Bitcoinlib Documentation

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MANUALS

Bitcoin and other Crypto Currency Library for Python.

Includes a fully functional wallet, with multi signature, multi currency and multiple accounts. Use this library to create and manage transactions, addresses/keys, wallets, mnemonic password phrases and blocks with simple and straightforward Python code.

You can use this library at a high level and create and manage wallets on the command line or at a low level and create your own custom made transactions, scripts, keys or wallets.

The BitcoinLib connects to various service providers automatically to update wallets, transactions and blockchain information.

CHAPTER

ONE

WALLET

This Bitcoin Library contains a wallet implementation using SQLAlchemy and SQLite3, MySQL or PostgreSQL to import, create and manage keys in a Hierarchical Deterministic way.

Example: Create wallet and generate new address (key) to receive bitcoins

```
>>> from bitcoinlib.wallets import Wallet
>>> w = Wallet.create('Wallet1')
>>> key1 = w.get_key()
>>> key1.address
'1Fo7STj6LdRhUuD1AiEsHpH65pXzraGJ9j'
```

Now send a small transaction to your wallet and use the scan() method to update transactions and UTXO's

```
>>> w.scan()
>>> w.info()  # Shows wallet information, keys, transactions and UTXO's
```

When your wallet received a payment and has unspent transaction outputs, you can send bitcoins easily. If successful a transaction ID is returned

```
>>> t = w.send_to('1PWXhWvUH3bcDWn6Fdq3xhMRPfxRXTjAi1', '0.001 BTC')
'b7feea5e7c79d4f6f343b5ca28fa2a1fcacfe9a2b7f44f3d2fd8d6c2d82c4078'
>>> t.info()  # Shows transaction information and send results
```

CHAPTER

TWO

SEGREGATED WITNESS WALLET

Easily create and manage Segwit wallets. Both native Segwit with base32/bech32 addresses and P2SH nested Segwit wallets with traditional addresses are available.

Create a native single key P2WPKH wallet:

```
>>> from bitcoinlib.wallets import Wallet
>>> w = Wallet.create('segwit_p2wpkh', witness_type='segwit')
>>> w.get_key().address
bc1q84y2quplejutvu0h4gw9hy59fppu3thg0u2xz3
```

Or create a P2SH nested single key P2SH_P2WPKH wallet:

```
>>> from bitcoinlib.wallets import Wallet
>>> w = Wallet.create('segwit_p2sh_p2wpkh', witness_type='p2sh-segwit')
>>> w.get_key().address
36ESSWgR4WxXJSc4ysDSJvecyY6FJkhUbp
```

CHAPTER

THREE

WALLET FROM PASSPHRASE WITH ACCOUNTS AND MULTIPLE CURRENCIES

The following code creates a wallet with two bitcoin and one litecoin account from a Mnemonic passphrase. The complete wallet can be recovered from the passphrase which is the masterkey.

```
from bitcoinlib.wallets import Wallet, wallet_delete
from bitcoinlib.mnemonic import Mnemonic

passphrase = Mnemonic().generate()
print(passphrase)
w = Wallet.create("Wallet2", keys=passphrase, network='bitcoin')
account_btc2 = w.new_account('Account BTC 2')
account_ltc1 = w.new_account('Account LTC', network='litecoin')
w.get_key()
w.get_key(account_btc2.account_id)
w.get_key(account_ltc1.account_id)
w.info()
```

CHAPTER

FOUR

MULTI SIGNATURE WALLETS

Create a Multisig wallet with 2 cosigners which both need to sign a transaction.

```
from bitcoinlib.wallets import Wallet
from bitcoinlib.keys import HDKey

NETWORK = 'testnet'
k1 = HDKey(
↪'tprv8ZgxMBicQKsPd1Q44tfDiZC98iYouKRC2CzjT3HGt1yYw2zuX2awTotzGAZQEAU9bi2M5MCj8iedP9MREPjUgpDEBwBgGi2C
↪'
           '5zNYeiX8', network=NETWORK)
k2 = HDKey(
↪'tprv8ZgxMBicQKsPeUbMS6kswJc11zgVEXUnUZuGo3bF6bBrAg1ieFfUdPc9UHqbD5HcXizThrcKike1c4z6xHrz6MWGwy8L6YKV
↪'
           'MeQHdWDp', network=NETWORK)
w1 = Wallet.create('multisig_2of2_cosigner1', sigs_required=2,
                   keys=[k1, k2.public_master(multisig=True)], network=NETWORK)
w2 = Wallet.create('multisig_2of2_cosigner2',  sigs_required=2,
                   keys=[k1.public_master(multisig=True), k2], network=NETWORK)
print("Deposit testnet bitcoin to this address to create transaction: ", w1.get_key().
↪address)
```

Create a transaction in the first wallet

```
w1.utxos_update()
t = w1.sweep('mwCwTceJvYV27KXBc3NJZys6CjsgsoeHmf', min_confirms=0)
t.info()
```

And then import the transaction in the second wallet, sign it and push it to the network

```
w2.get_key()
t2 = w2.transaction_import(t)
t2.sign()
t2.send()
t2.info()
```

CHAPTER

FIVE

COMMAND LINE TOOL

With the command line tool you can create and manage wallet without any Python programming.

To create a new Bitcoin wallet

```
$ clw newwallet
Command Line Wallet for BitcoinLib

Wallet newwallet does not exist, create new wallet [yN]? y

CREATE wallet 'newwallet' (bitcoin network)

Your mnemonic private key sentence is: force humble chair kiss season ready elbow cool␣
↪awake divorce famous tunnel

Please write down on paper and backup. With this key you can restore your wallet and all␣
↪keys
```

You can use the command line wallet 'clw' to create simple or multisig wallets for various networks, manage public and private keys and managing transactions.

For the full command line wallet documentation please read

http://bitcoinlib.readthedocs.io/en/latest/_static/manuals.command-line-wallet.html

CHAPTER

SIX

SERVICE PROVIDERS

Communicates with pools of bitcoin service providers to retreive transaction, address, blockchain information. To push a transaction to the network. To determine optimal service fee for a transaction. Or to update your wallet's balance.

Example: Get estimated transactionfee in Sathosis per Kb for confirmation within 5 blocks

```
>>> from bitcoinlib.services.services import Service
>>> Service().estimatefee(5)
138964
```

CHAPTER

SEVEN

OTHER DATABASES

Bitcoinlib uses the SQLite database by default but other databases are supported as well. See http://bitcoinlib.readthedocs.io/en/latest/_static/manuals.databases.html for instructions on how to use MySQL or PostgreSQL.

CHAPTER

EIGHT

MORE EXAMPLES

For more examples see https://github.com/1200wd/bitcoinlib/tree/master/examples

8.1 Install, Update and Tweak BitcoinLib

8.1.1 Installation

8.1.1.1 Install with pip

```
$ pip install bitcoinlib
```

Package can be found at https://pypi.org/project/bitcoinlib/

8.1.1.2 Install from source

Required packages:

```
sudo apt install -y postgresql postgresql-contrib mysql-server libpq-dev
libmysqlclient-dev
```

Create a virtual environment for instance on linux with virtualenv:

```
$ virtualenv -p python3 venv/bitcoinlib
$ source venv/bitcoinlib/bin/activate
```

Then clone the repository and install dependencies:

```
$ git clone https://github.com/1200wd/bitcoinlib.git
$ cd bitcoinlib
$ pip install -r requirements-dev.txt
```

8.1.1.3 Package dependencies

Required Python Packages, are automatically installed upon installing bitcoinlib:

- fastecdsa
- pyaes
- scrypt (or much slower pyscript)
- sqlalchemy
- requests
- enum34 (for older Python installations)
- pathlib2 (for Python 2)
- six

8.1.1.4 Other requirements Linux

On Debian, Ubuntu or their derivatives:

```
sudo apt install build-essential python-dev python3-dev libgmp3-dev
```

On Fedora, CentOS or RHEL:

```
sudo dnf install python3-devel gmp-devel
```

To install OpenSSL development package on Debian, Ubuntu or their derivatives

```
sudo apt install libssl-dev
```

To install OpenSSL development package on Fedora, CentOS or RHEL

```
sudo yum install gcc openssl-devel
```

8.1.1.5 Development environment

Install database packages for MySQL and PostgreSQL

```
sudo apt install mysql-server postgresql postgresql-contrib libmysqlclient-dev
```

Check for the latest version of the PostgreSQL dev server:

```
sudo apt install postgresql-server-dev-<version>
```

From library root directory install the Python requirements

```
pip install -r requirements-dev.txt
```

Then run the unittests to see if everything works

```
python setup.py test
```

8.1.1.6 Other requirements Windows

This library requires a Microsoft Visual C++ Compiler. For python version 3.5+ you will need Visual C++ 14.0. Install Microsoft Visual Studio and include the "Microsoft Visual C++ Build Tools" which can be downloaded from https://visualstudio.microsoft.com/downloads. Also see https://wiki.python.org/moin/WindowsCompilers

The fastecdsa library is not enabled at this moment in the windows install, the slower ecdsa library is installed. Installation of fastecdsa on Windows is possible but not easy, read https://github.com/AntonKueltz/fastecdsa/issues/11 for steps you could take to install this library.

If you have problems with installing this library on Windows you could try to use the pyscrypt library instead of scrypt. The pyscrypt library is pure Python so it doesn't need any C compilers installed. But this will run slower.

8.1.2 Update Bitcoinlib

Before you update make sure to backup your database! Also backup your settings files in ./bitcoinlib/config if you have made any changes.

If you installed the library with pip upgrade with

```
$ pip install bitcoinlib --upgrade
```

Otherwise pull the git repository.

After an update it might be necessary to update the config files. The config files will be overwritten with new versions if you delete the .bitcoinlib/install.log file.

```
$ rm .bitcoinlib/install.log
```

If the new release contains database updates you have to migrate the database with the updatedb.py command. This program extracts keys and some wallet information from the old database and then creates a new database. The updatedb.py command is just a helper tool and not guaranteed to work, it might fail if there are a lot of database changes. So backup database / private keys first and use at your own risk!

```
$ python updatedb.py
Wallet and Key data will be copied to new database. Transaction data will NOT be copied
Updating database file: /home/guest/.bitcoinlib/database/bitcoinlib.sqlite
Old database will be backed up to /home/guest/.bitcoinlib/database/bitcoinlib.sqlite.
↪backup-20180711-01:46
Type 'y' or 'Y' to continue or any other key to cancel: y
```

8.1.3 Troubleshooting

When you experience issues with the scrypt package when installing you can try to solve this by installing scrypt seperately:

```
$ pip uninstall scrypt
$ pip install scrypt
```

Please make sure you also have the Python development and SSL development packages installed, see 'Other requirements' above.

You can also use pyscrypt instead of scrypt. Pyscrypt is a pure Python scrypt password-based key derivation library. It works but it is slow when using BIP38 password protected keys.

```
$ pip install pyscrypt
```

If you run into issues do not hesitate to contact us or file an issue at https://github.com/1200wd/bitcoinlib/issues

8.1.4 Using library in other software

If you use the library in other software and want to change file locations and other settings you can specify a location for a config file in the BCL_CONFIG_FILE:

```
os.environ['BCL_CONFIG_FILE'] = '/var/www/blocksmurfer/bitcoinlib.ini'
```

8.1.5 Tweak BitcoinLib

You can Add another service Provider to this library by updating settings and write a new service provider class.

If you use this library in a production environment it is advised to run your own Bcoin, Bitcoin, Litecoin or Dash node, both for privacy and reliability reasons. More setup information: Setup connection to bitcoin node

Some service providers require an API key to function or allow additional requests. You can add this key to the provider settings file in .bitcoinlib/providers.json

8.2 Command Line Wallet

Manage wallets from commandline. Allows you to

- Show wallets and wallet info
- Create single and multi signature wallets
- Delete wallets
- Generate receive addresses
- Create transactions
- Import and export transactions
- Sign transactions with available private keys
- Broadcast transaction to the network

The Command Line wallet Script can be found in the tools directory. If you call the script without arguments it will show all available wallets.

Specify a wallet name or wallet ID to show more information about a wallet. If you specify a wallet which doesn't exists the script will ask you if you want to create a new wallet.

8.2.1 Create wallet

To create a wallet just specify an unused wallet name:

```
$ clw mywallet
Command Line Wallet for BitcoinLib

Wallet mywallet does not exist, create new wallet [yN]? y

CREATE wallet 'mywallet' (bitcoin network)

Your mnemonic private key sentence is: mutual run dynamic armed brown meadow height␣
↪elbow citizen put industry work

Please write down on paper and backup. With this key you can restore your wallet and all␣
↪keys

Type 'yes' if you understood and wrote down your key: yes
Updating wallet
```

8.2.2 Generate / show receive addresses

To show an unused address to receive funds use the -r or –receive option. If you want to show QR codes on the commandline install the pyqrcode module.

```
$ clw mywallet -r
Command Line Wallet for BitcoinLib

Receive address is 1JMKBiiDMdjTx6rfqGumALvcRMX6DQNeG1
```

8.2.3 Send funds / create transaction

To send funds use the -t option followed by the address and amount. You can also repeat this to send to multiple addresses.

A manual fee can be entered with the -f / –fee option.

The default behavior is to just show the transaction info and raw transaction. You can push this to the network with a 3rd party. Use the -p / –push option to push the transaction to the network.

```
$ clw -d dbtest mywallet -t 1FpBBJ2E9w9nqxHUAtQME8X4wGeAKBsKwZ 10000
```

8.2.4 Restore wallet with passphrase

To restore or create a wallet with a passphrase use new wallet name and the –passphrase option. If it's an old wallet you can recreate and scan it with the -s option. This will create new addresses and update unspend outputs.

```
$ clw mywallet --passphrase "mutual run dynamic armed brown meadow height elbow citizen␣
↪put industry work"
$ clw mywallet -s
```

8.2.5 Options Overview

Command Line Wallet for BitcoinLib

```
usage: clw.py [-h] [--wallet-remove] [--list-wallets] [--wallet-info]
                   [--update-utxos] [--update-transactions]
                   [--wallet-recreate] [--receive [NUMBER_OF_ADDRESSES]]
                   [--generate-key] [--export-private]
                   [--passphrase [PASSPHRASE [PASSPHRASE ...]]]
                   [--passphrase-strength PASSPHRASE_STRENGTH]
                   [--network NETWORK] [--database DATABASE]
                   [--create-from-key KEY]
                   [--create-multisig [NUMBER_OF_SIGNATURES_REQUIRED [KEYS ...]]]
                   [--create-transaction [ADDRESS_1 [AMOUNT_1 ...]]]
                   [--sweep ADDRESS] [--fee FEE] [--fee-per-kb FEE_PER_KB]
                   [--push] [--import-tx TRANSACTION]
                   [--import-tx-file FILENAME_TRANSACTION]
                   [wallet_name]

BitcoinLib CLI

positional arguments:
  wallet_name           Name of wallet to create or open. Used to store your
                        all your wallet keys and will be printed on each paper
                        wallet

optional arguments:
  -h, --help            show this help message and exit

Wallet Actions:
  --wallet-remove       Name or ID of wallet to remove, all keys and
                        transactions will be deleted
  --list-wallets, -l    List all known wallets in BitcoinLib database
  --wallet-info, -w     Show wallet information
  --update-utxos, -x    Update unspent transaction outputs (UTXO's) for this
                        wallet
  --update-transactions, -u
                        Update all transactions and UTXO's for this wallet
  --wallet-recreate, -z
                        Delete all keys and transactions and recreate wallet,
                        except for the masterkey(s). Use when updating fails
                        or other errors occur. Please backup your database and
                        masterkeys first.
  --receive [COSIGNER_ID], -r [COSIGNER_ID]
                        Show unused address to receive funds. Generate new
                        payment and change addresses if no unused addresses are
                        available.
  --generate-key, -k    Generate a new masterkey, and show passphrase, WIF and
                        public account key. Use to create multisig wallet
  --export-private, -e  Export private key for this wallet and exit

Wallet Setup:
  --passphrase [PASSPHRASE [PASSPHRASE ...]]
```

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```
                        Passphrase to recover or create a wallet. Usually 12
                        or 24 words
  --passphrase-strength PASSPHRASE_STRENGTH
                        Number of bits for passphrase key. Default is 128,
                        lower is not adviced but can be used for testing. Set
                        to 256 bits for more future proof passphrases
  --network NETWORK, -n NETWORK
                        Specify 'bitcoin', 'litecoin', 'testnet' or other
                        supported network
  --database DATABASE, -d DATABASE
                        Name of specific database file to use
  --create-from-key KEY, -c KEY
                        Create a new wallet from specified key
  --create-multisig [NUMBER_OF_SIGNATURES_REQUIRED [KEYS ...]], -m [NUMBER_OF_SIGNATURES_
↪REQUIRED [KEYS ...]]
                        Specificy number of signatures required followed by a
                        list of signatures. Example: -m 2 tprv8ZgxMBicQKsPd1Q4
                        4tfDiZC98iYouKRC2CzjT3HGt1yYw2zuX2awTotzGAZQEAU9bi2M5M
                        Cj8iedP9MREPjUgpDEBwBgGi2C8eK5zNYeiX8 tprv8ZgxMBicQKsP
                        eUbMS6kswJc11zgVEXUnUZuGo3bF6bBrAg1ieFfUdPc9UHqbD5HcXi
                        zThrcKike1c4z6xHrz6MWGwy8L6YKVbgJMeQHdWDp

Transactions:
  --create-transaction [ADDRESS_1 [AMOUNT_1 ...]], -t [ADDRESS_1 [AMOUNT_1 ...]]
                        Create transaction. Specify address followed by
                        amount. Repeat for multiple outputs
  --sweep ADDRESS       Sweep wallet, transfer all funds to specified address
  --fee FEE, -f FEE     Transaction fee
  --fee-per-kb FEE_PER_KB
                        Transaction fee in sathosis (or smallest denominator)
                        per kilobyte
  --push, -p            Push created transaction to the network
  --import-tx TRANSACTION, -i TRANSACTION
                        Import raw transaction hash or transaction dictionary
                        in wallet and sign it with available key(s)
  --import-tx-file FILENAME_TRANSACTION, -a FILENAME_TRANSACTION
                        Import transaction dictionary or raw transaction
                        string from specified filename and sign it with
                        available key(s)
```

8.3 Add a new Service Provider

The Service class connects to providers such as Blockchain.info or Blockchair.com to retreive transaction, network, block, address information, etc

The Service class automatically selects a provider which has requested method available and selects another provider if method fails.

8.3.1 Steps to add a new provider

- The preferred way is to create a github clone and update code there (and do a pull request...)
- Add the provider settings in the providers.json file in the configuration directory.

Example:

```
{
    "bitgo": {
        "provider": "bitgo",
        "network": "bitcoin",
        "client_class": "BitGo",
        "provider_coin_id": "",
        "url": "https://www.bitgo.com/api/v1/",
        "api_key": "",
        "priority": 10,
        "denominator": 1,
        "network_overrides": null
    }
}
```

- Create a new Service class in bitcoinlib.services. Create a method for available API calls and rewrite output if needed.

Example:

```
from bitcoinlib.services.baseclient import BaseClient

PROVIDERNAME = 'bitgo'


class BitGoClient(BaseClient):

    def __init__(self, network, base_url, denominator, api_key=''):
        super(self.__class__, self).\
            __init__(network, PROVIDERNAME, base_url, denominator, api_key)

    def compose_request(self, category, data, cmd='', variables=None, method='get'):
        if data:
            data = '/' + data
        url_path = category + data
        if cmd:
            url_path += '/' + cmd
        return self.request(url_path, variables, method=method)
```

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```
    def estimatefee(self, blocks):
        res = self.compose_request('tx', 'fee', variables={'numBlocks': blocks})
        return res['feePerKb']
```

- Add this service class to __init__.py

```
import bitcoinlib.services.bitgo
```

- Remove install.log file in bitcoinlib's log directory, this will copy all provider settings next time you run the bitcoin library. See 'initialize_lib' method in main.py
- Specify new provider and create service class object to test your new class and it's method

```
from bitcoinlib import services

srv = Service(providers=['blockchair'])
print(srv.estimatefee(5))
```

8.4 How to connect bitcoinlib to a bitcoin node

This manual explains how to connect to a bitcoind server on your localhost or an a remote server.

Running your own bitcoin node allows you to create a large number of requests, faster response times, and more control, privacy and independence. However you need to install and maintain it and it used a lot of resources.

8.4.1 Bitcoin node settings

This manual assumes you have a full bitcoin node up and running. For more information on how to install a full node read https://bitcoin.org/en/full-node

Please make sure you have server and txindex option set to 1.

So your bitcoin.conf file for testnet should look something like this. For mainnet use port 8332, and remove the 'testnet=1' line.

```
[rpc]
rpcuser=bitcoinrpc
rpcpassword=some_long_secure_password
server=1
port=18332
txindex=1
testnet=1
```

8.4.2 Connect using config files

Bitcoinlib looks for bitcoind config files on localhost. So if you running a full bitcoin node from your local PC as the same user everything should work out of the box.

Config files are read from the following files in this order: * [USER_HOME_DIR]/.bitcoinlib/bitcoin.conf * [USER_HOME_DIR]/.bitcoin/bitcoin.conf

If your config files are at another location, you can specify this when you create a BitcoindClient instance.

```
from bitcoinlib.services.bitcoind import BitcoindClient

bdc = BitcoindClient.from_config('/usr/local/src/.bitcoinlib/bitcoin.conf')
txid = 'e0cee8955f516d5ed333d081a4e2f55b999debfff91a49e8123d20f7ed647ac5'
rt = bdc.getrawtransaction(txid)
print("Raw: %s" % rt)
```

8.4.3 Connect using provider settings

Connection settings can also be added to the service provider settings file in .bitcoinlib/config/providers.json

Example:

```
{
  "bitcoind.testnet": {
    "provider": "bitcoind",
    "network": "testnet",
    "client_class": "BitcoindClient",
    "url": "http://user:password@server_url:18332",
    "api_key": "",
    "priority": 11,
    "denominator": 100000000
  }
}
```

8.4.4 Connect using base_url argument

Another options is to pass the 'base_url' argument to the BitcoindClient object directly.

This provides more flexibility but also the responsibility to store user and password information in a secure way.

```
from bitcoinlib.services.bitcoind import BitcoindClient

base_url = 'http://user:password@server_url:18332'
bdc = BitcoindClient(base_url=base_url)
txid = 'e0cee8955f516d5ed333d081a4e2f55b999debfff91a49e8123d20f7ed647ac5'
rt = bdc.getrawtransaction(txid)
print("Raw: %s" % rt)
```

8.4.5 Please note: Using a remote bitcoind server

Using RPC over a public network is unsafe, so since bitcoind version 0.18 remote RPC for all network interfaces is disabled. The rpcallowip option cannot be used to listen on all network interfaces and rpcbind has to be used to define specific IP addresses to listen on. See https://bitcoin.org/en/release/v0.18.0#configuration-option-changes

You could setup a openvpn or ssh tunnel to connect to a remote server to avoid this issues.

8.5 Using MySQL or PostgreSQL databases

Bitcoinlib uses the SQLite database by default, because it easy to use and requires no installation.

But you can also use other databases. At this moment Bitcoinlib is tested with MySQL and PostgreSQL.

8.5.1 Using MySQL database

We assume you have a MySQL server at localhost. Unlike with the SQLite database MySQL databases are not created automatically, so create one from the mysql command prompt:

```
mysql> create database bitcoinlib;
```

Now create a user for your application and grant this user access. And off course replace the password 'secret' with a better password.

```
mysql> create user bitcoinlib@localhost identified by 'secret';
mysql> grant all on bitcoinlib.* to bitcoinlib@localhost with grant option;
```

In your application you can create a database link. The database tables are created when you first run the application

```
db_uri = 'mysql://bitcoinlib:secret@localhost:3306/bitcoinlib'
w = wallet_create_or_open('wallet_mysql', db_uri=db_uri)
w.info()
```

8.5.2 Using PostgreSQL database

First create a user and the database from a shell. We assume you have a PostgreSQL server running at your Linux machine.

```
$ su - postgres
postgres@localhost:~$ createuser --interactive --pwprompt
Enter name of role to add: bitcoinlib
Enter password for new role:
Enter it again:
Shall the new role be a superuser? (y/n) n
Shall the new role be allowed to create databases? (y/n) n
Shall the new role be allowed to create more new roles? (y/n) n
$ createdb bitcoinlib
```

And assume you unwisely have chosen the password 'secret' you can use the database as follows:

```
db_uri = 'postgresql://bitcoinlib:secret@localhost:5432/'
w = wallet_create_or_open('wallet_mysql', db_uri=db_uri)
w.info()
```

8.6 Using SQLCipher encrypted database

To protect your data such as the private keys you can use SQLCipher to encrypt the full database. SQLCipher is a SQLite extension which uses 256-bit AES encryption and also works together with SQLAlchemy.

Is quite easy to setup and use with Bitcoinlib. First install the required packages, the following works on Ubuntu, but your system might require other packages. Please read https://www.zetetic.net/sqlcipher/ for installations instructions.

```
$ sudo apt install sqlcipher libsqlcipher0 libsqlcipher-dev
$ pip install pysqlcipher3
```

Now you can use a SQLCipher database URI to create and query a encrypted database:

```
password = 'secret'
filename = '~/.bitcoinlib/database/bcl_encrypted.db'
db_uri = 'sqlite+pysqlcipher://:%s@/%s?cipher=aes-256-cfb&kdf_iter=64000' % (password,␣
↪filename)
wlt = Wallet.create('bcltestwlt4', network='bitcoinlib_test', db_uri=db_uri)
```

If you look at the contents of the SQLite database you can see it is encrypted.

```
$ cat ~/.bitcoinlib/database/bcl_encrypted.db
<outputs unreadable random garbage>
```

8.7 10 Tips to Increase Privacy and Security

Ten tips for more privacy and security when using Bitcoin and Bitcoinlib:

1. Run your own Bitcoin or Bcoin node, so you are not depending on external Blockchain API service providers anymore. This not only increases your privacy, but also makes your application much faster and more reliable. And as extra bonus you support the Bitcoin network.
2. Use multi-signature wallets. So you are able to store your private keys in separate (offline) locations.
3. Use a minimal amount of inputs when creating a transaction. This is default behavior the Bitcoinlib Wallet object. You can set a hard limit when sending from a wallet with the max_utxos=1 attribute.
4. Use a random number of change outputs and shuffle order of inputs and outputs. This way it is not visible which output is the change output. In the Wallet object you can set the number_of_change_outputs to zero to generate a random number of change outputs.
5. Encrypt your database with SQLCipher.
6. Use password protected private keys. For instance use a password when creating wallets.
7. Backup private keys and passwords! I have no proof but I assume more bitcoins are lost because of lost private keys then there are lost due to hacking…

8. When using Bitcoinlib wallets the private keys are stored in a database. Make sure the database is in a safe location and check encryption, access rights, etc. Also check tip 2 and 5 again and see how you can minimize risks.
9. Test, try, review. Before working with any real value carefully test your applications using the testnet or small value transactions.
10. Read this tips, read some more about Security and Privacy and then think thorough about the best wallet setup, which is always a tradeoff between security, privacy and usability.

8.8 Caching

Results from queries to service providers are store in a cache database. Once transactions are confirmed and stored on the blockchain they are immutable, so they can be stored in a local cache for an indefinite time.

8.8.1 What is cached?

The cache stores transactions, but also address information and transactions-address relations. This speeds up the gettransactions(), getutxos() and getbalance() method since all old transactions can be read from cache, and we only have to check if new transactions are available for a certain address.

The latest block - block number of the last block on the network - is stored in cache for 60 seconds. So the Service object only checks for a new block every minute.

The fee estimation for a specific network is stored for 10 minutes.

8.8.2 Using other databases

By default the cache is stored in a SQLite database in the database folder: ~/.bitcoinlib/databases/bitcoinlib_cache.sqlite The location and type of database can be changed in the config.ini with the default_databasefile_cache variable.

Other type of databases can be used as well, check http://bitcoinlib.readthedocs.io/en/latest/_static/manuals.databases.html for more information.

8.8.3 Disable caching

Caching is enabled by default. To disable caching set the environment variable SERVICE_CACHING_ENABLED to False or set this variable (service_caching_enabled) in the config.ini file placed in your .bitcoinlib/ directory.

8.8.4 Troubleshooting

8.8.4.1 Nothing is cached, what is the problem?

- If the min_providers parameter is set to 2 or more caching will be disabled.
- If a service providers returns an incomplete result no cache will be stored.
- If the after_txid parameter is used in gettransactions() or getutxos() no cache will be stored if this the 'after_txid' transaction is not found in the cache. Because the transaction cache has to start from the first transaction for a certain address and no gaps can occur.

8.8.4.2 I get incomplete or incorrect results!

- Please post an issues in the Github issue-tracker so we can take a look.
- You can delete the database in ~/.bitcoinlib/databases/bitcoinlib_cache.sqlite for an easy fix, or disable caching if that really doesn't work out.

8.9 bitcoinlib.keys module

class bitcoinlib.keys.**Address**(*data=''*, *hashed_data=''*, *prefix=None*, *script_type=None*, *compressed=None*, *encoding=None*, *witness_type=None*, *depth=None*, *change=None*, *address_index=None*, *network='bitcoin'*, *network_overrides=None*)

Bases: `object`

Class to store, convert and analyse various address types as representation of public keys or scripts hashes

Initialize an Address object. Specify a public key, redeemscript or a hash.

```
>>> addr = Address(
↪'03715219f51a2681b7642d1e0e35f61e5288ff59b87d275be9eaf1a5f481dcdeb6', encoding=
↪'bech32', script_type='p2wsh')
>>> addr.address
'bc1qaehsuffn0stxmugx3z69z9hm6gnjd9qzeqlfv92cpf5adw63x4tsfl7vwl'
```

Parameters

- **data** (*str, bytes*) – Public key, redeem script or other type of script.
- **hashed_data** (*str, bytes*) – Hash of a public key or script. Will be generated if 'data' parameter is provided
- **prefix** (*str, bytes*) – Address prefix. Use default network / script_type prefix if not provided
- **script_type** (*str*) – Type of script, i.e. p2sh or p2pkh.
- **encoding** (*str*) – Address encoding. Default is base58 encoding, for native segwit addresses specify bech32 encoding
- **witness_type** (*str*) – Specify 'legacy', 'segwit' or 'p2sh-segwit'. Legacy for old-style bitcoin addresses, segwit for native segwit addresses and p2sh-segwit for segwit embedded in a p2sh script. Leave empty to derive automatically from script type if possible
- **network** (*str, Network*) – Bitcoin, testnet, litecoin or other network
- **network_overrides** (*dict*) – Override network settings for specific prefixes, i.e.: {"prefix_address_p2sh": "32"}. Used by settings in providers.json

as_dict()

Get current Address class as dictionary. Byte values are represented by hexadecimal strings

Return dict

as_json()

Get current key as json formatted string

Return str

property data

property hashed_data

classmethod import_address(*address*, *compressed=None*, *encoding=None*, *depth=None*, *change=None*, *address_index=None*, *network=None*, *network_overrides=None*)

Import an address to the Address class. Specify network if available, otherwise it will be derived form the address.

Parameters

- **address** (*str*) – Address to import
- **compressed** (*bool*) – Is key compressed or not, default is None
- **encoding** (*str*) – Address encoding. Default is base58 encoding, for native segwit addresses specify bech32 encoding. Leave empty to derive from address
- **depth** (*int*) – Level of depth in BIP32 key path
- **change** (*int*) – Use 0 for normal address/key, and 1 for change address (for returned/change payments)
- **address_index** (*int*) – Index of address. Used in BIP32 key paths
- **network** (*str*) – Specify network filter, i.e.: bitcoin, testnet, litecoin, etc. Wil trigger check if address is valid for this network
- **network_overrides** (*dict*) – Override network settings for specific prefixes, i.e.: {"prefix_address_p2sh": "32"}. Used by settings in providers.json

Return Address

classmethod parse(*address*, *compressed=None*, *encoding=None*, *depth=None*, *change=None*, *address_index=None*, *network=None*, *network_overrides=None*)

Import an address to the Address class. Specify network if available, otherwise it will be derived form the address.

```
>>> addr = Address.parse(
↪'bc1qyftqrh3hm2yapnhh0ukaht83d02a7pda8l5uhkxk9ftzqsmyu7pst6rke3')
>>> addr.as_dict()
{'network': 'bitcoin', '_data': None, 'script_type': 'p2wsh', 'encoding':
↪'bech32', 'compressed': None, 'witness_type': 'segwit', 'depth': None, 'change
↪': None, 'address_index': None, 'prefix': 'bc', 'redeemscript': '', '_hashed_
↪data': None, 'address':
↪'bc1qyftqrh3hm2yapnhh0ukaht83d02a7pda8l5uhkxk9ftzqsmyu7pst6rke3', 'address_
↪orig': 'bc1qyftqrh3hm2yapnhh0ukaht83d02a7pda8l5uhkxk9ftzqsmyu7pst6rke3'}
```

Parameters

- **address** (*str*) – Address to import
- **compressed** (*bool*) – Is key compressed or not, default is None
- **encoding** (*str*) – Address encoding. Default is base58 encoding, for native segwit addresses specify bech32 encoding. Leave empty to derive from address
- **depth** (*int*) – Level of depth in BIP32 key path
- **change** (*int*) – Use 0 for normal address/key, and 1 for change address (for returned/change payments)
- **address_index** (*int*) – Index of address. Used in BIP32 key paths

- **network** (*str*) – Specify network filter, i.e.: bitcoin, testnet, litecoin, etc. Wil trigger check if address is valid for this network
- **network_overrides** (*dict*) – Override network settings for specific prefixes, i.e.: {"prefix_address_p2sh": "32"}. Used by settings in providers.json

Return Address

with_prefix(*prefix*)

Convert address using another prefix

Parameters **prefix** (*str, bytes*) – Address prefix

Return str Converted address

exception bitcoinlib.keys.**BKeyError**(*msg=''*)

Bases: Exception

Handle Key class Exceptions

class bitcoinlib.keys.**HDKey**(*import_key=None*, *key=None*, *chain=None*, *depth=0*, *parent_fingerprint=b'\x00\x00\x00\x00'*, *child_index=0*, *is_private=True*, *network=None*, *key_type='bip32'*, *password=''*, *compressed=True*, *encoding=None*, *witness_type=None*, *multisig=False*)

Bases: *bitcoinlib.keys.Key*

Class for Hierarchical Deterministic keys as defined in BIP0032

Besides a private or public key a HD Key has a chain code, allowing to create a structure of related keys.

The structure and key-path are defined in BIP0043 and BIP0044.

Hierarchical Deterministic Key class init function.

If no import_key is specified a key will be generated with systems cryptographically random function. Import key can be any format normal or HD key (extended key) accepted by get_key_format. If a normal key with no chain part is provided, an chain with only 32 0-bytes will be used.

```
>>> private_hex = '221ff330268a9bb5549a02c801764cffbc79d5c26f4041b26293a425fd5b557c'
>>> k = HDKey(private_hex)
>>> k
<HDKey(public_
↪hex=0363c152144dcd5253c1216b733fdc6eb8a94ab2cd5caa8ead5e59ab456ff99927, wif_
↪public=xpub661MyMwAqRbcEYS8w7XLSVeEsBXy79zSzH1J8vCdxAZningWLdN3zgtU6SmypHzZG2cYrwpGkWJqRxS6EAW77g
↪ network=bitcoin)>
```

Parameters

- **import_key** (*str, bytes, int*) – HD Key to import in WIF format or as byte with key (32 bytes) and chain (32 bytes)
- **key** (*bytes*) – Private or public key (length 32)
- **chain** (*bytes*) – A chain code (length 32)
- **depth** (*int*) – Level of depth in BIP32 key path
- **parent_fingerprint** (*bytes*) – 4-byte fingerprint of parent
- **child_index** (*int*) – Index number of child as integer
- **is_private** (*bool*) – True for private, False for public key. Default is True
- **network** (*str, Network*) – Network name. Derived from import_key if possible

- **key_type** (*str*) – HD BIP32 or normal Private Key. Default is 'bip32'
- **password** (*str*) – Optional password if imported key is password protected
- **compressed** (*bool*) – Is key compressed or not, default is True
- **encoding** (*str*) – Encoding used for address, i.e.: base58 or bech32. Default is base58 or derive from witness type
- **witness_type** (*str*) – Witness type used when creating scripts: legacy, p2sh-segwit or segwit.
- **multisig** (*bool*) – Specify if key is part of multisig wallet, used when creating key representations such as WIF and addreses

Return HDKey

address(*compressed=None*, *prefix=None*, *script_type=None*, *encoding=None*)

Get address derived from public key

```
>>> wif =
↪'xpub661MyMwAqRbcFcXi3aM3fVdd42FGDSdufhrr5tdobiPjMrPUykFMTdaFEr7yoy1xxeifDY8kh2k4h9N77MY6rk1
↪'
>>> k = HDKey(wif)
>>> k.address()
'15CacK61qnzJKpSpx9PFiC8X1ajeQxhq8a'
```

Parameters

- **compressed** (*bool*) – Always return compressed address
- **prefix** (*str, bytes*) – Specify versionbyte prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings
- **script_type** (*str*) – Type of script, i.e. p2sh or p2pkh.
- **encoding** (*str*) – Address encoding. Default is base58 encoding, for segwit you can specify bech32 encoding

Return str Base58 or Bech32 encoded address

as_dict(*include_private=False*)

Get current HDKey class as dictionary. Byte values are represented by hexadecimal strings.

Parameters **include_private** (*bool*) – Include private key information in dictionary

Return collections.OrderedDict

as_json(*include_private=False*)

Get current key as json formatted string

Parameters **include_private** (*bool*) – Include private key information in dictionary

Return str

bip38_encrypt(*password*)

BIP0038 non-ec-multiply encryption. Returns BIP0038 encrypted private key Based on code from https://github.com/nomorecoin/python-bip38-testing

```
>>> k = HDKey(
↪'zprvAWgYBBk7JR8GjAHfvjhGLKFGUJNcnPtkNryWfstePYJc4SVFYbaFk3Fpqn9dSmtPLKrPWB7WzsgzZzFiB1Qnhzo
↪')
>>> k.bip38_encrypt('my-secret-password')
'6PYUAKyDYo7Q6sSJ3ZYo4EFeWFTMkUES2mdvsMNBSoN5QyXPmeogxfumfW'
```

Parameters **password** (*str*) – Required password for encryption

Return str BIP38 password encrypted private key

child_private(*index=0*, *hardened=False*, *network=None*)

Use Child Key Derivation (CDK) to derive child private key of current HD Key object.

Used by *subkey_for_path()* to create key paths for instance to use in HD wallets. You can use this method to create your own key structures.

This method create private child keys, use *child_public()* to create public child keys.

```
>>> private_hex =
↪'d02220828cad5e0e0f25057071f4dae9bf38720913e46a596fd7eb8f83ad045d'
>>> k = HDKey(private_hex)
>>> ck = k.child_private(10)
>>> ck.address()
'1FgHK5JUa87ASxz5mz3ypeaUV23z9yW654'
>>> ck.depth
1
>>> ck.child_index
10
```

Parameters

- **index** (*int*) – Key index number
- **hardened** (*bool*) – Specify if key must be hardened (True) or normal (False)
- **network** (*str*) – Network name.

Return HDKey HD Key class object

child_public(*index=0*, *network=None*)

Use Child Key Derivation to derive child public key of current HD Key object.

Used by *subkey_for_path()* to create key paths for instance to use in HD wallets. You can use this method to create your own key structures.

This method create public child keys, use *child_private()* to create private child keys.

```
>>> private_hex =
↪'d02220828cad5e0e0f25057071f4dae9bf38720913e46a596fd7eb8f83ad045d'
>>> k = HDKey(private_hex)
>>> ck = k.child_public(15)
>>> ck.address()
'1PfLJJgKs8nUbMPpaQUucbGmr8qyNSMGeK'
>>> ck.depth
1
>>> ck.child_index
15
```

Parameters

- **index** (*int*) – Key index number
- **network** (*str*) – Network name.

Return HDKey HD Key class object

property fingerprint

Get key fingerprint: the last for bytes of the hash160 of this key.

Return bytes

static from_passphrase(*passphrase*, *password=''*, *network='bitcoin'*, *key_type='bip32'*, *compressed=True*, *encoding=None*, *witness_type='legacy'*, *multisig=False*)

Create key from Mnemonic passphrase

Parameters

- **passphrase** (*str*) – Mnemonic passphrase, list of words as string seperated with a space character
- **password** (*str*) – Password to protect passphrase
- **network** (*str, Network*) – Network to use
- **key_type** (*str*) – HD BIP32 or normal Private Key. Default is 'bip32'
- **compressed** (*bool*) – Is key compressed or not, default is True
- **encoding** (*str*) – Encoding used for address, i.e.: base58 or bech32. Default is base58 or derive from witness type
- **witness_type** (*str*) – Witness type used when creating scripts: legacy, p2sh-segwit or segwit.
- **multisig** (*bool*) – Specify if key is part of multisig wallet, used when creating key representations such as WIF and addreses

Return HDKey

static from_seed(*import_seed*, *key_type='bip32'*, *network='bitcoin'*, *compressed=True*, *encoding=None*, *witness_type='legacy'*, *multisig=False*)

Used by class init function, import key from seed

Parameters

- **import_seed** (*str, bytes*) – Private key seed as bytes or hexstring
- **key_type** (*str*) – Specify type of key, default is BIP32
- **network** (*str, Network*) – Network to use
- **compressed** (*bool*) – Is key compressed or not, default is True
- **encoding** (*str*) – Encoding used for address, i.e.: base58 or bech32. Default is base58 or derive from witness type
- **witness_type** (*str*) – Witness type used when creating scripts: legacy, p2sh-segwit or segwit.
- **multisig** (*bool*) – Specify if key is part of multisig wallet, used when creating key representations such as WIF and addresses

Return HDKey

info()
Prints key information to standard output

network_change(*new_network*)
Change network for current key

Parameters **new_network** (*str*) – Name of new network

Return bool True

public()
Public version of current private key. Strips all private information from HDKey object, returns deepcopy version of current object

Return HDKey

public_master(*account_id=0*, *purpose=None*, *multisig=None*, *witness_type=None*, *as_private=False*)
Derives a public master key for current HDKey. A public master key can be shared with other software administration tools to create readonly wallets or can be used to create multisignature wallets.

```
>>> private_hex =
↪'b66ed9778029d32ebede042c79f448da8f7ab9efba19c63b7d3cdf6925203b71'
>>> k = HDKey(private_hex)
>>> pm = k.public_master()
>>> pm.wif()

↪'xpub6CjFexgdDZEtHdW7V4LT8wS9rtG3m187pM9qhTpoZdViFhSv3tW9sWonQNtFN1TCkRGAQGKj1UC2ViHTqb7vJV3
↪'
```

Parameters

- **account_id** (*int*) – Account ID. Leave empty for account 0
- **purpose** (*int*) – BIP standard used, i.e. 44 for default, 45 for multisig, 84 for segwit. Derived from witness_type and multisig arguments if not provided
- **multisig** (*bool*) – Key is part of a multisignature wallet?
- **witness_type** (*str*) – Specify witness type, default is legacy. Use 'segwit' or 'p2sh-segwit' for segregated witness.
- **as_private** – Return private key if available. Default is to return public key

Return HDKey

public_master_multisig(*account_id=0*, *purpose=None*, *witness_type=None*, *as_private=False*)
Derives a public master key for current HDKey for use with multi signature wallets. Wrapper for the *public_master()* method.

Parameters

- **account_id** (*int*) – Account ID. Leave empty for account 0
- **purpose** (*int*) – BIP standard used, i.e. 44 for default, 45 for multisig, 84 for segwit.
- **witness_type** (*str*) – Specify witness type, default is legacy. Use 'segwit' or 'p2sh-segwit' for segregated witness.
- **as_private** – Return private key if available. Default is to return public key

Return HDKey

subkey_for_path(*path*, *network=None*)

Determine subkey for HD Key for given path. Path format: m / purpose' / coin_type' / account' / change / address_index

See BIP0044 bitcoin proposal for more explanation.

```
>>> wif =
↪'xprv9s21ZrQH143K4LvcS93AHEZh7gBiYND6zMoRiZQGL5wqbpCU2KJDY87Txuv9dduk9hAcsL76F8b5JKzDREf8EmX
↪'
>>> k = HDKey(wif)
>>> k.subkey_for_path("m/44'/0'/0'/0/2")
<HDKey(public_
↪hex=03004331ca7f0dcdd925abc4d0800a0d4a0562a02c257fa39185c55abdfc4f0c0c, wif_
↪public=xpub6GyQoEbMUNwu1LnbiCSaD8wLrcjyRCEQA8tNsFCH4pnvCbuWSZkSB6LUNe89YsCBTg1Ncs7vHJBjMvw2Q
↪ network=bitcoin)>
```

Parameters

- **path** (*str, list*) – BIP0044 key path
- **network** (*str*) – Network name.

Return HDKey HD Key class object of subkey

wif(*is_private=None*, *child_index=None*, *prefix=None*, *witness_type=None*, *multisig=None*)

Get Extended WIF of current key

```
>>> private_hex =
↪'221ff330268a9bb5549a02c801764cffbc79d5c26f4041b26293a425fd5b557c'
>>> k = HDKey(private_hex)
>>> k.wif()

↪'xpub661MyMwAqRbcEYS8w7XLSVeEsBXy79zSzH1J8vCdxAZningWLdN3zgtU6SmypHzZG2cYrwpGkWJqRxS6EAW77gd
↪'
```

Parameters

- **is_private** (*bool*) – Return public or private key
- **child_index** (*int*) – Change child index of output WIF key
- **prefix** (*str, bytes*) – Specify version prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings
- **witness_type** (*str*) – Specify witness type, default is legacy. Use 'segwit' for segregated witness.
- **multisig** (*bool*) – Key is part of a multisignature wallet?

Return str Base58 encoded WIF key

wif_key(*prefix=None*)

Get WIF of Key object. Call to parent object Key.wif()

Parameters **prefix** (*str, bytes*) – Specify versionbyte prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings

Return str Base58Check encoded Private Key WIF

wif_private(*prefix=None*, *witness_type=None*, *multisig=None*)
Get Extended WIF private key. Wrapper for the *wif()* method

Parameters

- **prefix** (*str, bytes*) – Specify version prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings
- **witness_type** (*str*) – Specify witness type, default is legacy. Use 'segwit' for segregated witness.
- **multisig** (*bool*) – Key is part of a multi signature wallet?

Return str Base58 encoded WIF key

wif_public(*prefix=None*, *witness_type=None*, *multisig=None*)
Get Extended WIF public key. Wrapper for the *wif()* method

Parameters

- **prefix** (*str, bytes*) – Specify version prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings
- **witness_type** (*str*) – Specify witness type, default is legacy. Use 'segwit' for segregated witness.
- **multisig** (*bool*) – Key is part of a multisignature wallet?

Return str Base58 encoded WIF key

class bitcoinlib.keys.**Key**(*import_key=None*, *network=None*, *compressed=True*, *password=''*, *is_private=None*, *strict=True*)

Bases: object

Class to generate, import and convert public cryptographic key pairs used for bitcoin.

If no key is specified when creating class a cryptographically secure Private Key is generated using the os.urandom() function.

Initialize a Key object. Import key can be in WIF, bytes, hexstring, etc. If import_key is empty a new private key will be generated.

If a private key is imported a public key will be derived. If a public is imported the private key data will be empty.

Both compressed and uncompressed key version is available, the compressed boolean attribute tells if the original imported key was compressed or not.

```
>>> k = Key('cNUpWJbC1hVJtyxyV4bVAnb4uJ7FPhr82geo1vnoA29XWkeiiCQn')
>>> k.secret
121272277086107546203375539852452923964442161118036950284195449442134423903 63
```

Can also be used to import BIP-38 password protected keys

```
>>> k2 = Key('6PYM8wAnnmAK5mHYoF7zqj88y5HtK7eiPeqPdu4WnYEFkYKEEoMFEVfuDg', password=
↪'test', network='testnet')
>>> k2.secret
121272277086107546203375539852452923964442161118036950284195449442134423903 63
```

Parameters

- **import_key** (*str, int, bytes*) – If specified import given private or public key. If not specified a new private key is generated.

- **network** (*str, Network*) – Bitcoin, testnet, litecoin or other network
- **compressed** (*bool*) – Is key compressed or not, default is True
- **password** (*str*) – Optional password if imported key is password protected
- **is_private** (*bool*) – Specify if imported key is private or public. Default is None: derive from provided key
- **strict** (*bool*) – Raise BKeyError if key is invalid. Default is True. Set to False if you're parsing blockchain transactions, as some may contain invalid keys, but the transaction is/was still valid.

Returns Key object

address(*compressed=None*, *prefix=None*, *script_type=None*, *encoding=None*)
Get address derived from public key

Parameters

- **compressed** (*bool*) – Always return compressed address
- **prefix** (*str, bytes*) – Specify versionbyte prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings
- **script_type** (*str*) – Type of script, i.e. p2sh or p2pkh.
- **encoding** (*str*) – Address encoding. Default is base58 encoding, for segwit you can specify bech32 encoding

Return str Base58 or Bech32 encoded address

property address_obj
Get address object property. Create standard address object if not defined already.

Return Address

address_uncompressed(*prefix=None*, *script_type=None*, *encoding=None*)
Get uncompressed address from public key

Parameters

- **prefix** (*str, bytes*) – Specify versionbyte prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings
- **script_type** (*str*) – Type of script, i.e. p2sh or p2pkh.
- **encoding** (*str*) – Address encoding. Default is base58 encoding, for segwit you can specify bech32 encoding

Return str Base58 encoded address

as_dict(*include_private=False*)
Get current Key class as dictionary. Byte values are represented by hexadecimal strings.

Parameters **include_private** (*bool*) – Include private key information in dictionary

Return collections.OrderedDict

as_json(*include_private=False*)
Get current key as json formatted string

Parameters **include_private** (*bool*) – Include private key information in dictionary

Return str

bip38_encrypt(*password*)
BIP0038 non-ec-multiply encryption. Returns BIP0038 encrypted private key Based on code from https://github.com/nomorecoin/python-bip38-testing

```
>>> k = Key('cNUpWJbC1hVJtyxyV4bVAnb4uJ7FPhr82geo1vnoA29XWkeiiCQn')
>>> k.bip38_encrypt('test')
'6PYM8wAnnmAK5mHYoF7zqj88y5HtK7eiPeqPdu4WnYEFkYKEEoMFEVfuDg'
```

Parameters **password** (*str*) – Required password for encryption

Return str BIP38 password encrypted private key

property hash160
Get public key in RIPEMD-160 + SHA256 format

Return bytes

hex()

info()
Prints key information to standard output

public()
Get public version of current key. Removes all private information from current key

Return Key Public key

public_point()
Get public key point on Elliptic curve

Return tuple (x, y) point

wif(*prefix=None*)
Get private Key in Wallet Import Format, steps: # Convert to Binary and add 0x80 hex # Calculate Double SHA256 and add as checksum to end of key

Parameters **prefix** (*str, bytes*) – Specify versionbyte prefix in hexstring or bytes. Normally doesn't need to be specified, method uses default prefix from network settings

Return str Base58Check encoded Private Key WIF

property x

property y

class bitcoinlib.keys.**Signature**(*r*, *s*, *txid=None*, *secret=None*, *signature=None*, *der_signature=None*, *public_key=None*, *k=None*, *hash_type=1*)
Bases: object

Signature class for transactions. Used to create signatures to sign transaction and verification

Sign a transaction hash with a private key and show DER encoded signature:

```
>>> sk = HDKey('f2620684cef2b677dc2f043be8f0873b61e79b274c7e7feeb434477c082e0dc2')
>>> txid = 'c77545c8084b6178366d4e9a06cf99a28d7b5ff94ba8bd76bbbce66ba8cdef70'
>>> signature = sign(txid, sk)
>>> signature.as_der_encoded().hex()

↪'30440220015f9d39d8b53c68c7549d5dc4cbdafe1c71bae3656b93a02d2209e413d9bbcd00220615cf626da0a81945a70
↪'
```

Initialize Signature object with provided r and r value

```
>>> r =␣
↪32979225540043540145671192266052053680452913207619328973512110841045982813493
>>> s =␣
↪12990793585889366641563976043319195006380846016310271470330687369836458989268
>>> sig = Signature(r, s)
>>> sig.hex()

↪'48e994862e2cdb372149bad9d9894cf3a5562b4565035943efe0acc502769d351cb88752b5fe8d70d85f3541046df617
↪'
```

Parameters

- **r** (*int*) – r value of signature
- **s** (*int*) – s value of signature
- **txid** (*bytes, hexstring*) – Transaction hash z to sign if known
- **secret** (*int*) – Private key secret number
- **signature** (*str, bytes*) – r and s value of signature as string
- **der_signature** (*str, bytes*) – DER encoded signature
- **public_key** (HDKey, Key, *str, hexstring, bytes*) – Provide public key P if known
- **k** (*int*) – k value used for signature

as_der_encoded(*as_hex=False*, *include_hash_type=True*)

Get DER encoded signature

Parameters

- **as_hex** (*bool*) – Output as hexstring
- **include_hash_type** (*bool*) – Include hash_type byte at end of signatures as used in raw scripts. Default is True

Return bytes

bytes()

Signature r and s value as single bytes string

Return bytes

static create(*txid*, *private*, *use_rfc6979=True*, *k=None*)

Sign a transaction hash and create a signature with provided private key.

```
>>> k = 'b2da575054fb5daba0efde613b0b8e37159b8110e4be50f73cbe6479f6038f5b'
>>> txid = '0d12fdc4aac9eaaab9730999e0ce84c3bd5bb38dfd1f4c90c613ee177987429c'
>>> sig = Signature.create(txid, k)
>>> sig.hex()

↪'48e994862e2cdb372149bad9d9894cf3a5562b4565035943efe0acc502769d351cb88752b5fe8d70d85f3541046
↪'
>>> sig.r
32979225540043540145671192266052053680452913207619328973512110841045982813493
>>> sig.s
12990793585889366641563976043319195006380846016310271470330687369836458989268
```

Parameters

- **txid** (*bytes, str*) – Transaction signature or transaction hash. If unhashed transaction or message is provided the double_sha256 hash of message will be calculated.
- **private** (HDKey, Key, *str*, *hexstring*, *bytes*) – Private key as HDKey or Key object, or any other string accepted by HDKey object
- **use_rfc6979** (*bool*) – Use deterministic value for k nonce to derive k from txid/message according to RFC6979 standard. Default is True, set to False to use random k
- **k** (*int*) – Provide own k. Only use for testing or if you known what you are doing. Providing wrong value for k can result in leaking your private key!

Return Signature

from_str()
staticmethod(function) -> method

Convert a function to be a static method.

A static method does not receive an implicit first argument. To declare a static method, use this idiom:

class C: @staticmethod def f(arg1, arg2, ...):

...

It can be called either on the class (e.g. C.f()) or on an instance (e.g. C().f()). The instance is ignored except for its class.

Static methods in Python are similar to those found in Java or C++. For a more advanced concept, see the classmethod builtin.

hex()
Signature r and s value as single hexadecimal string

Return hexstring

classmethod parse(*signature*, *public_key=None*)

static parse_bytes(*signature*, *public_key=None*)
Create a signature from signature string with r and s part. Signature length must be 64 bytes or 128 character hexstring

Parameters

- **signature** (*bytes*) – Signature string
- **public_key** (HDKey, Key, *str*, *hexstring*, *bytes*) – Public key as HDKey or Key object or any other string accepted by HDKey object

Return Signature

classmethod parse_hex(*signature*, *public_key=None*)

property public_key
Return public key as HDKey object

Return HDKey

property txid

verify(*txid=None*, *public_key=None*)
Verify this signature. Provide txid or public_key if not already known

```
>>> k = 'b2da575054fb5daba0efde613b0b8e37159b8110e4be50f73cbe6479f6038f5b'
>>> pub_key = HDKey(k).public()
>>> txid = '0d12fdc4aac9eaaab9730999e0ce84c3bd5bb38dfd1f4c90c613ee177987429c'
>>> sig =
↪'48e994862e2cdb372149bad9d9894cf3a5562b4565035943efe0acc502769d351cb88752b5fe8d70d85f3541046
↪'
>>> sig = Signature.parse_hex(sig)
>>> sig.verify(txid, pub_key)
True
```

Parameters

- **txid** (*bytes, hexstring*) – Transaction hash
- **public_key** (HDKey, Key, *str, hexstring, bytes*) – Public key P

Return bool

bitcoinlib.keys.**addr_convert**(*addr*, *prefix*, *encoding=None*, *to_encoding=None*)

Convert address to another encoding and/or address with another prefix.

```
>>> addr_convert('1GMDUKLom6bJuY37RuFNc6PHv1rv2Hziuo', prefix='bc', to_encoding=
↪'bech32')
'bc1q4pwfmstmw8q80nxtxud2h42lev9xzcjqwqyq7t'
```

Parameters

- **addr** (*str*) – Base58 address
- **prefix** (*str, bytes*) – New address prefix
- **encoding** (*str*) – Encoding of original address: base58 or bech32. Leave empty to extract from address
- **to_encoding** (*str*) – Encoding of converted address: base58 or bech32. Leave empty use same encoding as original address

Return str New converted address

bitcoinlib.keys.**check_network_and_key**(*key*, *network=None*, *kf_networks=None*, *default_network='bitcoin'*)

Check if given key corresponds with given network and return network if it does. If no network is specified this method tries to extract the network from the key. If no network can be extracted from the key the default network will be returned.

```
>>> check_network_and_key('L4dTuJf2ceEdWDvCPsLhYf8GiiuYqXtqfbcKdC21BPDvEM1ykJRC')
'bitcoin'
```

A BKeyError will be raised if key does not correspond with network or if multiple network are found.

Parameters

- **key** (*str, int, bytes*) – Key in any format recognized by get_key_format function
- **network** (*str, None*) – Optional network. Method raises BKeyError if keys belongs to another network
- **kf_networks** (*list, None*) – Optional list of networks which is returned by get_key_format. If left empty the get_key_format function will be called.

- **default_network** (*str, None*) – Specify different default network, leave empty for default (bitcoin)

Return str Network name

bitcoinlib.keys.**deserialize_address**(*address*, *encoding=None*, *network=None*)

Deserialize address. Calculate public key hash and try to determine script type and network.

The 'network' dictionary item with contains the network with highest priority if multiple networks are found. Same applies for the script type.

Specify the network argument if network is known to avoid unexpected results.

If more networks and or script types are found you can find these in the 'networks' field.

```
>>> deserialize_address('1Khyc5eUddbhYZ8bEZi9wiN8TrmQ8uND4j')
{'address': '1Khyc5eUddbhYZ8bEZi9wiN8TrmQ8uND4j', 'encoding': 'base58', 'public_key_
↪hash': 'cd322766c02e7c37c3e3f9b825cd41ffbdcd17d7', 'public_key_hash_bytes': b"\
↪xcd2'f\xc0.|7\xc3\xe3\xf9\xb8%\xcdA\xff\xbd\xcd\x17\xd7", 'prefix': b'\x00',
↪'network': 'bitcoin', 'script_type': 'p2pkh', 'witness_type': 'legacy', 'networks
↪': ['bitcoin', 'regtest']}
```

Parameters

- **address** (*str*) – A base58 or bech32 encoded address
- **encoding** (*str*) – Encoding scheme used for address encoding. Attempts to guess encoding if not specified.
- **network** (*str*) – Specify network filter, i.e.: bitcoin, testnet, litecoin, etc. Wil trigger check if address is valid for this network

Return dict with information about this address

bitcoinlib.keys.**ec_point**(*m*)

Method for elliptic curve multiplication on the secp256k1 curve. Multiply Generator point G with m

Parameters **m** (*int*) – A point on the elliptic curve

Return Point Point multiplied by generator G

bitcoinlib.keys.**get_key_format**(*key*, *is_private=None*)

Determines the type (private or public), format and network key.

This method does not validate if a key is valid.

```
>>> get_key_format('L4dTuJf2ceEdWDvCPsLhYf8GiiuYqXtqfbcKdC21BPDvEM1ykJRC')
{'format': 'wif_compressed', 'networks': ['bitcoin', 'regtest'], 'is_private': True,
↪ 'script_types': [], 'witness_types': ['legacy'], 'multisig': [False]}
```

```
>>> get_key_format('becc7ac3b383cd609bd644aa5f102a811bac49b6a34bbd8afe706e32a9ac5c5e
↪')
{'format': 'hex', 'networks': None, 'is_private': True, 'script_types': [],
↪'witness_types': ['legacy'], 'multisig': [False]}
```

```
>>> get_key_format(
↪'Zpub6vZyhw1ShkEwNxtqfjk7jiwoEbZYMJdbWLHvEwo6Ns2fFc9rdQn3SerYFQXYxtZYbA8a1d83shW3g4WbsnVsymy2L8m7
↪')
{'format': 'hdkey_public', 'networks': ['bitcoin', 'regtest'], 'is_private': False,
↪'script_types': ['p2wsh'], 'witness_types': ['segwit'], 'multisig': [True]}
```

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Parameters

- **key** (*str, int, bytes*) – Any private or public key
- **is_private** (*bool*) – Is key private or not?

Return dict Dictionary with format, network and is_private

bitcoinlib.keys.**mod_sqrt**(*a*)

Compute the square root of 'a' using the secp256k1 'bitcoin' curve

Used to calculate y-coordinate if only x-coordinate from public key point is known. Formula: y ** 2 == x ** 3 + 7

Parameters **a** (*int*) – Number to calculate square root

Return int

bitcoinlib.keys.**path_expand**(*path*, *path_template=None*, *level_offset=None*, *account_id=0*, *cosigner_id=0*, *purpose=44*, *address_index=0*, *change=0*, *witness_type='legacy'*, *multisig=False*, *network='bitcoin'*)

Create key path. Specify part of key path and path settings

```
>>> path_expand([10, 20], witness_type='segwit')
['m', "84'", "0'", "0'", '10', '20']
```

Parameters

- **path** (*list, str*) – Part of path, for example [0, 2] for change=0 and address_index=2
- **path_template** (*list*) – Template for path to create, default is BIP 44: ["m", "purpose'", "coin_type'", "account'", "change", "address_index"]
- **level_offset** (*int*) – Just create part of path. For example -2 means create path with the last 2 items (change, address_index) or 1 will return the master key 'm'
- **account_id** (*int*) – Account ID
- **cosigner_id** (*int*) – ID of cosigner
- **purpose** (*int*) – Purpose value
- **address_index** (*int*) – Index of key, normally provided to 'path' argument
- **change** (*int*) – Change key = 1 or normal = 0, normally provided to 'path' argument
- **witness_type** (*str*) – Witness type for paths with a script ID, specify 'p2sh-segwit' or 'segwit'
- **multisig** (*bool*) – Is path for multisig keys?
- **network** (*str*) – Network name. Leave empty for default network

Return list

bitcoinlib.keys.**sign**(*txid*, *private*, *use_rfc6979=True*, *k=None*)

Sign transaction hash or message with secret private key. Creates a signature object.

Sign a transaction hash with a private key and show DER encoded signature

```
>>> sk = HDKey('728afb86a98a0b60cc81faadaa2c12bc17d5da61b8deaf1c08fc07caf424d493')
>>> txid = 'c77545c8084b6178366d4e9a06cf99a28d7b5ff94ba8bd76bbbce66ba8cdef70'
>>> signature = sign(txid, sk)
>>> signature.as_der_encoded().hex()

↪'30440220792f04c5ba654e27eb636ceb7804c5590051dd77da8b80244f1fa8dfbff369b302204ba03b039c808a0403d0
↪'
```

Parameters

- **txid** (*bytes, str*) – Transaction signature or transaction hash. If unhashed transaction or message is provided the double_sha256 hash of message will be calculated.
- **private** (HDKey, Key, *str, hexstring, bytes*) – Private key as HDKey or Key object, or any other string accepted by HDKey object
- **use_rfc6979** (*bool*) – Use deterministic value for k nonce to derive k from txid/message according to RFC6979 standard. Default is True, set to False to use random k
- **k** (*int*) – Provide own k. Only use for testing or if you known what you are doing. Providing wrong value for k can result in leaking your private key!

Return Signature

bitcoinlib.keys.**verify**(*txid*, *signature*, *public_key=None*)

Verify provided signature with txid message. If provided signature is no Signature object a new object will be created for verification.

```
>>> k = 'b2da575054fb5daba0efde613b0b8e37159b8110e4be50f73cbe6479f6038f5b'
>>> pub_key = HDKey(k).public()
>>> txid = '0d12fdc4aac9eaaab9730999e0ce84c3bd5bb38dfd1f4c90c613ee177987429c'
>>> sig =
↪'48e994862e2cdb372149bad9d9894cf3a5562b4565035943efe0acc502769d351cb88752b5fe8d70d85f3541046df617
↪'
>>> verify(txid, sig, pub_key)
True
```

Parameters

- **txid** (*bytes, hexstring*) – Transaction hash
- **signature** (*str, bytes*) – signature as hexstring or bytes
- **public_key** (HDKey, Key, *str, hexstring, bytes*) – Public key P. If not provided it will be derived from provided Signature object or raise an error if not available

Return bool

8.10 bitcoinlib.transactions module

class bitcoinlib.transactions.**Input**(*prev_txid*, *output_n*, *keys=None*, *signatures=None*, *public_hash=b''*, *unlocking_script=b''*, *unlocking_script_unsigned=None*, *script=None*, *script_type=None*, *address=''*, *sequence=4294967295*, *compressed=None*, *sigs_required=None*, *sort=False*, *index_n=0*, *value=0*, *double_spend=False*, *locktime_cltv=None*, *locktime_csv=None*, *key_path=''*, *witness_type=None*, *witnesses=None*, *encoding=None*, *strict=True*, *network='bitcoin'*)

Bases: `object`

Transaction Input class, used by Transaction class

An Input contains a reference to an UTXO or Unspent Transaction Output (prev_txid + output_n). To spent the UTXO an unlocking script can be included to prove ownership.

Inputs are verified by the Transaction class.

Create a new transaction input

Parameters

- **prev_txid** (*bytes, str*) – Transaction hash of the UTXO (previous output) which will be spent.
- **output_n** (*bytes, int*) – Output number in previous transaction.
- **keys** (*list (bytes, str, Key)*) – A list of Key objects or public / private key string in various formats. If no list is provided but a bytes or string variable, a list with one item will be created. Optional
- **signatures** (*list (bytes, str, Signature)*) – Specify optional signatures
- **public_hash** (*bytes*) – Public key hash or script hash. Specify if key is not available
- **unlocking_script** (*bytes, hexstring*) – Unlocking script (scriptSig) to prove ownership. Optional
- **unlocking_script_unsigned** (*bytes, hexstring*) – Unlocking script for signing transaction
- **script_type** (*str*) – Type of unlocking script used, i.e. p2pkh or p2sh_multisig. Default is p2pkh
- **address** (*str, Address*) – Address string or object for input
- **sequence** (*bytes, int*) – Sequence part of input, you normally do not have to touch this
- **compressed** (*bool*) – Use compressed or uncompressed public keys. Default is compressed
- **sigs_required** (*int*) – Number of signatures required for a p2sh_multisig unlocking script
- **sort** (*boolean*) – Sort public keys according to BIP0045 standard. Default is False to avoid unexpected change of key order.
- **index_n** (*int*) – Index of input in transaction. Used by Transaction class.
- **value** (*int, Value, str*) – Value of input in smallest denominator integers (Satoshi's) or as Value object or string
- **double_spend** (*bool*) – Is this input also spend in another transaction
- **locktime_cltv** (*int*) – Check Lock Time Verify value. Script level absolute time lock for this input

- **locktime_csv** (*int*) – Check Sequence Verify value
- **key_path** (*str, list*) – Key path of input key as BIP32 string or list
- **witness_type** (*str*) – Specify witness/signature position: 'segwit' or 'legacy'. Determine from script, address or encoding if not specified.
- **witnesses** (*list of bytes, list of str*) – List of witnesses for inputs, used for segwit transactions for instance.
- **encoding** (*str*) – Address encoding used. For example bech32/base32 or base58. Leave empty for default
- **strict** (*bool*) – Raise exception when input is malformed, incomplete or not understood
- **network** (*str, Network*) – Network, leave empty for default

as_dict()
Get transaction input information in json format

Return dict Json with output_n, prev_txid, output_n, type, address, public_key, public_hash, unlocking_script and sequence

classmethod parse(*raw*, *witness_type='segwit'*, *index_n=0*, *strict=True*, *network='bitcoin'*)
Parse raw BytesIO string and return Input object

Parameters

- **raw** (*BytesIO*) – Input
- **witness_type** (*str*) – Specify witness/signature position: 'segwit' or 'legacy'. Derived from script if not specified.
- **index_n** (*int*) – Index number of input
- **strict** (*bool*) – Raise exception when input is malformed, incomplete or not understood
- **network** (*str, Network*) – Network, leave empty for default

Return Input

update_scripts(*hash_type=1*)
Method to update Input scripts.

Creates or updates unlocking script, witness script for segwit inputs, multisig redeemscripts and locktime scripts. This method is called when initializing a Input class or when signing an input.

Parameters **hash_type** (*int*) – Specific hash type, default is SIGHASH_ALL

Return bool Always returns True when method is completed

class bitcoinlib.transactions.**Output**(*value*, *address=''*, *public_hash=b''*, *public_key=b''*, *lock_script=b''*, *spent=False*, *output_n=0*, *script_type=None*, *encoding=None*, *spending_txid=''*, *spending_index_n=None*, *strict=True*, *network='bitcoin'*)

Bases: object

Transaction Output class, normally part of Transaction class.

Contains the amount and destination of a transaction.

Create a new transaction output

An transaction outputs locks the specified amount to a public key. Anyone with the private key can unlock this output.

The transaction output class contains an amount and the destination which can be provided either as address, public key, public key hash or a locking script. Only one needs to be provided as the they all can be derived from each other, but you can provide as much attributes as you know to improve speed.

Parameters

- **value** (*int*, Value, *str*) – Amount of output in smallest denominator integers (Satoshi's) or as Value object or string
- **address** (*str*, Address, HDKey) – Destination address of output. Leave empty to derive from other attributes you provide. An instance of an Address or HDKey class is allowed as argument.
- **public_hash** (*bytes*, *str*) – Hash of public key or script
- **public_key** (*bytes*, *str*) – Destination public key
- **lock_script** (*bytes*, *str*) – Locking script of output. If not provided a default unlocking script will be provided with a public key hash.
- **spent** (*bool*) – Is output already spent? Default is False
- **output_n** (*int*) – Output index number, default is 0. Index number has to be unique per transaction and 0 for first output, 1 for second, etc
- **script_type** (*str*) – Script type of output (p2pkh, p2sh, segwit p2wpkh, etc). Extracted from lock_script if provided.
- **encoding** (*str*) – Address encoding used. For example bech32/base32 or base58. Leave empty to derive from address or default base58 encoding
- **spending_txid** (*str*) – Transaction hash of input spending this transaction output
- **spending_index_n** (*int*) – Index number of input spending this transaction output
- **strict** (*bool*) – Raise exception when output is malformed, incomplete or not understood
- **network** (*str*, Network) – Network, leave empty for default

as_dict()
Get transaction output information in json format

Return dict Json with amount, locking script, public key, public key hash and address

classmethod parse(*raw*, *output_n=0*, *strict=True*, *network='bitcoin'*)
Parse raw BytesIO string and return Output object

Parameters

- **raw** (*BytesIO*) – raw output stream
- **output_n** (*int*) – Output number of Transaction output
- **strict** (*bool*) – Raise exception when output is malformed, incomplete or not understood
- **network** (*str*, Network) – Network, leave empty for default network

Return Output

set_locktime_relative(*locktime*)
Relative timelocks with CHECKSEQUENCEVERIFY (CSV) as defined in BIP112 :param locktime: :return:

set_locktime_relative_blocks(*blocks*)
Set nSequence relative locktime for this transaction input. The transaction will only be valid if the specified number of blocks has been mined since the previous UTXO is confirmed.

Maximum number of blocks is 65535 as defined in BIP-0068, which is around 455 days.

When setting an relative timelock, the transaction version must be at least 2. The transaction will be updated so existing signatures for this input will be removed.

Parameters **blocks** (*int*) – The blocks value is the number of blocks since the previous transaction output has been confirmed.

Return None

set_locktime_relative_time(*seconds*)

Set nSequence relative locktime for this transaction input. The transaction will only be valid if the specified amount of seconds have been passed since the previous UTXO is confirmed.

Number of seconds will be rounded to the nearest 512 seconds. Any value below 512 will be interpreted as 512 seconds.

Maximum number of seconds is 33553920 (512 * 65535), which equals 384 days. See BIP-0068 definition.

When setting an relative timelock, the transaction version must be at least 2. The transaction will be updated so existing signatures for this input will be removed.

Parameters **seconds** – Number of seconds since the related previous transaction output has been confirmed.

Returns

class bitcoinlib.transactions.**Transaction**(*inputs=None*, *outputs=None*, *locktime=0*, *version=None*, *network='bitcoin'*, *fee=None*, *fee_per_kb=None*, *size=None*, *txid=''*, *txhash=''*, *date=None*, *confirmations=None*, *block_height=None*, *block_hash=None*, *input_total=0*, *output_total=0*, *rawtx=b''*, *status='new'*, *coinbase=False*, *verified=False*, *witness_type='legacy'*, *flag=None*)

Bases: object

Transaction Class

Contains 1 or more Input class object with UTXO's to spent and 1 or more Output class objects with destinations. Besides the transaction class contains a locktime and version.

Inputs and outputs can be included when creating the transaction, or can be add later with add_input and add_output respectively.

A verify method is available to check if the transaction Inputs have valid unlocking scripts.

Each input in the transaction can be signed with the sign method provided a valid private key.

Create a new transaction class with provided inputs and outputs.

You can also create a empty transaction and add input and outputs later.

To verify and sign transactions all inputs and outputs need to be included in transaction. Any modification after signing makes the transaction invalid.

Parameters

- **inputs** (*list (Input)*) – Array of Input objects. Leave empty to add later
- **outputs** (*list (Output)*) – Array of Output object. Leave empty to add later
- **locktime** (*int*) – Transaction level locktime. Locks the transaction until a specified block (value from 1 to 5 million) or until a certain time (Timestamp in seconds after 1-jan-1970). Default value is 0 for transactions without locktime
- **version** (*bytes, int*) – Version rules. Defaults to 1 in bytes

- **network** (*str, Network*) – Network, leave empty for default network
- **fee** (*int*) – Fee in smallest denominator (ie Satoshi) for complete transaction
- **fee_per_kb** (*int*) – Fee in smallest denominator per kilobyte. Specify when exact transaction size is not known.
- **size** (*int*) – Transaction size in bytes
- **txid** (*str*) – The transaction id (same for legacy/segwit) based on [nVersion][txins][txouts][nLockTime as hexadecimal string
- **txhash** (*str*) – The transaction hash (differs from txid for witness transactions), based on [nVersion][marker][flag][txins][txouts][witness][nLockTime] in Segwit (as hexadecimal string). Unused at the moment
- **date** (*datetime*) – Confirmation date of transaction
- **confirmations** (*int*) – Number of confirmations
- **block_height** (*int*) – Block number which includes transaction
- **block_hash** (*str*) – Hash of block for this transaction
- **input_total** (*int*) – Total value of inputs
- **output_total** (*int*) – Total value of outputs
- **rawtx** (*bytes*) – Bytes representation of complete transaction
- **status** (*str*) – Transaction status, for example: 'new', 'unconfirmed', 'confirmed'
- **coinbase** (*bool*) – Coinbase transaction or not?
- **verified** (*bool*) – Is transaction successfully verified? Updated when verified() method is called
- **witness_type** (*str*) – Specify witness/signature position: 'segwit' or 'legacy'. Determine from script, address or encoding if not specified.
- **flag** (*bytes, str*) – Transaction flag to indicate version, for example for SegWit

add_input(*prev_txid*, *output_n*, *keys=None*, *signatures=None*, *public_hash=b''*, *unlocking_script=b''*, *unlocking_script_unsigned=None*, *script_type=None*, *address=''*, *sequence=4294967295*, *compressed=True*, *sigs_required=None*, *sort=False*, *index_n=None*, *value=None*, *double_spend=False*, *locktime_cltv=None*, *locktime_csv=None*, *key_path=''*, *witness_type=None*, *witnesses=None*, *encoding=None*, *strict=True*)

Add input to this transaction

Wrapper for append method of Input class.

Parameters

- **prev_txid** (*bytes, hexstring*) – Transaction hash of the UTXO (previous output) which will be spent.
- **output_n** (*bytes, int*) – Output number in previous transaction.
- **keys** (*bytes, str*) – Public keys can be provided to construct an Unlocking script. Optional
- **signatures** (*bytes, str*) – Add signatures to input if already known
- **public_hash** (*bytes*) – Specify public hash from key or redeemscript if key is not available

- **unlocking_script** (*bytes, hexstring*) – Unlocking script (scriptSig) to prove ownership. Optional
- **unlocking_script_unsigned** (*bytes, str*) – TODO: find better name...
- **script_type** (*str*) – Type of unlocking script used, i.e. p2pkh or p2sh_multisig. Default is p2pkh
- **address** (*str, Address*) – Specify address of input if known, default is to derive from key or scripts
- **sequence** (*int, bytes*) – Sequence part of input, used for timelocked transactions
- **compressed** (*bool*) – Use compressed or uncompressed public keys. Default is compressed
- **sigs_required** – Number of signatures required for a p2sh_multisig unlocking script
- **sigs_required** – int
- **sort** (*boolean*) – Sort public keys according to BIP0045 standard. Default is False to avoid unexpected change of key order.
- **index_n** (*int*) – Index number of position in transaction, leave empty to add input to end of inputs list
- **value** (*int*) – Value of input
- **double_spend** (*bool*) – True if double spend is detected, depends on which service provider is selected
- **locktime_cltv** (*int*) – Check Lock Time Verify value. Script level absolute time lock for this input
- **locktime_csv** (*int*) – Check Sequency Verify value.
- **key_path** (*str, list*) – Key path of input key as BIP32 string or list
- **witness_type** (*str*) – Specify witness/signature position: 'segwit' or 'legacy'. Determine from script, address or encoding if not specified.
- **witnesses** (*list of bytes, list of str*) – List of witnesses for inputs, used for segwit transactions for instance.
- **encoding** (*str*) – Address encoding used. For example bech32/base32 or base58. Leave empty to derive from script or script type
- **strict** (*bool*) – Raise exception when input is malformed or incomplete

Return int Transaction index number (index_n)

add_output(*value*, *address=''*, *public_hash=b''*, *public_key=b''*, *lock_script=b''*, *spent=False*, *output_n=None*, *encoding=None*, *spending_txid=None*, *spending_index_n=None*, *strict=True*)

Add an output to this transaction

Wrapper for the append method of the Output class.

Parameters

- **value** (*int*) – Value of output in smallest denominator of currency, for example satoshi's for bitcoins
- **address** (*str, Address*) – Destination address of output. Leave empty to derive from other attributes you provide.
- **public_hash** (*bytes, str*) – Hash of public key or script

- **public_key** (*bytes, str*) – Destination public key
- **lock_script** (*bytes, str*) – Locking script of output. If not provided a default unlocking script will be provided with a public key hash.
- **spent** (*bool, None*) – Has output been spent in new transaction?
- **output_n** (*int*) – Index number of output in transaction
- **encoding** (*str*) – Address encoding used. For example bech32/base32 or base58. Leave empty for to derive from script or script type
- **spending_txid** (*str*) – Transaction hash of input spending this transaction output
- **spending_index_n** (*int*) – Index number of input spending this transaction output
- **strict** (*bool*) – Raise exception when output is malformed or incomplete

Return int Transaction output number (output_n)

as_dict()
Return Json dictionary with transaction information: Inputs, outputs, version and locktime

Return dict

as_json()
Get current key as json formatted string

Return str

calc_weight_units()
Calculate weight units and vsize for this Transaction. Weight units are used to determine fee.

Return int

calculate_fee()
Get fee for this transaction in smallest denominator (i.e. Satoshi) based on its size and the transaction.fee_per_kb value

Return int Estimated transaction fee

estimate_size(*number_of_change_outputs=0*)
Get estimated vsize in for current transaction based on transaction type and number of inputs and outputs.

For old-style legacy transaction the vsize is the length of the transaction. In segwit transaction the witness data has less weight. The formula used is: math.ceil(((est_size-witness_size) * 3 + est_size) / 4)

Parameters **number_of_change_outputs** (*int*) – Number of change outputs, default is 0

Return int Estimated transaction size

static import_raw(*rawtx*, *network='bitcoin'*, *check_size=True*)
Import a raw transaction and create a Transaction object

Uses the transaction_deserialize method to parse the raw transaction and then calls the init method of this transaction class to create the transaction object

REPLACED BY THE PARSE() METHOD

Parameters

- **rawtx** (*bytes, str*) – Raw transaction string
- **network** (*str, Network*) – Network, leave empty for default
- **check_size** (*bool*) – Check if no bytes are left when parsing is finished. Disable when parsing list of transactions, such as the transactions in a raw block. Default is True

Return Transaction

`info()`
Prints transaction information to standard output

`static load(txid=None, filename=None)`
Load transaction object from file which has been stored with the *save()* method.

Specify transaction ID or filename.

Parameters

- **txid** (*str*) – Transaction ID. Transaction object will be read from .bitcoinlib datadir
- **filename** (*str*) – Name of transaction object file

Return Transaction

`merge_transaction(transaction)`
Merge this transaction with provided Transaction object.

Add all inputs and outputs of a transaction to this Transaction object. Because the transaction signature changes with this operation, the transaction inputs need to be signed again.

Can be used to implement CoinJoin. Where two or more unrelated Transactions are merged into 1 transaction to safe fees and increase privacy.

Parameters **transaction** (Transaction) – The transaction to be merged

`classmethod parse(rawtx, strict=True, network='bitcoin')`
Parse a raw transaction and create a Transaction object

Parameters

- **rawtx** (*BytesIO, bytes, str*) – Raw transaction string
- **strict** (*bool*) – Raise exception when transaction is malformed, incomplete or not understood
- **network** (*str, Network*) – Network, leave empty for default network

Return Transaction

`classmethod parse_bytes(rawtx, strict=True, network='bitcoin')`
Parse a raw bytes transaction and create a Transaction object. Wrapper for the *parse_bytesio()* method

Parameters

- **rawtx** (*bytes*) – Raw transaction hexadecimal string
- **strict** (*bool*) – Raise exception when transaction is malformed, incomplete or not understood
- **network** (*str, Network*) – Network, leave empty for default network

Return Transaction

`classmethod parse_bytesio(rawtx, strict=True, network='bitcoin')`
Parse a raw transaction and create a Transaction object

Parameters

- **rawtx** (*BytesIO*) – Raw transaction string
- **strict** (*bool*) – Raise exception when transaction is malformed, incomplete or not understood
- **network** (*str, Network*) – Network, leave empty for default network

Return Transaction

classmethod parse_hex(*rawtx*, *strict=True*, *network='bitcoin'*)

Parse a raw hexadecimal transaction and create a Transaction object. Wrapper for the *parse_bytesio()* method

Parameters

- **rawtx** (*str*) – Raw transaction hexadecimal string
- **strict** (*bool*) – Raise exception when transaction is malformed, incomplete or not understood
- **network** (*str, Network*) – Network, leave empty for default network

Return Transaction

raw(*sign_id=None*, *hash_type=1*, *witness_type=None*)

Serialize raw transaction

Return transaction with signed inputs if signatures are available

Parameters

- **sign_id** (*int, None*) – Create raw transaction which can be signed by transaction with this input ID
- **hash_type** (*int*) – Specific hash type, default is SIGHASH_ALL
- **witness_type** (*str*) – Serialize transaction with other witness type then default. Use to create legacy raw transaction for segwit transaction to create transaction signature ID's

Return bytes

raw_hex(*sign_id=None*, *hash_type=1*, *witness_type=None*)

Wrapper for raw() method. Return current raw transaction hex

Parameters

- **sign_id** (*int*) – Create raw transaction which can be signed by transaction with this input ID
- **hash_type** (*int*) – Specific hash type, default is SIGHASH_ALL
- **witness_type** (*str*) – Serialize transaction with other witness type then default. Use to create legacy raw transaction for segwit transaction to create transaction signature ID's

Return hexstring

save(*filename=None*)

Store transaction object as file so it can be imported in bitcoinlib later with the *load()* method.

Parameters **filename** (*str*) – Location and name of file, leave empty to store transaction in bitcoinlib data directory: .bitcoinlib/<transaction_id.tx)

Returns

set_locktime_blocks(*blocks*)

Set nLocktime, a transaction level absolute lock time in blocks using the transaction sequence field.

So for example if you set this value to 600000 the transaction will only be valid after block 600000.

Parameters **blocks** (*int*) – Transaction is valid after supplied block number. Value must be between 0 and 500000000. Zero means no locktime.

Returns

set_locktime_relative_blocks(*blocks*, *input_index_n=0*)
Set nSequence relative locktime for this transaction. The transaction will only be valid if the specified number of blocks has been mined since the previous UTXO is confirmed.

Maximum number of blocks is 65535 as defined in BIP-0068, which is around 455 days.

When setting an relative timelock, the transaction version must be at least 2. The transaction will be updated so existing signatures for this input will be removed.

Parameters

- **blocks** (*int*) – The blocks value is the number of blocks since the previous transaction output has been confirmed.
- **input_index_n** (*int*) – Index number of input for nSequence locktime

Returns

set_locktime_relative_time(*seconds*, *input_index_n=0*)
Set nSequence relative locktime for this transaction. The transaction will only be valid if the specified amount of seconds have been passed since the previous UTXO is confirmed.

Number of seconds will be rounded to the nearest 512 seconds. Any value below 512 will be interpreted as 512 seconds.

Maximum number of seconds is 33553920 (512 * 65535), which equals 384 days. See BIP-0068 definition.

When setting an relative timelock, the transaction version must be at least 2. The transaction will be updated so existing signatures for this input will be removed.

Parameters

- **seconds** (*int*) – Number of seconds since the related previous transaction output has been confirmed.
- **input_index_n** (*int*) – Index number of input for nSequence locktime

Returns

set_locktime_time(*timestamp*)
Set nLocktime, a transaction level absolute lock time in timestamp using the transaction sequence field.

Parameters **timestamp** – Transaction is valid after the given timestamp. Value must be between 500000000 and 0xfffffffe

Returns

shuffle()
Shuffle transaction inputs and outputs in random order.

Returns

shuffle_inputs()
Shuffle transaction inputs in random order.

Returns

shuffle_outputs()
Shuffle transaction outputs in random order.

Returns

sign(*keys=None*, *index_n=None*, *multisig_key_n=None*, *hash_type=1*, *fail_on_unknown_key=True*, *replace_signatures=False*)
Sign the transaction input with provided private key

Parameters

- **keys** (HDKey, Key, *bytes*, *list*) – A private key or list of private keys
- **index_n** (*int*) – Index of transaction input. Leave empty to sign all inputs
- **multisig_key_n** (*int*) – Index number of key for multisig input for segwit transactions. Leave empty if not known. If not specified all possibilities will be checked
- **hash_type** (*int*) – Specific hash type, default is SIGHASH_ALL
- **fail_on_unknown_key** (*bool*) – Method fails if public key from signature is not found in public key list
- **replace_signatures** (*bool*) – Replace signature with new one if already signed.

Return None

sign_and_update(*index_n=None*)
Update transaction ID and resign. Use if some properties of the transaction changed

Parameters **index_n** (*int*) – Index of transaction input. Leave empty to sign all inputs

Returns

signature(*sign_id=None*, *hash_type=1*, *witness_type=None*)
Serializes transaction and calculates signature for Legacy or Segwit transactions

Parameters

- **sign_id** (*int*) – Index of input to sign
- **hash_type** (*int*) – Specific hash type, default is SIGHASH_ALL
- **witness_type** (*str*) – Legacy or Segwit witness type? Leave empty to use Transaction witness type

Return bytes Transaction signature

signature_hash(*sign_id=None*, *hash_type=1*, *witness_type=None*, *as_hex=False*)
Double SHA256 Hash of Transaction signature

Parameters

- **sign_id** (*int*) – Index of input to sign
- **hash_type** (*int*) – Specific hash type, default is SIGHASH_ALL
- **witness_type** (*str*) – Legacy or Segwit witness type? Leave empty to use Transaction witness type
- **as_hex** (*bool*) – Return value as hexadecimal string. Default is False

Return bytes Transaction signature hash

signature_segwit(*sign_id*, *hash_type=1*)
Serialize transaction signature for segregated witness transaction

Parameters

- **sign_id** (*int*) – Index of input to sign
- **hash_type** (*int*) – Specific hash type, default is SIGHASH_ALL

Return bytes Segwit transaction signature

update_totals()
Update input_total, output_total and fee according to inputs and outputs of this transaction

Return int

verify()
Verify all inputs of a transaction, check if signatures match public key.

Does not check if UTXO is valid or has already been spent

Return bool True if enough signatures provided and if all signatures are valid

property weight_units

witness_data()
Get witness data for all inputs of this transaction

Return bytes

exception bitcoinlib.transactions.**TransactionError**(*msg=''*)
Bases: Exception

Handle Transaction class Exceptions

bitcoinlib.transactions.**get_unlocking_script_type**(*locking_script_type*, *witness_type='legacy'*, *multisig=False*)
Specify locking script type and get corresponding script type for unlocking script

```
>>> get_unlocking_script_type('p2wsh')
'p2sh_multisig'
```

Parameters

- **locking_script_type** (*str*) – Locking script type. I.e.: p2pkh, p2sh, p2wpkh, p2wsh
- **witness_type** (*str*) – Type of witness: legacy or segwit. Default is legacy
- **multisig** (*bool*) – Is multisig script or not? Default is False

Return str Unlocking script type such as sig_pubkey or p2sh_multisig

bitcoinlib.transactions.**script_add_locktime_cltv**(*locktime_cltv*, *script*)

bitcoinlib.transactions.**script_add_locktime_csv**(*locktime_csv*, *script*)

bitcoinlib.transactions.**script_deserialize**(*script*, *script_types=None*, *locking_script=None*, *size_bytes_check=True*)
Deserialize a script: determine type, number of signatures and script data.

Parameters

- **script** (*str, bytes*) – Raw script
- **script_types** (*list*) – Limit script type determination to this list. Leave to default None to search in all script types.
- **locking_script** (*bool*) – Only deserialize locking scripts. Specify False to only deserialize for unlocking scripts. Default is None for both
- **size_bytes_check** (*bool*) – Check if script or signature starts with size bytes and remove size bytes before parsing. Default is True

Return list With this items: [script_type, data, number_of_sigs_n, number_of_sigs_m]

bitcoinlib.transactions.**script_to_string**(*script*, *name_data=False*)
Convert script to human readable string format with OP-codes, signatures, keys, etc

Parameters

- **script** (*bytes, str*) – A locking or unlocking script
- **name_data** (*bool*) – Replace signatures and keys strings with name

Return str

bitcoinlib.transactions.**serialize_multisig_redeemscript**(*key_list*, *n_required=None*, *compressed=True*)

Create a multisig redeemscript used in a p2sh.

Contains the number of signatures, followed by the list of public keys and the OP-code for the number of signatures required.

Parameters

- **key_list** (*Key, list*) – List of public keys
- **n_required** (*int*) – Number of required signatures
- **compressed** (*bool*) – Use compressed public keys?

Return bytes A multisig redeemscript

bitcoinlib.transactions.**transaction_deserialize**(*rawtx*, *network='bitcoin'*, *check_size=True*)

Deserialize a raw transaction

Returns a dictionary with list of input and output objects, locktime and version.

Will raise an error if wrong number of inputs are found or if there are no output found.

Parameters

- **rawtx** (*str, bytes*) – Raw transaction as hexadecimal string or bytes
- **network** (*str, Network*) – Network code, i.e. 'bitcoin', 'testnet', 'litecoin', etc. Leave emtpy for default network
- **check_size** (*bool*) – Check if not bytes are left when parsing is finished. Disable when parsing list of transactions, such as the transactions in a raw block. Default is True

Return Transaction

bitcoinlib.transactions.**transaction_update_spents**(*txs*, *address*)

Update spent information for list of transactions for a specific address. This method assumes the list of transaction complete and up-to-date.

This methods loops through all the transaction and update all transaction outputs for given address, checks if the output is spent and add the spending transaction ID and index number to the outputs.

The same list of transactions with updates outputs will be returned

Parameters

- **txs** (*list of Transaction*) – Complete list of transactions for given address
- **address** (*str*) – Address string

Return list of Transaction

8.11 bitcoinlib.scripts module

class bitcoinlib.scripts.**Script**(*commands=None*, *message=None*, *script_types=''*, *is_locking=True*, *keys=None*, *signatures=None*, *blueprint=None*, *tx_data=None*, *public_hash=b''*, *sigs_required=None*, *redeemscript=b''*, *hash_type=1*)

Bases: `object`

Create a Script object with specified parameters. Use parse() method to create a Script from raw hex

```
>>> s = Script([op.op_2, op.op_4, op.op_add])
>>> s
<Script([op.op_2, op.op_4, op.op_add])>
>>> s.blueprint
[82, 84, 147]
>>> s.evaluate()
True
```

Stack is empty now, because evaluate pops last item from stack and check if is non-zero >>> s.stack []

Parameters

- **commands** (*list*) – List of script language commands
- **message** (*bytes*) – Signed message to verify, normally a transaction hash. Used to validate script
- **script_types** (*list of str*) – List of script_types as defined in SCRIPT_TYPES
- **is_locking** (*bool*) – Is this a locking script (Output), otherwise unlocking (Input)
- **keys** (*list of Key*) – Provide list of keys to create script
- **signatures** (*list of Signature*) – Provide list of signatures to create script
- **blueprint** (*list of str*) – Simplified version of script, normally generated by Script object
- **tx_data** (*dict*) – Dictionary with extra information needed to verify script. Such as 'redeemscript' for multisignature scripts and 'blockcount' for time locked scripts
- **public_hash** (*bytes*) – Public hash of key or redeemscript used to create scripts
- **sigs_required** (*int*) – Nubmer of signatures required to create multisig script
- **redeemscript** (*bytes*) – Provide redeemscript to create a new (multisig) script
- **hash_type** (*int*) – Specific script hash type, default is SIGHASH_ALL

property blueprint

evaluate(*message=None*, *tx_data=None*)

Evaluate script, run all commands and check if it is valid

```
>>> s = Script([op.op_2, op.op_4, op.op_add])
>>> s
<Script([op.op_2, op.op_4, op.op_add])>
>>> s.blueprint
[82, 84, 147]
>>> s.evaluate()
True
```

```
>>> lock_script = bytes.fromhex(
↪'76a914f9cc73824051cc82d64a716c836c54467a21e22c88ac')
>>> unlock_script = bytes.fromhex(
↪'483045022100ba2ec7c40257b3d22864c9558738eea4d8771ab97888368124e176fdd6d7cd8602200f47c8d0c43
↪')
>>> s = Script.parse_bytes(unlock_script + lock_script)
>>> transaction_hash = bytes.fromhex(
↪'12824db63e7856d00ee5e109fd1c26ac8a6a015858c26f4b336274f6b52da1c3')
>>> s.evaluate(message=transaction_hash)
True
```

Parameters

- **message** (*bytes*) – Signed message to verify, normally a transaction hash. Leave empty to use Script.message. If supplied Script.message will be ignored.
- **tx_data** – Dictionary with extra information needed to verify script. Such as 'redeemscript' for multisignature scripts and 'blockcount' for time locked scripts. Leave emtpy to use Script.tx_data. If supplied Script.tx_data will be ignored

Return bool Valid or not valid

classmethod parse(*script*, *message=None*, *tx_data=None*, *strict=True*, *_level=0*)

Parse raw script and return Script object. Extracts script commands, keys, signatures and other data.

Wrapper for the *parse_bytesio()* method. Convert hexadecimal string or bytes script to BytesIO.

```
>>> Script.parse('76a914af8e14a2cecd715c363b3a72b55b59a31e2acac988ac')
<Script([op.op_dup, op.op_hash160, data-20, op.op_equalverify, op.op_checksig])>
```

Parameters

- **script** (*BytesIO, bytes, str*) – Raw script to parse in bytes, BytesIO or hexadecimal string format
- **message** (*bytes*) – Signed message to verify, normally a transaction hash
- **tx_data** (*dict*) – Dictionary with extra information needed to verify script. Such as 'redeemscript' for multisignature scripts and 'blockcount' for time locked scripts
- **strict** (*bool*) – Raise exception when script is malformed, incomplete or not understood. Default is True
- **_level** (*int*) – Internal argument used to avoid recursive depth

Return Script

classmethod parse_bytes(*script*, *message=None*, *tx_data=None*, *strict=True*, *_level=0*)

Parse raw script and return Script object. Extracts script commands, keys, signatures and other data.

Wrapper for the *parse_bytesio()* method. Convert bytes script to BytesIO.

Parameters

- **script** (*bytes*) – Raw script to parse in bytes format
- **message** (*bytes*) – Signed message to verify, normally a transaction hash
- **tx_data** (*dict*) – Dictionary with extra information needed to verify script. Such as 'redeemscript' for multisignature scripts and 'blockcount' for time locked scripts

- **strict** (*bool*) – Raise exception when script is malformed or incomplete
- **_level** (*int*) – Internal argument used to avoid recursive depth

Return Script

classmethod parse_bytesio(*script*, *message=None*, *tx_data=None*, *strict=True*, *_level=0*)

Parse raw script and return Script object. Extracts script commands, keys, signatures and other data.

Parameters

- **script** (*BytesIO*) – Raw script to parse in bytes, BytesIO or hexadecimal string format
- **message** (*bytes*) – Signed message to verify, normally a transaction hash
- **tx_data** (*dict*) – Dictionary with extra information needed to verify script. Such as 'redeemscript' for multisignature scripts and 'blockcount' for time locked scripts
- **strict** (*bool*) – Raise exception when script is malformed, incomplete or not understood. Default is True
- **_level** (*int*) – Internal argument used to avoid recursive depth

Return Script

classmethod parse_hex(*script*, *message=None*, *tx_data=None*, *strict=True*, *_level=0*)

Parse raw script and return Script object. Extracts script commands, keys, signatures and other data.

Wrapper for the *parse_bytesio()* method. Convert hexadecimal string script to BytesIO.

```
>>> Script.parse_hex('76a914af8e14a2cecd715c363b3a72b55b59a31e2acac988ac')
<Script([op.op_dup, op.op_hash160, data-20, op.op_equalverify, op.op_checksig])>
```

Parameters

- **script** (*str*) – Raw script to parse in hexadecimal string format
- **message** (*bytes*) – Signed message to verify, normally a transaction hash
- **tx_data** (*dict*) – Dictionary with extra information needed to verify script. Such as 'redeemscript' for multisignature scripts and 'blockcount' for time locked scripts
- **strict** (*bool*) – Raise exception when script is malformed, incomplete or not understood. Default is True
- **_level** (*int*) – Internal argument used to avoid recursive depth

Return Script

property raw

serialize()

Serialize script. Return all commands and data as bytes

```
>>> s = Script.parse_hex('76a914af8e14a2cecd715c363b3a72b55b59a31e2acac988ac')
>>> s.serialize().hex()
'76a914af8e14a2cecd715c363b3a72b55b59a31e2acac988ac'
```

Return bytes

serialize_list()

Serialize script and return commands and data as list

```
>>> s = Script.parse_hex('76a9')
>>> s.serialize_list()
[b'v', b'\xa9']
```

Return list of bytes

exception bitcoinlib.scripts.**ScriptError**(*msg=''*)
Bases: Exception

Handle Key class Exceptions

class bitcoinlib.scripts.**Stack**(*iterable=(), /*)
Bases: list

The Stack object is a child of the Python list object with extra operational (OP) methods. The operations as used in the Script language can be used to manipulate the stack / list.

For documentation of the op-methods you could check https://en.bitcoin.it/wiki/Script

as_ints()
Return the Stack as list of integers

```
>>> st = Stack.from_ints([1, 2])
>>> st.as_ints()
[1, 2]
```

Return list of int

classmethod from_ints(*list_ints*)
Create a Stack item with a list of integers.

```
>>> Stack.from_ints([1, 2])
[b'\x01', b'\x02']
```

Parameters **list_ints** –

Returns

is_arithmetic(*items=1*)
Check if top stack item is or last stock are arithmetic and has no more then 4 bytes

Return bool

op_0notequal()

op_1add()

op_1sub()

op_2drop()

op_2dup()

op_2over()

op_2rot()

op_2swap()

op_3dup()

op_abs()

op_add()

op_booland()

op_boolor()

op_checklocktimeverify(*sequence*, *tx_locktime*)
Implements CHECKLOCKTIMEVERIFY opcode (CLTV) as defined in BIP65.

CLTV is an absolute timelock and is added to an output locking script. It locks an output until a certain time or block.

Parameters

- **sequence** (*int*) – Sequence value from the transaction. Must be 0xffffffff to be valid
- **tx_locktime** (*int*) – The nLocktime value from the transaction in blocks or as Median Time Past timestamp

Return bool

op_checkmultisig(*message*, *data=None*)

op_checkmultisigverify(*message*, *data=None*)

op_checksequenceverify(*sequence*, *version*)
Implements CHECKSEQUENCEVERIFY opcode (CSV) as defined in BIP112

CSV is a relative timelock and is added to an output locking script. It locks an output for a certain number of blocks or time.

Parameters

- **sequence** (*int*) – Sequence value from the transaction
- **version** (*int*) – Transaction verion. Must be 2 or higher

Return bool

op_checksig(*message*, *_=None*)

op_checksigverify(*message*, *_=None*)

op_depth()

op_drop()

op_dup()

op_equal()

op_equalverify()

op_hash160()

op_hash256()

op_if(*commands*)

op_ifdup()

op_max()

op_min()

op_negate()

op_nip()

op_nop()

op_nop1()

op_nop10()

op_nop4()

op_nop5()

op_nop6()

op_nop7()

op_nop8()

op_nop9()

op_not()

op_notif(*commands*)

op_numequal()

op_numequalverify()

op_numgreaterthan()

op_numgreaterthanorequal()

op_numlessthan()

op_numlessthanorequal()

op_numnotequal()

op_over()

op_pick()

static op_return()

op_ripemd160()

op_roll()

op_rot()

op_sha1()

op_sha256()

op_size()

op_sub()

op_swap()

op_tuck()

op_verify()

op_within()

pop_as_number()

Pop the latest item from the list and decode as number

```
>>> st = Stack.from_ints([1, 2])
>>> st.pop_as_number()
2
```

Return int

bitcoinlib.scripts.**data_pack**(*data*)
Add data length prefix to data string to include data in a script

Parameters **data** (*bytes*) – Data to be packed

Return bytes

bitcoinlib.scripts.**decode_num**(*encoded*)
Decode byte representation of number used in Script language to integer.

```
>>> decode_num(b'')
0
>>> decode_num(b'@B\x0f')
1000000
```

Parameters **encoded** (*bytes*) – Number as bytes

Return int

bitcoinlib.scripts.**encode_num**(*num*)
Encode number as byte used in Script language. Bitcoin specific little endian format with sign for negative integers.

```
>>> encode_num(0)
b''
>>> encode_num(1)
b'\x01'
>>> encode_num(1000)
b'\xe8\x03'
>>> encode_num(1000000)
b'@B\x0f'
```

Parameters **num** (*int*) – number to represent

Return bytes

bitcoinlib.scripts.**get_data_type**(*data*)
Get type of data in script. Recognises signatures, keys, hashes or sequence data. Return 'other' if data is not recognised.

Parameters **data** (*bytes*) – Data part of script

Return str

8.12 bitcoinlib.wallets module

class bitcoinlib.wallets.**Wallet**(*wallet*, *db_uri=None*, *session=None*, *main_key_object=None*)
Bases: object

Class to create and manage keys Using the BIP0044 Hierarchical Deterministic wallet definitions, so you can use one Masterkey to generate as much child keys as you want in a structured manner.

You can import keys in many format such as WIF or extended WIF, bytes, hexstring, seeds or private key integer. For the Bitcoin network, Litecoin or any other network you define in the settings.

Easily send and receive transactions. Compose transactions automatically or select unspent outputs.

Each wallet name must be unique and can contain only one cointype and purpose, but practically unlimited accounts and addresses.

Open a wallet with given ID or name

Parameters

- **wallet** (*int, str*) – Wallet name or ID
- **db_uri** (*str*) – URI of the database
- **session** (*sqlalchemy.orm.session.Session*) – Sqlalchemy session
- **main_key_object** (HDKey) – Pass main key object to save time

account(*account_id*)

Returns wallet key of specific BIP44 account.

Account keys have a BIP44 path depth of 3 and have the format m/purpose'/network'/account'

I.e: Use account(0).key().wif_public() to get wallet's public master key

Parameters **account_id** (*int*) – ID of account. Default is 0

Return WalletKey

accounts(*network='bitcoin'*)

Get list of accounts for this wallet

Parameters **network** (*str*) – Network name filter. Default filter is DEFAULT_NETWORK

Return list of integers List of accounts IDs

addresslist(*account_id=None*, *used=None*, *network=None*, *change=None*, *depth=None*, *key_id=None*)

Get list of addresses defined in current wallet. Wrapper for the *keys()* methods.

Use *keys_addresses()* method to receive full key objects

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.addresslist()[0]
'16QaHuFkfuebXGcYHmehRXBBX7RG9NbtLg'
```

Parameters

- **account_id** (*int*) – Account ID
- **used** (*bool, None*) – Only return used or unused keys
- **network** (*str*) – Network name filter
- **change** – Only include change addresses or not. Default is None which returns both
- **depth** (*int*) – Filter by key depth. Default is None for standard key depth. Use -1 to show all keys
- **key_id** (*int*) – Key ID to get address of just 1 key

Return list of str List of address strings

as_dict(*include_private=False*)

Return wallet information in dictionary format

Parameters **include_private** (*bool*) – Include private key information in dictionary

Return dict

as_json(*include_private=False*)
Get current key as json formatted string

Parameters **include_private** (*bool*) – Include private key information in JSON

Return str

balance(*account_id=None*, *network=None*, *as_string=False*)
Get total of unspent outputs

Parameters

- **account_id** (*int*) – Account ID filter
- **network** (*str*) – Network name. Leave empty for default network
- **as_string** (*boolean*) – Set True to return a string in currency format. Default returns float.

Return float, str Key balance

balance_update_from_serviceprovider(*account_id=None*, *network=None*)
Update balance of currents account addresses using default Service objects `getbalance()` method. Update total wallet balance in database.

Please Note: Does not update UTXO's or the balance per key! For this use the `updatebalance()` method instead

Parameters

- **account_id** (*int*) – Account ID. Leave empty for default account
- **network** (*str*) – Network name. Leave empty for default network

Return int Total balance

classmethod create(*name*, *keys=None*, *owner=''*, *network=None*, *account_id=0*, *purpose=0*, *scheme='bip32'*, *sort_keys=True*, *password=''*, *witness_type=None*, *encoding=None*, *multisig=None*, *sigs_required=None*, *cosigner_id=None*, *key_path=None*, *db_uri=None*)
Create Wallet and insert in database. Generate masterkey or import key when specified.

When only a name is specified an legacy Wallet with a single masterkey is created with standard p2wpkh scripts.

```
>>> if wallet_delete_if_exists('create_legacy_wallet_test'): pass
>>> w = Wallet.create('create_legacy_wallet_test')
>>> w
<Wallet(name=create_legacy_wallet_test, db_uri="None")>
```

To create a multi signature wallet specify multiple keys (private or public) and provide the sigs_required argument if it different then len(keys)

```
>>> if wallet_delete_if_exists('create_legacy_multisig_wallet_test'): pass
>>> w = Wallet.create('create_legacy_multisig_wallet_test', keys=[HDKey(),␣
↪HDKey().public()])
```

To create a native segwit wallet use the option witness_type = 'segwit' and for old style addresses and p2sh embedded segwit script us 'ps2h-segwit' as witness_type.

```
>>> if wallet_delete_if_exists('create_segwit_wallet_test'): pass
>>> w = Wallet.create('create_segwit_wallet_test', witness_type='segwit')
```

Use a masterkey WIF when creating a wallet:

```
>>> wif =
↪'xprv9s21ZrQH143K3cxbMVswDTYgAc9CeXABQjCD9zmXCpXw4MxN93LanEARbBmV3utHZS9Db4FX1C1RbC5KSNAjQ5W
↪'
>>> if wallet_delete_if_exists('bitcoinlib_legacy_wallet_test', force=True):␣
↪pass
>>> w = Wallet.create('bitcoinlib_legacy_wallet_test', wif)
>>> w
<Wallet(name=bitcoinlib_legacy_wallet_test, db_uri="None")>
>>> # Add some test utxo data:
>>> if w.utxo_add('16QaHuFkfuebXGcYHmehRXBBX7RG9NbtLg', 100000000,
↪'748799c9047321cb27a6320a827f1f69d767fe889c14bf11f27549638d566fe4', 0): pass
```

Please mention account_id if you are using multiple accounts.

Parameters

- **name** (*str*) – Unique name of this Wallet
- **keys** (*str, bytes, int*) – Masterkey to or list of keys to use for this wallet. Will be automatically created if not specified. One or more keys are obligatory for multisig wallets. Can contain all key formats accepted by the HDKey object, a HDKey object or BIP39 passphrase
- **owner** (*str*) – Wallet owner for your own reference
- **network** (*str*) – Network name, use default if not specified
- **account_id** (*int*) – Account ID, default is 0
- **purpose** (*int*) – BIP43 purpose field, will be derived from witness_type and multisig by default
- **scheme** (*str*) – Key structure type, i.e. BIP32 or single
- **sort_keys** (*bool*) – Sort keys according to BIP45 standard (used for multisig keys)
- **password** (*str*) – Password to protect passphrase, only used if a passphrase is supplied in the 'key' argument.
- **witness_type** (*str*) – Specify witness type, default is 'legacy'. Use 'segwit' for native segregated witness wallet, or 'p2sh-segwit' for legacy compatible wallets
- **encoding** (*str*) – Encoding used for address generation: base58 or bech32. Default is derive from wallet and/or witness type
- **multisig** (*bool*) – Multisig wallet or child of a multisig wallet, default is None / derive from number of keys.
- **sigs_required** (*int*) – Number of signatures required for validation if using a multisignature wallet. For example 2 for 2-of-3 multisignature. Default is all keys must signed
- **cosigner_id** (*int*) – Set this if wallet contains only public keys, more then one private key or if you would like to create keys for other cosigners. Note: provided keys of a multisig wallet are sorted if sort_keys = True (default) so if your provided key list is not sorted the cosigned_id may be different.
- **key_path** (*list, str*) – Key path for multisig wallet, use to create your own non-standard key path. Key path must follow the following rules: * Path start with masterkey (m) and end with change / address_index * If accounts are used, the account level must

be 3. I.e.: m/purpose/coin_type/account/ * All keys must be hardened, except for change, address_index or cosigner_id * Max length of path is 8 levels

- **db_uri** (*str*) – URI of the database

Return Wallet

property default_account_id

default_network_set(*network*)

get_key(*account_id=None*, *network=None*, *cosigner_id=None*, *change=0*)

Get a unused key / address or create a new one with *new_key()* if there are no unused keys. Returns a key from this wallet which has no transactions linked to it.

Use the get_keys() method to a list of unused keys. Calling the get_key() method repeatelly to receive a list of key doesn't work: since the key is unused it would return the same result every time you call this method.

```
>>> w = Wallet('create_legacy_wallet_test')
>>> w.get_key()
<WalletKey(key_id=..., name=..., wif=..., path=m/44'/0'/0'/0/...)>
```

Parameters

- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **network** (*str*) – Network name. Leave empty for default network
- **cosigner_id** (*int*) – Cosigner ID for key path
- **change** (*int*) – Payment (0) or change key (1). Default is 0

Return WalletKey

get_key_change(*account_id=None*, *network=None*)

Get a unused change key or create a new one if there are no unused keys. Wrapper for the *get_key()* method

Parameters

- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **network** (*str*) – Network name. Leave empty for default network

Return WalletKey

get_keys(*account_id=None*, *network=None*, *cosigner_id=None*, *number_of_keys=1*, *change=0*)

Get a list of unused keys / addresses or create a new ones with *new_key()* if there are no unused keys. Returns a list of keys from this wallet which has no transactions linked to it.

Use the get_key() method to get a single key.

Parameters

- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **network** (*str*) – Network name. Leave empty for default network
- **cosigner_id** (*int*) – Cosigner ID for key path
- **number_of_keys** (*int*) – Number of keys to return. Default is 1
- **change** (*int*) – Payment (0) or change key (1). Default is 0

Return list of WalletKey

get_keys_change(*account_id=None*, *network=None*, *number_of_keys=1*)
Get a unused change key or create a new one if there are no unused keys. Wrapper for the *get_key()* method

Parameters

- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **network** (*str*) – Network name. Leave empty for default network
- **number_of_keys** (*int*) – Number of keys to return. Default is 1

Return list of WalletKey

import_key(*key*, *account_id=0*, *name=''*, *network=None*, *purpose=44*, *key_type=None*)
Add new single key to wallet.

Parameters

- **key** (*str, bytes, int, HDKey, Address*) – Key to import
- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **name** (*str*) – Specify name for key, leave empty for default
- **network** (*str*) – Network name, method will try to extract from key if not specified. Raises warning if network could not be detected
- **purpose** (*int*) – BIP definition used, default is BIP44
- **key_type** (*str*) – Key type of imported key, can be single (unrelated to wallet, bip32, bip44 or master for new or extra master key import. Default is 'single'

Return WalletKey

import_master_key(*hdkey*, *name='Masterkey (imported)'*)
Import (another) masterkey in this wallet

Parameters

- **hdkey** (*HDKey, str*) – Private key
- **name** (*str*) – Key name of masterkey

Return HDKey Main key as HDKey object

info(*detail=3*)
Prints wallet information to standard output

Parameters **detail** (*int*) – Level of detail to show. Specify a number between 0 and 5, with 0 low detail and 5 highest detail

key(*term*)
Return single key with given ID or name as WalletKey object

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.key('change 0').address
'1HabJXe8mTwXiMzUWW5KdpYbFWu3hvtsbF'
```

Parameters **term** (*int, str*) – Search term can be key ID, key address, key WIF or key name

Return WalletKey Single key as object

key_for_path(*path*, *level_offset=None*, *name=None*, *account_id=None*, *cosigner_id=None*, *address_index=0*, *change=0*, *network=None*, *recreate=False*)

Return key for specified path. Derive all wallet keys in path if they not already exists

```
>>> w = wallet_create_or_open('key_for_path_example')
>>> key = w.key_for_path([0, 0])
>>> key.path
"m/44'/0'/0'/0/0"
```

```
>>> w.key_for_path([], level_offset=-2).path
"m/44'/0'/0'"
```

```
>>> w.key_for_path([], w.depth_public_master + 1).path
"m/44'/0'/0'"
```

Arguments provided in 'path' take precedence over other arguments. The address_index argument is ignored: >>> key = w.key_for_path([0, 10], address_index=1000) >>> key.path "m/44'/0'/0'/0/10" >>> key.address_index 10

Parameters

- **path** (*list, str*) – Part of key path, i.e. [0, 0] for [change=0, address_index=0]
- **level_offset** (*int*) – Just create part of path, when creating keys. For example -2 means create path with the last 2 items (change, address_index) or 1 will return the master key 'm'
- **name** (*str*) – Specify key name for latest/highest key in structure
- **account_id** (*int*) – Account ID
- **cosigner_id** (*int*) – ID of cosigner
- **address_index** (*int*) – Index of key, normally provided to 'path' argument
- **change** (*int*) – Change key = 1 or normal = 0, normally provided to 'path' argument
- **network** (*str*) – Network name. Leave empty for default network
- **recreate** (*bool*) – Recreate key, even if already found in wallet. Can be used to update public key with private key info

Return WalletKey

keys(*account_id=None*, *name=None*, *key_id=None*, *change=None*, *depth=None*, *used=None*, *is_private=None*, *has_balance=None*, *is_active=None*, *network=None*, *include_private=False*, *as_dict=False*)

Search for keys in database. Include 0 or more of account_id, name, key_id, change and depth.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> all_wallet_keys = w.keys()
>>> w.keys(depth=0)
[<DbKey(id=..., name='bitcoinlib_legacy_wallet_test', wif=
↪'xprv9s21ZrQH143K3cxbMVswDTYgAc9CeXABQjCD9zmXCpXw4MxN93LanEARbBmV3utHZS9Db4FX1C1RbC5KSNAjQ5W
↪'>]
```

Returns a list of DbKey object or dictionary object if as_dict is True

Parameters

- **account_id** (*int*) – Search for account ID

- **name** (*str*) – Search for Name
- **key_id** (*int*) – Search for Key ID
- **change** (*int*) – Search for Change
- **depth** (*int*) – Only include keys with this depth
- **used** (*bool*) – Only return used or unused keys
- **is_private** (*bool*) – Only return private keys
- **has_balance** (*bool*) – Only include keys with a balance or without a balance, default is both
- **is_active** (*bool*) – Hide inactive keys. Only include active keys with either a balance or which are unused, default is None (show all)
- **network** (*str*) – Network name filter
- **include_private** (*bool*) – Include private key information in dictionary
- **as_dict** (*bool*) – Return keys as dictionary objects. Default is False: DbKey objects

Return list of DbKey List of Keys

keys_accounts(*account_id=None*, *network='bitcoin'*, *as_dict=False*)

Get Database records of account key(s) with for current wallet. Wrapper for the *keys()* method.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> account_key = w.keys_accounts()
>>> account_key[0].path
"m/44'/0'/0'"
```

Returns nothing if no account keys are available for instance in multisig or single account wallets. In this case use *accounts()* method instead.

Parameters

- **account_id** (*int*) – Search for Account ID
- **network** (*str*) – Network name filter
- **as_dict** (*bool*) – Return as dictionary or DbKey object. Default is False: DbKey objects

Return list of (DbKey, dict)

keys_address_change(*account_id=None*, *used=None*, *network=None*, *as_dict=False*)

Get payment addresses (change=1) of specified account_id for current wallet. Wrapper for the *keys()* methods.

Parameters

- **account_id** (*int*) – Account ID
- **used** (*bool*) – Only return used or unused keys
- **network** (*str*) – Network name filter
- **as_dict** (*bool*) – Return as dictionary or DbKey object. Default is False: DbKey objects

:return list of (DbKey, dict)

keys_address_payment(*account_id=None*, *used=None*, *network=None*, *as_dict=False*)

Get payment addresses (change=0) of specified account_id for current wallet. Wrapper for the *keys()* methods.

Parameters

- **account_id** (*int*) – Account ID
- **used** (*bool*) – Only return used or unused keys
- **network** (*str*) – Network name filter
- **as_dict** (*bool*) – Return as dictionary or DbKey object. Default is False: DbKey objects

:return list of (DbKey, dict)

keys_addresses(*account_id=None*, *used=None*, *is_active=None*, *change=None*, *network=None*, *depth=None*, *as_dict=False*)

Get address keys of specified account_id for current wallet. Wrapper for the *keys()* methods.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.keys_addresses()[0].address
'16QaHuFkfuebXGcYHmehRXBBX7RG9NbtLg'
```

Parameters

- **account_id** (*int*) – Account ID
- **used** (*bool*) – Only return used or unused keys
- **is_active** (*bool*) – Hide inactive keys. Only include active keys with either a balance or which are unused, default is True
- **change** (*int*) – Search for Change
- **network** (*str*) – Network name filter
- **depth** (*int*) – Filter by key depth. Default for BIP44 and multisig is 5
- **as_dict** (*bool*) – Return as dictionary or DbKey object. Default is False: DbKey objects

:return list of (DbKey, dict)

keys_networks(*used=None*, *as_dict=False*)

Get keys of defined networks for this wallet. Wrapper for the *keys()* method

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> network_key = w.keys_networks()
>>> # Address index of hardened key 0' is 2147483648
>>> network_key[0].address_index
2147483648
>>> network_key[0].path
"m/44'/0'"
```

Parameters

- **used** (*bool*) – Only return used or unused keys
- **as_dict** (*bool*) – Return as dictionary or DbKey object. Default is False: DbKey objects

Return list of (DbKey, dict)

property name

Get wallet name

Return str

network_list(*field='name'*)
Wrapper for *networks()* method, returns a flat list with currently used networks for this wallet.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.network_list()
['bitcoin']
```

Return list of str

networks(*as_dict=False*)
Get list of networks used by this wallet

Parameters **as_dict** (*bool*) – Return as dictionary or as Network objects, default is Network objects

Return list of (Network, dict)

new_account(*name=''*, *account_id=None*, *network=None*)
Create a new account with a child key for payments and 1 for change.

An account key can only be created if wallet contains a masterkey.

Parameters

- **name** (*str*) – Account Name. If not specified 'Account #" with the account_id will be used
- **account_id** (*int*) – Account ID. Default is last accounts ID + 1
- **network** (*str*) – Network name. Leave empty for default network

Return WalletKey

new_key(*name=''*, *account_id=None*, *change=0*, *cosigner_id=None*, *network=None*)
Create a new HD Key derived from this wallet's masterkey. An account will be created for this wallet with index 0 if there is no account defined yet.

```
>>> w = Wallet('create_legacy_wallet_test')
>>> w.new_key('my key')
<WalletKey(key_id=..., name=my key, wif=..., path=m/44'/0'/0'/0/...)>
```

Parameters

- **name** (*str*) – Key name. Does not have to be unique but if you use it at reference you might chooce to enforce this. If not specified 'Key #' with an unique sequence number will be used
- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **change** (*int*) – Change (1) or payments (0). Default is 0
- **cosigner_id** (*int*) – Cosigner ID for key path
- **network** (*str*) – Network name. Leave empty for default network

Return WalletKey

new_key_change(*name=''*, *account_id=None*, *network=None*)
Create new key to receive change for a transaction. Calls *new_key()* method with change=1.

Parameters

- **name** (*str*) – Key name. Default name is 'Change #' with an address index

- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **network** (*str*) – Network name. Leave empty for default network

Return WalletKey

property owner
Get wallet Owner

Return str

path_expand(*path*, *level_offset=None*, *account_id=None*, *cosigner_id=0*, *address_index=None*, *change=0*, *network='bitcoin'*)
Create key path. Specify part of key path to expand to key path used in this wallet.

```
>>> w = Wallet('create_legacy_wallet_test')
>>> w.path_expand([0,1200])
['m', "44'", "0'", "0'", '0', '1200']
```

```
>>> w = Wallet('create_legacy_multisig_wallet_test')
>>> w.path_expand([0,2], cosigner_id=1)
['m', "45'", '1', '0', '2']
```

Parameters

- **path** (*list, str*) – Part of path, for example [0, 2] for change=0 and address_index=2
- **level_offset** (*int*) – Just create part of path. For example -2 means create path with the last 2 items (change, address_index) or 1 will return the master key 'm'
- **account_id** (*int*) – Account ID
- **cosigner_id** (*int*) – ID of cosigner
- **address_index** (*int*) – Index of key, normally provided to 'path' argument
- **change** (*int*) – Change key = 1 or normal = 0, normally provided to 'path' argument
- **network** (*str*) – Network name. Leave empty for default network

Return list

public_master(*account_id=None*, *name=None*, *as_private=False*, *network=None*)
Return public master key(s) for this wallet. Use to import in other wallets to sign transactions or create keys.

For a multisig wallet all public master keys are return as list.

Returns private key information if available and as_private is True is specified

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.public_master().wif

↪'xpub6D2qEr8Z8WYKKns2xZYyyvvRviPh1NKt1kfHwwfiTxJwj7peReEJt3iXoWWsr8tXWTsejDjMfAezM53KVFVkSZz
↪'
```

Parameters

- **account_id** (*int*) – Account ID of key to export
- **name** (*str*) – Optional name for account key

- **as_private** (*bool*) – Export public or private key, default is False
- **network** (*str*) – Network name. Leave empty for default network

Return list of WalletKey, WalletKey

scan(*scan_gap_limit=5*, *account_id=None*, *change=None*, *rescan_used=False*, *network=None*, *keys_ignore=None*)

Generate new addresses/keys and scan for new transactions using the Service providers. Updates all UTXO's and balances.

Keep scanning for new transactions until no new transactions are found for 'scan_gap_limit' addresses. Only scan keys from default network and account unless another network or account is specified.

Use the faster *utxos_update()* method if you are only interested in unspent outputs. Use the *transactions_update()* method if you would like to manage the key creation yourself or if you want to scan a single key.

Parameters

- **scan_gap_limit** (*int*) – Amount of new keys and change keys (addresses) created for this wallet. Default is 5, so scanning stops if after 5 addresses no transaction are found.
- **account_id** (*int*) – Account ID. Default is last used or created account ID.
- **change** (*bool*) – Filter by change addresses. Set to True to include only change addresses, False to only include regular addresses. None (default) to disable filter and include both
- **rescan_used** (*bool*) – Rescan already used addressed. Default is False, so funds send to old addresses will be ignored by default.
- **network** (*str*) – Network name. Leave empty for default network
- **keys_ignore** (*list of int*) – Id's of keys to ignore

Returns

scan_key(*key*)

Scan for new transactions for specified wallet key and update wallet transactions

Parameters **key** (*WalletKey, int*) – The wallet key as object or index

Return bool New transactions found?

select_inputs(*amount*, *variance=None*, *input_key_id=None*, *account_id=None*, *network=None*, *min_confirms=1*, *max_utxos=None*, *return_input_obj=True*, *skip_dust_amounts=True*)

Select available unspent transaction outputs (UTXO's) which can be used as inputs for a transaction for the specified amount.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.select_inputs(50000000)
[<Input(prev_txid=
↪'748799c9047321cb27a6320a827f1f69d767fe889c14bf11f27549638d566fe4', output_
↪n=0, address='16QaHuFkfuebXGcYHmehRXBBX7RG9NbtLg', index_n=0, type='sig_pubkey
↪')>]
```

Parameters

- **amount** (*int*) – Total value of inputs in smallest denominator (sathosi) to select
- **variance** (*int*) – Allowed difference in total input value. Default is dust amount of selected network. Difference will be added to transaction fee.

- **input_key_id** (*int, list*) – Limit UTXO's search for inputs to this key ID or list of key IDs. Only valid if no input array is specified
- **account_id** (*int*) – Account ID
- **network** (*str*) – Network name. Leave empty for default network
- **min_confirms** (*int*) – Minimal confirmation needed for an UTXO before it will included in inputs. Default is 1 confirmation. Option is ignored if input_arr is provided.
- **max_utxos** (*int*) – Maximum number of UTXO's to use. Set to 1 for optimal privacy. Default is None: No maximum
- **return_input_obj** (*bool*) – Return inputs as Input class object. Default is True
- **skip_dust_amounts** (*bool*) – Do not include small amount to avoid dust inputs

Returns List of previous outputs

Return type list of DbTransactionOutput, list of Input

send(*output_arr*, *input_arr=None*, *input_key_id=None*, *account_id=None*, *network=None*, *fee=None*, *min_confirms=1*, *priv_keys=None*, *max_utxos=None*, *locktime=0*, *offline=False*, *number_of_change_outputs=1*)

Create a new transaction with specified outputs and push it to the network. Inputs can be specified but if not provided they will be selected from wallets utxo's Output array is a list of 1 or more addresses and amounts.

Uses the *transaction_create()* method to create a new transaction, and uses a random service client to send the transaction.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> t = w.send([('1J9GDZMKEr3ZTj8q6pwtMy4Arvt92FDBTb', 200000)], offline=True)
>>> t
<WalletTransaction(input_count=1, output_count=2, status=new, network=bitcoin)>
>>> t.outputs
[<Output(value=..., address=..., type=p2pkh)>, <Output(value=..., address=...,␣
↪type=p2pkh)>]
```

Parameters

- **output_arr** (*list*) – List of output tuples with address and amount. Must contain at least one item. Example: [('mxdLD8SAGS9fe2EeCXALDHcdTTbppMHp8N', 5000000)]. Address can be an address string, Address object, HDKey object or WalletKey object
- **input_arr** (*list*) – List of inputs tuples with reference to a UTXO, a wallet key and value. The format is [(txid, output_n, key_id, value)]
- **input_key_id** (*int, list*) – Limit UTXO's search for inputs to this key ID or list of key IDs. Only valid if no input array is specified
- **account_id** (*int*) – Account ID
- **network** (*str*) – Network name. Leave empty for default network
- **fee** (*int*) – Set fee manually, leave empty to calculate fees automatically. Set fees in smallest currency denominator, for example satoshi's if you are using bitcoins
- **min_confirms** (*int*) – Minimal confirmation needed for an UTXO before it will included in inputs. Default is 1. Option is ignored if input_arr is provided.
- **priv_keys** (*HDKey, list*) – Specify extra private key if not available in this wallet

- **max_utxos** (*int*) – Maximum number of UTXO's to use. Set to 1 for optimal privacy. Default is None: No maximum
- **locktime** (*int*) – Transaction level locktime. Locks the transaction until a specified block (value from 1 to 5 million) or until a certain time (Timestamp in seconds after 1-jan-1970). Default value is 0 for transactions without locktime
- **offline** (*bool*) – Just return the transaction object and do not send it when offline = True. Default is False
- **number_of_change_outputs** (*int*) – Number of change outputs to create when there is a change value. Default is 1. Use 0 for random number of outputs: between 1 and 5 depending on send and change amount

Return WalletTransaction

send_to(*to_address*, *amount*, *input_key_id=None*, *account_id=None*, *network=None*, *fee=None*, *min_confirms=1*, *priv_keys=None*, *locktime=0*, *offline=False*, *number_of_change_outputs=1*)

Create transaction and send it with default Service objects `services.sendrawtransaction()` method.

Wrapper for wallet *send()* method.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> t = w.send_to('1J9GDZMKEr3ZTj8q6pwtMy4Arvt92FDBTb', 200000, offline=True)
>>> t
<WalletTransaction(input_count=1, output_count=2, status=new, network=bitcoin)>
>>> t.outputs
[<Output(value=..., address=..., type=p2pkh)>, <Output(value=..., address=...,␣
↪type=p2pkh)>]
```

Parameters

- **to_address** (*str*, Address, HDKey, WalletKey) – Single output address as string Address object, HDKey object or WalletKey object
- **amount** (*int*, *str*, Value) – Output is smallest denominator for this network (ie: Satoshi's for Bitcoin), as Value object or value string as accepted by Value class
- **input_key_id** (*int*, *list*) – Limit UTXO's search for inputs to this key ID or list of key IDs. Only valid if no input array is specified
- **account_id** (*int*) – Account ID, default is last used
- **network** (*str*) – Network name. Leave empty for default network
- **fee** (*int*) – Fee to use for this transaction. Leave empty to automatically estimate.
- **min_confirms** (*int*) – Minimal confirmation needed for an UTXO before it will included in inputs. Default is 1. Option is ignored if input_arr is provided.
- **priv_keys** (HDKey, *list*) – Specify extra private key if not available in this wallet
- **locktime** (*int*) – Transaction level locktime. Locks the transaction until a specified block (value from 1 to 5 million) or until a certain time (Timestamp in seconds after 1-jan-1970). Default value is 0 for transactions without locktime
- **offline** (*bool*) – Just return the transaction object and do not send it when offline = True. Default is False
- **number_of_change_outputs** (*int*) – Number of change outputs to create when there is a change value. Default is 1. Use 0 for random number of outputs: between 1 and 5 depending on send and change amount

Return WalletTransaction

sweep(*to_address*, *account_id=None*, *input_key_id=None*, *network=None*, *max_utxos=999*, *min_confirms=1*, *fee_per_kb=None*, *fee=None*, *locktime=0*, *offline=False*)

Sweep all unspent transaction outputs (UTXO's) and send them to one or more output addresses.

Wrapper for the *send()* method.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> t = w.sweep('1J9GDZMKEr3ZTj8q6pwtMy4Arvt92FDBTb', offline=True)
>>> t
<WalletTransaction(input_count=1, output_count=1, status=new, network=bitcoin)>
>>> t.outputs
[<Output(value=..., address=1J9GDZMKEr3ZTj8q6pwtMy4Arvt92FDBTb, type=p2pkh)>]
```

Output to multiple addresses

```
>>> to_list = [('1J9GDZMKEr3ZTj8q6pwtMy4Arvt92FDBTb', 100000), (w.get_key(), 0)]
>>> w.sweep(to_list, offline=True)
<WalletTransaction(input_count=1, output_count=2, status=new, network=bitcoin)>
```

Parameters

- **to_address** (*str, list*) – Single output address or list of outputs in format [(<address>, <amount>)]. If you specify a list of outputs, use amount value = 0 to indicate a change output
- **account_id** (*int*) – Wallet's account ID
- **input_key_id** (*int, list*) – Limit sweep to UTXO's with this key ID or list of key IDs
- **network** (*str*) – Network name. Leave empty for default network
- **max_utxos** (*int*) – Limit maximum number of outputs to use. Default is 999
- **min_confirms** (*int*) – Minimal confirmations needed to include utxo
- **fee_per_kb** (*int*) – Fee per kilobyte transaction size, leave empty to get estimated fee costs from Service provider. This option is ignored when the 'fee' option is specified
- **fee** (*int*) – Total transaction fee in smallest denominator (i.e. satoshis). Leave empty to get estimated fee from service providers.
- **locktime** (*int*) – Transaction level locktime. Locks the transaction until a specified block (value from 1 to 5 million) or until a certain time (Timestamp in seconds after 1-jan-1970). Default value is 0 for transactions without locktime
- **offline** (*bool*) – Just return the transaction object and do not send it when offline = True. Default is False

Return WalletTransaction

transaction(*txid*)

Get WalletTransaction object for given transaction ID (transaction hash)

Parameters **txid** (*str*) – Hexadecimal transaction hash

Return WalletTransaction

transaction_create(*output_arr*, *input_arr=None*, *input_key_id=None*, *account_id=None*, *network=None*, *fee=None*, *min_confirms=1*, *max_utxos=None*, *locktime=0*, *number_of_change_outputs=1*, *random_output_order=True*)

Create new transaction with specified outputs.

Inputs can be specified but if not provided they will be selected from wallets utxo's with *select_inputs()* method.

Output array is a list of 1 or more addresses and amounts.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> t = w.transaction_create([('1J9GDZMKEr3ZTj8q6pwtMy4Arvt92FDBTb', 200000)])
>>> t
<WalletTransaction(input_count=1, output_count=2, status=new, network=bitcoin)>
>>> t.outputs
[<Output(value=..., address=..., type=p2pkh)>, <Output(value=..., address=...,␣
↪type=p2pkh)>]
```

Parameters

- **output_arr** (*list of Output, tuple*) – List of output as Output objects or tuples with address and amount. Must contain at least one item. Example: [('mxdLD8SAGS9fe2EeCXALDHcdTTbppMHp8N', 5000000)]
- **input_arr** (*list of Input, tuple*) – List of inputs as Input objects or tuples with reference to a UTXO, a wallet key and value. The format is [(txid, output_n, key_ids, value, signatures, unlocking_script, address)]
- **input_key_id** (*int*) – Limit UTXO's search for inputs to this key_id. Only valid if no input array is specified
- **account_id** (*int*) – Account ID
- **network** (*str*) – Network name. Leave empty for default network
- **fee** (*int*) – Set fee manually, leave empty to calculate fees automatically. Set fees in smallest currency denominator, for example satoshi's if you are using bitcoins
- **min_confirms** (*int*) – Minimal confirmation needed for an UTXO before it will included in inputs. Default is 1 confirmation. Option is ignored if input_arr is provided.
- **max_utxos** (*int*) – Maximum number of UTXO's to use. Set to 1 for optimal privacy. Default is None: No maximum
- **locktime** (*int*) – Transaction level locktime. Locks the transaction until a specified block (value from 1 to 5 million) or until a certain time (Timestamp in seconds after 1-jan-1970). Default value is 0 for transactions without locktime
- **number_of_change_outputs** (*int*) – Number of change outputs to create when there is a change value. Default is 1. Use 0 for random number of outputs: between 1 and 5 depending on send and change amount :type number_of_change_outputs: int
- **random_output_order** (*bool*) – Shuffle order of transaction outputs to increase privacy. Default is True

Return WalletTransaction object

transaction_import(*t*)

Import a Transaction into this wallet. Link inputs to wallet keys if possible and return WalletTransaction object. Only imports Transaction objects or dictionaries, use *transaction_import_raw()* method to import a raw transaction.

Parameters **t** (*Transaction, dict*) – A Transaction object or dictionary

Return WalletTransaction

transaction_import_raw(*rawtx*, *network=None*)
Import a raw transaction. Link inputs to wallet keys if possible and return WalletTransaction object

Parameters

- **rawtx** (*str, bytes*) – Raw transaction
- **network** (*str*) – Network name. Leave empty for default network

Return WalletTransaction

transaction_last(*address*)
Get transaction ID for latest transaction in database for given address

Parameters **address** (*str*) – The address

Return str

transaction_load(*txid=None*, *filename=None*)
Load transaction object from file which has been stored with the `Transaction.save()` method.

Specify transaction ID or filename.

Parameters

- **txid** (*str*) – Transaction ID. Transaction object will be read from .bitcoinlib datadir
- **filename** (*str*) – Name of transaction object file

Return Transaction

transaction_spent(*txid*, *output_n*)
Check if transaction with given transaction ID and output_n is spent and return txid of spent transaction.

Retrieves information from database, does not update transaction and does not check if transaction is spent with service providers.

Parameters

- **txid** (*str, bytes*) – Hexadecimal transaction hash
- **output_n** (*int, bytes*) – Output n

Return str Transaction ID

transactions(*account_id=None*, *network=None*, *include_new=False*, *key_id=None*, *as_dict=False*)
Get all known transactions input and outputs for this wallet.

The transaction only includes the inputs and outputs related to this wallet. To get full transactions use the *transactions_full()* method.

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.transactions()
[<WalletTransaction(input_count=0, output_count=1, status=confirmed,␣
↪network=bitcoin)>]
```

Parameters

- **account_id** (*int, None*) – Filter by Account ID. Leave empty for default account_id
- **network** (*str, None*) – Filter by network name. Leave empty for default network

- **include_new** (*bool*) – Also include new and incomplete transactions in list. Default is False
- **key_id** (*int, None*) – Filter by key ID
- **as_dict** (*bool*) – Output as dictionary or WalletTransaction object

Return list of WalletTransaction List of WalletTransaction or transactions as dictionary

transactions_export(*account_id=None*, *network=None*, *include_new=False*, *key_id=None*, *skip_change=True*)

Export wallets transactions as list of tuples with the following fields: (transaction_date, transaction_hash, in/out, addresses_in, addresses_out, value, value_cumulative, fee)

Parameters

- **account_id** (*int, None*) – Filter by Account ID. Leave empty for default account_id
- **network** (*str, None*) – Filter by network name. Leave empty for default network
- **include_new** (*bool*) – Also include new and incomplete transactions in list. Default is False
- **key_id** (*int, None*) – Filter by key ID
- **skip_change** (*bool*) – Do not include change outputs. Default is True

Return list of tuple

transactions_full(*network=None*, *include_new=False*)

Get all transactions of this wallet as WalletTransaction objects

Use the *transactions()* method to only get the inputs and outputs transaction parts related to this wallet

Parameters

- **network** (*str*) – Filter by network name. Leave empty for default network
- **include_new** (*bool*) – Also include new and incomplete transactions in list. Default is False

Return list of WalletTransaction

transactions_update(*account_id=None*, *used=None*, *network=None*, *key_id=None*, *depth=None*, *change=None*, *limit=20*)

Update wallets transaction from service providers. Get all transactions for known keys in this wallet. The balances and unspent outputs (UTXO's) are updated as well. Only scan keys from default network and account unless another network or account is specified.

Use the *scan()* method for automatic address generation/management, and use the *utxos_update()* method to only look for unspent outputs and balances.

Parameters

- **account_id** (*int*) – Account ID
- **used** (*bool, None*) – Only update used or unused keys, specify None to update both. Default is None
- **network** (*str*) – Network name. Leave empty for default network
- **key_id** (*int*) – Key ID to just update 1 key

- **depth** (*int*) – Only update keys with this depth, default is depth 5 according to BIP0048 standard. Set depth to None to update all keys of this wallet.
- **change** (*int*) – Only update change or normal keys, default is both (None)
- **limit** (*int*) – Stop update after limit transactions to avoid timeouts with service providers. Default is MAX_TRANSACTIONS defined in config.py

Return bool True if all transactions are updated

transactions_update_by_txids(*txids*)

Update transaction or list or transaction for this wallet with provided transaction ID

Parameters **txids** (*str, list of str, bytes, list of bytes*) – Transaction ID, or list of transaction IDs

Returns

transactions_update_confirmations()

Update number of confirmations and status for transactions in database

Returns

utxo_add(*address*, *value*, *txid*, *output_n*, *confirmations=1*, *script=''*)

Add a single UTXO to the wallet database. To update all utxo's use *utxos_update()* method.

Use this method for testing, offline wallets or if you wish to override standard method of retreiving UTXO's

This method does not check if UTXO exists or is still spendable.

Parameters

- **address** (*str*) – Address of Unspent Output. Address should be available in wallet
- **value** (*int*) – Value of output in sathosis or smallest denominator for type of currency
- **txid** (*str*) – Transaction hash or previous output as hex-string
- **output_n** (*int*) – Output number of previous transaction output
- **confirmations** (*int*) – Number of confirmations. Default is 0, unconfirmed
- **script** (*str*) – Locking script of previous output as hex-string

Return int Number of new UTXO's added, so 1 if successful

utxo_last(*address*)

Get transaction ID for latest utxo in database for given address

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.utxo_last('16QaHuFkfuebXGcYHmehRXBBX7RG9NbtLg')
'748799c9047321cb27a6320a827f1f69d767fe889c14bf11f27549638d566fe4'
```

Parameters **address** (*str*) – The address

Return str

utxos(*account_id=None*, *network=None*, *min_confirms=0*, *key_id=None*)

Get UTXO's (Unspent Outputs) from database. Use *utxos_update()* method first for updated values

```
>>> w = Wallet('bitcoinlib_legacy_wallet_test')
>>> w.utxos()
[{'value': 100000000, 'script': '', 'output_n': 0, 'transaction_id': ..., 'spent
↪': False, 'script_type': 'p2pkh', 'key_id': ..., 'address':
↪'16QaHuFkfuebXGcYHmehRXBBX7RG9NbtLg', 'confirmations': 0, 'txid':
↪'748799c9047321cb27a6320a827f1f69d767fe889c14bf11f27549638d566fe4', 'network_
↪name': 'bitcoin'}]
```

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Parameters

- **account_id** (*int*) – Account ID
- **network** (*str*) – Network name. Leave empty for default network
- **min_confirms** (*int*) – Minimal confirmation needed to include in output list
- **key_id** (*int, list*) – Key ID or list of key IDs to filter utxo's for specific keys

Return list List of transactions

utxos_update(*account_id=None*, *used=None*, *networks=None*, *key_id=None*, *depth=None*, *change=None*, *utxos=None*, *update_balance=True*, *max_utxos=20*, *rescan_all=True*)

Update UTXO's (Unspent Outputs) for addresses/keys in this wallet using various Service providers.

This method does not import transactions: use *transactions_update()* function or to look for new addresses use *scan()*.

Parameters

- **account_id** (*int*) – Account ID
- **used** (*bool*) – Only check for UTXO for used or unused keys. Default is both
- **networks** (*str, list*) – Network name filter as string or list of strings. Leave empty to update all used networks in wallet
- **key_id** (*int*) – Key ID to just update 1 key
- **depth** (*int*) – Only update keys with this depth, default is depth 5 according to BIP0048 standard. Set depth to None to update all keys of this wallet.
- **change** (*int*) – Only update change or normal keys, default is both (None)
- **utxos** (*list of dict.*) – List of unspent outputs in dictionary format specified below. For usage on an offline PC, you can import utxos with the utxos parameter as a list of dictionaries

```
{
  "address": "n2S9Czehjvdmpwd2YqekxuUC1Tz5ZdK3YN",
  "script": "",
  "confirmations": 10,
  "output_n": 1,
  "txid": "9df91f89a3eb4259ce04af66ad4caf3c9a297feea5e0b3bc506898b6728c5003",
  "value": 8970937
}
```

Parameters

- **update_balance** (*bool*) – Option to disable balance update after fetching UTXO's. Can be used when utxos_update method is called several times in a row. Default is True
- **max_utxos** (*int*) – Maximum number of UTXO's to update
- **rescan_all** (*bool*) – Remove old utxo's and rescan wallet. Default is True. Set to False if you work with large utxo's sets. Value will be ignored if key_id is specified in your call

Return int Number of new UTXO's added

wif(*is_private=False*, *account_id=0*)

Return Wallet Import Format string for master private or public key which can be used to import key and recreate wallet in other software.

A list of keys will be exported for a multisig wallet.

Parameters

- **is_private** (*bool*) – Export public or private key, default is False
- **account_id** (*bool*) – Account ID of key to export

Return list, str

exception bitcoinlib.wallets.**WalletError**(*msg=''*)

Bases: Exception

Handle Wallet class Exceptions

class bitcoinlib.wallets.**WalletKey**(*key_id*, *session*, *hdkey_object=None*)

Bases: object

Used as attribute of Wallet class. Contains HDKey class, and adds extra wallet related information such as key ID, name, path and balance.

All WalletKeys are stored in a database

Initialize WalletKey with specified ID, get information from database.

Parameters

- **key_id** (*int*) – ID of key as mentioned in database
- **session** (*sqlalchemy.orm.session.Session*) – Required Sqlalchemy Session object
- **hdkey_object** (HDKey) – Optional HDKey object. Specify HDKey object if available for performance

as_dict(*include_private=False*)

Return current key information as dictionary

Parameters **include_private** (*bool*) – Include private key information in dictionary

balance(*as_string=False*)

Get total value of unspent outputs

Parameters **as_string** (*bool*) – Specify 'string' to return a string in currency format

Return float, str Key balance

static from_key(*name*, *wallet_id*, *session*, *key*, *account_id=0*, *network=None*, *change=0*, *purpose=44*, *parent_id=0*, *path='m'*, *key_type=None*, *encoding=None*, *witness_type='legacy'*, *multisig=False*, *cosigner_id=None*)

Create WalletKey from a HDKey object or key.

Normally you don't need to call this method directly. Key creation is handled by the Wallet class.

```
>>> w = wallet_create_or_open('hdwalletkey_test')
>>> wif =
↪'xprv9s21ZrQH143K2mcs9jcK4EjALbu2z1N9qsMTUG1frmnXM3NNCSGR57yLhwTccfNCwdSQEDftgjCGm96P29wGGcb
↪'
>>> wk = WalletKey.from_key('import_key', w.wallet_id, w._session, wif)
>>> wk.address
'1MwVEhGq6gg1eeSrEdZom5bHyPqXtJSnPg'
```

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```
>>> wk
<WalletKey(key_id=..., name=import_key,␣
↪wif=xprv9s21ZrQH143K2mcs9jcK4EjALbu2z1N9qsMTUG1frmnXM3NNCSGR57yLhwTccfNCwdSQEDftgjCGm96P29wG
↪ path=m)>
```

Parameters

- **name** (*str*) – New key name
- **wallet_id** (*int*) – ID of wallet where to store key
- **session** (*sqlalchemy.orm.session.Session*) – Required Sqlalchemy Session object
- **key** (*str, int, byte,* HDKey) – Optional key in any format accepted by the HDKey class
- **account_id** (*int*) – Account ID for specified key, default is 0
- **network** (*str*) – Network of specified key
- **change** (*int*) – Use 0 for normal key, and 1 for change key (for returned payments)
- **purpose** (*int*) – BIP0044 purpose field, default is 44
- **parent_id** (*int*) – Key ID of parent, default is 0 (no parent)
- **path** (*str*) – BIP0044 path of given key, default is 'm' (masterkey)
- **key_type** (*str*) – Type of key, single or BIP44 type
- **encoding** (*str*) – Encoding used for address, i.e.: base58 or bech32. Default is base58
- **witness_type** (*str*) – Witness type used when creating transaction script: legacy, p2sh-segwit or segwit.
- **multisig** (*bool*) – Specify if key is part of multisig wallet, used for create keys and key representations such as WIF and addreses
- **cosigner_id** (*int*) – Set this if you would like to create keys for other cosigners.

Return WalletKey WalletKey object

key()
Get HDKey object for current WalletKey

Return HDKey

property name
Return name of wallet key

Return str

public()
Return current key as public WalletKey object with all private information removed

Return WalletKey

class bitcoinlib.wallets.**WalletTransaction**(*hdwallet*, *account_id=None*, **args*, ***kwargs*)
Bases: *bitcoinlib.transactions.Transaction*

Used as attribute of Wallet class. Child of Transaction object with extra reference to wallet and database object.

All WalletTransaction items are stored in a database

Initialize WalletTransaction object with reference to a Wallet object

Parameters

- **hdwallet** – Wallet object, wallet name or ID
- **account_id** (*int*) – Account ID
- **args** (*args*) – Arguments for HDWallet parent class
- **kwargs** (*kwargs*) – Keyword arguments for Wallet parent class

delete()

Delete this transaction from database.

WARNING: Results in incomplete wallets, transactions will NOT be automatically downloaded again when scanning or updating wallet. In nomal situations only use to remove old unconfirmed transactions

Return int Number of deleted transactions

export(*skip_change=True*)

Export this transaction as list of tuples in the following format: (transaction_date, transaction_hash, in/out, addresses_in, addresses_out, value, fee)

A transaction with multiple inputs or outputs results in multiple tuples.

Parameters **skip_change** (*boolean*) – Do not include outputs to own wallet (default). Please note: So if this is set to True, then an internal transfer is not exported.

Return list of tuple

classmethod from_transaction(*hdwallet*, *t*)

Create WalletTransaction object from Transaction object

Parameters

- **hdwallet** (*HDwallet, str, int*) – Wallet object, wallet name or ID
- **t** (Transaction) – Specify Transaction object

Return WalletClass

classmethod from_txid(*hdwallet*, *txid*)

Read single transaction from database with given transaction ID / transaction hash

Parameters

- **hdwallet** (Wallet) – Wallet object
- **txid** (*str, bytes*) – Transaction hash as hexadecimal string

Return WalletClass

info()

Print Wallet transaction information to standard output. Include send information.

save(*filename=None*)

Store transaction object as file so it can be imported in bitcoinlib later with the `load()` method.

Parameters **filename** (*str*) – Location and name of file, leave empty to store transaction in bitcoinlib data directory: .bitcoinlib/<transaction_id.tx)

Returns

send(*offline=False*)

Verify and push transaction to network. Update UTXO's in database after successful send

Parameters **offline** (*bool*) – Just return the transaction object and do not send it when offline = True. Default is False

Return None

sign(*keys=None*, *index_n=0*, *multisig_key_n=None*, *hash_type=1*, *fail_on_unknown_key=False*, *replace_signatures=False*)

Sign this transaction. Use existing keys from wallet or use keys argument for extra keys.

Parameters

- **keys** (HDKey, *str*) – Extra private keys to sign the transaction
- **index_n** (*int*) – Transaction index_n to sign
- **multisig_key_n** (*int*) – Index number of key for multisig input for segwit transactions. Leave empty if not known. If not specified all possibilities will be checked
- **hash_type** (*int*) – Hashtype to use, default is SIGHASH_ALL
- **fail_on_unknown_key** (*bool*) – Method fails if public key from signature is not found in public key list
- **replace_signatures** (*bool*) – Replace signature with new one if already signed.

Return None

store()

Store this transaction to database

Return int Transaction index number

bitcoinlib.wallets.**normalize_path**(*path*)

Normalize BIP0044 key path for HD keys. Using single quotes for hardened keys

```
>>> normalize_path("m/44h/2p/1'/0/100")
"m/44'/2'/1'/0/100"
```

Parameters **path** (*str*) – BIP0044 key path

Return str Normalized BIP0044 key path with single quotes

bitcoinlib.wallets.**wallet_create_or_open**(*name*, *keys=''*, *owner=''*, *network=None*, *account_id=0*, *purpose=None*, *scheme='bip32'*, *sort_keys=True*, *password=''*, *witness_type=None*, *encoding=None*, *multisig=None*, *sigs_required=None*, *cosigner_id=None*, *key_path=None*, *db_uri=None*)

Create a wallet with specified options if it doesn't exist, otherwise just open

Returns Wallet object

See Wallets class create method for option documentation

bitcoinlib.wallets.**wallet_delete**(*wallet*, *db_uri=None*, *force=False*)

Delete wallet and associated keys and transactions from the database. If wallet has unspent outputs it raises a WalletError exception unless 'force=True' is specified

Parameters

- **wallet** (*int*, *str*) – Wallet ID as integer or Wallet Name as string
- **db_uri** (*str*) – URI of the database

- **force** (*bool*) – If set to True wallet will be deleted even if unspent outputs are found. Default is False

Return int Number of rows deleted, so 1 if successful

bitcoinlib.wallets.**wallet_delete_if_exists**(*wallet*, *db_uri=None*, *force=False*)

Delete wallet and associated keys from the database. If wallet has unspent outputs it raises a WalletError exception unless 'force=True' is specified. If wallet wallet does not exist return False

Parameters

- **wallet** (*int, str*) – Wallet ID as integer or Wallet Name as string
- **db_uri** (*str*) – URI of the database
- **force** (*bool*) – If set to True wallet will be deleted even if unspent outputs are found. Default is False

Return int Number of rows deleted, so 1 if successful

bitcoinlib.wallets.**wallet_empty**(*wallet*, *db_uri=None*)

Remove all generated keys and transactions from wallet. Does not delete the wallet itself or the masterkey, so everything can be recreated.

Parameters

- **wallet** (*int, str*) – Wallet ID as integer or Wallet Name as string
- **db_uri** (*str*) – URI of the database

Return bool True if successful

bitcoinlib.wallets.**wallet_exists**(*wallet*, *db_uri=None*)

Check if Wallets is defined in database

Parameters

- **wallet** (*int, str*) – Wallet ID as integer or Wallet Name as string
- **db_uri** (*str*) – URI of the database

Return bool True if wallet exists otherwise False

bitcoinlib.wallets.**wallets_list**(*db_uri=None*, *include_cosigners=False*)

List Wallets from database

Parameters

- **db_uri** (*str*) – URI of the database
- **include_cosigners** (*bool*) – Child wallets for multisig wallets are for internal use only and are skipped by default

Return dict Dictionary of wallets defined in database

8.13 bitcoinlib.mnemonic module

class bitcoinlib.mnemonic.**Mnemonic**(*language='english'*)

Bases: object

Class to convert, generate and parse Mnemonic sentences

Implementation of BIP0039 for Mnemonics passphrases

Took some parts from Pavol Rusnak Trezors implementation, see https://github.com/trezor/python-mnemonic

Init Mnemonic class and read wordlist of specified language

Parameters **language** (*str*) – use specific wordlist, i.e. chinese, dutch (in development), english, french, italian, japanese or spanish. Leave empty for default 'english'

static checksum(*data*)

Calculates checksum for given data key

Parameters **data** (*bytes, hexstring*) – key string

Return str Checksum of key in bits

static detect_language(*words*)

Detect language of given phrase

```
>>> Mnemonic().detect_language('chunk gun celery million wood kite tackle␣
↪twenty story episode raccoon dutch')
'english'
```

Parameters **words** (*str*) – List of space separated words

Return str Language

generate(*strength=128*, *add_checksum=True*)

Generate a random Mnemonic key

Uses cryptographically secure os.urandom() function to generate data. Then creates a Mnemonic sentence with the 'to_mnemonic' method.

Parameters

- **strength** (*int*) – Key strength in number of bits as multiply of 32, default is 128 bits. It advised to specify 128 bits or more, i.e.: 128, 256, 512 or 1024
- **add_checksum** (*bool*) – Included a checksum? Default is True

Return str Mnemonic passphrase consisting of a space seperated list of words

sanitize_mnemonic(*words*)

Check and convert list of words to utf-8 encoding.

Raises an error if unrecognised word is found

Parameters **words** (*str*) – List of space separated words

Return str Sanitized list of words

to_entropy(*words*, *includes_checksum=True*)

Convert Mnemonic words back to key data entropy

```
>>> Mnemonic().to_entropy('chunk gun celery million wood kite tackle twenty␣
↪story episode raccoon dutch').hex()
'28acfc94465fd2f6774759d6897ec122'
```

Parameters

- **words** (*str*) – Mnemonic words as string of list of words
- **includes_checksum** (*bool*) – Boolean to specify if checksum is used. Default is True

Return bytes Entropy seed

to_mnemonic(*data*, *add_checksum=True*, *check_on_curve=True*)

Convert key data entropy to Mnemonic sentence

```
>>> Mnemonic().to_mnemonic('28acfc94465fd2f6774759d6897ec122')
'chunk gun celery million wood kite tackle twenty story episode raccoon dutch'
```

Parameters

- **data** (*bytes, hexstring*) – Key data entropy
- **add_checksum** (*bool*) – Included a checksum? Default is True
- **check_on_curve** (*bool*) – Check if data integer value is on secp256k1 curve. Should be enabled when not testing and working with crypto

Return str Mnemonic passphrase consisting of a space seperated list of words

to_seed(*words*, *password=''*, *validate=True*)

Use Mnemonic words and optionally a password to create a PBKDF2 seed (Password-Based Key Derivation Function 2)

First use 'sanitize_mnemonic' to determine language and validate and check words

```
>>> Mnemonic().to_seed('chunk gun celery million wood kite tackle twenty story␣
↪episode raccoon dutch').hex()

↪'6969ed4666db67fc74fae7869e2acf3c766b5ef95f5e31eb2fcebd93d76069c6de971225f700042b0b513f0ad6c8
↪'
```

Parameters

- **words** (*str*) – Mnemonic passphrase as string with space separated words
- **password** (*str*) – A password to protect key, leave empty to disable
- **validate** (*bool*) – Validate checksum for given word phrase, default is True

Return bytes PBKDF2 seed

word(*index*)

Get word from wordlist

Parameters **index** (*int*) – word index ID

Return str A word from the dictionary

wordlist()

Get full selected wordlist. A wordlist is selected when initializing Mnemonic class

Return list Full list with 2048 words

8.14 bitcoinlib.networks module

class bitcoinlib.networks.**Network**(*network_name='bitcoin'*)

Bases: object

Network class with all network definitions.

Prefixes for WIF, P2SH keys, HD public and private keys, addresses. A currency symbol and type, the denominator (such as satoshi) and a BIP0044 cointype.

print_value(*value*, *rep='string'*, *denominator=1*, *decimals=None*)

Return the value as string with currency symbol

Print value for 100000 satoshi as string in human readable format

```
>>> Network('bitcoin').print_value(100000)
'0.00100000 BTC'
```

Parameters

- **value** (*int, float*) – Value in smallest denominator such as Satoshi
- **rep** (*str*) – Currency representation: 'string', 'symbol', 'none' or your own custom name
- **denominator** (*float*) – Unit to use in representation. Default is 1. I.e. 1 = 1 BTC, 0.001 = milli BTC / mBTC
- **decimals** (*int*) – Number of digits after the decimal point, leave empty for automatic determination based on value. Use integer value between 0 and 8

Return str

wif_prefix(*is_private=False*, *witness_type='legacy'*, *multisig=False*)

Get WIF prefix for this network and specifications in arguments

```
>>> Network('bitcoin').wif_prefix()  # xpub
b'\x04\x88\xb2\x1e'
>>> Network('bitcoin').wif_prefix(is_private=True, witness_type='segwit',␣
↪multisig=True)  # Zprv
b'\x02\xaaz\x99'
```

Parameters

- **is_private** (*bool*) – Private or public key, default is True
- **witness_type** (*str*) – Legacy, segwit or p2sh-segwit
- **multisig** (*bool*) – Multisignature or single signature wallet. Default is False: no multisig

Return bytes

exception bitcoinlib.networks.**NetworkError**(*msg=''*)

Bases: Exception

Network Exception class

bitcoinlib.networks.**network_by_value**(*field*, *value*)
Return all networks for field and (prefix) value.

Example, get available networks for WIF or address prefix

```
>>> network_by_value('prefix_wif', 'B0')
['litecoin', 'litecoin_legacy']
>>> network_by_value('prefix_address', '6f')
['testnet', 'litecoin_testnet']
```

This method does not work for HD prefixes, use 'wif_prefix_search' instead

```
>>> network_by_value('prefix_address', '043587CF')
[]
```

Parameters

- **field** (*str*) – Prefix name from networks definitions (networks.json)
- **value** (*str*) – Value of network prefix

Return list Of network name strings

bitcoinlib.networks.**network_defined**(*network*)
Is network defined?

Networks of this library are defined in networks.json in the operating systems user path.

```
>>> network_defined('bitcoin')
True
>>> network_defined('ethereum')
False
```

Parameters **network** (*str*) – Network name

Return bool

bitcoinlib.networks.**network_values_for**(*field*)
Return all prefixes for field, i.e.: prefix_wif, prefix_address_p2sh, etc

```
>>> network_values_for('prefix_wif')
[b'\x99', b'\x80', b'\xef', b'\xb0', b'\xcc', b'\x9e', b'\xf1']
>>> network_values_for('prefix_address_p2sh')
[b'\x95', b'\x05', b'\xc4', b'2', b':', b'\x10', b'\x13', b'\x16']
```

Parameters **field** (*str*) – Prefix name from networks definitions (networks.json)

Return str

bitcoinlib.networks.**print_value**(*value*, *network='bitcoin'*, *rep='string'*, *denominator=1*, *decimals=None*)
Return the value as string with currency symbol

Wrapper for the Network().print_value method.

Parameters

- **value** (*int, float*) – Value in smallest denominator such as Satoshi
- **network** (*str*) – Network name as string, default is 'bitcoin'

- **rep** (*str*) – Currency representation: 'string', 'symbol', 'none' or your own custom name
- **denominator** (*float*) – Unit to use in representation. Default is 1. I.e. 1 = 1 BTC, 0.001 = milli BTC / mBTC, 1e-8 = Satoshi's
- **decimals** (*int*) – Number of digits after the decimal point, leave empty for automatic determination based on value. Use integer value between 0 and 8

Return str

bitcoinlib.networks.**wif_prefix_search**(*wif*, *witness_type=None*, *multisig=None*, *network=None*)

Extract network, script type and public/private information from HDKey WIF or WIF prefix.

Example, get bitcoin 'xprv' info:

```
>>> wif_prefix_search('0488ADE4', network='bitcoin', multisig=False)
[{'prefix': '0488ADE4', 'is_private': True, 'prefix_str': 'xprv', 'network':
↪'bitcoin', 'witness_type': 'legacy', 'multisig': False, 'script_type': 'p2pkh'}]
```

Or retreive info with full WIF string:

```
>>> wif_prefix_search(
↪'xprv9wTYmMFdV23N21MM6dLNavSQV7Sj7meSPXx6AV5eTdqqGLjycVjb115Ec5LgRAXscPZgy5G4jQ9csyyZLN3PZLxoM1h3
↪', network='bitcoin', multisig=False)
[{'prefix': '0488ADE4', 'is_private': True, 'prefix_str': 'xprv', 'network':
↪'bitcoin', 'witness_type': 'legacy', 'multisig': False, 'script_type': 'p2pkh'}]
```

Can return multiple items if no network is specified:

```
>>> [nw['network'] for nw in wif_prefix_search('0488ADE4', multisig=True)]
['bitcoin', 'regtest', 'dash', 'dogecoin']
```

Parameters

- **wif** (*str*) – WIF string or prefix as hexadecimal string
- **witness_type** (*str*) – Limit search to specific witness type
- **multisig** (*bool*) – Limit search to multisig: false, true or None for both. Default is both
- **network** (*str*) – Limit search to specified network

Return dict

8.15 bitcoinlib.blocks module

class bitcoinlib.blocks.**Block**(*block_hash*, *version*, *prev_block*, *merkle_root*, *time*, *bits*, *nonce*, *transactions=None*, *height=None*, *confirmations=None*, *network='bitcoin'*)

Bases: `object`

Create a new Block object with provided parameters.

```
>>> b = Block('000000000000000000000154ba9d02ddd6cee0d71d1ea232753e02c9ac6affd709',␣
↪version=0x20000000, prev_block=
↪'0000000000000000000f9578cda278ae7a2002e50d8e6079d11e2ea1f672b483', merkle_root=
↪'20e86f03c24c53c12014264d0e405e014e15a02ad02c174f017ee040750f8d9d',␣
↪time=1592848036, bits=387044594, nonce=791719079)
>>> b
<Block(000000000000000000000154ba9d02ddd6cee0d71d1ea232753e02c9ac6affd709, None,␣
↪transactions: 0)>
```

Parameters

- **block_hash** (*bytes, str*) – Hash value of serialized block
- **version** (*bytes, str, in*) – Block version to indicate which software / BIPs are used to create block
- **prev_block** (*bytes, str*) – Hash of previous block in blockchain
- **merkle_root** (*bytes, str*) – Merkle root. Top item merkle chain tree to validate transactions.
- **time** (*int, bytes*) – Timestamp of time when block was included in blockchain
- **bits** (*bytes, str, int*) – Bits are used to indicate target / difficulty
- **nonce** (*bytes, str, int*) – Number used once, n-once is used to create randomness for miners to find a suitable block hash
- **transactions** (*list of Transaction, list of str*) – List of transaction included in this block. As list of transaction objects or list of transaction IDs strings
- **height** (*int*) – Height of this block in the Blockchain
- **confirmations** (*int*) – Number of confirmations for this block, or depth. Increased when new blocks are found
- **network** (*str, Network*) – Network, leave empty for default network

as_dict()

Get representation of current Block as dictionary.

Return dict

check_proof_of_work()

Check proof of work for this block. Block hash must be below target.

This library is not optimised for mining, but you can use this for testing or learning purposes.

```
>>> b = Block('000000000000000000000154ba9d02ddd6cee0d71d1ea232753e02c9ac6affd709
↪', version=0x20000000, prev_block=
↪'0000000000000000000f9578cda278ae7a2002e50d8e6079d11e2ea1f672b483', merkle_
↪root='20e86f03c24c53c12014264d0e405e014e15a02ad02c174f017ee040750f8d9d',␣
↪time=1592848036, bits=387044594, nonce=791719079)
>>> b.check_proof_of_work()
True
```

Return bool

property difficulty

Block difficulty calculated from bits / target. Human readable representation of block's target.

Genesis block has difficulty of 1.0

```
>>> from bitcoinlib.services.services import Service
>>> srv = Service()
>>> b = srv.getblock(0)
>>> b.difficulty
1.0
```

Return float

classmethod from_raw(*raw*, *block_hash=None*, *height=None*, *parse_transactions=False*, *limit=0*, *network='bitcoin'*)

Create Block object from raw serialized block in bytes.

Get genesis block:

```
>>> from bitcoinlib.services.services import Service
>>> srv = Service()
>>> b = srv.getblock(0)
>>> b.block_hash.hex()
'000000000019d6689c085ae165831e934ff763ae46a2a6c172b3f1b60a8ce26f'
```

Parameters

- **raw** (*bytes*) – Raw serialize block
- **block_hash** (*bytes*) – Specify block hash if known to verify raw block. Value error will be raised if calculated block hash is different than specified.
- **height** (*int*) – Specify height if known. Will be derived from coinbase transaction if not provided.
- **parse_transactions** (*bool*) – Indicate if transactions in raw block need to be parsed and converted to Transaction objects. Default is False
- **limit** (*int*) – Maximum number of transactions to parse. Default is 0: parse all transactions. Only used if parse_transaction is set to True
- **network** (*str*) – Name of network

Return Block

classmethod parse(*raw*, *block_hash=None*, *height=None*, *parse_transactions=False*, *limit=0*, *network='bitcoin'*)

Create Block object from raw serialized block in bytes or BytesIO format. Wrapper for *parse_bytesio()*

Get genesis block:

```
>>> from bitcoinlib.services.services import Service
>>> srv = Service()
>>> b = srv.getblock(0)
>>> b.block_hash.hex()
'000000000019d6689c085ae165831e934ff763ae46a2a6c172b3f1b60a8ce26f'
```

Parameters

- **raw** (*BytesIO, bytes*) – Raw serialize block
- **block_hash** (*bytes*) – Specify block hash if known to verify raw block. Value error will be raised if calculated block hash is different than specified.
- **height** (*int*) – Specify height if known. Will be derived from coinbase transaction if not provided.
- **parse_transactions** (*bool*) – Indicate if transactions in raw block need to be parsed and converted to Transaction objects. Default is False
- **limit** (*int*) – Maximum number of transactions to parse. Default is 0: parse all transactions. Only used if parse_transaction is set to True
- **network** (*str*) – Name of network

Return Block

classmethod parse_bytes(*raw_bytes*, *block_hash=None*, *height=None*, *parse_transactions=False*, *limit=0*, *network='bitcoin'*)

Create Block object from raw serialized block in bytes or BytesIO format. Wrapper for *parse_bytesio()*

Get genesis block:

```
>>> from bitcoinlib.services.services import Service
>>> srv = Service()
>>> b = srv.getblock(0)
>>> b.block_hash.hex()
'000000000019d6689c085ae165831e934ff763ae46a2a6c172b3f1b60a8ce26f'
```

Parameters

- **raw_bytes** (*bytes*) – Raw serialize block
- **block_hash** (*bytes*) – Specify block hash if known to verify raw block. Value error will be raised if calculated block hash is different than specified.
- **height** (*int*) – Specify height if known. Will be derived from coinbase transaction if not provided.
- **parse_transactions** (*bool*) – Indicate if transactions in raw block need to be parsed and converted to Transaction objects. Default is False
- **limit** (*int*) – Maximum number of transactions to parse. Default is 0: parse all transactions. Only used if parse_transaction is set to True
- **network** (*str*) – Name of network

Return Block

classmethod parse_bytesio(*raw*, *block_hash=None*, *height=None*, *parse_transactions=False*, *limit=0*, *network='bitcoin'*)

Create Block object from raw serialized block in BytesIO format

Get genesis block:

```
>>> from bitcoinlib.services.services import Service
>>> srv = Service()
>>> b = srv.getblock(0)
>>> b.block_hash.hex()
'000000000019d6689c085ae165831e934ff763ae46a2a6c172b3f1b60a8ce26f'
```

Parameters

- **raw** (*BytesIO*) – Raw serialize block
- **block_hash** (*bytes*) – Specify block hash if known to verify raw block. Value error will be raised if calculated block hash is different than specified.
- **height** (*int*) – Specify height if known. Will be derived from coinbase transaction if not provided.
- **parse_transactions** (*bool*) – Indicate if transactions in raw block need to be parsed and converted to Transaction objects. Default is False
- **limit** (*int*) – Maximum number of transactions to parse. Default is 0: parse all transactions. Only used if parse_transaction is set to True
- **network** (*str*) – Name of network

Return Block

parse_transactions(*limit=0*)

Parse raw transactions from Block, if transaction data is available in txs_data attribute. Creates Transaction objects in Block.transactions list

Parameters **limit** – Maximum number of transactions to parse

Returns

serialize()

Serialize raw block in bytes.

A block consists of a 80 bytes header: * version - 4 bytes * previous block - 32 bytes * merkle root - 32 bytes * timestamp - 4 bytes * bits - 4 bytes * nonce - 4 bytes

Followed by a list of raw serialized transactions.

Method will raise an error if one of the header fields is missing or has an incorrect size.

Return bytes

property target

Block target calculated from block's bits. Block hash must be below this target. Used to calculate block difficulty.

Return int

property target_hex

Block target in hexadecimal string of 64 characters.

Return str

property version_bin

Get the block version as binary string. Since BIP9 protocol changes are signaled by changing one of the 29 last bits of the version number.

```
>>> from bitcoinlib.services.services import Service
>>> srv = Service()
>>> b = srv.getblock(450001)
>>> print(b.version_bin)
00100000000000000000000000000010
```

Return str

version_bips()

Extract version signaling information from the block's version number.

The block version shows which software the miner used to create the block. Changes to the bitcoin protocol are described in Bitcoin Improvement Proposals (BIPs) and a miner shows which BIPs it supports in the block version number.

This method returns a list of BIP version number as string.

Example: This block uses the BIP9 versioning system and signals BIP141 (segwit) >>> from bitcoinlib.services.services import Service >>> srv = Service() >>> b = srv.getblock(450001) >>> print(b.version_bips()) ['BIP9', 'BIP141']

Return list of str

8.16 bitcoinlib.values module

class bitcoinlib.values.**Value**(*value*, *denominator=None*, *network='bitcoin'*)

Bases: object

Class to represent and convert cryptocurrency values

Create a new Value class. Specify value as integer, float or string. If a string is provided the amount, denominator and currency will be extracted if provided

Examples: Initialize value class >>> Value(10) Value(value=10.00000000000000, denominator=1.00000000, network='bitcoin')

```
>>> Value('15 mBTC')
Value(value=0.01500000000000, denominator=0.00100000, network='bitcoin')
```

```
>>> Value('10 sat')
Value(value=0.00000010000000, denominator=0.00000001, network='bitcoin')
```

```
>>> Value('1 doge')
Value(value=1.00000000000000, denominator=1.00000000, network='dogecoin')
```

```
>>> Value(500, 'm')
Value(value=0.50000000000000, denominator=0.00100000, network='bitcoin')
```

```
>>> Value(500, 0.001)
Value(value=0.50000000000000, denominator=0.00100000, network='bitcoin')
```

All frequently used arithmetic, comparision and logical operators can be used on the Value object. So you can compare Value object, add them together, divide or multiply them, etc.

Values need to use the same network / currency if you work with multiple Value objects. I.e. Value('1 BTC') + Value('1 LTC') raises an error.

Examples: Value operators >>> Value('50000 sat') == Value('5000 fin') # 1 Satoshi equals 10 Finney, see https://en.bitcoin.it/wiki/Units True

```
>>> Value('1 btc') > Value('2 btc')
False
```

```
>>> Value('1000 LTC') / 5
Value(value=200.00000000000000, denominator=1.00000000, network='litecoin')
```

```
>>> Value('0.002 BTC') + 0.02
Value(value=0.02200000000000, denominator=1.00000000, network='bitcoin')
```

The Value class can be represented in several formats.

Examples: Format Value class >>> int(Value("10.1 BTC")) 10

```
>>> float(Value("10.1 BTC"))
10.1
```

```
>>> round(Value("10.123 BTC"), 2).str()
'10.12000000 BTC'
```

```
>>> hex(Value("10.1 BTC"))
'0x3c336080'
```

Parameters

- **value** (*int, float, str*) – Value as integer, float or string. Numeric values must be supllied in smallest denominator such as Satoshi's. String values must be in the format: <value> [<denominator>][<currency_symbol>]
- **denominator** (*int, float, str*) – Denominator as integer or string. Such as 0.001 or m for milli, 1000 or k for kilo, etc. See NETWORK_DENOMINATORS for list of available denominator symbols.
- **network** (*str, Network*) – Specify network if not supplied already in the value string

classmethod from_satoshi(*value*, *denominator=None*, *network='bitcoin'*)

Initialize Value class with smallest denominator as input. Such as represented in script and transactions cryptocurrency values.

Parameters

- **value** (*int*) – Amount of Satoshi's / smallest denominator for this network
- **denominator** (*int, float, str*) – Denominator as integer or string. Such as 0.001 or m for milli, 1000 or k for kilo, etc. See NETWORK_DENOMINATORS for list of available denominator symbols.
- **network** (*str, Network*) – Specify network if not supplied already in the value string

Return Value

str(*denominator=None*, *decimals=None*, *currency_repr='code'*)

Get string representation of Value with requested denominator and number of decimals.

```
>>> Value(1200000, 'sat').str('m')  # milli Bitcoin
'12.00000 mBTC'
```

```
>>> Value(12000.3, 'sat').str(1)  # Use denominator = 1 for Bitcoin
'0.00012000 BTC'
```

```
>>> Value(12000, 'sat').str('auto')
'120.00 µBTC'
```

```
>>> Value(0.005).str('m')
'5.00000 mBTC'
```

```
>>> Value(12000, 'sat').str('auto', decimals=0)
'120 µBTC'
```

```
>>> Value('13000000 Doge').str('auto')  # Yeah, mega Dogecoins...
'13.00000000 MDOGE'
```

```
>>> Value('2100000000').str('auto')
'2.10000000 GBTC'
```

```
>>> Value('1.5 BTC').str(currency_repr='symbol')
'1.50000000 '
```

```
>>> Value('1.5 BTC').str(currency_repr='name')
'1.50000000 bitcoins'
```

Parameters

- **denominator** (*int, float, str*) – Denominator as integer or string. Such as 0.001 or m for milli, 1000 or k for kilo, etc. See NETWORK_DENOMINATORS for list of available denominator symbols. If not provided the default self.denominator value is used. Use value 'auto' to automatically determine best denominator for human readability.
- **decimals** (*float*) – Number of decimals to use
- **currency_repr** (*str*) – Representation of currency. I.e. code: BTC, name: bitcoins, symbol:

Return str

str_auto(*decimals=None*, *currency_repr='code'*)

String representation of this Value. Wrapper for the *str()* method, but automatically determines the denominator depending on the value.

```
>>> Value('0.0000012 BTC').str_auto()
'120 sat'
```

```
>>> Value('0.0005 BTC').str_auto()
'500.00 µBTC'
```

Parameters

- **decimals** (*float*) – Number of decimals to use
- **currency_repr** (*str*) – Representation of currency. I.e. code: BTC, name: Bitcoin, symbol:

Return str

str_unit(*decimals=None*, *currency_repr='code'*)
String representation of this Value. Wrapper for the *str()* method, but always uses 1 as denominator, meaning main denominator such as BTC, LTC.

```
>>> Value('12000 sat').str_unit()
'0.00012000 BTC'
```

Parameters

- **decimals** (*float*) – Number of decimals to use
- **currency_repr** (*str*) – Representation of currency. I.e. code: BTC, name: Bitcoin, symbol:

Return str

to_bytes(*length=8*, *byteorder='little'*)
Representation of value_sat (value in smallest denominator: satoshi's) as bytes string. Used for script or transaction serialization.

```
>>> Value('1 sat').to_bytes()
b'\x01\x00\x00\x00\x00\x00\x00\x00'
```

Parameters

- **length** (*int*) – Length of bytes string to return, default is 8 bytes
- **byteorder** (*str*) – Order of bytes: little or big endian. Default is 'little'

Return bytes

to_hex(*length=16*, *byteorder='little'*)
Representation of value_sat (value in smallest denominator: satoshi's) as hexadecimal string.

```
>>> Value('15 sat').to_hex()
'0f00000000000000'
```

Parameters

- **length** (*int*) – Length of hexadecimal string to return, default is 16 characters
- **byteorder** (*str*) – Order of bytes: little or big endian. Default is 'little'

Returns

property value_sat
Value in smallest denominator, i.e. Satoshi for the Bitcoin network

Return int

bitcoinlib.values.**value_to_satoshi**(*value*, *network=None*)
Convert Value object or value string to smallest denominator amount as integer

Parameters

- **value** (*str, int, float, Value*) – Value object, value string as accepted by Value class or numeric value amount
- **network** (*str, Network*) – Specify network to validate value string

Return int

8.17 bitcoinlib.services.services module

class bitcoinlib.services.services.**Cache**(*network*, *db_uri=''*)

Bases: object

Store transaction, utxo and address information in database to increase speed and avoid duplicate calls to service providers.

Once confirmed a transaction is immutable so we have to fetch it from a service provider only once. When checking for new transactions or utxo's for a certain address we only have to check the new blocks.

This class is used by the Service class and normally you won't need to access it directly.

Open Cache class

Parameters

- **network** (*str*, Network) – Specify network used
- **db_uri** (*str*) – Database to use for caching

blockcount(*never_expires=False*)

Get number of blocks on the current network from cache if recent data is available.

Parameters **never_expires** (*bool*) – Always return latest blockcount found. Can be used to avoid return to old blocks if service providers are not up-to-date.

Return int

cache_enabled()

Check if caching is enabled. Returns False if SERVICE_CACHING_ENABLED is False or no session is defined.

Return bool

commit()

Commit queries in self.session. Rollback if commit fails.

Returns

estimatefee(*blocks*)

Get fee estimation from cache for confirmation within specified amount of blocks.

Stored in cache in three groups: low, medium and high fees.

Parameters **blocks** (*int*) – Expection confirmation time in blocks.

Return int Fee in smallest network denominator (satoshi)

getaddress(*address*)

Get address information from cache, with links to transactions and utxo's and latest update information.

Parameters **address** (*str*) – Address string

Return DbCacheAddress An address cache database object

getblock(*blockid*)

Get specific block from database cache.

Parameters **blockid** (*int, str*) – Block height or block hash

Return Block

getblocktransactions(*height*, *page*, *limit*)

Get range of transactions from a block

Parameters

- **height** (*int*) – Block height
- **page** (*int*) – Transaction page
- **limit** (*int*) – Number of transactions per page

Returns

getrawtransaction(*txid*)

Get a raw transaction string from the database cache if available

Parameters **txid** (*bytes*) – Transaction identification hash

Return str Raw transaction as hexstring

gettransaction(*txid*)

Get transaction from cache. Returns False if not available

Parameters **txid** (*bytes*) – Transaction identification hash

Return Transaction A single Transaction object

gettransactions(*address*, *after_txid=''*, *limit=20*)

Get transactions from cache. Returns empty list if no transactions are found or caching is disabled.

Parameters

- **address** (*str*) – Address string
- **after_txid** (*bytes*) – Transaction ID of last known transaction. Only check for transactions after given tx id. Default: Leave empty to return all transaction. If used only provide a single address
- **limit** (*int*) – Maximum number of transactions to return

Return list List of Transaction objects

getutxos(*address*, *after_txid=''*)

Get list of unspent outputs (UTXO's) for specified address from database cache.

Sorted from old to new, so highest number of confirmations first.

Parameters

- **address** (*str*) – Address string
- **after_txid** (*bytes*) – Transaction ID of last known transaction. Only check for utxos after given tx id. Default: Leave empty to return all utxos.

Return dict UTXO's per address

store_address(*address*, *last_block=None*, *balance=0*, *n_utxos=None*, *txs_complete=False*, *last_txid=None*)

Store address information in cache

param address Address string

type address str

param last_block Number or last block retrieved from service provider. For instance if address contains a large number of transactions and they will be retrieved in more then one request.

type last_block int

param balance Total balance of address in sathosis, or smallest network detominator

type balance int

param n_utxos Total number of UTXO's for this address

type n_utxos int

param txs_complete True if all transactions for this address are added to cache

type txs_complete bool

param last_txid Transaction ID of last transaction downloaded from blockchain

type last_txid bytes

. :return:

`store_block`(*block*)
Store block in cache database

Parameters **block** (Block) – Block

Returns

`store_blockcount`(*blockcount*)
Store network blockcount in cache for 60 seconds

Parameters **blockcount** (*int, str*) – Number of latest block

Returns

`store_estimated_fee`(*blocks*, *fee*)
Store estimated fee retrieved from service providers in cache.

Parameters

- **blocks** (*int*) – Confirmation within x blocks
- **fee** (*int*) – Estimated fee in Sathosis

Returns

`store_transaction`(*t*, *order_n=None*, *commit=True*)
Store transaction in cache. Use order number to determine order in a block

Parameters

- **t** (Transaction) – Transaction
- **order_n** (*int*) – Order in block
- **commit** – Commit transaction to database. Default is True. Can be disabled if a larger number of transactions are added to cache, so you can commit outside this method.

Returns

`class bitcoinlib.services.services.Service`(*network='bitcoin'*, *min_providers=1*, *max_providers=1*, *providers=None*, *timeout=5*, *cache_uri=None*, *ignore_priority=False*, *exclude_providers=None*, *max_errors=4*)

Bases: `object`

Class to connect to various cryptocurrency service providers. Use to receive network and blockchain information, get specific transaction information, current network fees or push a raw transaction.

The Service class connects to 1 or more service providers at random to retrieve or send information. If a service providers fails to correctly respond the Service class will try another available provider.

Create a service object for the specified network. By default the object connect to 1 service provider, but you can specify a list of providers or a minimum or maximum number of providers.

Parameters

- **network** (*str, Network*) – Specify network used
- **min_providers** (*int*) – Minimum number of providers to connect to. Default is 1. Use for instance to receive fee information from a number of providers and calculate the average fee.
- **max_providers** (*int*) – Maximum number of providers to connect to. Default is 1.
- **providers** (*list of str*) – List of providers to connect to. Default is all providers and select a provider at random.
- **timeout** (*int*) – Timeout for web requests. Leave empty to use default from config settings
- **cache_uri** (*str*) – Database to use for caching
- **ignore_priority** (*bool*) – Ignores provider priority if set to True. Could be used for unit testing, so no providers are missed when testing. Default is False
- **exclude_providers** (*list of str*) – Exclude providers in this list, can be used when problems with certain providers arise.

blockcount()

Get latest block number: The block number of last block in longest chain on the Blockchain.

Block count is cashed for BLOCK_COUNT_CACHE_TIME seconds to avoid to many calls to service providers.

Return int

estimatefee(*blocks=3*)

Estimate fee per kilobyte for a transaction for this network with expected confirmation within a certain amount of blocks

Parameters **blocks** (*int*) – Expection confirmation time in blocks. Default is 3.

Return int Fee in smallest network denominator (satoshi)

getbalance(*addresslist*, *addresses_per_request=5*)

Get total balance for address or list of addresses

Parameters

- **addresslist** (*list, str*) – Address or list of addresses
- **addresses_per_request** (*int*) – Maximum number of addresses per request. Default is 5. Use lower setting when you experience timeouts or service request errors, or higher when possible.

Return dict Balance per address

getblock(*blockid*, *parse_transactions=True*, *page=1*, *limit=None*)

Get block with specified block height or block hash from service providers.

If parse_transaction is set to True a list of Transaction object will be returned otherwise a list of transaction ID's.

Some providers require 1 or 2 extra request per transaction, so to avoid timeouts or rate limiting errors you can specify a page and limit for the transaction. For instance with page=2, limit=4 only transaction 5 to 8 are returned in the Blocks's 'transaction' attribute.

If you only use a local bcoin or bitcoind provider, make sure you set the limit to maximum (i.e. 9999) because all transactions are already downloaded when fetching the block.

```
>>> from bitcoinlib.services.services import Service
>>> srv = Service()
>>> b = srv.getblock(0)
>>> b
<Block(000000000019d6689c085ae165831e934ff763ae46a2a6c172b3f1b60a8ce26f, 0,␣
↪transactions: 1)>
```

Parameters

- **blockid** (*str, int*) – Hash or block height of block
- **parse_transactions** (*bool*) – Return Transaction objects or just transaction ID's. Default is return txids.
- **page** (*int*) – Page number of transaction paging. Default is start from the beginning: 1
- **limit** (*int*) – Maximum amount of transaction to return. Default is 10 is parse transaction is enabled, otherwise returns all txid's (9999)

Return Block

getcacheaddressinfo(*address*)

Get address information from cache. I.e. balance, number of transactions, number of utox's, etc

Cache will only be filled after all transactions for a specific address are retrieved (with gettransactions ie)

Parameters **address** (*str*) – address string

Return dict

getinfo()

Returns info about current network. Such as difficulty, latest block, mempool size and network hashrate.

Return dict

getinputvalues(*t*)

Retrieve values for transaction inputs for given Transaction.

Raw transactions as stored on the blockchain do not contain the input values but only the previous transaction hash and index number. This method retrieves the previous transaction and reads the value.

Parameters **t** (Transaction) – Transaction

Return Transaction

getrawblock(*blockid*)

Get raw block as hexadecimal string for block with specified hash or block height.

Not many providers offer this option, and it can be slow, so it is advised to use a local client such as bitcoind.

Parameters **blockid** (*str, int*) – Block hash or block height

Return str

getrawtransaction(*txid*)

Get a raw transaction by its transaction hash

Parameters **txid** (*str*) – Transaction identification hash

Return str Raw transaction as hexstring

gettransaction(*txid*)

Get a transaction by its transaction hashtxos. Convert to Bitcoinlib transaction object.

Parameters **txid** (*str*) – Transaction identification hash

Return Transaction A single transaction object

gettransactions(*address*, *after_txid=''*, *limit=20*)
Get all transactions for specified address.

Sorted from old to new, so transactions with highest number of confirmations first.

Parameters

- **address** (*str*) – Address string
- **after_txid** (*str*) – Transaction ID of last known transaction. Only check for transactions after given tx id. Default: Leave empty to return all transaction. If used only provide a single address
- **limit** (*int*) – Maximum number of transactions to return

Return list List of Transaction objects

getutxos(*address*, *after_txid=''*, *limit=20*)
Get list of unspent outputs (UTXO's) for specified address.

Sorted from old to new, so highest number of confirmations first.

Parameters

- **address** (*str*) – Address string
- **after_txid** (*str*) – Transaction ID of last known transaction. Only check for utxos after given tx id. Default: Leave empty to return all utxos.
- **limit** (*int*) – Maximum number of utxo's to return

Return dict UTXO's per address

isspent(*txid*, *output_n*)
Check if the output with provided transaction ID and output number is spent.

Parameters

- **txid** (*str*) – Transaction ID hex
- **output_n** (*int*) – Output number

Return bool

mempool(*txid=''*)
Get list of all transaction IDs in the current mempool

A full list of transactions ID's will only be returned if a bcoin or bitcoind client is available. Otherwise specify the txid option to verify if a transaction is added to the mempool.

Parameters **txid** (*str*) – Check if transaction with this hash exists in memory pool

Return list

sendrawtransaction(*rawtx*)
Push a raw transaction to the network

Parameters **rawtx** (*str*) – Raw transaction as hexstring or bytes

Return dict Send transaction result

exception bitcoinlib.services.services.**ServiceError**(*msg=''*)
Bases: Exception

8.18 bitcoinlib.services package

8.18.1 Submodules

8.18.1.1 bitcoinlib.services.authproxy module

Copyright 2011 Jeff Garzik

AuthServiceProxy has the following improvements over python-jsonrpc's ServiceProxy class:

- HTTP connections persist for the life of the AuthServiceProxy object (if server supports HTTP/1.1)
- sends protocol 'version', per JSON-RPC 1.1
- sends proper, incrementing 'id'
- sends Basic HTTP authentication headers
- parses all JSON numbers that look like floats as Decimal
- uses standard Python json lib

Previous copyright, from python-jsonrpc/jsonrpc/proxy.py:

Copyright (c) 2007 Jan-Klaas Kollhof

This file is part of jsonrpc.

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You should have received a copy of the GNU Lesser General Public License along with this software; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

class bitcoinlib.services.authproxy.**AuthServiceProxy**(*service_url*, *service_name=None*, *timeout=30*, *connection=None*)

Bases: object

batch_(*rpc_calls*)

Batch RPC call. Pass array of arrays: [["method", params…], …] Returns array of results.

bitcoinlib.services.authproxy.**EncodeDecimal**(*o*)

exception bitcoinlib.services.authproxy.**JSONRPCException**(*rpc_error*)

Bases: Exception

8.18.1.2 bitcoinlib.services.baseclient module

class bitcoinlib.services.baseclient.**BaseClient**(*network*, *provider*, *base_url*, *denominator*, *api_key=''*, *provider_coin_id=''*, *network_overrides=None*, *timeout=5*, *latest_block=None*)

Bases: object

request(*url_path*, *variables=None*, *method='get'*, *secure=True*, *post_data=''*)

exception bitcoinlib.services.baseclient.**ClientError**(*msg=''*)

Bases: Exception

8.18.1.3 bitcoinlib.services.bcoin module

class bitcoinlib.services.bcoin.**BcoinClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

Class to interact with Bcoin API

blockcount()

compose_request(*func*, *data=''*, *parameter=''*, *variables=None*, *method='get'*)

estimatefee(*blocks*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawtransaction(*txid*)

gettransaction(*txid*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *index*)

mempool(*txid=''*)

sendrawtransaction(*rawtx*)

8.18.1.4 bitcoinlib.services.bitaps module

class bitcoinlib.services.bitaps.**BitapsClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*category*, *command=''*, *data=''*, *variables=None*, *req_type='blockchain'*, *method='get'*)

getbalance(*addresslist*)

getrawtransaction(*txid*)

getutxos(*address*, *after_txid=''*, *limit=20*)

8.18.1.5 bitcoinlib.services.bitcoind module

class bitcoinlib.services.bitcoind.**BitcoindClient**(*network='bitcoin'*, *base_url=''*, *denominator=100000000*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

Class to interact with bitcoind, the Bitcoin deamon

Open connection to bitcoin node

Parameters

- **network** – Bitcoin mainnet or testnet. Default is bitcoin mainnet
- **base_url** – Connection URL in format http(s)://user:password@host:port.
- **denominator** – Denominator for this currency. Should be always 100000000 (satoshis) for bitcoin

Type str

Type str

Type str

blockcount()

estimatefee(*blocks*)

static from_config(*configfile=None*, *network='bitcoin'*)

Read settings from bitcoind config file

Parameters

- **configfile** – Path to config file. Leave empty to look in default places
- **network** – Bitcoin mainnet or testnet. Default is bitcoin mainnet

Type str

Type str

Return BitcoindClient

getblock(*blockid*, *parse_transactions=True*, *page=1*, *limit=None*)

getinfo()

getrawblock(*blockid*)

getrawtransaction(*txid*)

gettransaction(*txid*)

isspent(*txid*, *index*)

mempool(*txid=''*)

sendrawtransaction(*rawtx*)

exception bitcoinlib.services.bitcoind.**ConfigError**(*msg=''*)

Bases: Exception

8.18.1.6 bitcoinlib.services.bitcoinlibtest module

class bitcoinlib.services.bitcoinlibtest.**BitcoinLibTestClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

Dummy service client for bitcoinlib test network. Only used for testing.

Does not make any connection to a service provider, so can be used offline.

blockcount()

estimatefee(*blocks*)

Dummy estimate fee method for the bitcoinlib testnet.

Parameters **blocks** (*int*) – Number of blocks

Return int Fee as 100000 // number of blocks

getbalance(*addresslist*)

Dummy getbalance method for bitcoinlib testnet

Parameters **addresslist** (*list*) – List of addresses

Return int

getutxos(*address*, *after_txid=''*, *limit=10*, *utxos_per_address=2*)

Dummy method to retreive UTXO's. This method creates a new UTXO for each address provided out of the testnet void, which can be used to create test transactions for the bitcoinlib testnet.

Parameters

- **address** (*str*) – Address string
- **after_txid** (*str*) – Transaction ID of last known transaction. Only check for utxos after given tx id. Default: Leave empty to return all utxos. If used only provide a single address
- **limit** (*int*) – Maximum number of utxo's to return

Return list The created UTXO set

mempool(*txid=''*)

sendrawtransaction(*rawtx*)

Dummy method to send transactions on the bitcoinlib testnet. The bitcoinlib testnet does not exists, so it just returns the transaction hash.

Parameters **rawtx** (*bytes, str*) – A raw transaction hash

Return str Transaction hash

8.18.1.7 bitcoinlib.services.bitflyer module

class bitcoinlib.services.bitflyer.**BitflyerClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*function*, *parameter=''*, *parameter2=''*, *method='get'*)

getbalance(*addresslist*)

8.18.1.8 bitcoinlib.services.bitgo module

class bitcoinlib.services.bitgo.**BitGoClient**(*network*, *base_url*, *denominator*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*category*, *data*, *cmd=''*, *variables=None*, *method='get'*)

estimatefee(*blocks*)

getbalance(*addresslist*)

getutxos(*address*, *after_txid=''*, *limit=20*)

8.18.1.9 bitcoinlib.services.blockchaininfo module

class bitcoinlib.services.blockchaininfo.**BlockchainInfoClient**(*network*, *base_url*, *denominator*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*cmd*, *parameter=''*, *variables=None*, *method='get'*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawblock(*blockid*)

getrawtransaction(*txid*)

gettransaction(*txid*, *latest_block=None*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

mempool(*txid=''*)

8.18.1.10 bitcoinlib.services.blockchair module

class bitcoinlib.services.blockchair.**BlockChairClient**(*network*, *base_url*, *denominator*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()
Get latest block number: The block number of last block in longest chain on the blockchain

Return int

compose_request(*command*, *query_vars=None*, *variables=None*, *data=None*, *offset=0*, *limit=100*, *method='get'*)

estimatefee(*blocks*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawblock(*blockid*)

getrawtransaction(*txid*)

gettransaction(*tx_id*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *output_n*)

mempool(*txid=''*)

sendrawtransaction(*rawtx*)

8.18.1.11 bitcoinlib.services.blockcypher module

class bitcoinlib.services.blockcypher.**BlockCypher**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*function*, *data*, *parameter=''*, *variables=None*, *method='get'*)

estimatefee(*blocks*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getrawtransaction(*txid*)

gettransaction(*txid*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *output_n*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.1.12 bitcoinlib.services.blocksmurfer module

class bitcoinlib.services.blocksmurfer.**BlocksmurferClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*function*, *parameter=''*, *parameter2=''*, *variables=None*, *post_data=''*, *method='get'*)

estimatefee(*blocks*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawtransaction(*txid*)

gettransaction(*txid*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *output_n*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.1.13 bitcoinlib.services.blockstream module

class bitcoinlib.services.blockstream.**BlockstreamClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*function*, *data=''*, *parameter=''*, *parameter2=''*, *variables=None*, *post_data=''*, *method='get'*)

estimatefee(*blocks*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getrawblock(*blockid*)

getrawtransaction(*txid*)

gettransaction(*txid*, *blockcount=None*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *output_n*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.1.14 bitcoinlib.services.chainso module

class bitcoinlib.services.chainso.**ChainSo**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*function*, *data=''*, *parameter=''*, *variables=None*, *method='get'*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawtransaction(*txid*)

gettransaction(*txid*, *block_height=None*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.1.15 bitcoinlib.services.cryptoid module

class bitcoinlib.services.cryptoid.**CryptoID**(*network*, *base_url*, *denominator*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*func=None*, *path_type='api'*, *variables=None*, *method='get'*)

getbalance(*addresslist*)

getrawtransaction(*txid*)

gettransaction(*txid*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

mempool(*txid*)

8.18.1.16 bitcoinlib.services.dashd module

exception bitcoinlib.services.dashd.**ConfigError**(*msg=''*)
Bases: Exception

class bitcoinlib.services.dashd.**DashdClient**(*network='dash'*, *base_url=''*, *denominator=100000000*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

Class to interact with dashd, the Dash deamon

Open connection to dashcore node

Parameters

- **network** – Dash mainnet or testnet. Default is dash mainnet
- **base_url** – Connection URL in format http(s)://user:password@host:port.
- **denominator** – Denominator for this currency. Should be always 100000000 (satoshis) for Dash

Type str

Type str

Type str

blockcount()

estimatefee(*blocks*)

static from_config(*configfile=None*, *network='dash'*)
Read settings from dashd config file

Parameters

- **configfile** – Path to config file. Leave empty to look in default places
- **network** – Dash mainnet or testnet. Default is dash mainnet

Type str

Type str

Return DashdClient

getblock(*blockid*, *parse_transactions=True*, *page=1*, *limit=None*)

getinfo()

getrawblock(*blockid*)

getrawtransaction(*txid*)

gettransaction(*txid*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *index*)

sendrawtransaction(*rawtx*)

8.18.1.17 bitcoinlib.services.dogecoind module

exception bitcoinlib.services.dogecoind.**ConfigError**(*msg=''*)
Bases: Exception

class bitcoinlib.services.dogecoind.**DogecoindClient**(*network='dogecoin'*, *base_url=''*, *denominator=100000000*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

Class to interact with dogecoind, the Dogecoin daemon

Open connection to dogecoin node

Parameters

- **network** – Dogecoin mainnet or testnet. Default is dogecoin mainnet
- **base_url** – Connection URL in format http(s)://user:password@host:port.
- **denominator** – Denominator for this currency. Should be always 100000000 (satoshis) for dogecoin

Type str

Type str

Type str

blockcount()

estimatefee(*blocks*)

static from_config(*configfile=None*, *network='dogecoin'*)
Read settings from dogecoind config file

Parameters

- **configfile** – Path to config file. Leave empty to look in default places
- **network** – Dogecoin mainnet or testnet. Default is dogecoin mainnet

Type str

Type str

Return DogecoindClient

getinfo()

getrawtransaction(*txid*)

gettransaction(*txid*, *block_height=None*, *get_input_values=True*)

getutxos(*address*, *after_txid=''*, *max_txs=20*)

mempool(*txid=''*)

sendrawtransaction(*rawtx*)

8.18.1.18 bitcoinlib.services.insightdash module

class bitcoinlib.services.insightdash.**InsightDashClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*category*, *data*, *cmd=''*, *variables=None*, *method='get'*, *offset=0*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawtransaction(*tx_id*)

gettransaction(*tx_id*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *output_n*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.1.19 bitcoinlib.services.litecoinblockexplorer module

class bitcoinlib.services.litecoinblockexplorer.**LitecoinBlockexplorerClient**(*network*, *base_url*, *denominator*, **args*)

Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*category*, *data*, *cmd=''*, *variables=None*, *method='get'*, *offset=0*)

estimatefee(*blocks*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawtransaction(*tx_id*)

gettransaction(*tx_id*)

getutxos(*address*, *after_txid=''*, *limit=20*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.1.20 bitcoinlib.services.litecoind module

exception bitcoinlib.services.litecoind.**ConfigError**(*msg=''*)
Bases: Exception

class bitcoinlib.services.litecoind.**LitecoindClient**(*network='litecoin'*, *base_url=''*, *denominator=100000000*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

Class to interact with litecoind, the Litecoin deamon

Open connection to litecoin node

Parameters

- **network** – Litecoin mainnet or testnet. Default is litecoin mainnet
- **base_url** – Connection URL in format http(s)://user:password@host:port.
- **denominator** – Denominator for this currency. Should be always 100000000 (satoshis) for litecoin

Type str

Type str

Type str

blockcount()

estimatefee(*blocks*)

static **from_config**(*configfile=None*, *network='litecoin'*)
Read settings from litecoind config file

Parameters

- **configfile** – Path to config file. Leave empty to look in default places
- **network** – Litecoin mainnet or testnet. Default is litecoin mainnet

Type str

Type str

Return LitecoindClient

getblock(*blockid*, *parse_transactions=True*, *page=1*, *limit=None*)

getinfo()

getrawblock(*blockid*)

getrawtransaction(*txid*)

gettransaction(*txid*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *index*)

mempool(*txid=''*)

sendrawtransaction(*rawtx*)

8.18.1.21 bitcoinlib.services.litecoreio module

class bitcoinlib.services.litecoreio.**LitecoreIOClient**(*network*, *base_url*, *denominator*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*category*, *data*, *cmd=''*, *variables=None*, *method='get'*, *offset=0*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getinfo()

getrawtransaction(*tx_id*)

gettransaction(*tx_id*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *output_n*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.1.22 bitcoinlib.services.smartbit module

class bitcoinlib.services.smartbit.**SmartbitClient**(*network*, *base_url*, *denominator*, **args*)
Bases: *bitcoinlib.services.baseclient.BaseClient*

blockcount()

compose_request(*category*, *command=''*, *data=''*, *variables=None*, *req_type='blockchain'*, *method='get'*)

getbalance(*addresslist*)

getblock(*blockid*, *parse_transactions*, *page*, *limit*)

getrawtransaction(*txid*)

gettransaction(*txid*)

gettransactions(*address*, *after_txid=''*, *limit=20*)

getutxos(*address*, *after_txid=''*, *limit=20*)

isspent(*txid*, *output_n*)

mempool(*txid*)

sendrawtransaction(*rawtx*)

8.18.2 Module contents

8.19 bitcoinlib.config package

8.19.1 Submodules

8.19.1.1 bitcoinlib.config.config module

bitcoinlib.config.config.**initialize_lib**()

bitcoinlib.config.config.**read_config**()

8.19.1.2 bitcoinlib.config.opcodes module

bitcoinlib.config.opcodes.**op**()

8.19.1.3 bitcoinlib.config.secp256k1 module

8.19.2 Module contents

8.20 bitcoinlib.db module

class bitcoinlib.db.**Db**(*db_uri=None*, *password=None*)

Bases: object

Bitcoinlib Database object used by Service() and HDWallet() class. Initialize database and open session when creating database object.

Create new database if is doesn't exist yet

drop_db(*yes_i_am_sure=False*)

class bitcoinlib.db.**DbConfig**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base

BitcoinLib configuration variables

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

value

variable

class bitcoinlib.db.**DbKey**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base

Database definitions for keys in Sqlalchemy format

Part of a wallet, and used by transactions

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

account_id
ID of account if key is part of a HD structure

address
Address representation of key. An cryptocurrency address is a hash of the public key

address_index
Index of address in HD key structure address level

balance
Total balance of UTXO's linked to this key

change
Change or normal address: Normal=0, Change=1

compressed
Is key compressed or not. Default is True

cosigner_id
ID of cosigner, used if key is part of HD Wallet

depth
Depth of key if it is part of a HD structure. Depth=0 means masterkey, depth=1 are the masterkeys children.

encoding
Encoding used to represent address: base58 or bech32

id
Unique Key ID

is_private
Is key private or not?

key_type
Type of key: single, bip32 or multisig. Default is bip32

latest_txid
TxId of latest transaction downloaded from the blockchain

multisig_children
List of children keys

multisig_parents
List of parent keys

name
Key name string

network
DbNetwork object for this key

network_name
Name of key network, i.e. bitcoin, litecoin, dash

parent_id
Parent Key ID. Used in HD wallets

path
String of BIP-32 key path

private
Bytes representation of private key

public
Bytes representation of public key

purpose
Purpose ID, default is 44

transaction_inputs
All DbTransactionInput objects this key is part of

transaction_outputs
All DbTransactionOutput objects this key is part of

used
Has key already been used on the blockchain in as input or output? Default is False

wallet
Related Wallet object

wallet_id
Wallet ID which contains this key

wif
Public or private WIF (Wallet Import Format) representation

class bitcoinlib.db.**DbKeyMultisigChildren**(***kwargs*)
Bases: sqlalchemy.ext.declarative.api.Base

Use many-to-many relationship for multisig keys. A multisig keys contains 2 or more child keys and a child key can be used in more then one multisig key.

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

child_id

key_order

parent_id

class bitcoinlib.db.**DbNetwork**(***kwargs*)
Bases: sqlalchemy.ext.declarative.api.Base

Database definitions for networks in Sqlalchemy format

Most network settings and variables can be found outside the database in the libraries configurations settings. Use the bitcoinlib/data/networks.json file to view and manage settings.

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

description

name
Network name, i.e.: bitcoin, litecoin, dash

class bitcoinlib.db.**DbTransaction**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base

Database definitions for transactions in Sqlalchemy format

Refers to 1 or more keys which can be part of a wallet

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in `kwargs`.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

account_id
ID of account

block_height
Number of block this transaction is included in

coinbase
Is True when this is a coinbase transaction, default is False

confirmations
Number of confirmation when this transaction is included in a block. Default is 0: unconfirmed

date
Date when transaction was confirmed and included in a block. Or when it was created when transaction is not send or confirmed

fee
Transaction fee

id
Unique transaction index for internal usage

input_total
Total value of the inputs of this transaction. Input total = Output total + fee. Default is 0

inputs
List of all inputs as DbTransactionInput objects

is_complete
Allow to store incomplete transactions, for instance if not all inputs are known when retrieving UTXO's

locktime
Transaction level locktime. Locks the transaction until a specified block (value from 1 to 5 million) or until a certain time (Timestamp in seconds after 1-jan-1970). Default value is 0 for transactions without locktime

network
Link to DbNetwork object

network_name
Blockchain network name of this transaction

output_total
Total value of the outputs of this transaction. Output total = Input total - fee

outputs
List of all outputs as DbTransactionOutput objects

raw
Raw transaction hexadecimal string. Transaction is included in raw format on the blockchain

size
Size of the raw transaction in bytes

status
Current status of transaction, can be one of the following: new', 'unconfirmed', 'confirmed'. Default is 'new'

txid
Bytes representation of transaction ID

verified
Is transaction verified. Default is False

version
Tranaction version. Default is 1 but some wallets use another version number

wallet
Link to Wallet object which contains this transaction

wallet_id
ID of wallet which contains this transaction

witness_type
Is this a legacy or segwit transaction?

class bitcoinlib.db.**DbTransactionInput**(***kwargs*)
Bases: sqlalchemy.ext.declarative.api.Base

Transaction Input Table

Relates to Transaction table and Key table

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

address
Address string of input, used if no key is associated. An cryptocurrency address is a hash of the public key or a redeemscript

double_spend
Indicates if a service provider tagged this transaction as double spend

index_n
Index number of transaction input

key
Related DbKey object

key_id
ID of key used in this input

output_n
Output_n of previous transaction output that is spent in this input

prev_txid
Transaction hash of previous transaction. Previous unspent outputs (UTXO) is spent in this input

script
Unlocking script to unlock previous locked output

script_type
Unlocking script type. Can be 'coinbase', 'sig_pubkey', 'p2sh_multisig', 'signature', 'unknown', 'p2sh_p2wpkh' or 'p2sh_p2wsh'. Default is sig_pubkey

sequence
Transaction sequence number. Used for timelock transaction inputs

transaction
Related DbTransaction object

transaction_id
Input is part of transaction with this ID

value
Value of transaction input

witness_type
Type of transaction, can be legacy, segwit or p2sh-segwit. Default is legacy

class bitcoinlib.db.**DbTransactionOutput**(***kwargs*)
Bases: sqlalchemy.ext.declarative.api.Base

Transaction Output Table

Relates to Transaction and Key table

When spent is False output is considered an UTXO

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

address
Address string of output, used if no key is associated. An cryptocurrency address is a hash of the public key or a redeemscript

key
List of DbKey object used in this output

key_id
ID of key used in this transaction output

output_n
Sequence number of transaction output

script
Locking script which locks transaction output

script_type
Locking script type. Can be one of these values: 'p2pkh', 'multisig', 'p2sh', 'p2pk', 'nulldata', 'unknown', 'p2wpkh' or 'p2wsh'. Default is p2pkh

spending_index_n
Index number of transaction input which spends this output

spending_txid
Transaction hash of input which spends this output

spent
Indicated if output is already spent in another transaction

transaction
Link to transaction object

transaction_id
Transaction ID of parent transaction

value
Total transaction output value

class bitcoinlib.db.**DbWallet**(***kwargs*)
Bases: sqlalchemy.ext.declarative.api.Base

Database definitions for wallets in Sqlalchemy format

Contains one or more keys.

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in `kwargs`.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

children
Wallet IDs of children wallets, used in multisig wallets

cosigner_id
ID of cosigner of this wallet. Used in multisig wallets to differentiate between different wallets

default_account_id
ID of default account for this wallet if multiple accounts are used

encoding
Default encoding to use for address generation, i.e. base58 or bech32. Default is base58.

id
Unique wallet ID

key_path
Key path structure used in this wallet. Key path for multisig wallet, use to create your own non-standard key path. Key path must follow the following rules: * Path start with masterkey (m) and end with change / address_index * If accounts are used, the account level must be 3. I.e.: m/purpose/coin_type/account/ * All keys must be hardened, except for change, address_index or cosigner_id Max length of path is 8 levels

keys
Link to keys (DbKeys objects) in this wallet

main_key_id
Masterkey ID for this wallet. All other keys are derived from the masterkey in a HD wallet bip32 wallet

multisig
Indicates if wallet is a multisig wallet. Default is True

multisig_n_required
Number of required signature for multisig, only used for multisignature master key

name
Unique wallet name

network
Link to DbNetwork object

network_name
Name of network, i.e.: bitcoin, litecoin

owner
Wallet owner

parent_id
Wallet ID of parent wallet, used in multisig wallets

purpose
Wallet purpose ID. BIP-44 purpose field, indicating which key-scheme is used default is 44

scheme
Key structure type, can be BIP-32 or single

sort_keys
Sort keys in multisig wallet

transactions
Link to transaction (DbTransactions) in this wallet

witness_type
Wallet witness type. Can be 'legacy', 'segwit' or 'p2sh-segwit'. Default is legacy.

bitcoinlib.db.**add_column**(*engine*, *table_name*, *column*)
Used to add new column to database with migration and update scripts

Parameters

- **engine** –
- **table_name** –
- **column** –

Returns

bitcoinlib.db.**compile_largebinary_mysql**(*type_*, *compiler*, ***kwargs*)

bitcoinlib.db.**db_update**(*db*, *version_db*, *code_version='0.6.2'*)

bitcoinlib.db.**db_update_version_id**(*db*, *version*)

8.21 bitcoinlib.db_cache module

class bitcoinlib.db_cache.**DbCache**(*db_uri=None*)
Bases: `object`

Cache Database object. Initialize database and open session when creating database object.

Create new database if is doesn't exist yet

drop_db()

class bitcoinlib.db_cache.**DbCacheAddress**(***kwargs*)
Bases: `sqlalchemy.ext.declarative.api.Base`

Address Cache Table

Stores transactions and unspent outputs (UTXO's) per address

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in `kwargs`.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

address
Address string base32 or base58 encoded

balance
Total balance of UTXO's linked to this key

last_block
Number of last updated block

last_txid
Transaction ID of latest transaction in cache

n_txs
Total number of transactions for this address

n_utxos
Total number of UTXO's for this address

network_name
Blockchain network name of this transaction

class bitcoinlib.db_cache.**DbCacheBlock**(***kwargs*)
Bases: sqlalchemy.ext.declarative.api.Base

Block Cache Table

Stores block headers

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

bits
Encoding for proof-of-work, used to determine target and difficulty

block_hash
Hash of this block

height
Height or sequence number for this block

merkle_root
Merkle root used to validate transaction in block

network_name
Blockchain network name

nonce
Nonce (number used only once or n-once) is used to create different block hashes

prev_block
Block hash of previous block

time
Timestamp to indicated when block was created

tx_count
Number of transactions included in this block

version
Block version to specify which features are used (hex)

class bitcoinlib.db_cache.**DbCacheTransaction**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base

Transaction Cache Table

Database which stores transactions received from service providers as cache

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in `kwargs`.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

block_height
Height of block this transaction is included in

confirmations
Number of confirmation when this transaction is included in a block. Default is 0: unconfirmed

date
Date when transaction was confirmed and included in a block

fee
Transaction fee

locktime
Transaction level locktime. Locks the transaction until a specified block (value from 1 to 5 million) or until a certain time (Timestamp in seconds after 1-jan-1970). Default value is 0 for transactions without locktime

network_name
Blockchain network name of this transaction

nodes
List of all inputs and outputs as DbCacheTransactionNode objects

order_n
Order of transaction in block

txid
Hexadecimal representation of transaction hash or transaction ID

version
Tranaction version. Default is 1 but some wallets use another version number

witness_type
Transaction type enum: legacy or segwit

class bitcoinlib.db_cache.**DbCacheTransactionNode**(***kwargs*)

Bases: sqlalchemy.ext.declarative.api.Base

Link table for cache transactions and addresses

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in `kwargs`.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

address
Address string base32 or base58 encoded

index_n
Order of input/output in this transaction

is_input
True if input, False if output

output_n()

prev_txid()

ref_index_n
Index number of transaction input which spends this output

ref_txid
Transaction hash of input which spends this output

script
Locking or unlocking script

sequence
Transaction sequence number. Used for timelock transaction inputs

spending_index_n()

spending_txid()

spent
Is output spent?

transaction
Related transaction object

txid

value
Value of transaction input

witnesses
Witnesses (signatures) used in Segwit transaction inputs

class bitcoinlib.db_cache.**DbCacheVars**(***kwargs*)
Bases: sqlalchemy.ext.declarative.api.Base

Table to store various blockchain related variables

A simple constructor that allows initialization from kwargs.

Sets attributes on the constructed instance using the names and values in kwargs.

Only keys that are present as attributes of the instance's class are allowed. These could be, for example, any mapped columns or relationships.

expires
Datetime value when variable expires

network_name
Blockchain network name of this transaction

type
Type of variable: int, string or float

value
Value of variable

varname
Variable unique name

class bitcoinlib.db_cache.**WitnessTypeTransactions**(*value*)

Bases: enum.Enum

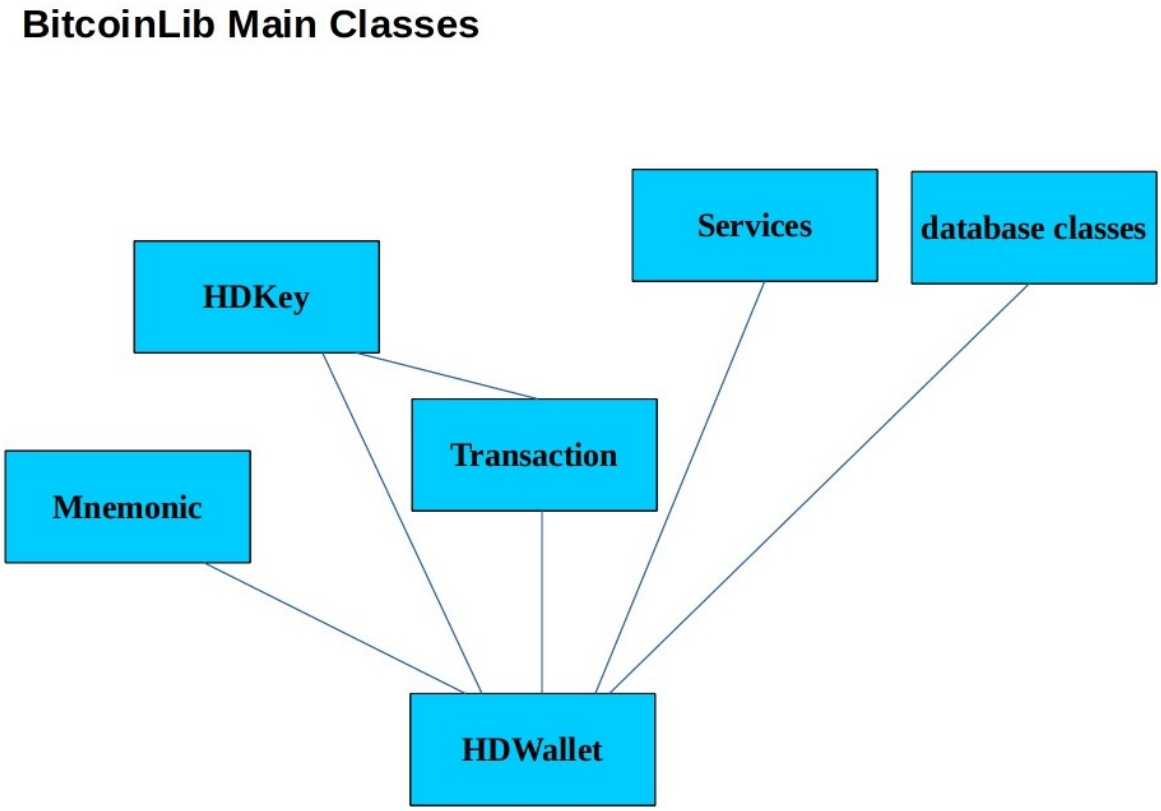
An enumeration.

legacy = 'legacy'

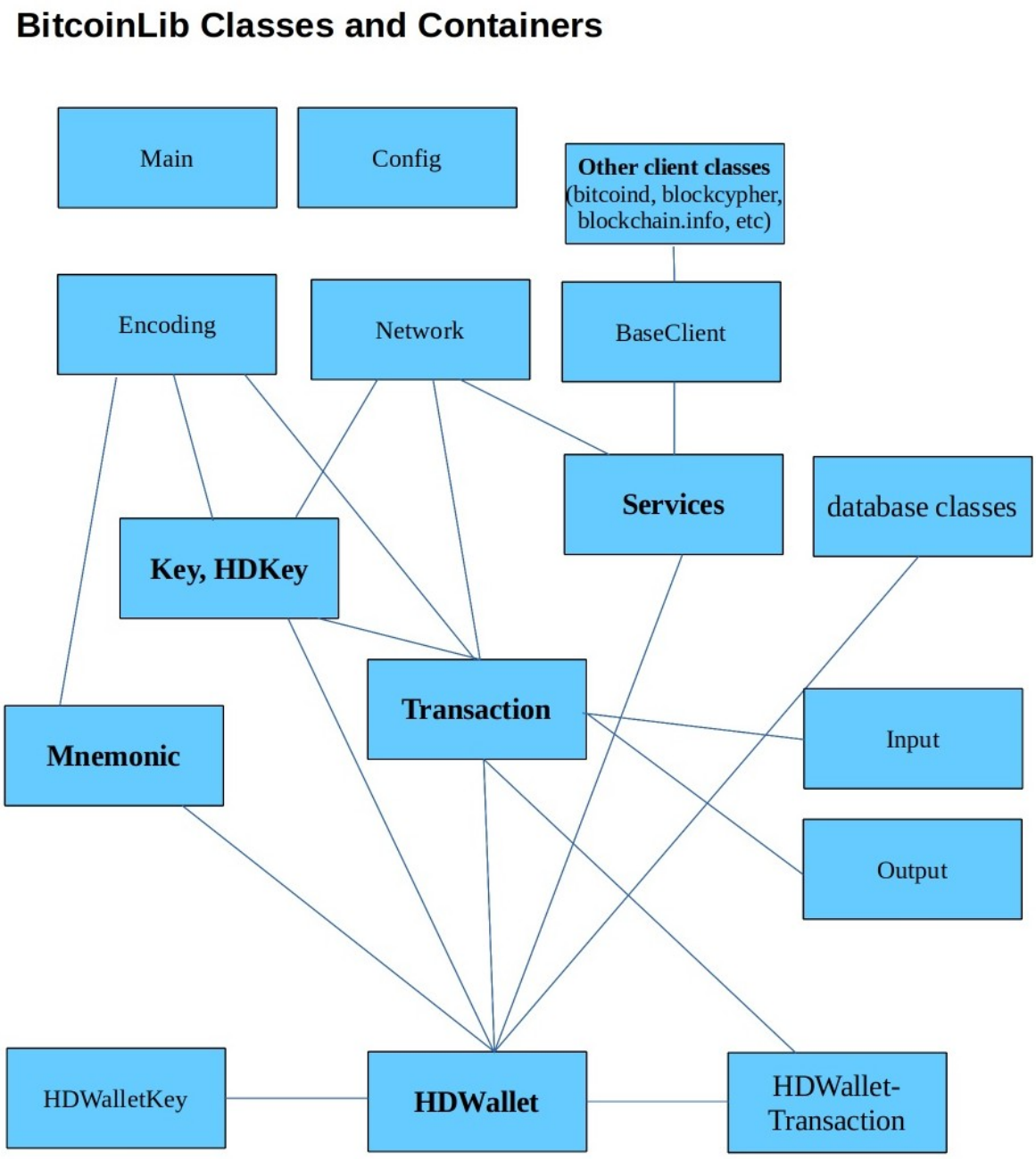
segwit = 'segwit'

8.22 Classes Overview

These are the main Bitcoinlib classes



This is an overview of all BitcoinLib classes.



So most classes can be used individually and without database setup. The Wallet class needs a proper database setup and is dependent upon most other classes.

8.23 bitcoinlib

8.23.1 bitcoinlib package

8.23.1.1 Subpackages

bitcoinlib.tools package

Submodules

bitcoinlib.tools.clw module

bitcoinlib.tools.mnemonic_key_create module

bitcoinlib.tools.sign_raw module

bitcoinlib.tools.wallet_multisig_2of3 module

Module contents

8.23.1.2 Submodules

bitcoinlib.encoding module

exception bitcoinlib.encoding.**EncodingError**(*msg=''*)
Bases: Exception

Log and raise encoding errors

class bitcoinlib.encoding.**Quantity**(*value*, *units=''*, *precision=3*)
Bases: object

Class to convert very large or very small numbers to a readable format.

Provided value is converted to number between 0 and 1000, and a metric prefix will be added.

```
>>> # Example - the Hashrate on 10th July 2020
>>> str(Quantity(122972532877979100000, 'H/s'))
'122.973 EH/s'
```

Convert given value to number between 0 and 1000 and determine metric prefix

Parameters

- **value** (*int, float*) – Value as integer in base 0
- **units** (*str*) – Base units, so 'g' for grams for instance
- **precision** (*int*) – Number of digits after the comma

bitcoinlib.encoding.**addr_base58_to_pubkeyhash**(*address*, *as_hex=False*)
Convert Base58 encoded address to public key hash

```
>>> addr_base58_to_pubkeyhash('142Zp9WZn9Fh4MV8F3H5Dv4Rbg7Ja1sPWZ', as_hex=True)
'21342f229392d7c9ed82c932916cee6517fbc9a2'
```

Parameters

- **address** (*str, bytes*) – Crypto currency address in base-58 format
- **as_hex** (*bool*) – Output as hexstring

Return bytes, str Public Key Hash

bitcoinlib.encoding.**addr_bech32_to_pubkeyhash**(*bech*, *prefix=None*, *include_witver=False*, *as_hex=False*)

Decode bech32 / segwit address to public key hash

```
>>> addr_bech32_to_pubkeyhash('bc1qy8qmc6262m68ny0ftlexs4h9paud8sgce3sf84', as_
↪hex=True)
'21c1bc695a56f47991e95ff26856e50f78d3c118'
```

Validate the bech32 string, and determine HRP and data. Only standard data size of 20 and 32 bytes are excepted

Parameters

- **bech** (*str*) – Bech32 address to convert
- **prefix** (*str*) – Address prefix called Human-readable part. Default is None and tries to derive prefix, for bitcoin specify 'bc' and for bitcoin testnet 'tb'
- **include_witver** (*bool*) – Include witness version in output? Default is False
- **as_hex** (*bool*) – Output public key hash as hex or bytes. Default is False

Return str Public Key Hash

bitcoinlib.encoding.**addr_to_pubkeyhash**(*address*, *as_hex=False*, *encoding=None*)

Convert base58 or bech32 address to public key hash

Wrapper for the *addr_base58_to_pubkeyhash()* and *addr_bech32_to_pubkeyhash()* method

Parameters

- **address** (*str*) – Crypto currency address in base-58 format
- **as_hex** (*bool*) – Output as hexstring
- **encoding** (*str*) – Address encoding used: base58 or bech32. Default is base58. Try to derive from address if encoding=None is provided

Return bytes, str public key hash

bitcoinlib.encoding.**bip38_decrypt**(*encrypted_privkey*, *password*)

BIP0038 non-ec-multiply decryption. Returns WIF private key. Based on code from https://github.com/nomorecoin/python-bip38-testing This method is called by Key class init function when importing BIP0038 key.

Parameters

- **encrypted_privkey** (*str*) – Encrypted private key using WIF protected key format
- **password** (*str*) – Required password for decryption

Return tupple (bytes, bytes) (Private Key bytes, 4 byte address hash for verification)

bitcoinlib.encoding.**bip38_encrypt**(*private_hex*, *address*, *password*, *flagbyte=b'\xe0'*)

BIP0038 non-ec-multiply encryption. Returns BIP0038 encrypted private key Based on code from https://github.com/nomorecoin/python-bip38-testing

Parameters

- **private_hex** (*str*) – Private key in hex format
- **address** (*str*) – Address string
- **password** (*str*) – Required password for encryption
- **flagbyte** (*bytes*) – Flagbyte prefix for WIF

Return str BIP38 password encrypted private key

bitcoinlib.encoding.**change_base**(*chars*, *base_from*, *base_to*, *min_length=0*, *output_even=None*, *output_as_list=None*)

Convert input chars from one numeric base to another. For instance from hexadecimal (base-16) to decimal (base-10)

From and to numeric base can be any base. If base is not found in definitions an array of index numbers will be returned

Examples:

```
>>> change_base('FF', 16, 10)
255
>>> change_base('101', 2, 10)
5
```

Convert base-58 public WIF of a key to hexadecimal format

```
>>> change_base(
↪'xpub661MyMwAqRbcFnkbk13gaJba22ibnEdJS7KAMY99C4jBBHMxWaCBSTrTinNTc9G5LTFtUqbLpWnzY5yPTNEF9u8sB1kF
↪', 58, 16)

↪'0488b21e000000000000000000007d3cc6702f48bf618f3f14cce5ee2cacf3f70933345ee4710af6fa4a330cc7d503c045
↪'
```

Convert base-58 address to public key hash: '00' + length '21' + 20 byte key

```
>>> change_base('142Zp9WZn9Fh4MV8F3H5Dv4Rbg7Ja1sPWZ', 58, 16)
'0021342f229392d7c9ed82c932916cee6517fbc9a2487cd97a'
```

Convert to 2048-base, for example a Mnemonic word list. Will return a list of integers

```
>>> change_base(100, 16, 2048)
[100]
```

Parameters

- **chars** (*any*) – Input string
- **base_from** (*int*) – Base number or name from input. For example 2 for binary, 10 for decimal and 16 for hexadecimal
- **base_to** (*int*) – Base number or name for output. For example 2 for binary, 10 for decimal and 16 for hexadecimal
- **min_length** (*int*) – Minimal output length. Required for decimal, advised for all output to avoid leading zeros conversion problems.
- **output_even** (*bool*) – Specify if output must contain a even number of characters. Sometimes handy for hex conversions.
- **output_as_list** (*bool*) – Always output as list instead of string.

Return str, list Base converted input as string or list.

bitcoinlib.encoding.**convert_der_sig**(*signature*, *as_hex=True*)
Extract content from DER encoded string: Convert DER encoded signature to signature string.

Parameters

- **signature** (*bytes*) – DER signature
- **as_hex** (*bool*) – Output as hexstring

Return bytes, str Signature

bitcoinlib.encoding.**convertbits**(*data*, *frombits*, *tobits*, *pad=True*)
'General power-of-2 base conversion'

Source: https://github.com/sipa/bech32/tree/master/ref/python

Parameters

- **data** (*list*) – Data values to convert
- **frombits** (*int*) – Number of bits in source data
- **tobits** (*int*) – Number of bits in result data
- **pad** (*bool*) – Use padding zero's or not. Default is True

Return list Converted values

bitcoinlib.encoding.**der_encode_sig**(*r*, *s*)
Create DER encoded signature string with signature r and s value.

Parameters

- **r** (*int*) – r value of signature
- **s** (*int*) – s value of signature

Return bytes

bitcoinlib.encoding.**double_sha256**(*string*, *as_hex=False*)
Get double SHA256 hash of string

Parameters

- **string** (*bytes*) – String to be hashed
- **as_hex** (*bool*) – Return value as hexadecimal string. Default is False

Return bytes, str

bitcoinlib.encoding.**hash160**(*string*)
Creates a RIPEMD-160 + SHA256 hash of the input string

Parameters **string** (*bytes*) – Script

Return bytes RIPEMD-160 hash of script

bitcoinlib.encoding.**int_to_varbyteint**(*inp*)
Convert integer to CompactSize Variable length integer in byte format.

See https://en.bitcoin.it/wiki/Protocol_documentation#Variable_length_integer for specification

```
>>> int_to_varbyteint(10000).hex()
'fd1027'
```

Parameters **inp** (*int*) – Integer to convert

Returns byteint: 1-9 byte representation as integer

bitcoinlib.encoding.**normalize_string**(*string*)
Normalize a string to the default NFKD unicode format See https://en.wikipedia.org/wiki/Unicode_equivalence#Normalization

Parameters **string** (*bytes, str*) – string value

Returns string

bitcoinlib.encoding.**normalize_var**(*var*, *base=256*)
For Python 2 convert variable to string

For Python 3 convert to bytes

Convert decimals to integer type

Parameters

- **var** (*str, byte*) – input variable in any format
- **base** (*int*) – specify variable format, i.e. 10 for decimal, 16 for hex

Returns Normalized var in string for Python 2, bytes for Python 3, decimal for base10

bitcoinlib.encoding.**pubkeyhash_to_addr**(*pubkeyhash*, *prefix=None*, *encoding='base58'*)
Convert public key hash to base58 encoded address

Wrapper for the *pubkeyhash_to_addr_base58()* and *pubkeyhash_to_addr_bech32()* method

Parameters

- **pubkeyhash** (*bytes, str*) – Public key hash
- **prefix** (*str, bytes*) – Prefix version byte of network, default is bitcoin ‘’
- **encoding** (*str*) – Encoding of address to calculate: base58 or bech32. Default is base58

Return str Base58 or bech32 encoded address

bitcoinlib.encoding.**pubkeyhash_to_addr_base58**(*pubkeyhash*, *prefix=b'\x00'*)
Convert public key hash to base58 encoded address

```
>>> pubkeyhash_to_addr_base58('21342f229392d7c9ed82c932916cee6517fbc9a2')
'142Zp9WZn9Fh4MV8F3H5Dv4Rbg7Ja1sPWZ'
```

Parameters

- **pubkeyhash** (*bytes, str*) – Public key hash
- **prefix** (*str, bytes*) – Prefix version byte of network, default is bitcoin ‘’

Return str Base-58 encoded address

bitcoinlib.encoding.**pubkeyhash_to_addr_bech32**(*pubkeyhash*, *prefix='bc'*, *witver=0*, *separator='1'*)
Encode public key hash as bech32 encoded (segwit) address

```
>>> pubkeyhash_to_addr_bech32('21c1bc695a56f47991e95ff26856e50f78d3c118')
'bc1qy8qmc6262m68ny0ftlexs4h9paud8sgce3sf84'
```

Format of address is prefix/hrp + seperator + bech32 address + checksum

For more information see BIP173 proposal at https://github.com/bitcoin/bips/blob/master/bip-0173.mediawiki

Parameters

- **pubkeyhash** (*str, bytes*) – Public key hash
- **prefix** (*str*) – Address prefix or Human-readable part. Default is 'bc' an abbreviation of Bitcoin. Use 'tb' for testnet.
- **witver** (*int*) – Witness version between 0 and 16
- **separator** (*str*) – Separator char between hrp and data, should always be left to '1' otherwise its not standard.

Return str Bech32 encoded address

bitcoinlib.encoding.**read_varbyteint**(*s*)

Read variable length integer from BytesIO stream. Wrapper for the varbyteint_to_int method

Parameters **s** (*BytesIO*) – A binary stream

Return int

bitcoinlib.encoding.**to_bytes**(*string*, *unhexlify=True*)

Convert string, hexadecimal string to bytes

Parameters

- **string** (*str, bytes*) – String to convert
- **unhexlify** (*bool*) – Try to unhexlify hexstring

Returns Bytes var

bitcoinlib.encoding.**to_hexstring**(*string*)

Convert bytes, string to a hexadecimal string. Use instead of built-in hex() method if format of input string is not known.

```
>>> to_hexstring(b'\x12\xaa\xdd')
'12aadd'
```

Parameters **string** (*bytes, str*) – Variable to convert to hex string

Returns hexstring

bitcoinlib.encoding.**varbyteint_to_int**(*byteint*)

Convert CompactSize Variable length integer in byte format to integer.

See https://en.bitcoin.it/wiki/Protocol_documentation#Variable_length_integer for specification

```
>>> varbyteint_to_int(bytes.fromhex('fd1027'))
(10000, 3)
```

Parameters **byteint** (*bytes, list*) – 1-9 byte representation

Return (int, int) tuple wit converted integer and size

bitcoinlib.encoding.**varstr**(*string*)

Convert string to variably sized string: Bytestring preceded with length byte

```
>>> varstr(to_bytes('546869732073747269e67206861732061206c656e677468206f66203330
↪')).hex()
'1e546869732073747269e67206861732061206c656e677468206f66203330'
```

Parameters **string** (*bytes, str*) – String input

Return bytes varstring

bitcoinlib.main module

bitcoinlib.main.**deprecated**(*func*)
This is a decorator which can be used to mark functions as deprecated. It will result in a warning being emitted when the function is used.

bitcoinlib.main.**get_encoding_from_witness**(*witness_type=None*)
Derive address encoding (base58 or bech32) from transaction witness type.

Returns 'base58' for legacy and p2sh-segwit witness type and 'bech32' for segwit

Parameters **witness_type** (*str*) – Witness type: legacy, p2sh-segwit or segwit

Return str

bitcoinlib.main.**script_type_default**(*witness_type=None*, *multisig=False*, *locking_script=False*)
Determine default script type for provided witness type and key type combination used in this library.

```
>>> script_type_default('segwit', locking_script=True)
'p2wpkh'
```

Parameters

- **witness_type** (*str*) – Witness type used: standard, p2sh-segwit or segwit
- **multisig** (*bool*) – Multi-signature key or not, default is False
- **locking_script** (*bool*) – Limit search to locking_script. Specify False for locking scripts and True for unlocking scripts

Return str Default script type

8.23.1.3 Module contents

8.24 Script types

This is an overview script types used in transaction Input and Outputs.

They are defined in main.py

8.24.1 Locking scripts

Scripts lock funds in transaction outputs (UTXO's). Also called ScriptSig.

Lock Script	Script to Unlock	Encoding	Key type / Script	Prefix BTC
p2pkh	Pay to Public Key Hash	base58	Public key hash	1
p2sh	Pay to Script Hash	base58	Redeemscript hash	3
p2wpkh	Pay to Wallet Pub Key Hash	bech32	Public key hash	bc
p2wsh	Pay to Wallet Script Hash	bech32	Redeemscript hash	bc
multisig	Multisig Script	base58	Multisig script	3
pubkey	Public Key (obsolete)	base58	Public Key	1
nulldata	Nulldata	n/a	OP_RETURN script	n/a

8.24.2 Unlocking scripts

Scripts used in transaction inputs to unlock funds from previous outputs. Also called ScriptPubKey.

Locking sc.	Name	Unlocks	Key type / Script
sig_pubkey	Signature, Public Key	p2pkh	Sign. + Public key
p2sh_multisig	Pay to Script Hash	p2sh, multisig	Multisig + Redeemscript
p2sh_p2wpkh	Pay to Wallet Pub Key Hash	p2wpkh	PK Hash + Redeemscript
p2sh_p2wsh	Multisig script	p2wsh	Redeemscript
signature	Sig for public key (old)	pubkey	Signature

8.24.3 Bitcoinlib script support

The 'pubkey' lockscript and 'signature' unlocking script are ancient and not supported by BitcoinLib at the moment.

Using different encodings for addresses then the one listed in the Locking Script table is possible but not adviced: It is not standard and not sufficiently tested.

CHAPTER

NINE

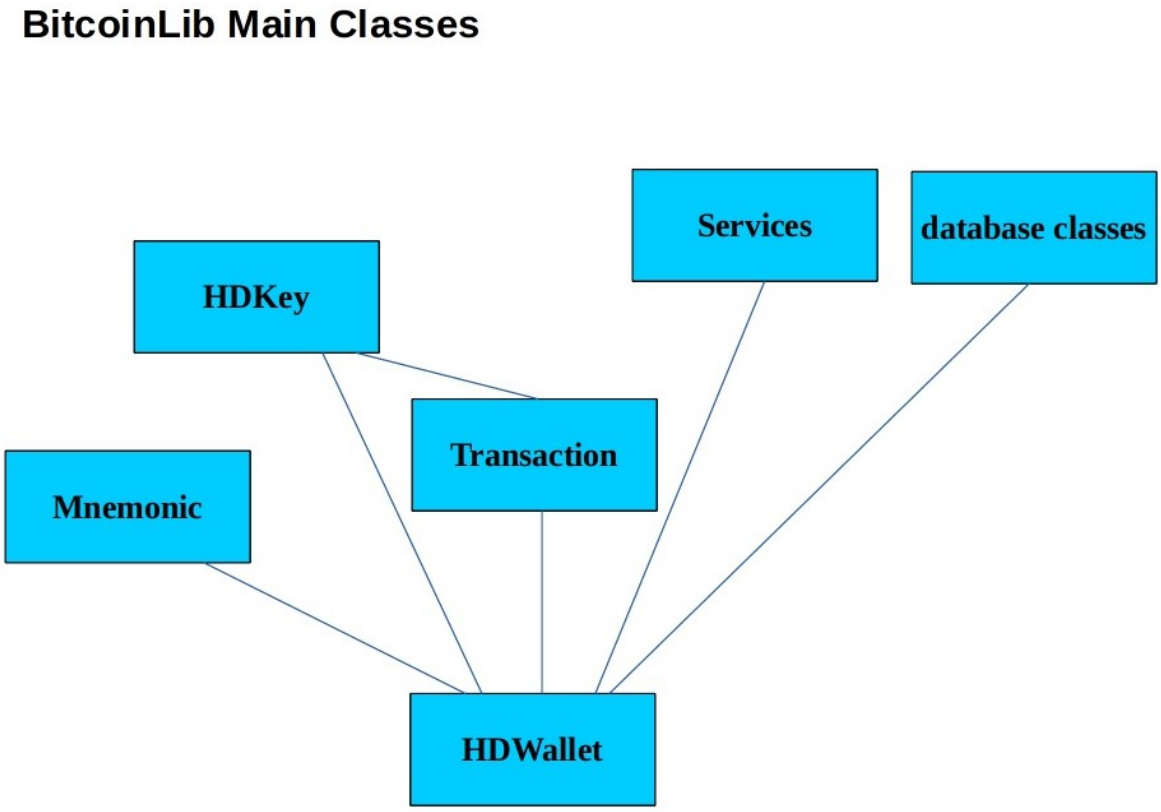
DISCLAIMER

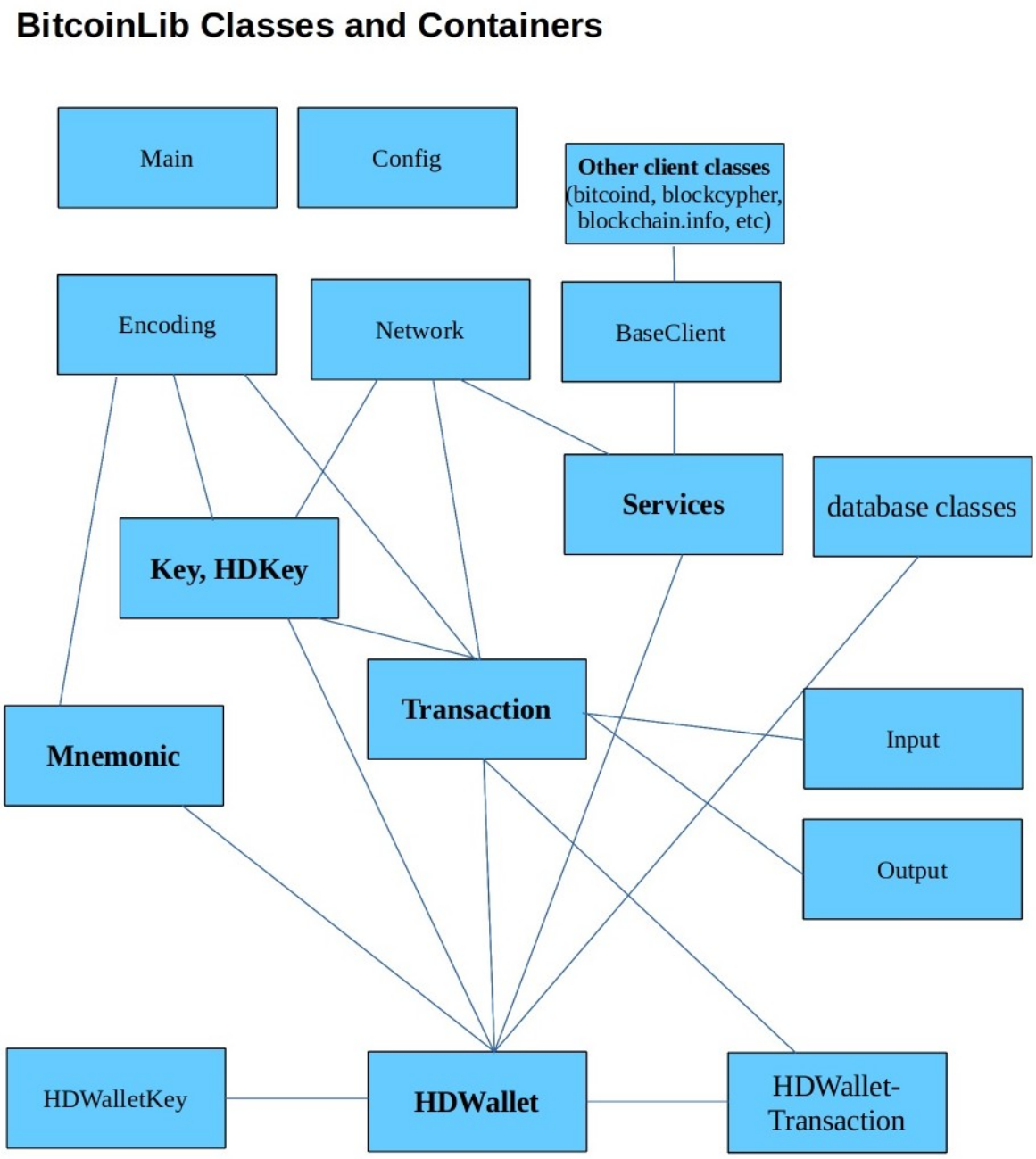
This library is still in development, please use at your own risk and test sufficiently before using it in a production environment.

CHAPTER

TEN

SCHEMATIC OVERVIEW

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