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# HappyBase

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<b>1</b>	<b>Example</b>	<b>3</b>
<b>2</b>	<b>Core documentation</b>	<b>5</b>
2.1	Installation guide . . . . .	5
2.2	User guide . . . . .	6
2.3	API reference . . . . .	14
<b>3</b>	<b>Additional documentation</b>	<b>25</b>
3.1	Version history . . . . .	25
3.2	Development . . . . .	27
3.3	To-do list and possible future work . . . . .	28
3.4	Frequently asked questions . . . . .	28
3.5	License . . . . .	29
<b>4</b>	<b>External links</b>	<b>33</b>
<b>5</b>	<b>Indices and tables</b>	<b>35</b>



**HappyBase** is a developer-friendly [Python](#) library to interact with [Apache HBase](#). HappyBase is designed for use in standard HBase setups, and offers application developers a Pythonic API to interact with HBase. Below the surface, HappyBase uses the [Python Thrift library](#) to connect to HBase using its [Thrift](#) gateway, which is included in the standard HBase 0.9x releases.

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**Note: Do you enjoy HappyBase?** Please consider making a small [donation](#) to let me know you appreciate my work. Thanks!

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## Example

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The example below illustrates basic usage of the library. The [user guide](#) contains many more examples.

```
import happybase

connection = happybase.Connection('hostname')
table = connection.table('table-name')

table.put('row-key', {'family:qual1': 'value1',
                     'family:qual2': 'value2'})

row = table.row('row-key')
print row['family:qual1'] # prints 'value1'

for key, data in table.rows(['row-key-1', 'row-key-2']):
    print key, data # prints row key and data for each row

for key, data in table.scan(row_prefix='row'):
    print key, data # prints 'value1' and 'value2'

row = table.delete('row-key')
```





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## Core documentation

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## 2.1 Installation guide

This guide describes how to install HappyBase.

### On this page

- *Setting up a virtual environment*
- *Installing the HappyBase package*
- *Testing the installation*

### 2.1.1 Setting up a virtual environment

The recommended way to install HappyBase and Thrift is to use a virtual environment created by *virtualenv*. Setup and activate a new virtual environment like this:

```
$ virtualenv envname
$ source envname/bin/activate
```

If you use the *virtualenvwrapper* scripts, type this instead:

```
$ mkvirtualenv envname
```

### 2.1.2 Installing the HappyBase package

The next step is to install HappyBase. The easiest way is to use *pip* to fetch the package from the [Python Package Index \(PyPI\)](#). This will also install the Thrift package for Python.

```
(envname) $ pip install happybase
```

---

**Note:** Generating and installing the HBase Thrift Python modules (using `thrift --gen py` on the `.thrift` file) is not necessary, since HappyBase bundles pregenerated versions of those modules.

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### 2.1.3 Testing the installation

Verify that the packages are installed correctly:

```
(envname) $ python -c 'import happybase'
```

If you don't see any errors, the installation was successful. Congratulations!

#### Next steps

Now that you successfully installed HappyBase on your machine, continue with the [user guide](#) to learn how to use it.

## 2.2 User guide

This user guide explores the HappyBase API and should provide you with enough information to get you started. Note that this user guide is intended as an introduction to HappyBase, not to HBase in general. Readers should already have a basic understanding of HBase and its data model.

While the user guide does cover most features, it is not a complete reference guide. More information about the HappyBase API is available from the [API documentation](#).

#### On this page

- *Establishing a connection*
- *Working with tables*
  - *Using table 'namespaces'*
- *Retrieving data*
  - *Retrieving rows*
  - *Making more fine-grained selections*
  - *Scanning over rows in a table*
- *Manipulating data*
  - *Storing data*
  - *Deleting data*
  - *Performing batch mutations*
  - *Using atomic counters*
- *Using the connection pool*
  - *Instantiating the pool*
  - *Obtaining connections*
  - *Handling broken connections*

### 2.2.1 Establishing a connection

We'll get started by connecting to HBase. Just create a new *Connection* instance:

```
import happybase

connection = happybase.Connection('somehost')
```

In some setups, the *Connection* class needs some additional information about the HBase version it will be connecting to, and which Thrift transport to use. If you're still using HBase 0.90.x, you need to set the *compat* argument

to make sure HappyBase speaks the correct wire protocol. Additionally, if you're using HBase 0.94 with a non-standard Thrift transport mode, make sure to supply the right *transport* argument. See the API documentation for the *Connection* class for more information about these arguments and their supported values.

When a *Connection* is created, it automatically opens a socket connection to the HBase Thrift server. This behaviour can be disabled by setting the *autoconnect* argument to *False*, and opening the connection manually using *Connection.open()*:

```
connection = happybase.Connection('somehost', autoconnect=False)

# before first use:
connection.open()
```

The *Connection* class provides the main entry point to interact with HBase. For instance, to list the available tables, use *Connection.tables()*:

```
print connection.tables()
```

Most other methods on the *Connection* class are intended for system management tasks like creating, dropping, enabling and disabling tables. See the [API documentation](#) for the *Connection* class contains more information. This user guide does not cover those since it's more likely you are already using the HBase shell for these system management tasks.

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**Note:** HappyBase also features a connection pool, which is covered later in this guide.

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## 2.2.2 Working with tables

The *Table* class provides the main API to retrieve and manipulate data in HBase. In the example above, we already asked for the available tables using the *Connection.tables()* method. If there weren't any tables yet, you can create a new one using *Connection.create\_table()*:

```
connection.create_table(
    'mytable',
    {'cf1': dict(max_versions=10),
     'cf2': dict(max_versions=1, block_cache_enabled=False),
     'cf3': dict(), # use defaults
    }
)
```

---

**Note:** The HBase shell is often a better alternative for many HBase administration tasks, since the shell is more powerful compared to the limited Thrift API that HappyBase uses.

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The next step is to obtain a *Table* instance to work with. Simply call *Connection.table()*, passing it the table name:

```
table = connection.table('mytable')
```

Obtaining a *Table* instance does *not* result in a round-trip to the Thrift server, which means application code may ask the *Connection* instance for a new *Table* whenever it needs one, without negative performance consequences. A side effect is that no check is done to ensure that the table exists, since that would involve a round-trip. Expect errors if you try to interact with non-existing tables later in your code. For this guide, we assume the table exists.

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**Note:** The 'heavy' *HTable* HBase class from the Java HBase API, which performs the real communication with the

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region servers, is at the other side of the Thrift connection. There is no direct mapping between *Table* instances on the Python side and *HTable* instances on the server side.

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### Using table ‘namespaces’

If a single HBase instance is shared by multiple applications, table names used by different applications may collide. A simple solution to this problem is to add a ‘namespace’ prefix to the names of all tables ‘owned’ by a specific application, e.g. for a project *myproject* all tables have names like *myproject\_XYZ*.

Instead of adding this application-specific prefix each time a table name is passed to HappyBase, the *table\_prefix* argument to *Connection* can take care of this. HappyBase will prepend that prefix (and an underscore) to each table name handled by that *Connection* instance. For example:

```
connection = happybase.Connection('somehost', table_prefix='myproject')
```

At this point, *Connection.tables()* no longer includes tables in other ‘namespaces’. HappyBase will only return tables with a *myproject\_* prefix, and will also remove the prefix transparently when returning results, e.g.:

```
print connection.tables()  # Table "myproject_XYZ" in HBase will be
                           # returned as simply "XYZ"
```

This also applies to other methods that take table names, such as *Connection.table()*:

```
table = connection.table('XYZ')  # Operates on myproject_XYZ in HBase
```

The end result is that the table prefix is specified only once in your code, namely in the call to the *Connection* constructor, and that only a single change is necessary in case it needs changing.

## 2.2.3 Retrieving data

The HBase data model is a multidimensional sparse map. A table in HBase contains column families with column qualifiers containing a value and a timestamp. In most of the HappyBase API, column family and qualifier names are specified as a single string, e.g. *cf1:col1*, and not as two separate arguments. While column families and qualifiers are different concepts in the HBase data model, they are almost always used together when interacting with data, so treating them as a single string makes the API a lot simpler.

### Retrieving rows

The *Table* class offers various methods to retrieve data from a table in HBase. The most basic one is *Table.row()*, which retrieves a single row from the table, and returns it as a dictionary mapping columns to values:

```
row = table.row('row-key')
print row['cf1:col1']  # prints the value of cf1:col1
```

The *Table.rows()* method works just like *Table.row()*, but takes multiple row keys and returns those as (*key*, *data*) tuples:

```
rows = table.rows(['row-key-1', 'row-key-2'])
for key, data in rows:
    print key, data
```

If you want the results that *Table.rows()* returns as a dictionary or ordered dictionary, you will have to do this yourself. This is really easy though, since the return value can be passed directly to the dictionary constructor. For a normal dictionary, order is lost:

```
rows_as_dict = dict(table.rows(['row-key-1', 'row-key-2']))
```

...whereas for a `OrderedDict`, order is preserved:

```
from collections import OrderedDict
rows_as_ordered_dict = OrderedDict(table.rows(['row-key-1', 'row-key-2']))
```

## Making more fine-grained selections

HBase's data model allows for more fine-grained selections of the data to retrieve. If you know beforehand which columns are needed, performance can be improved by specifying those columns explicitly to `Table.row()` and `Table.rows()`. The `columns` argument takes a list (or tuple) of column names:

```
row = table.row('row-key', columns=['cf1:col1', 'cf1:col2'])
print row['cf1:col1']
print row['cf1:col2']
```

Instead of providing both a column family and a column qualifier, items in the `columns` argument may also be just a column family, which means that all columns from that column family will be retrieved. For example, to get all columns and values in the column family `cf1`, use this:

```
row = table.row('row-key', columns=['cf1'])
```

In HBase, each cell has a timestamp attached to it. In case you don't want to work with the latest version of data stored in HBase, the methods that retrieve data from the database, e.g. `Table.row()`, all accept a `timestamp` argument that specifies that the results should be restricted to values with a timestamp up to the specified timestamp:

```
row = table.row('row-key', timestamp=123456789)
```

By default, HappyBase does not include timestamps in the results it returns. In your application needs access to the timestamps, simply set the `include_timestamp` argument to `True`. Now, each cell in the result will be returned as a `(value, timestamp)` tuple instead of just a value:

```
row = table.row('row-key', columns=['cf1:col1'], include_timestamp=True)
value, timestamp = row['cf1:col1']
```

HBase supports storing multiple versions of the same cell. This can be configured for each column family. To retrieve all versions of a column for a given row, `Table.cells()` can be used. This method returns an ordered list of cells, with the most recent version coming first. The `versions` argument specifies the maximum number of versions to return. Just like the methods that retrieve rows, the `include_timestamp` argument determines whether timestamps are included in the result. Example:

```
values = table.cells('row-key', 'cf1:col1', versions=2)
for value in values:
    print "Cell data: %s" % value

cells = table.cells('row-key', 'cf1:col1', versions=3, include_timestamp=True)
for value, timestamp in cells:
    print "Cell data at %d: %s" % (timestamp, value)
```

Note that the result may contain fewer cells than requested. The cell may just have fewer versions, or you may have requested more versions than HBase keeps for the column family.

## Scanning over rows in a table

In addition to retrieving data for known row keys, rows in HBase can be efficiently iterated over using a table scanner, created using `Table.scan()`. A basic scanner that iterates over all rows in the table looks like this:

```
for key, data in table.scan():
    print key, data
```

Doing full table scans like in the example above is prohibitively expensive in practice. Scans can be restricted in several ways to make more selective range queries. One way is to specify start or stop keys, or both. To iterate over all rows from row *aaa* to the end of the table:

```
for key, data in table.scan(row_start='aaa'):
    print key, data
```

To iterate over all rows from the start of the table up to row *xyz*, use this:

```
for key, data in table.scan(row_stop='xyz'):
    print key, data
```

To iterate over all rows between row *aaa* (included) and *xyz* (not included), supply both:

```
for key, data in table.scan(row_start='aaa', row_stop='xyz'):
    print key, data
```

An alternative is to use a key prefix. For example, to iterate over all rows starting with *abc*:

```
for key, data in table.scan(row_prefix='abc'):
    print key, data
```

The scanner examples above only limit the results by row key using the *row\_start*, *row\_stop*, and *row\_prefix* arguments, but scanners can also limit results to certain columns, column families, and timestamps, just like *Table.row()* and *Table.rows()*. For advanced users, a filter string can be passed as the *filter* argument. Additionally, the optional *limit* argument defines how much data is at most retrieved, and the *batch\_size* argument specifies how big the transferred chunks should be. The *Table.scan()* API documentation provides more information on the supported scanner options.

## 2.2.4 Manipulating data

HBase does not have any notion of *data types*; all row keys, column names and column values are simply treated as raw byte strings. By design, HappyBase does *not* do any automatic string conversion. This means that data must be converted to byte strings in your application before you pass it to HappyBase, for instance by calling `str()` or by employing more advanced string serialisation techniques like `struct.pack()`.

In HBase, all mutations either store data or mark data for deletion; there is no such thing as an in-place *update* or *delete*. HappyBase provides methods to do single inserts or deletes, and a batch API to perform multiple mutations in one go.

### Storing data

To store a single cell of data in our table, we can use *Table.put()*, which takes the row key, and the data to store. The data should be a dictionary mapping the column name to a value:

```
table.put('row-key', {'cf:col1': 'value1',
                     'cf:col2': 'value2'})
```

Use the *timestamp* argument if you want to provide timestamps explicitly:

```
table.put('row-key', {'cf:col1': 'value1'}, timestamp=123456789)
```

If omitted, HBase defaults to the current system time.

## Deleting data

The `Table.delete()` method deletes data from a table. To delete a complete row, just specify the row key:

```
table.delete('row-key')
```

To delete one or more columns instead of a complete row, also specify the `columns` argument:

```
table.delete('row-key', columns=['cf1:col1', 'cf1:col2'])
```

The optional `timestamp` argument restricts the delete operation to data up to the specified timestamp.

## Performing batch mutations

The `Table.put()` and `Table.delete()` methods both issue a command to the HBase Thrift server immediately. This means that using these methods is not very efficient when storing or deleting multiple values. It is much more efficient to aggregate a bunch of commands and send them to the server in one go. This is exactly what the `Batch` class, created using `Table.batch()`, does. A `Batch` instance has `put` and `delete` methods, just like the `Table` class, but the changes are sent to the server in a single round-trip using `Batch.send()`:

```
b = table.batch()
b.put('row-key-1', {'cf:col1': 'value1', 'cf:col2': 'value2'})
b.put('row-key-2', {'cf:col2': 'value2', 'cf:col3': 'value3'})
b.put('row-key-3', {'cf:col3': 'value3', 'cf:col4': 'value4'})
b.delete('row-key-4')
b.send()
```

**Note:** Storing and deleting data for the same row key in a single batch leads to unpredictable results, so don't do that.

While the methods on the `Batch` instance resemble the `put()` and `delete()` methods, they do not take a `timestamp` argument for each mutation. Instead, you can specify a single `timestamp` argument for the complete batch:

```
b = table.batch(timestamp=123456789)
b.put(...)
b.delete(...)
b.send()
```

`Batch` instances can be used as *context managers*, which are most useful in combination with Python's `with` construct. The example above can be simplified to read:

```
with table.batch() as b:
    b.put('row-key-1', {'cf:col1': 'value1', 'cf:col2': 'value2'})
    b.put('row-key-2', {'cf:col2': 'value2', 'cf:col3': 'value3'})
    b.put('row-key-3', {'cf:col3': 'value3', 'cf:col4': 'value4'})
    b.delete('row-key-4')
```

As you can see, there is no call to `Batch.send()` anymore. The batch is automatically applied when the `with` code block terminates, even in case of errors somewhere in the `with` block, so it behaves basically the same as a `try/finally` clause. However, some applications require transactional behaviour, sending the batch only if no exception occurred. Without a context manager this would look something like this:

```
b = table.batch()
try:
    b.put('row-key-1', {'cf:col1': 'value1', 'cf:col2': 'value2'})
    b.put('row-key-2', {'cf:col2': 'value2', 'cf:col3': 'value3'})
    b.put('row-key-3', {'cf:col3': 'value3', 'cf:col4': 'value4'})
```

```
b.delete('row-key-4')
    raise ValueError("Something went wrong!")
except ValueError as e:
    # error handling goes here; nothing is sent to HBase
    pass
else:
    # no exceptions; send data
    b.send()
```

Obtaining the same behaviour is easier using a with block. The *transaction* argument to *Table.batch()* is all you need:

```
try:
    with table.batch(transaction=True) as b:
        b.put('row-key-1', {'cf:col1': 'value1', 'cf:col2': 'value2'})
        b.put('row-key-2', {'cf:col2': 'value2', 'cf:col3': 'value3'})
        b.put('row-key-3', {'cf:col3': 'value3', 'cf:col4': 'value4'})
        b.delete('row-key-4')
        raise ValueError("Something went wrong!")
except ValueError:
    # error handling goes here; nothing is sent to HBase
    pass

# when no error occurred, the transaction succeeded
```

As you may have imagined already, a *Batch* keeps all mutations in memory until the batch is sent, either by calling *Batch.send()* explicitly, or when the with block ends. This doesn't work for applications that need to store huge amounts of data, since it may result in batches that are too big to send in one round-trip, or in batches that use too much memory. For these cases, the *batch\_size* argument can be specified. The *batch\_size* acts as a threshold: a *Batch* instance automatically sends all pending mutations when there are more than *batch\_size* pending operations. For example, this will result in three round-trips to the server (two batches with 1000 cells, and one with the remaining 400):

```
with table.batch(batch_size=1000) as b:
    for i in range(1200):
        # this put() will result in two mutations (two cells)
        b.put('row-%04d' % i, {'cf1:col1': 'v1',
                               'cf1:col2': 'v2',})
```

The appropriate *batch\_size* is very application-specific since it depends on the data size, so just experiment to see how different sizes work for your specific use case.

## Using atomic counters

The *Table.counter\_inc()* and *Table.counter\_dec()* methods allow for atomic incrementing and decrementing of 8 byte wide values, which are interpreted as big-endian 64-bit signed integers by HBase. Counters are automatically initialised to 0 upon first use. When incrementing or decrementing a counter, the value after modification is returned. Example:

```
print table.counter_inc('row-key', 'cf1:counter') # prints 1
print table.counter_inc('row-key', 'cf1:counter') # prints 2
print table.counter_inc('row-key', 'cf1:counter') # prints 3
print table.counter_dec('row-key', 'cf1:counter') # prints 2
```

The optional *value* argument specifies how much to increment or decrement by:



```
print table.counter_inc('row-key', 'cf1:counter', value=3) # prints 5
```

While counters are typically used with the increment and decrement functions shown above, the `Table.counter_get()` and `Table.counter_set()` methods can be used to retrieve or set a counter value directly:

```
print table.counter_get('row-key', 'cf1:counter') # prints 5
table.counter_set('row-key', 'cf1:counter', 12)
```

**Note:** An application should *never* `counter_get()` the current value, modify it in code and then `counter_set()` the modified value; use the atomic `counter_inc()` and `counter_dec()` instead!

## 2.2.5 Using the connection pool

HappyBase comes with a thread-safe connection pool that allows multiple threads to share and reuse open connections. This is most useful in multi-threaded server applications such as web applications served using Apache's `mod_wsgi`. When a thread asks the pool for a connection (using `ConnectionPool.connection()`), it will be granted a lease, during which the thread has exclusive access to the connection. After the thread is done using the connection, it returns the connection to the pool so that it becomes available for other threads.

### Instantiating the pool

The pool is provided by the `ConnectionPool` class. The `size` argument to the constructor specifies the number of connections in the pool. Additional arguments are passed on to the `Connection` constructor:

```
pool = happybase.ConnectionPool(size=3, host='...', table_prefix='myproject')
```

Upon instantiation, the connection pool will establish a connection immediately, so that simple problems like wrong host names are detected immediately. For the remaining connections, the pool acts lazy: new connections will be opened only when needed.

### Obtaining connections

Connections can only be obtained using Python's context manager protocol, i.e. using a code block inside a `with` statement. This ensures that connections are actually returned to the pool after use. Example:

```
pool = happybase.ConnectionPool(size=3, host='...')
with pool.connection() as connection:
    print connection.tables()
```

**Warning:** Never use the `connection` instance after the `with` block has ended. Even though the variable is still in scope, the connection may have been assigned to another thread in the mean time.

Connections should be returned to the pool as quickly as possible, so that other threads can use them. This means that the amount of code included inside the `with` block should be kept to an absolute minimum. In practice, an application should only load data inside the `with` block, and process the data outside the `with` block:

```
with pool.connection() as connection:
    table = connection.table('table-name')
    row = table.row('row-key')

process_data(row)
```

An application thread can only hold one connection at a time. When a thread holds a connection and asks for a connection for a second time (e.g. because a called function also requests a connection from the pool), the same connection instance it already holds is returned, so this does not require any coordination from the application. This means that in the following example, both connection requests to the pool will return the exact same connection:

```
pool = happybase.ConnectionPool(size=3, host='...')

def do_something_else():
    with pool.connection() as connection:
        pass # use the connection here

with pool.connection() as connection:
    # use the connection here, e.g.
    print(connection.tables())

    # call another function that uses a connection
    do_something_else()
```

### Handling broken connections

The pool tries to detect broken connections and will replace those with fresh ones when the connection is returned to the pool. However, the connection pool does not capture raised exceptions, nor does it automatically retry failed operations. This means that the application still has to handle connection errors.

### Next steps

The next step is to try it out for yourself! The [API documentation](#) can be used as a reference.

## 2.3 API reference

This chapter contains detailed API documentation for HappyBase. It is suggested to read the [user guide](#) first to get a general idea about how HappyBase works.

The HappyBase API is organised as follows:

**Connection:** The `Connection` class is the main entry point for application developers. It connects to the HBase Thrift server and provides methods for table management.

**Table:** The `Table` class is the main class for interacting with data in tables. This class offers methods for data retrieval and data manipulation. Instances of this class can be obtained using the `Connection.table()` method.

**Batch:** The `Batch` class implements the batch API for data manipulation, and is available through the `Table.batch()` method.

**ConnectionPool:** The `ConnectionPool` class implements a thread-safe connection pool that allows an application to (re)use multiple connections.

### 2.3.1 Connection

```
class happybase.Connection (host='localhost', port=9090, timeout=None, autoconnect=True, table_prefix=None, table_prefix_separator='_', compat='0.96', transport='buffered')
```

Connection to an HBase Thrift server.

The *host* and *port* arguments specify the host name and TCP port of the HBase Thrift server to connect to. If omitted or *None*, a connection to the default port on *localhost* is made. If specified, the *timeout* argument specifies the socket timeout in milliseconds.

If *autoconnect* is *True* (the default) the connection is made directly, otherwise *Connection.open()* must be called explicitly before first use.

The optional *table\_prefix* and *table\_prefix\_separator* arguments specify a prefix and a separator string to be prepended to all table names, e.g. when *Connection.table()* is invoked. For example, if *table\_prefix* is *myproject*, all tables will have names like *myproject\_XYZ*.

The optional *compat* argument sets the compatibility level for this connection. Older HBase versions have slightly different Thrift interfaces, and using the wrong protocol can lead to crashes caused by communication errors, so make sure to use the correct one. This value can be either the string *0.90*, *0.92*, *0.94*, or *0.96* (the default).

The optional *transport* argument specifies the Thrift transport mode to use. Supported values for this argument are *buffered* (the default) and *framed*. Make sure to choose the right one, since otherwise you might see non-obvious connection errors or program hangs when making a connection. HBase versions before 0.94 always use the buffered transport. Starting with HBase 0.94, the Thrift server optionally uses a framed transport, depending on the argument passed to the *hbase-daemon.sh start thrift* command. The default *-threadpool* mode uses the buffered transport; the *-hsha*, *-nonblocking*, and *-threadedselector* modes use the framed transport.

New in version 0.5: *timeout* argument

New in version 0.4: *table\_prefix\_separator* argument

New in version 0.4: support for framed Thrift transports

#### Parameters

- **host** (*str*) – The host to connect to
- **port** (*int*) – The port to connect to
- **timeout** (*int*) – The socket timeout in milliseconds (optional)
- **autoconnect** (*bool*) – Whether the connection should be opened directly
- **table\_prefix** (*str*) – Prefix used to construct table names (optional)
- **table\_prefix\_separator** (*str*) – Separator used for *table\_prefix*
- **compat** (*str*) – Compatibility mode (optional)
- **transport** (*str*) – Thrift transport mode (optional)

```
close()
```

Close the underlying transport to the HBase instance.

This method closes the underlying Thrift transport (TCP connection).

```
compact_table (name, major=False)
```

Compact the specified table.

#### Parameters

- **name** (*str*) – The table name
- **major** (*bool*) – Whether to perform a major compaction.

**create\_table** (*name*, *families*)

Create a table.

**Parameters**

- **name** (*str*) – The table name
- **families** (*dict*) – The name and options for each column family

The *families* argument is a dictionary mapping column family names to a dictionary containing the options for this column family, e.g.

```
families = {
    'cf1': dict(max_versions=10),
    'cf2': dict(max_versions=1, block_cache_enabled=False),
    'cf3': dict(), # use defaults
}
connection.create_table('mytable', families)
```

These options correspond to the ColumnDescriptor structure in the Thrift API, but note that the names should be provided in Python style, not in camel case notation, e.g. *time\_to\_live*, not *timeToLive*. The following options are supported:

- **max\_versions** (*int*)
- **compression** (*str*)
- **in\_memory** (*bool*)
- **bloom\_filter\_type** (*str*)
- **bloom\_filter\_vector\_size** (*int*)
- **bloom\_filter\_nb\_hashes** (*int*)
- **block\_cache\_enabled** (*bool*)
- **time\_to\_live** (*int*)

**delete\_table** (*name*, *disable=False*)

Delete the specified table.

New in version 0.5: *disable* argument

In HBase, a table always needs to be disabled before it can be deleted. If the *disable* argument is *True*, this method first disables the table if it wasn't already and then deletes it.

**Parameters**

- **name** (*str*) – The table name
- **disable** (*bool*) – Whether to first disable the table if needed

**disable\_table** (*name*)

Disable the specified table.

**Parameters** **name** (*str*) – The table name

**enable\_table** (*name*)

Enable the specified table.

**Parameters** **name** (*str*) – The table name

**is\_table\_enabled** (*name*)

Return whether the specified table is enabled.

**Parameters** **name** (*str*) – The table name

**Returns** whether the table is enabled

**Return type** bool

**open** ()

Open the underlying transport to the HBase instance.

This method opens the underlying Thrift transport (TCP connection).

**table** (*name*, *use\_prefix=True*)

Return a table object.

Returns a `happybase.Table` instance for the table named *name*. This does not result in a round-trip to the server, and the table is not checked for existence.

The optional *use\_prefix* argument specifies whether the table prefix (if any) is prepended to the specified *name*. Set this to *False* if you want to use a table that resides in another ‘prefix namespace’, e.g. a table from a ‘friendly’ application co-hosted on the same HBase instance. See the *table\_prefix* argument to the `Connection` constructor for more information.

**Parameters**

- **name** (*str*) – the name of the table
- **use\_prefix** (*bool*) – whether to use the table prefix (if any)

**Returns** Table instance

**Return type** `Table`

**tables** ()

Return a list of table names available in this HBase instance.

If a *table\_prefix* was set for this `Connection`, only tables that have the specified prefix will be listed.

**Returns** The table names

**Return type** List of strings

## 2.3.2 Table

**class** `happybase.Table` (*name*, *connection*)

HBase table abstraction class.

This class cannot be instantiated directly; use `Connection.table()` instead.

**batch** (*timestamp=None*, *batch\_size=None*, *transaction=False*, *wal=True*)

Create a new batch operation for this table.

This method returns a new `Batch` instance that can be used for mass data manipulation. The *timestamp* argument applies to all puts and deletes on the batch.

If given, the *batch\_size* argument specifies the maximum batch size after which the batch should send the mutations to the server. By default this is unbounded.

The *transaction* argument specifies whether the returned `Batch` instance should act in a transaction-like manner when used as context manager in a `with` block of code. The *transaction* flag cannot be used in combination with *batch\_size*.

The *wal* argument determines whether mutations should be written to the HBase Write Ahead Log (WAL). This flag can only be used with recent HBase versions. If specified, it provides a default for all the put and delete operations on this batch. This default value can be overridden for individual operations using the *wal* argument to *Batch.put()* and *Batch.delete()*.

New in version 0.7: *wal* argument

#### Parameters

- **transaction** (*bool*) – whether this batch should behave like a transaction (only useful when used as a context manager)
- **batch\_size** (*int*) – batch size (optional)
- **timestamp** (*int*) – timestamp (optional)
- **bool** (*wal*) – whether to write to the WAL (optional)

**Returns** Batch instance

**Return type** *Batch*

**cells** (*row*, *column*, *versions=None*, *timestamp=None*, *include\_timestamp=False*)

Retrieve multiple versions of a single cell from the table.

This method retrieves multiple versions of a cell (if any).

The *versions* argument defines how many cell versions to retrieve at most.

The *timestamp* and *include\_timestamp* arguments behave exactly the same as for *row()*.

#### Parameters

- **row** (*str*) – the row key
- **column** (*str*) – the column name
- **versions** (*int*) – the maximum number of versions to retrieve
- **timestamp** (*int*) – timestamp (optional)
- **include\_timestamp** (*bool*) – whether timestamps are returned

**Returns** cell values

**Return type** list of values

**counter\_dec** (*row*, *column*, *value=1*)

Atomically decrement (or increments) a counter column.

This method is a shortcut for calling *Table.counter\_inc()* with the value negated.

**Returns** counter value after decrementing

**Return type** int

**counter\_get** (*row*, *column*)

Retrieve the current value of a counter column.

This method retrieves the current value of a counter column. If the counter column does not exist, this function initialises it to 0.

Note that application code should *never* store a incremented or decremented counter value directly; use the atomic *Table.counter\_inc()* and *Table.counter\_dec()* methods for that.

#### Parameters

- **row** (*str*) – the row key

- **column** (*str*) – the column name

**Returns** counter value

**Return type** int

**counter\_inc** (*row*, *column*, *value*=1)

Atomically increment (or decrements) a counter column.

This method atomically increments or decrements a counter column in the row specified by *row*. The *value* argument specifies how much the counter should be incremented (for positive values) or decremented (for negative values). If the counter column did not exist, it is automatically initialised to 0 before incrementing it.

#### Parameters

- **row** (*str*) – the row key
- **column** (*str*) – the column name
- **value** (*int*) – the amount to increment or decrement by (optional)

**Returns** counter value after incrementing

**Return type** int

**counter\_set** (*row*, *column*, *value*=0)

Set a counter column to a specific value.

This method stores a 64-bit signed integer value in the specified column.

Note that application code should *never* store a incremented or decremented counter value directly; use the atomic `Table.counter_inc()` and `Table.counter_dec()` methods for that.

#### Parameters

- **row** (*str*) – the row key
- **column** (*str*) – the column name
- **value** (*int*) – the counter value to set

**delete** (*row*, *columns*=None, *timestamp*=None, *wal*=True)

Delete data from the table.

This method deletes all columns for the row specified by *row*, or only some columns if the *columns* argument is specified.

Note that, in many situations, `batch()` is a more appropriate method to manipulate data.

New in version 0.7: *wal* argument

#### Parameters

- **row** (*str*) – the row key
- **columns** (*list\_or\_tuple*) – list of columns (optional)
- **timestamp** (*int*) – timestamp (optional)
- **bool** (*wal*) – whether to write to the WAL (optional)

**families** ()

Retrieve the column families for this table.

**Returns** Mapping from column family name to settings dict

**Return type** dict

**put** (*row*, *data*, *timestamp=None*, *wal=True*)

Store data in the table.

This method stores the data in the *data* argument for the row specified by *row*. The *data* argument is dictionary that maps columns to values. Column names must include a family and qualifier part, e.g. *cf:col*, though the qualifier part may be the empty string, e.g. *cf:*.

Note that, in many situations, *batch()* is a more appropriate method to manipulate data.

New in version 0.7: *wal* argument

#### Parameters

- **row** (*str*) – the row key
- **data** (*dict*) – the data to store
- **timestamp** (*int*) – timestamp (optional)
- **bool** (*wal*) – whether to write to the WAL (optional)

**regions** ()

Retrieve the regions for this table.

**Returns** regions for this table

**Return type** list of dicts

**row** (*row*, *columns=None*, *timestamp=None*, *include\_timestamp=False*)

Retrieve a single row of data.

This method retrieves the row with the row key specified in the *row* argument and returns the columns and values for this row as a dictionary.

The *row* argument is the row key of the row. If the *columns* argument is specified, only the values for these columns will be returned instead of all available columns. The *columns* argument should be a list or tuple containing strings. Each name can be a column family, such as *cf1* or *cf1:* (the trailing colon is not required), or a column family with a qualifier, such as *cf1:coll*.

If specified, the *timestamp* argument specifies the maximum version that results may have. The *include\_timestamp* argument specifies whether cells are returned as single values or as (*value*, *timestamp*) tuples.

#### Parameters

- **row** (*str*) – the row key
- **columns** (*list\_or\_tuple*) – list of columns (optional)
- **timestamp** (*int*) – timestamp (optional)
- **include\_timestamp** (*bool*) – whether timestamps are returned

**Returns** Mapping of columns (both qualifier and family) to values

**Return type** dict

**rows** (*rows*, *columns=None*, *timestamp=None*, *include\_timestamp=False*)

Retrieve multiple rows of data.

This method retrieves the rows with the row keys specified in the *rows* argument, which should be should be a list (or tuple) of row keys. The return value is a list of (*row\_key*, *row\_dict*) tuples.

The *columns*, *timestamp* and *include\_timestamp* arguments behave exactly the same as for *row()*.

#### Parameters



- **rows** (*list*) – list of row keys
- **columns** (*list\_or\_tuple*) – list of columns (optional)
- **timestamp** (*int*) – timestamp (optional)
- **include\_timestamp** (*bool*) – whether timestamps are returned

**Returns** List of mappings (columns to values)

**Return type** list of dicts

**scan** (*row\_start=None, row\_stop=None, row\_prefix=None, columns=None, filter=None, timestamp=None, include\_timestamp=False, batch\_size=1000, scan\_batching=None, limit=None, sorted\_columns=False*)

Create a scanner for data in the table.

This method returns an iterable that can be used for looping over the matching rows. Scanners can be created in two ways:

- The *row\_start* and *row\_stop* arguments specify the row keys where the scanner should start and stop. It does not matter whether the table contains any rows with the specified keys: the first row after *row\_start* will be the first result, and the last row before *row\_stop* will be the last result. Note that the start of the range is inclusive, while the end is exclusive.
- Both *row\_start* and *row\_stop* can be *None* to specify the start and the end of the table respectively. If both are omitted, a full table scan is done. Note that this usually results in severe performance problems.
- Alternatively, if *row\_prefix* is specified, only rows with row keys matching the prefix will be returned. If given, *row\_start* and *row\_stop* cannot be used.

The *columns*, *timestamp* and *include\_timestamp* arguments behave exactly the same as for *row()*.

The *filter* argument may be a filter string that will be applied at the server by the region servers.

If *limit* is given, at most *limit* results will be returned.

The *batch\_size* argument specifies how many results should be retrieved per batch when retrieving results from the scanner. Only set this to a low value (or even 1) if your data is large, since a low batch size results in added round-trips to the server.

The optional *scan\_batching* is for advanced usage only; it translates to *Scan.setBatching()* at the Java side (inside the Thrift server). By setting this value rows may be split into partial rows, so result rows may be incomplete, and the number of results returned by the scanner may no longer correspond to the number of rows matched by the scan.

If *sorted\_columns* is *True*, the columns in the rows returned by this scanner will be retrieved in sorted order, and the data will be stored in *OrderedDict* instances.

#### Compatibility notes:

- The *filter* argument is only available when using HBase 0.92 (or up). In HBase 0.90 compatibility mode, specifying a *filter* raises an exception.
- The *sorted\_columns* argument is only available when using HBase 0.96 (or up).

New in version 0.8: *sorted\_columns* argument

#### Parameters

- **row\_start** (*str*) – the row key to start at (inclusive)
- **row\_stop** (*str*) – the row key to stop at (exclusive)
- **row\_prefix** (*str*) – a prefix of the row key that must match

- **columns** (*list\_or\_tuple*) – list of columns (optional)
- **filter** (*str*) – a filter string (optional)
- **timestamp** (*int*) – timestamp (optional)
- **include\_timestamp** (*bool*) – whether timestamps are returned
- **batch\_size** (*int*) – batch size for retrieving results
- **scan\_batching** (*bool*) – server-side scan batching (optional)
- **limit** (*int*) – max number of rows to return
- **sorted\_columns** (*bool*) – whether to return sorted columns

**Returns** generator yielding the rows matching the scan

**Return type** iterable of (*row\_key*, *row\_data*) tuples

### 2.3.3 Batch

**class** `happybase.Batch` (*table*, *timestamp=None*, *batch\_size=None*, *transaction=False*, *wal=True*)

Batch mutation class.

This class cannot be instantiated directly; use `Table.batch()` instead.

**delete** (*row*, *columns=None*, *wal=None*)

Delete data from the table.

See `Table.put()` for a description of the *row*, *data*, and *wal* arguments. The *wal* argument should normally not be used; its only use is to override the batch-wide value passed to `Table.batch()`.

**put** (*row*, *data*, *wal=None*)

Store data in the table.

See `Table.put()` for a description of the *row*, *data*, and *wal* arguments. The *wal* argument should normally not be used; its only use is to override the batch-wide value passed to `Table.batch()`.

**send** ()

Send the batch to the server.

### 2.3.4 Connection pool

**class** `happybase.ConnectionPool` (*size*, *\*\*kwargs*)

Thread-safe connection pool.

New in version 0.5.

The *size* argument specifies how many connections this pool manages. Additional keyword arguments are passed unmodified to the `happybase.Connection` constructor, with the exception of the *autoconnect* argument, since maintaining connections is the task of the pool.

#### Parameters

- **size** (*int*) – the maximum number of concurrently open connections
- **kwargs** – keyword arguments passed to `happybase.Connection`

**connection** (*\*args*, *\*\*kws*)

Obtain a connection from the pool.

This method *must* be used as a context manager, i.e. with Python's `with` block. Example:

```
with pool.connection() as connection:
    pass # do something with the connection
```

If *timeout* is specified, this is the number of seconds to wait for a connection to become available before *NoConnectionsAvailable* is raised. If omitted, this method waits forever for a connection to become available.

**Parameters** *timeout* (*int*) – number of seconds to wait (optional)

**Returns** active connection from the pool

**Return type** *happybase.Connection*

**class** *happybase.NoConnectionsAvailable*

Exception raised when no connections are available.

This happens if a timeout was specified when obtaining a connection, and no connection became available within the specified timeout.

New in version 0.5.



---

## Additional documentation

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### 3.1 Version history

#### 3.1.1 HappyBase 0.8

Release date: 2014-02-25

- Add (and default to) '0.96' compatibility mode in *Connection*.
- Add support for retrieving sorted columns, which is possible with the HBase 0.96 Thrift API. This feature uses a new *sorted\_columns* argument to *Table.scan()*. An `'OrderedDict'` implementation is required for this feature; with Python 2.7 this is available from the standard library, but for Python 2.6 a separate `'ordereddict'` package has to be installed from PyPI. ([issue #39](#))
- The *batch\_size* argument to *Table.scan()* is no longer propagated to *Scan.setBatching()* at the Java side (inside the Thrift server). To influence the *Scan.setBatching()* (which may split rows into partial rows) a new *scan\_batching* argument to *Table.scan()* has been added. See [issue #54](#), [issue #56](#), and the HBase docs for *Scan.setBatching()* for more details.

#### 3.1.2 HappyBase 0.7

Release date: 2013-11-06

- Added a *wal* argument to various data manipulation methods on the *Table* and *Batch* classes to determine whether to write the mutation to the Write-Ahead Log (WAL). ([issue #36](#))
- Pass *batch\_size* to underlying Thrift Scan instance ([issue #38](#)).
- Expose server name and port in *Table.regions()* (recent HBase versions only) ([issue #37](#)).
- Regenerated bundled Thrift API modules using a recent upstream Thrift API definition. This is required to expose newly added API.

#### 3.1.3 HappyBase 0.6

Release date: 2013-06-12

- Rewrote exception handling in connection pool. Exception handling is now a lot cleaner and does not introduce cyclic references anymore. ([issue #25](#)).
- Regenerated bundled Thrift code using Thrift 0.9.0 with the new-style classes flag ([issue #27](#)).

### 3.1.4 HappyBase 0.5

Release date: 2013-05-24

- Added a thread-safe connection pool (*ConnectionPool*) to keep connections open and share them between threads ([issue #21](#)).
- The *Connection.delete\_table()* method now features an optional *disable* parameter to make deleting enabled tables easier.
- The debug log message emitted by *Table.scan()* when closing a scanner now includes both the number of rows returned to the calling code, and also the number of rows actually fetched from the server. If scanners are not completely iterated over (e.g. because of a ‘break’ statement in the for loop for the scanner), these numbers may differ. If this happens often, and the differences are big, this may be a hint that the *batch\_size* parameter to *Table.scan()* is not optimal for your application.
- Increased Thrift dependency to at least 0.8. Older versions are no longer available from PyPI. HappyBase should not be used with obsoleted Thrift versions.
- The *Connection* constructor now features an optional *timeout* parameter to specify the timeout to use for the Thrift socket ([issue #15](#)).
- The *timestamp* argument to various methods now also accepts *long* values in addition to *int* values. This fixes problems with large timestamp values on 32-bit systems. ([issue #23](#)).
- In some corner cases exceptions were raised during interpreter shutdown while closing any remaining open connections. ([issue #18](#))

### 3.1.5 HappyBase 0.4

Release date: 2012-07-11

- Add an optional *table\_prefix\_separator* argument to the *Connection* constructor, to specify the prefix used for the *table\_prefix* argument ([issue #3](#))
- Add support for framed Thrift transports using a new optional *transport* argument to *Connection* ([issue #6](#))
- Add the Apache license conditions in the [license statement](#) (for the included HBase parts)
- Documentation improvements

### 3.1.6 HappyBase 0.3

Release date: 2012-05-25

New features:

- Improved compatibility with HBase 0.90.x
  - In earlier versions, using *Table.scan()* in combination with HBase 0.90.x often resulted in crashes, caused by incompatibilities in the underlying Thrift protocol.
  - A new *compat* flag to the *Connection* constructor has been added to enable compatibility with HBase 0.90.x.
  - Note that the *Table.scan()* API has a few limitations when used with HBase 0.90.x.
- The *row\_prefix* argument to *Table.scan()* can now be used together with *filter* and *timestamp* arguments.

Other changes:

- Lower Thrift dependency to 0.6

- The *setup.py* script no longer installs the tests
- Documentation improvements

### 3.1.7 HappyBase 0.2

Release date: 2012-05-22

- Fix package installation, so that `pip install happybase` works as expected ([issue #1](#))
- Various small documentation improvements

### 3.1.8 HappyBase 0.1

Release date: 2012-05-20

- Initial release

## 3.2 Development

### 3.2.1 Getting the source

The HappyBase source code repository is hosted on GitHub:

<https://github.com/wbolster/happybase>

To grab a copy, use this:

```
$ git clone https://github.com/wbolster/happybase.git
```

### 3.2.2 Setting up a development environment

Setting up a development environment from a Git branch is easy:

```
$ cd /path/to/happybase/  
$ mkvirtualenv happybase  
(happybase)$ pip install -r test-requirements.txt  
(happybase)$ pip install -e .
```

### 3.2.3 Running the tests

The tests use the *nose* test suite. To execute the tests, run:

```
(happybase)$ make test
```

Test outputs are shown on the console. A test code coverage report is saved in *coverage/index.html*.

If the Thrift server is not running on localhost, you can specify these environment variables (both are optional) before running the tests:

```
(happybase)$ export HAPPYBASE_HOST=host.example.org  
(happybase)$ export HAPPYBASE_PORT=9091
```

To test the HBase 0.90 compatibility mode, use this:

```
(happybase) $ export HAPPYBASE_COMPAT=0.90
```

To test the framed Thrift transport mode, use this:

```
(happybase) $ export HAPPYBASE_TRANSPORT=framed
```

### 3.2.4 Contributing

Feel free to report any issues on GitHub. Patches and merge requests are also most welcome.

## 3.3 To-do list and possible future work

This document lists some ideas that the developers thought of, but have not yet implemented. The topics described below may be implemented (or not) in the future, depending on time, demand, and technical possibilities.

- Improved error handling instead of just propagating the errors from the Thrift layer. Maybe wrap the errors in a `HappyBase.Error`?
- Automatic retries for failed operations (but only those that can be retried)
- Port HappyBase over to the (still experimental) HBase Thrift2 API when it becomes mainstream, and expose more of the underlying features nicely in the HappyBase API.
- Python 3 support. This would be trivial for HappyBase, but the underlying Thrift library needs to be Python 3 compatible first.

## 3.4 Frequently asked questions

### 3.4.1 I love HappyBase! Can I donate?

Thanks, I'm glad to hear that you appreciate my work! If you feel like, please make a small [donation](#) to sponsor my (spare time!) work on HappyBase. Small gestures are really motivating for me and help me keep this project going!

### 3.4.2 Why not use the Thrift API directly?

While the HBase Thrift API can be used directly from Python using (automatically generated) HBase Thrift service classes, application code doing so is very verbose, cumbersome to write, and hence error-prone. The reason for this is that the HBase Thrift API is a flat, language-agnostic interface API closely tied to the RPC going over the wire-level protocol. In practice, this means that applications using Thrift directly need to deal with many imports, sockets, transports, protocols, clients, Thrift types and mutation objects. For instance, look at the code required to connect to HBase and store two values:

```
from thrift import Thrift
from thrift.transport import TSocket, TTransport
from thrift.protocol import TBinaryProtocol

from hbase import ttypes
from hbase.Hbase import Client, Mutation

sock = TSocket.TSocket('hostname', 9090)
```



```

transport = TTransport.TBufferedTransport(sock)
protocol = TBinaryProtocol.TBinaryProtocol(transport)
client = Client(protocol)
transport.open()

mutations = [Mutation(column='family:qual1', value='value1'),
              Mutation(column='family:qual2', value='value2')]
client.mutateRow('table-name', 'row-key', mutations)

```

**PEP 20** taught us that simple is better than complex, and as you can see, Thrift is certainly complex. HappyBase hides all the Thrift cruft below a friendly API. The resulting application code will be cleaner, more productive to write, and more maintainable. With HappyBase, the example above can be simplified to this:

```

import happybase

connection = happybase.Connection('hostname')
table = connection.table('table-name')
table.put('row-key', {'family:qual1': 'value1',
                      'family:qual2': 'value2'})

```

If you're not convinced and still think the Thrift API is not that bad, please try to accomplish some other common tasks, e.g. retrieving rows and scanning over a part of a table, and compare that to the HappyBase equivalents. If you're still not convinced by then, we're sorry to inform you that HappyBase is not the project for you, and we wish you all of luck maintaining your code or is it just Thrift boilerplate?

## 3.5 License

HappyBase itself is licensed under a [MIT License](#). HappyBase contains code originating from HBase sources, licensed under the [Apache License](#) (version 2.0). Both license texts are included below.

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## External links

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## Indices and tables

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- `genindex`
- `modindex`
- `search`





**B**

Batch (class in happybase), 22  
batch() (happybase.Table method), 17

**C**

cells() (happybase.Table method), 18  
close() (happybase.Connection method), 15  
compact\_table() (happybase.Connection method), 15  
Connection (class in happybase), 15  
connection() (happybase.ConnectionPool method), 22  
ConnectionPool (class in happybase), 22  
counter\_dec() (happybase.Table method), 18  
counter\_get() (happybase.Table method), 18  
counter\_inc() (happybase.Table method), 19  
counter\_set() (happybase.Table method), 19  
create\_table() (happybase.Connection method), 16

**D**

delete() (happybase.Batch method), 22  
delete() (happybase.Table method), 19  
delete\_table() (happybase.Connection method), 16  
disable\_table() (happybase.Connection method), 16

**E**

enable\_table() (happybase.Connection method), 16

**F**

families() (happybase.Table method), 19

**I**

is\_table\_enabled() (happybase.Connection method), 16

**N**

NoConnectionsAvailable (class in happybase), 23

**O**

open() (happybase.Connection method), 17

**P**

put() (happybase.Batch method), 22

put() (happybase.Table method), 19  
Python Enhancement Proposals  
PEP 20, 29

**R**

regions() (happybase.Table method), 20  
row() (happybase.Table method), 20  
rows() (happybase.Table method), 20

**S**

scan() (happybase.Table method), 21  
send() (happybase.Batch method), 22

**T**

Table (class in happybase), 17  
table() (happybase.Connection method), 17  
tables() (happybase.Connection method), 17