

Searchable_HEDB

1

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Chapter 1

HOW TO RUN

Searchable DB Library Install

```
cd ./big3_searchable_hedb/HDB_comparison_library
rm -r build
mkdir build
cd build
```

If HElib is installed as a library...

```
cmake ..
```

If HElib is locally installed...

```
cmake -Dhelib_DIR={PATH}/helib_install/helib_pack/share/cmake/helib ..
```

then

```
make install
```

installs the HDB library in the folder `./big3_searchable_hedb/lib_HDB`

To run main code...

```
cd ./big3_searchable_hedb
rm -r build
mkdir build
cd build
```

then run cmake and make as above. Compiled binary will be in `./big3_searchable_hedb/bin`

API

Can be found in the `./html` directory. Open `index.html` to access the API documentation.

Chapter 2

Namespace Index

2.1 Namespace List

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

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Chapter 3

Class Index

3.1 Class List

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

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Chapter 4

Namespace Documentation

4.1 HDB_supergate_ Namespace Reference

Classes

- struct [BGV_param](#)
- class [CSVIterator](#)
- class [CSVRange](#)
- class [CSVRow](#)
- class [CtxtIndex](#)
class representing an encrypted ciphertext index
- class [CtxtIndexFile](#)
class representing a ciphertext index file
- class [HEQuery](#)
Object representing a query object used to query the HEDB.
- class [PtxtIndex](#)
class representing a plaintext index
- class [PtxtIndexFile](#)
class representing a collection of PtxtIndexes
- struct [STD128_HDB](#)
- struct [TOY_HDB](#)

Typedefs

- typedef std::vector< helib::Ctxt > [Ctxt_vec](#)
- typedef std::vector< std::vector< helib::Ctxt > > [Ctxt_mat](#)

Enumerations

- enum [Q_TYPE_t](#) {
 EQ, LT, LEQ, MIN,
 MAX, EQ, LT, LEQ,
 MIN, MAX }
- enum [Q_TYPE_t](#) {
 EQ, LT, LEQ, MIN,
 MAX, EQ, LT, LEQ,
 MIN, MAX }

Functions

- `std::istream & operator>>` (`std::istream &str`, [CSVRow](#) &data)
- `struct BGV_param MakeBGVParam` (long, long, long, long, long, long, long, long, long)
- `helib::Context MakeBGVContext` (long, long, long, long, long, long)
- `helib::Context MakeBGVContext` (const struct [BGV_param](#))
- `void write_raw_string` (`std::ostream &os`, `std::string &s`)
- `void write_raw_string_vector` (`std::ostream &os`, `std::vector< std::string > &sv`)
- `std::string read_raw_string` (`std::istream &is`)
- `void read_raw_string_vector` (`std::istream &is`, `std::vector< std::string > &sv`)
- `void setIndexParams` (unsigned long, unsigned long, unsigned long, unsigned long &, unsigned long &, bool)
- `void dataToZZXSlot` (unsigned long data, `vector< ZZX > &dest`, unsigned long counter, unsigned long digit_base, unsigned long exp_len, unsigned long enc_base, [he_cmp::Comparator](#) &comparator)
- `void encryptAndInsert` (const `helib::Context &contx`, `helib::PubKey &pk`, `std::vector< NTL::ZZX > &ptxt`, [Ctxt_vec](#) &dest)
- `long findNSlots` (long, long)
- `istream & operator>>` (`istream &str`, [CSVRow](#) &data)
- `void encryptAndInsert` (const `Context &contx`, `PubKey &pk`, `vector< ZZX > &ptxt`, [Ctxt_vec](#) &dest)
- `ostream & operator<<` (`ostream &os`, const [CtxtIndex](#) &ci)
- `ostream & operator<<` (`ostream &os`, const [CtxtIndexFile](#) &file)
- `ostream & operator<<` (`ostream &os`, const [HEQuery](#) &q)

4.1.1 Detailed Description

main namespace for all utility functions for a HEDB

4.1.2 Typedef Documentation

4.1.2.1 Ctxt_mat

```
typedef std::vector< std::vector< helib::Ctxt > > HDB_supergate_::Ctxt_mat
```

a matrix of ciphertexts, `Ctxt_mat`

4.1.2.2 Ctxt_vec

```
typedef std::vector< helib::Ctxt > HDB_supergate_::Ctxt_vec
```

a vector of ciphertexts, `Ctxt_vec`

4.1.3 Enumeration Type Documentation

4.1.3.1 Q_TYPE_t [1/2]

```
enum HDB_supergate_::Q_TYPE_t
```

Query Type Enum A query can be equal EQ, less than LT, or less than or equal to LEQ. MIN and MAX queries are not supported yet.

4.1.3.2 Q_TYPE_t [2/2]

```
enum HDB_supergate_::Q_TYPE_t
```

Query Type Enum A query can be equal EQ, less than LT, or less than or equal to LEQ. MIN and MAX queries are not supported yet.

4.1.4 Function Documentation

4.1.4.1 MakeBGVContext() [1/2]

```
helib::Context HDB_supergate_::MakeBGVContext (
    long ,
    long ,
    long ,
    long ,
    long ,
    long )
```

function to create a helib::Context given parameters

4.1.4.2 MakeBGVContext() [2/2]

```
helib::Context HDB_supergate_::MakeBGVContext (
    const struct BGV_param )
```

function to create a helib::Context given BGV_Param struct

function to create a helib::Context given parameters

4.1.4.3 MakeBGVParam()

```
struct BGV_param HDB_supergate_::MakeBGVParam (
    long ,
    long ,
    long ,
    long ,
    long ,
    long ,
    long ,
    long )
```

function to create BGV_Param given parameters

4.1.4.4 read_raw_string()

```
std::string HDB_supergate_::read_raw_string (
    std::istream & is )
```

binary deserialization of string

4.1.4.5 read_raw_string_vector()

```
void HDB_supergate_::read_raw_string_vector (
    std::istream & is,
    std::vector< std::string > & sv )
```

binary deserialization of string vector

4.1.4.6 write_raw_string()

```
void HDB_supergate_::write_raw_string (
    std::ostream & os,
    std::string & s )
```

binary serialization of string

function to create a helib::Context given BGV_Param struct

4.1.4.7 write_raw_string_vector()

```
void HDB_supergate_::write_raw_string_vector (
    std::ostream & os,
    std::vector< std::string > & sv )
```

binary serialization of string vector

4.2 HDB_supergate_server_ Namespace Reference

Namespace for the [SERVER](#) class.

Classes

- class [SERVER](#)

Class that contains the DB and is queried upon.

4.2.1 Detailed Description

Namespace for the [SERVER](#) class.

4.3 HDB_supergate_user_ Namespace Reference

Namespace for the [USER](#) class.

Classes

- class [USER](#)

Class that simulates the [USER](#) that queries the DB.

4.3.1 Detailed Description

Namespace for the [USER](#) class.

Chapter 5

Class Documentation

5.1 HDB_supergate_::BGV_param Struct Reference

```
#include <HDB_supergate.hpp>
```

Public Attributes

- long **p**
- long **d**
- long **m**
- long **nb_primes**
- long **expansion_len**
- long **c**
- long **scale**
- long **r**

5.1.1 Detailed Description

[BGV_param](#) struct A struct representing all necessary parameters to construct a BGV crypto context and the necessary comparison logic.

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.2 helib::Binio Struct Reference

Static Public Attributes

- static constexpr int **BIT32** = 4
- static constexpr int **BIT64** = 8
- static constexpr std::array< char, 4 > **VERSION_0_0_1_0** = {0, 0, 1, 0}

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

- HDB_comparison_library/src/binio.h

5.3 he_cmp::Comparator Class Reference

Public Member Functions

- DoubleCRT **create_shift_mask** (double &size, long shift)
- void **create_all_shift_masks** ()
- void **compute_poly_params** ()
- void **create_poly** ()
- void **extraction_init** ()
- void **extract_mod_p** (vector< Ctxt > &mod_p_coefs, const Ctxt &ctxt_x) const
- void **batch_shift** (Ctxt &ctxt, long start, long shift) const
- void **batch_shift_for_mul** (Ctxt &ctxt, long start, long shift) const
- void **shift_and_add** (Ctxt &x, long start, long shift_direction=false) const
- void **shift_and_mul** (Ctxt &x, long start, long shift_direction=false) const
- void **mapTo01_subfield** (Ctxt &ctxt, long pow) const
- void **evaluate_univar_less_poly** (Ctxt &ret, Ctxt &ctxt_p_1, const Ctxt &x) const
- void **evaluate_min_max_poly** (Ctxt &ctxt_min, Ctxt &ctxt_max, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **less_than_bivar** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **less_than_bivar_tan** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **less_than_mod_2** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **less_than_mod_3** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **less_than_mod_5** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **less_than_mod_7** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **less_than_mod_any** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **is_zero** (Ctxt &ctxt_res, const Ctxt &ctxt_z, long pow=1) const
- void **min_max_digit** (Ctxt &ctxt_min, Ctxt &ctxt_max, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **int_to_slot** (ZZX &poly, unsigned long input, unsigned long enc_base) const
- void **get_sorting_index** (vector< Ctxt > &ctxt_out, const vector< Ctxt > &ctxt_in) const
- void **find_prim_root** (ZZ_pE &root) const
- **Comparator** (const Context &context, CircuitType type, unsigned long d, unsigned long expansion_len, PubKey &pk, bool verbose)
- const DoubleCRT & **get_mask** (double &size, long index) const
- const ZZX & **get_less_than_poly** () const
- const ZZX & **get_min_max_poly** () const
- void **compare** (Ctxt &ctxt_res, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **min_max** (Ctxt &ctxt_min, Ctxt &ctxt_max, const Ctxt &ctxt_x, const Ctxt &ctxt_y) const
- void **array_min** (Ctxt &ctxt_res, const vector< Ctxt > &ctxt_in, long depth=0) const
- void **sort** (vector< Ctxt > &ctxt_out, const vector< Ctxt > &ctxt_in) const

Public Attributes

- const Context & **m_context**
- unsigned long **m_slotDeg**
- unsigned long **m_expansionLen**
- vector< DoubleCRT > **m_mulMasks**
- vector< double > **m_mulMasksSize**
- CircuitType **m_type**
- ZZX **m_univar_less_poly**
- ZZX **m_univar_min_max_poly**
- mat_ZZ **m_bivar_less_coefs**
- long **m_bs_num_comp**
- long **m_bs_num_min**
- long **m_gs_num_comp**

- long **m_gs_num_min**
- ZZ **m_top_coef_comp**
- ZZ **m_top_coef_min**
- ZZ **m_extra_coef_comp**
- ZZ **m_extra_coef_min**
- long **m_baby_index**
- long **m_giant_index**
- ZZX **m_slot_gen**
- PubKey & **m_pk**
- vector< vector< DoubleCRT > > **m_extraction_const**
- vector< vector< double > > **m_extraction_const_size**
- bool **m_verbose**

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

- HDB_comparison_library/comp_lib/comparator.h
- HDB_comparison_library/comp_lib/comparator.cpp

5.4 HDB_supergate_::CSVIterator Class Reference

Public Types

- typedef std::input_iterator_tag **iterator_category**
- typedef CSVRow **value_type**
- typedef std::size_t **difference_type**
- typedef CSVRow * **pointer**
- typedef CSVRow & **reference**
- typedef std::input_iterator_tag **iterator_category**
- typedef CSVRow **value_type**
- typedef std::size_t **difference_type**
- typedef CSVRow * **pointer**
- typedef CSVRow & **reference**

Public Member Functions

- **CSVIterator** (std::istream &str)
- **CSVIterator** & **operator++** ()
- **CSVIterator** **operator++** (int)
- CSVRow const & **operator*** () const
- CSVRow const * **operator->** () const
- bool **operator==** (CSVIterator const &rhs)
- bool **operator!=** (CSVIterator const &rhs)
- **CSVIterator** (std::istream &str)
- **CSVIterator** & **operator++** ()
- **CSVIterator** **operator++** (int)
- CSVRow const & **operator*** () const
- CSVRow const * **operator->** () const
- bool **operator==** (CSVIterator const &rhs)
- bool **operator!=** (CSVIterator const &rhs)

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.5 HDB_supergate_::CSVRange Class Reference

Public Member Functions

- **CSVRange** (std::istream &str)
- **CSVIterator** **begin** () const
- **CSVIterator** **end** () const
- **CSVRange** (std::istream &str)
- **CSVIterator** **begin** () const
- **CSVIterator** **end** () const

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.6 HDB_supergate_::CSVRow Class Reference

Public Member Functions

- std::string_view **operator[]** (std::size_t index) const
- std::size_t **size** () const
- void **readNextRow** (std::istream &str)
- std::string_view **operator[]** (std::size_t index) const
- std::size_t **size** () const
- void **readNextRow** (std::istream &str)

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.7 HDB_supergate_::CtxtIndex Class Reference

class representing an encrypted ciphertext index

```
#include <HDB_supergate.hpp>
```

Public Member Functions

- void **encrypt** (PtxtIndex ptIndex, he_cmp::Comparator &comparator, const helib::Context &ctx, helib::PubKey &pk, unsigned long input_range, unsigned long digit_base, unsigned long enc_base, unsigned long exp_len, unsigned long nslots, unsigned long max_per, bool verbose)
- Ctxt_vec & **keys** ()
- Ctxt_mat & **uids** ()
- unsigned long **getX** ()
- unsigned long **getY** ()
- void **writeTo** (std::ostream &os) const
- void **read** (std::istream &is, helib::PubKey &pk)
- void **encrypt** (PtxtIndex ptIndex, he_cmp::Comparator &comparator, const helib::Context &ctx, helib::PubKey &pk, unsigned long input_range, unsigned long digit_base, unsigned long enc_base, unsigned long exp_len, unsigned long nslots, unsigned long max_per, bool verbose)
- Ctxt_vec & **keys** ()
- Ctxt_mat & **uids** ()
- unsigned long **getX** ()
- unsigned long **getY** ()
- void **writeTo** (std::ostream &os) const
- void **read** (std::istream &is, helib::PubKey &pk)

Friends

- `std::ostream & operator<< (std::ostream &, const CtxtIndex &)`
- `std::ostream & operator<< (std::ostream &, const CtxtIndex &)`

5.7.1 Detailed Description

class representing an encrypted ciphertext index

A ciphertext index has a Ctxt_vec type of encrypted keys and Ctxt_mat type of encrypted uids. The encrypted uids has dimension of X rows and Y columns.

5.7.2 Member Function Documentation

5.7.2.1 getX() [1/2]

```
unsigned long HDB_supergate_::CtxtIndex::getX ( ) [inline]
```

getter for X value

5.7.2.2 getX() [2/2]

```
unsigned long HDB_supergate_::CtxtIndex::getX ( ) [inline]
```

getter for X value

5.7.2.3 getY() [1/2]

```
unsigned long HDB_supergate_::CtxtIndex::getY ( ) [inline]
```

getter for Y value

5.7.2.4 getY() [2/2]

```
unsigned long HDB_supergate_::CtxtIndex::getY ( ) [inline]
```

getter for Y value

5.7.2.5 keys() [1/2]

```
Ctxt_vec& HDB_supergate_::CtxtIndex::keys ( ) [inline]
```

getter for enc_key

5.7.2.6 keys() [2/2]

```
Ctxt_vec& HDB_supergate_::CtxtIndex::keys ( ) [inline]
```

getter for enc_key

5.7.2.7 read()

```
void HDB_supergate_::CtxtIndex::read (
    std::istream & is,
    helib::PubKey & )
```

binary deserialization

5.7.2.8 uids() [1/2]

```
Ctxt_mat& HDB_supergate_::CtxtIndex::uids ( ) [inline]
```

getter for enc_uid

5.7.2.9 uids() [2/2]

```
Ctxt_mat& HDB_supergate_::CtxtIndex::uids ( ) [inline]
```

getter for enc_uid

5.7.2.10 writeTo()

```
void HDB_supergate_::CtxtIndex::writeTo (
    std::ostream & os ) const
```

binary serialization

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.8 HDB_supergate_::CtxtIndexFile Class Reference

class representing a ciphertext index file

```
#include <HDB_supergate.hpp>
```


Public Member Functions

- void **encrypt** (PtxtIndexFile &ptIndexFile, he_cmp::Comparator &comparator, const helib::Context &ctx, helib::PubKey &pk, unsigned long input_range, unsigned long digit_base, unsigned long enc_base, unsigned long exp_len, unsigned long nslots, unsigned long max_per, bool verbose)
- void **insert** (std::string colname, PtxtIndex &ptIndex, he_cmp::Comparator &comparator, const helib::Context &ctx, helib::PubKey &pk, unsigned long input_range, unsigned long digit_base, unsigned long enc_base, unsigned long exp_len, unsigned long nslots, unsigned long max_per, bool verbose)
- void **insert** (std::string colname, CtxtIndex &index)
- std::vector< std::pair< std::string, CtxtIndex > > **getIndexFile** ()
- CtxtIndex & **find** (unsigned long)
- CtxtIndex & **find** (std::string)
- unsigned long **indexOf** (std::string)
- void **write_raw_index_file** (std::ostream &os)
- void **read_raw_index_file** (std::istream &is, helib::PubKey &)
- void **writeTo** (std::ostream &os)
- void **read** (std::istream &is, helib::PubKey &)
- void **encrypt** (PtxtIndexFile &ptIndexFile, he_cmp::Comparator &comparator, const helib::Context &ctx, helib::PubKey &pk, unsigned long input_range, unsigned long digit_base, unsigned long enc_base, unsigned long exp_len, unsigned long nslots, unsigned long max_per, bool verbose)
- void **insert** (std::string colname, PtxtIndex &ptIndex, he_cmp::Comparator &comparator, const helib::Context &ctx, helib::PubKey &pk, unsigned long input_range, unsigned long digit_base, unsigned long enc_base, unsigned long exp_len, unsigned long nslots, unsigned long max_per, bool verbose)
- void **insert** (std::string colname, CtxtIndex &index)
- std::vector< std::pair< std::string, CtxtIndex > > **getIndexFile** ()
- CtxtIndex & **find** (unsigned long)
- CtxtIndex & **find** (std::string)
- unsigned long **indexOf** (std::string)
- void **write_raw_index_file** (std::ostream &os)
- void **read_raw_index_file** (std::istream &is, helib::PubKey &)
- void **writeTo** (std::ostream &os)
- void **read** (std::istream &is, helib::PubKey &)

Friends

- std::ostream & **operator**<< (std::ostream &, const CtxtIndexFile &)
- std::ostream & **operator**<< (std::ostream &, const CtxtIndexFile &)

5.8.1 Detailed Description

class representing a ciphertext index file

A ciphertext index file is a collection of CtxtIndexes. It is a collection of <column name, CtxtIndex> pairs, with the column name and corresponding ciphertext index as a pair.

5.8.2 Member Function Documentation

5.8.2.1 find() [1/4]

```
CtxtIndex & HDB_supergate_::CtxtIndexFile::find (
    unsigned long i )
```

Finds the corresponding [CtxtIndex](#) given index of column

5.8.2.2 find() [2/4]

```
CtxtIndex& HDB_supergate_::CtxtIndexFile::find (
    unsigned long )
```

Finds the corresponding [CtxtIndex](#) given index of column

5.8.2.3 find() [3/4]

```
CtxtIndex& HDB_supergate_::CtxtIndexFile::find (
    std::string )
```

Finds the corresponding [CtxtIndex](#) given column name

5.8.2.4 find() [4/4]

```
CtxtIndex& HDB_supergate_::CtxtIndexFile::find (
    std::string )
```

Finds the corresponding [CtxtIndex](#) given column name

5.8.2.5 indexOf() [1/2]

```
unsigned long HDB_supergate_::CtxtIndexFile::indexOf (
    std::string )
```

Returns the index given the column name

5.8.2.6 indexOf() [2/2]

```
unsigned long HDB_supergate_::CtxtIndexFile::indexOf (
    std::string )
```

Returns the index given the column name

5.8.2.7 insert() [1/2]

```
void HDB_supergate_::CtxtIndexFile::insert (
    std::string colname,
    CtxtIndex & index )
```

Inserts [CtxtIndex](#) for given colname

5.8.2.8 insert() [2/2]

```
void HDB_supergate_::CtxtIndexFile::insert (
    std::string colname,
    CtxtIndex & index )
```

Inserts [CtxtIndex](#) for given colname

5.8.2.9 read()

```
void HDB_supergate_::CtxtIndexFile::read (
    std::istream & is,
    helib::PubKey & )
```

binary deserialization

5.8.2.10 read_raw_index_file()

```
void HDB_supergate_::CtxtIndexFile::read_raw_index_file (
    std::istream & is,
    helib::PubKey & )
```

binary deserialization of `std::vector<std::pair<std::string, CtxtIndex>>` object

5.8.2.11 write_raw_index_file()

```
void HDB_supergate_::CtxtIndexFile::write_raw_index_file (
    std::ostream & os )
```

binary serialization of `std::vector<std::pair<std::string, CtxtIndex>>` object

5.8.2.12 writeTo()

```
void HDB_supergate_::CtxtIndexFile::writeTo (
    std::ostream & os )
```

binary serialization

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

- `HDB_comparison_library/include/HDB_supergate.hpp`
- `HDB_comparison_library/src/HDB_supergate.cpp`

5.9 helib::EyeCatcher Struct Reference

Static Public Attributes

- static constexpr int **SIZE** = 4
- static constexpr std::array< char, SIZE > **HEADER_BEGIN** = {'|','H','E','|'}
- static constexpr std::array< char, SIZE > **HEADER_END** = {'|','H','E','|'}
- static constexpr std::array< char, SIZE > **CONTEXT_BEGIN** = {'|','C','N','|'}
- static constexpr std::array< char, SIZE > **CONTEXT_END** = {'|','C','N','|'}
- static constexpr std::array< char, SIZE > **CTXT_BEGIN** = {'|','C','X','|'}
- static constexpr std::array< char, SIZE > **CTXT_END** = {'|','C','X','|'}
- static constexpr std::array< char, SIZE > **PK_BEGIN** = {'|','P','K','|'}
- static constexpr std::array< char, SIZE > **PK_END** = {'|','P','K','|'}
- static constexpr std::array< char, SIZE > **SK_BEGIN** = {'|','S','K','|'}
- static constexpr std::array< char, SIZE > **SK_END** = {'|','S','K','|'}
- static constexpr std::array< char, SIZE > **SKM_BEGIN** = {'|','K','M','|'}
- static constexpr std::array< char, SIZE > **SKM_END** = {'|','K','M','|'}

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

- HDB_comparison_library/src/binio.h

5.10 HDB_supergate_::HEQuery Class Reference

Object representing a query object used to query the HEDB.

```
#include <HDB_supergate.hpp>
```

Public Member Functions

- [HEQuery](#) (helib::PubKey &pk)
- void **insert** (long src, helib::Ctxt &EQ, helib::Ctxt <, helib::Ctxt &qry, std::vector< long > dst)
- void [writeTo](#) (std::ostream &os) const
- void [read](#) (std::istream &is)
- [HEQuery](#) (helib::PubKey &pk)
- void **insert** (long src, helib::Ctxt &EQ, helib::Ctxt <, helib::Ctxt &qry, std::vector< long > dst)
- void **writeTo** (std::ostream &os) const
- void **read** (std::istream &is)

Public Attributes

- long [source](#)
- helib::Ctxt [query](#)
- std::pair< helib::Ctxt, helib::Ctxt > [Q_type](#)
- std::vector< long > [dest](#)

Friends

- `std::ostream & operator<< (std::ostream &, const HEQuery &)`
- `std::ostream & operator<< (std::ostream &, const HEQuery &)`

5.10.1 Detailed Description

Object representing a query object used to query the HEDB.

5.10.2 Constructor & Destructor Documentation

5.10.2.1 [HEQuery\(\)](#) [1/2]

```
HDB_supergate_::HEQuery::HEQuery (
    helib::PubKey & pk ) [inline]
```

Constructor of the [HEQuery](#) class

The constructor takes in the public key to initialize query ciphertext and query type ctxt pair.

Parameters

| | |
|-----------|-----------------------------|
| <i>pk</i> | reference to the public key |
|-----------|-----------------------------|

5.10.2.2 [HEQuery\(\)](#) [2/2]

```
HDB_supergate_::HEQuery::HEQuery (
    helib::PubKey & pk ) [inline]
```

Constructor of the [HEQuery](#) class

The constructor takes in the public key to initialize query ciphertext and query type ctxt pair.

Parameters

| | |
|-----------|-----------------------------|
| <i>pk</i> | reference to the public key |
|-----------|-----------------------------|

5.10.3 Member Function Documentation

5.10.3.1 read()

```
void HDB_supergate_::HEQuery::read (
    std::istream & is )
```

binary serialization

5.10.3.2 writeTo()

```
void HDB_supergate_::HEQuery::writeTo (
    std::ostream & os ) const
```

binary serialization

5.10.4 Member Data Documentation

5.10.4.1 dest

```
std::vector< long > HDB_supergate_::HEQuery::dest
```

Collection of destination columns to query. TODO: encrypt these

5.10.4.2 Q_type

```
std::pair< helib::Ctxt, helib::Ctxt > HDB_supergate_::HEQuery::Q_type
```

query type EQ <E(1), E(0)>, LT <E(0), E(1)>, or LEQ <E(1),E(1)>

5.10.4.3 query

```
helib::Ctxt HDB_supergate_::HEQuery::query
```

the query ciphertext

5.10.4.4 source

```
long HDB_supergate_::HEQuery::source
```

The source column index. TODO: encrypt this too

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.11 HDB_supergate_::PtxtIndex Class Reference

class representing a plaintext index

```
#include <HDB_supergate.hpp>
```

Public Member Functions

- void [insert](#) (long k, unsigned long v)
- int [R](#) ()
- int [C](#) ()
- std::vector< long > [getKeys](#) ()
- bool [empty](#) (long)
- long [getSize](#) (long)
- long [popBack](#) (long, bool emty=false)
- void [printIndex](#) ()
- void [insert](#) (long k, unsigned long v)
- int [R](#) ()
- int [C](#) ()
- std::vector< long > [getKeys](#) ()
- bool [empty](#) (long)
- long [getSize](#) (long)
- long [popBack](#) (long, bool emty=false)
- void [printIndex](#) ()

5.11.1 Detailed Description

class representing a plaintext index

A plaintext index is a collection of <key, [uid]> pairs, so each key is mapped to a list of uids that describe rows in the DB. Key are currently represented as integers.

5.11.2 Member Function Documentation

5.11.2.1 [C\(\)](#) [1/2]

```
int HDB_supergate_::PtxtIndex::C ( ) [inline]
```

returns c, the maximum length of values array

5.11.2.2 [C\(\)](#) [2/2]

```
int HDB_supergate_::PtxtIndex::C ( ) [inline]
```

returns c, the maximum length of values array

5.11.2.3 empty() [1/2]

```
bool HDB_supergate_::PtxtIndex::empty (
    long key )
```

true if queried key does not have any values mapped to it

5.11.2.4 empty() [2/2]

```
bool HDB_supergate_::PtxtIndex::empty (
    long )
```

true if queried key does not have any values mapped to it

5.11.2.5 getKeys() [1/2]

```
std::vector<long> HDB_supergate_::PtxtIndex::getKeys ( ) [inline]
```

returns the keys vector

5.11.2.6 getKeys() [2/2]

```
std::vector<long> HDB_supergate_::PtxtIndex::getKeys ( ) [inline]
```

returns the keys vector

5.11.2.7 getSize() [1/2]

```
long HDB_supergate_::PtxtIndex::getSize (
    long key )
```

gets the size of index vector for given key

5.11.2.8 getSize() [2/2]

```
long HDB_supergate_::PtxtIndex::getSize (
    long )
```

gets the size of index vector for given key

5.11.2.9 insert() [1/2]

```
void HDB_supergate_::PtxtIndex::insert (
    long k,
    unsigned long v )
```

inserts value v into key k

5.11.2.10 insert() [2/2]

```
void HDB_supergate_::PtxtIndex::insert (
    long k,
    unsigned long v )
```

inserts value v into key k

5.11.2.11 popBack() [1/2]

```
long HDB_supergate_::PtxtIndex::popBack (
    long key,
    bool empty = false )
```

removes the right-most key value from keys vector

5.11.2.12 popBack() [2/2]

```
long HDB_supergate_::PtxtIndex::popBack (
    long ,
    bool empty = false )
```

removes the right-most key value from keys vector

5.11.2.13 printIndex() [1/2]

```
void HDB_supergate_::PtxtIndex::printIndex ( )
```

debug function to print the index

5.11.2.14 printIndex() [2/2]

```
void HDB_supergate_::PtxtIndex::printIndex ( )
```

debug function to print the index

5.11.2.15 R() [1/2]

```
int HDB_supergate_::PtxtIndex::R ( ) [inline]
```

returns the number of keys

5.11.2.16 R() [2/2]

```
int HDB_supergate_::PtxtIndex::R ( ) [inline]
```

returns the number of keys

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

- HDB_comparison_library/include/HDB_supergate.hpp
- HDB_comparison_library/src/HDB_supergate.cpp

5.12 HDB_supergate_::PtxtIndexFile Class Reference

class representing a collection of PtxtIndexes

```
#include <HDB_supergate.hpp>
```

Public Member Functions

- `std::vector< std::pair< std::string, PtxtIndex > > & getIndexFile ()`
- `void insert (std::string col, long k, unsigned long v)`
- `void printIndex (std::string col)`
- `void printIndexFile ()`
- `std::vector< std::pair< std::string, PtxtIndex > > & getIndexFile ()`
- `void insert (std::string col, long k, unsigned long v)`
- `void printIndex (std::string col)`
- `void printIndexFile ()`

5.12.1 Detailed Description

class representing a collection of PtxtIndexes

The plaintext index file is the object representing lots of plaintext indexes. It is represented as a vector of <column name, PtxtIndex> pairs, with an index associated with each column of a DB.

5.12.2 Member Function Documentation

5.12.2.1 getIndexFile() [1/2]

```
std::vector<std::pair<std::string, PtxtIndex> >& HDB_supergate_::PtxtIndexFile::getIndexFile
( ) [inline]
```

getter for the IndexFile

5.12.2.2 getIndexFile() [2/2]

```
std::vector<std::pair<std::string, PtxtIndex> >& HDB_supergate_::PtxtIndexFile::getIndexFile
( ) [inline]
```

getter for the IndexFile

5.12.2.3 printIndex() [1/2]

```
void HDB_supergate_::PtxtIndexFile::printIndex (
    std::string col )
```

inserts for column col, key k, value v debug function for printing a particular index, given column name

5.12.2.4 printIndex() [2/2]

```
void HDB_supergate_::PtxtIndexFile::printIndex (
    std::string col )
```

inserts for column col, key k, value v debug function for printing a particular index, given column name

5.12.2.5 printIndexFile() [1/2]

```
void HDB_supergate_::PtxtIndexFile::printIndexFile ( )
```

debug function for printing the entire [PtxtIndexFile](#)

5.12.2.6 printIndexFile() [2/2]

```
void HDB_supergate_::PtxtIndexFile::printIndexFile ( )
```

debug function for printing the entire [PtxtIndexFile](#)

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

- HDB_comparison_library/include/HDB_supergate.hpp
- HDB_comparison_library/src/HDB_supergate.cpp

5.13 helib::SerializeHeader< T > Struct Template Reference

Public Member Functions

- void **writeTo** (std::ostream &os)
- std::string **versionString** () const

Static Public Member Functions

- static [SerializeHeader](#) **readFrom** (std::istream &is)

Public Attributes

- const std::array< char, EyeCatcher::SIZE > **beginCatcher**
- const std::array< char, 4 > **version** = Binio::VERSION_0_0_1_0
- const std::array< char, 4 > **helibVersion**
- char **structId** = nameToStructId<T>()
- const char **reserved** [7] = {0, 0, 0, 0, 0, 0, 0}
- const std::array< char, EyeCatcher::SIZE > **endCatcher** = EyeCatcher::HEADER_END

5.13.1 Member Data Documentation

5.13.1.1 beginCatcher

```
template<typename T>
const std::array<char, EyeCatcher::SIZE> helib::SerializeHeader< T >::beginCatcher
```

Initial value:

```
=
    EyeCatcher::HEADER_BEGIN
```

5.13.1.2 helibVersion

```
template<typename T>
const std::array<char, 4> helib::SerializeHeader< T >::helibVersion
```

Initial value:

```
= {version::major,
                                     version::minor,
                                     version::patch,
                                     0}
```

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

- HDB_comparison_library/src/binio.h

5.14 HDB_supergate_server_::SERVER Class Reference

Class that contains the DB and is queried upon.

```
#include <HDB_supergate_server.hpp>
```

Public Member Functions

- [SERVER](#) ([he_cmp::Comparator](#) &comparator, [HDB_supergate_::Ctxt_mat](#) &db, [HDB_supergate_::Ctxt_mat](#) &indFile, bool v)
- void [Query](#) ([HDB_supergate_::HEQuery](#) &query, [HDB_supergate_::Ctxt_mat](#) &result)
- void [QueryExtensionField](#) ([HDB_supergate_::HEQuery](#) &query, [HDB_supergate_::Ctxt_mat](#) &result)
- void [QueryWithIndex](#) ([HDB_supergate_::HEQuery](#) &query, [HDB_supergate_::Ctxt_mat](#) &result)
- void [testTS](#) (Ctxt &)
- [SERVER](#) ([he_cmp::Comparator](#) &comparator, [HDB_supergate_::Ctxt_mat](#) &db, [HDB_supergate_::Ctxt_mat](#) &indFile, bool v)
- void [Query](#) ([HDB_supergate_::HEQuery](#) &query, [HDB_supergate_::Ctxt_mat](#) &result)
- void [QueryExtensionField](#) ([HDB_supergate_::HEQuery](#) &query, [HDB_supergate_::Ctxt_mat](#) &result)
- void [QueryWithIndex](#) ([HDB_supergate_::HEQuery](#) &query, [HDB_supergate_::Ctxt_mat](#) &result)
- void [testTS](#) (Ctxt &)

5.14.1 Detailed Description

Class that contains the DB and is queried upon.

[SERVER](#) class contains the encrypted database and the encrypted index file. This simulates the REE.

5.14.2 Constructor & Destructor Documentation

5.14.2.1 SERVER() [1/2]

```
HDB_supergate_server_::SERVER::SERVER (
    he_cmp::Comparator & comparator,
    HDB_supergate_::Ctxt_mat & db,
    HDB_supergate_::CtxtIndexFile & indFile,
    bool v ) [explicit]
```

Constructor of the [SERVER](#) class

Parameters

| | |
|-------------------|---------------------------------------|
| <i>comparator</i> | the reference to comparator class |
| <i>db</i> | reference to the encrypted database |
| <i>indFile</i> | reference to the encrypted index file |
| <i>v</i> | verbose |

5.14.2.2 SERVER() [2/2]

```
HDB_supergate_server_::SERVER::SERVER (
    he_cmp::Comparator & comparator,
    HDB_supergate_::Ctxt_mat & db,
    HDB_supergate_::CtxtIndexFile & indFile,
    bool v ) [explicit]
```

Constructor of the [SERVER](#) class

Parameters

| | |
|-------------------|---------------------------------------|
| <i>comparator</i> | the reference to comparator class |
| <i>db</i> | reference to the encrypted database |
| <i>indFile</i> | reference to the encrypted index file |
| <i>v</i> | verbose |

5.14.3 Member Function Documentation

5.14.3.1 testTS() [1/2]

```
void HDB_supergate_server_::SERVER::testTS (
    Ctxt & )
```

debugging function for SERVER::totalSums

5.14.3.2 testTS() [2/2]

```
void HDB_supergate_server_::SERVER::testTS (
    Ctxt & ctxt )
```

debugging function for SERVER::totalSums

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

- HDB_comparison_library/include/HDB_supergate_server.hpp
- HDB_comparison_library/src/HDB_supergate_server.cpp

5.15 HDB_supergate_::STD128_HDB Struct Reference

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.16 HDB_supergate_::TOY_HDB Struct Reference

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

- HDB_comparison_library/include/HDB_supergate.hpp

5.17 HDB_supergate_user_::USER Class Reference

Class that simulates the [USER](#) that queries the DB.

```
#include <HDB_supergate_user.hpp>
```

Collaboration diagram for HDB_supergate_user_::USER:

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