BaseTransferFunction.cpp File Reference

```
#include <BaseTransferFunction.h>
```
Include dependency graph for BaseTransferFunction.cpp:

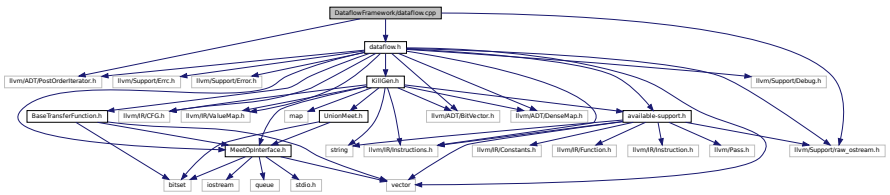


Namespaces

- llvm

7.5 DataflowFramework/dataflow.cpp File Reference

```
#include <dataflow.h>
#include <llvm/ADT/PostOrderIterator.h>
#include <llvm/Support/raw_ostream.h>
```
Include dependency graph for dataflow.cpp:



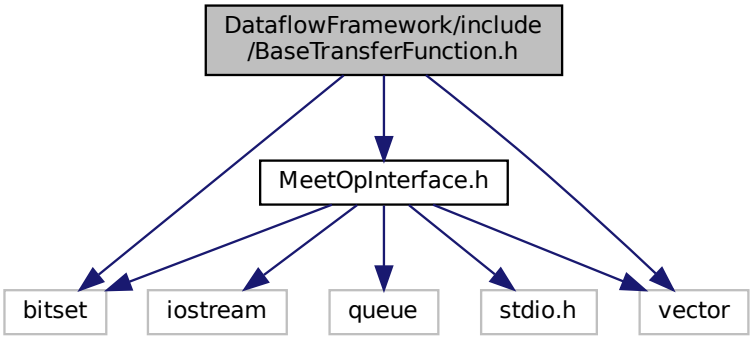
Namespaces

- llvm

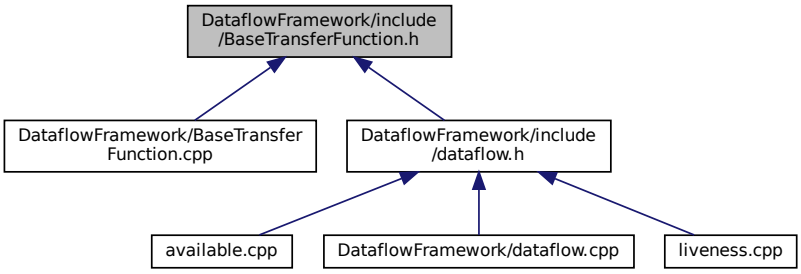
7.6 DataflowFramework/include/BaseTransferFunction.h File Reference

```
#include <MeetOpInterface.h>
#include <bitset>
#include <vector>
```

Include dependency graph for BaseTransferFunction.h:



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



Classes

- class llvm::BaseTransferFunction

  Holds the base implementation of a transfer function, to be extended later if we require additional steps to be added to the transfer function.

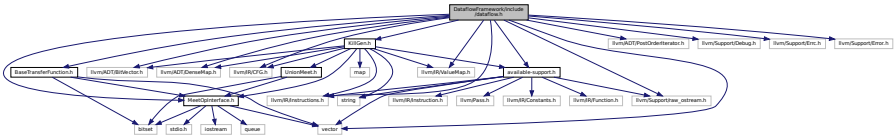
Namespaces

- llvm

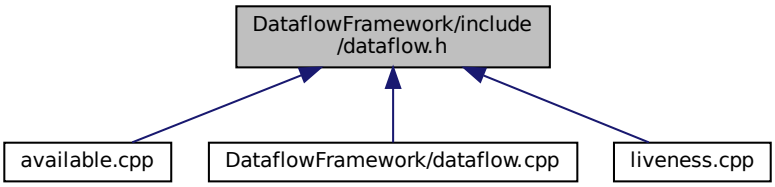
7.7 DataflowFramework/include/dataflow.h File Reference

```
#include "llvm/ADT/BitVector.h"
#include "llvm/ADT/DenseMap.h"
#include "llvm/IR/CFG.h"
#include "llvm/IR/Instructions.h"
#include "llvm/IR/ValueMap.h"
#include <llvm/ADT/PostOrderIterator.h>
#include <llvm/Support/Debug.h>
#include <llvm/Support/Errc.h>
#include <llvm/Support/Error.h>
#include <llvm/Support/raw_ostream.h>
#include <vector>
#include <BaseTransferFunction.h>
#include <KillGen.h>
#include <MeetOpInterface.h>
#include <available-support.h>
```

Include dependency graph for dataflow.h:



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



Classes

- class llvm::BBInOutBits
- class llvm::DataflowFramework< D >

Namespaces

- llvm

Enumerations

- enum MeetOperator { UNION, INTERSECTION }
- enum FlowDirection { FORWARD, BACKWARD }
- enum BoundaryCondition { EMPTY, UNIVERSAL }

7.7.1 Enumeration Type Documentation

7.7.1.1 BoundaryCondition

enum BoundaryCondition

Enumerator

EMPTY	
UNIVERSAL	

7.7.1.2 FlowDirection

enum FlowDirection

Enumerator

FORWARD	
BACKWARD	

7.7.1.3 MeetOperator

enum MeetOperator

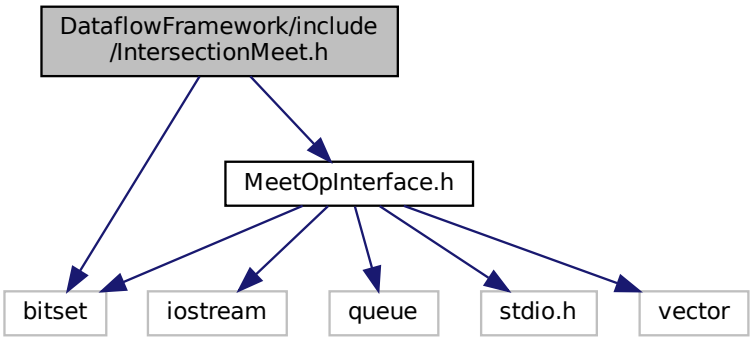
Enumerator

UNION	
INTERSECTION	

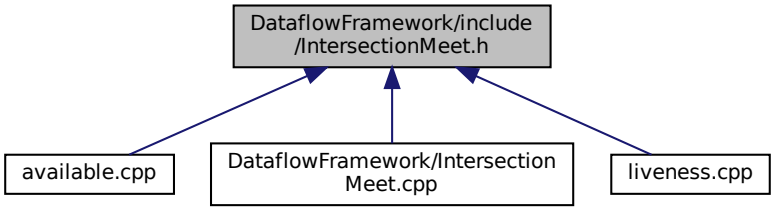
7.8 DataflowFramework/include/IntersectionMeet.h File Reference

```
#include <MeetOpInterface.h>
#include <bitset>
```

Include dependency graph for IntersectionMeet.h:



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



Classes

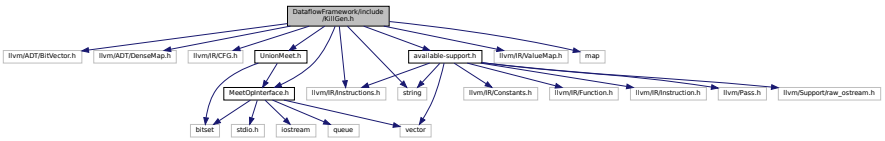
- class IntersectionMeet

7.9 DataflowFramework/include/KillGen.h File Reference

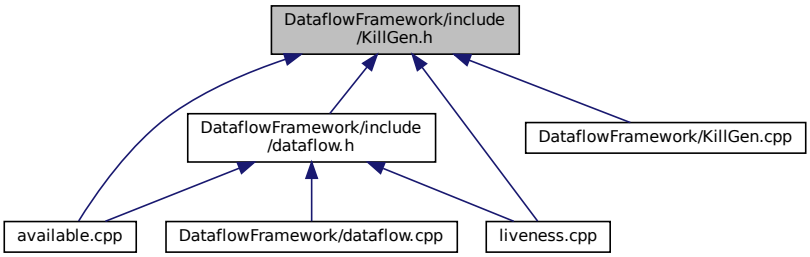
```
#include "llvm/ADT/BitVector.h"
#include "llvm/ADT/DenseMap.h"
#include "llvm/IR/CFG.h"
#include "llvm/IR/Instructions.h"
#include "llvm/IR/ValueMap.h"
#include <MeetOpInterface.h>
#include <UnionMeet.h>
#include <available-support.h>
#include <map>
```

```
#include <string>
```

Include dependency graph for KillGen.h:



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



Classes

- class llvm::KillGen< D >

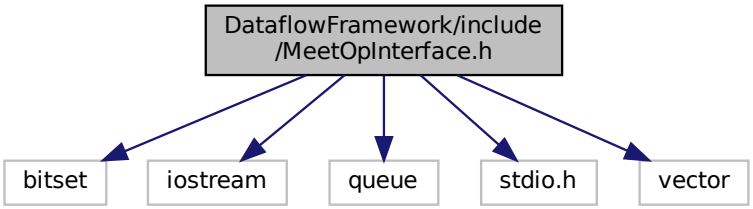
Namespaces

- llvm

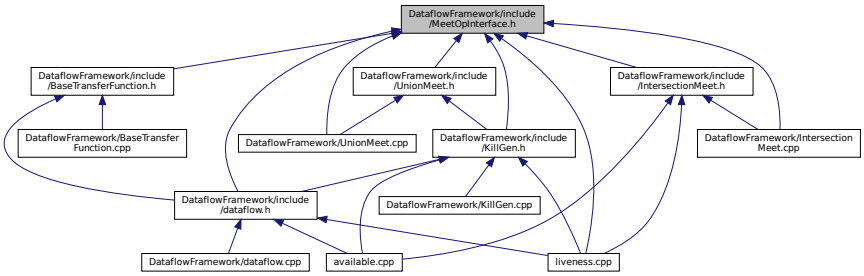
7.10 DataflowFramework/include/MeetOpInterface.h File Reference

```
#include <bitset>
#include <iostream>
#include <queue>
#include <stdio.h>
#include <vector>
```

Include dependency graph for MeetOpInterface.h:



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



Classes

- class IMeetOp

Macros

- #define MAX_BITS_SIZE 4096
- #define MAX_PRINT_SIZE 32

Enumerations

- enum BitsVal { ZEROS, ONES }

7.10.1 Macro Definition Documentation

7.10.1.1 MAX_BITS_SIZE

```
#define MAX_BITS_SIZE 4096
```

7.10.1.2 MAX_PRINT_SIZE

```
#define MAX_PRINT_SIZE 32
```

7.10.2 Enumeration Type Documentation

7.10.2.1 BitsVal

```
enum BitsVal
```

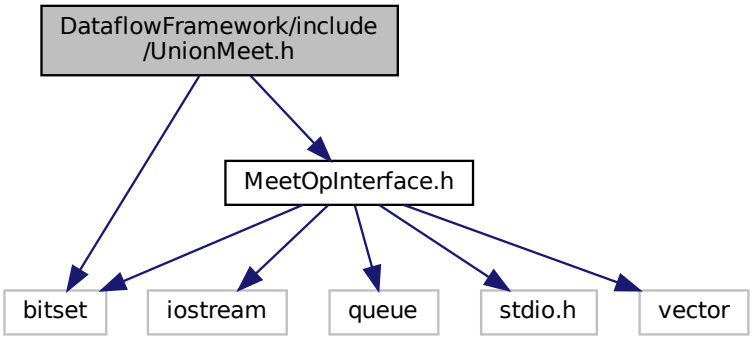
Enumerator

ZEROS	
ONES	

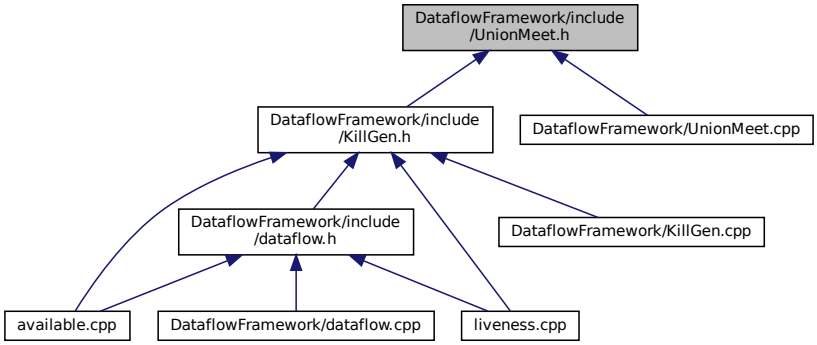
7.11 DataflowFramework/include/UnionMeet.h File Reference

```
#include <MeetOpInterface.h>
#include <bitset>
```

Include dependency graph for UnionMeet.h:



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



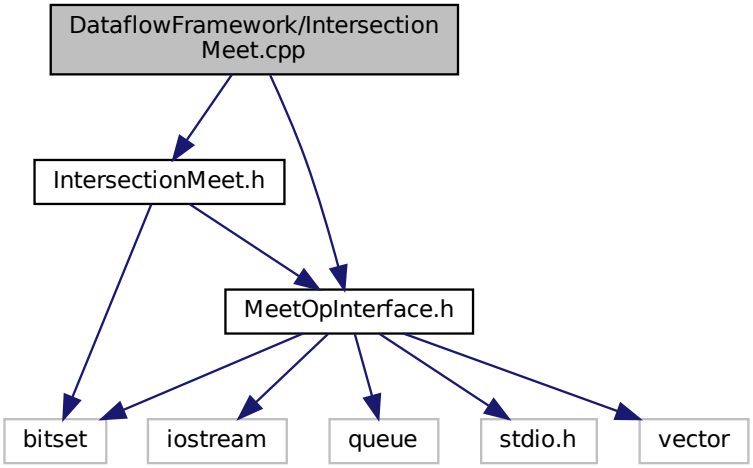
Classes

- class UnionMeet

7.12 DataflowFramework/IntersectionMeet.cpp File Reference

```
#include <IntersectionMeet.h>
#include <MeetOpInterface.h>
```

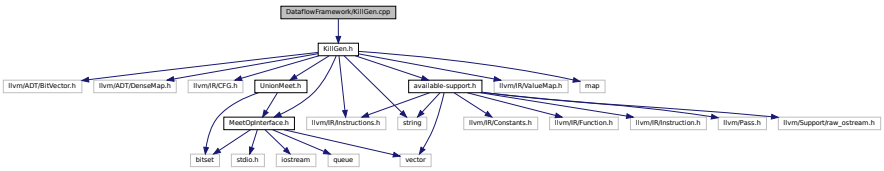
Include dependency graph for IntersectionMeet.cpp:



7.13 DataflowFramework/KillGen.cpp File Reference

```
#include <KillGen.h>
```

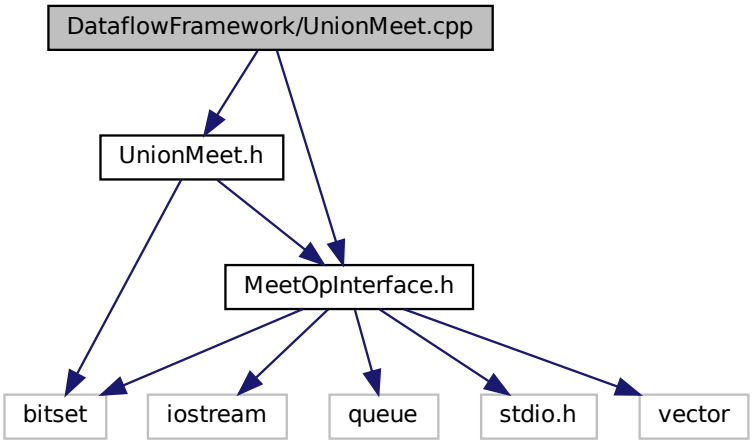
Include dependency graph for KillGen.cpp:



7.14 DataflowFramework/UnionMeet.cpp File Reference

```
#include <MeetOpInterface.h>
#include <UnionMeet.h>
```

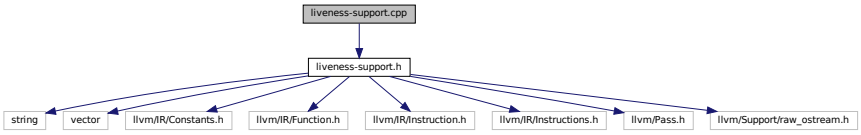
Include dependency graph for UnionMeet.cpp:



7.15 liveness-support.cpp File Reference

```
#include "liveness-support.h"
```

Include dependency graph for liveness-support.cpp:



Namespaces

- llvm

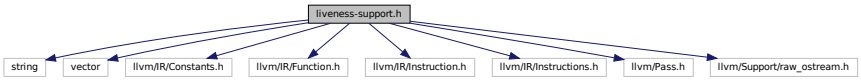
Functions

- void llvm::printSet (std::vector< Expression > *x)
- std::string llvm::getShortValueName (Value *v)

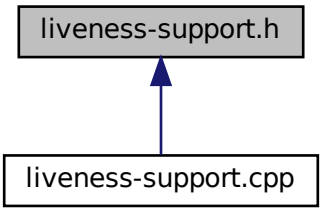
7.16 liveness-support.h File Reference

```
#include <string>
#include <vector>
#include "llvm/IR/Constants.h"
#include "llvm/IR/Function.h"
#include "llvm/IR/Instruction.h"
#include "llvm/IR/Instructions.h"
#include "llvm/Pass.h"
#include "llvm/Support/raw_ostream.h"
```

Include dependency graph for liveness-support.h:



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



Classes

- class llvm::Expression

Namespaces

- llvm

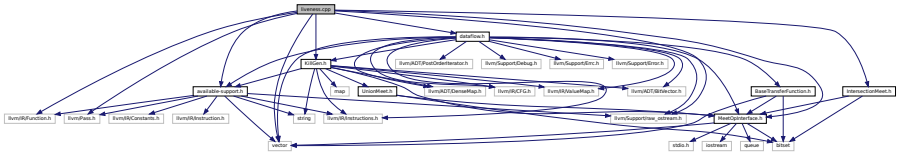
Functions

- std::string llvm::getShortValueName (Value ∗v)
- void llvm::printSet (std::vector< Expression > ∗x)

7.17 liveness.cpp File Reference

```
#include "KillGen.h"
#include "MeetOpInterface.h"
#include "dataflow.h"
#include "llvm/IR/Function.h"
#include "llvm/Pass.h"
#include "llvm/Support/raw_ostream.h"
#include <IntersectionMeet.h>
#include <available-support.h>
#include <vector>
```

Include dependency graph for liveness.cpp:



Classes

- class anonymous_namespace{liveness.cpp}::KillGenLive
- class anonymous_namespace{liveness.cpp}::Liveness

Namespaces

- anonymous_namespace{liveness.cpp}

Functions

- RegisterPass< Liveness > anonymous_namespace{liveness.cpp}::X ("liveness", "ECE 5984 Liveness")

7.18 tests/test.c File Reference

Functions

- int main ()

7.18.1 Function Documentation

7.18.1.1 main()

```
int main ( )
```