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# **GnuPG Wrapper for Python Documentation**

***Release 0.5.0***

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The `gnupg` module allows Python programs to make use of the functionality provided by the [GNU Privacy Guard](#) (abbreviated GPG or GnuPG). Using this module, Python programs can encrypt and decrypt data, digitally sign documents and verify digital signatures, manage (generate, list and delete) encryption keys, using Public Key Infrastructure (PKI) encryption technology based on OpenPGP.

This module is expected to be used with Python versions  $\geq 3.6$ , or Python 2.7 for legacy code. Install this module using `pip install python-gnupg`. You can then use this module in your own code by doing `import gnupg` or similar.

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**Note:** There is at least one fork of this project, which was apparently created because an earlier version of this software used the `subprocess` module with `shell=True`, making it vulnerable to shell injection. **This is no longer the case.**

Forks may not be drop-in compatible with this software, so take care to use the correct version, as indicated in the `pip install` command above.

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## Deployment Requirements

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Apart from a recent-enough version of Python, in order to use this module you need to have access to a compatible version of the GnuPG executable. The system has been tested with GnuPG v1.4.9 on Windows and Ubuntu. On a Linux platform, this will typically be installed via your distribution's package manager (e.g. `apt-get` on Debian/Ubuntu). Windows binaries are available [here](#) – use one of the `gnupg-w32cli-1.4.x.exe` installers for the simplest deployment options.

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**Note:** On Windows, it is *not* necessary to perform a full installation of GnuPG, using the standard installer, on each computer: it is normally sufficient to distribute only the executable, `gpg.exe`, and a DLL which it depends on, `iconv.dll`. These files do not need to be placed in system directories, nor are registry changes needed. The files need to be placed in a location such that implicit invocation will find them - such as the working directory of the application which uses the `gnupg` module, or on the system path if that is appropriate for your requirements. Alternatively, you can specify the full path to the `gpg` executable. *Note, however, that if you want to use GnuPG 2.0, then this simple deployment approach may not work, because there are more dependent files which you have to ship. For this reason, our recommendation is to stick with GnuPG 1.4.x on Windows, unless you specifically need 2.0 features - in which case, you may have to do a full installation rather than just relying on a couple of files.*

Recent versions of GnuPG ( $\geq 2.1.x$ ) introduce a number of changes:

- By default, passphrases cannot be passed via streams to `gpg` unless the line `allow-loopback-pinentry` is added to `gpg-agent.conf` in the home directory used by `gpg` (this is also where the keyring files are kept). If that file does not exist, you will need to create it with that single line. Note that even with this configuration, some versions of GnuPG 2.1.x won't work as expected. In our testing, we found, for example, that the 2.1.11 executable shipped with Ubuntu 16.04 didn't behave helpfully, whereas a GnuPG 2.1.15 executable compiled from source on the same machine worked as expected.
  - To export secret keys, a passphrase must be provided.
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### Acknowledgements

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This module is based on an earlier version, `GPG.py`, written by Andrew Kuchling. This was further improved by Richard Jones, and then even further by Steve Traugott. The `gnupg` module is derived from [Steve Traugott's module](#) (the original site no longer exists - this link is to the Wayback Machine), and uses Python's `subprocess` module to communicate with the GnuPG executable, which it uses to spawn a subprocess to do the real work.

I've gratefully incorporated improvements contributed or suggested by:

- Paul Cunnane (detached signature support)
- Daniel Folkinshteyn (`recv_keys`, handling of subkeys and `SIGEXPIRED`, `KEYEXPIRED` while verifying, `EXPKEYSIG`, `REVKEYSIG`)
- Dmitry Gladkov (handle `KEYEXPIRED` when importing)
- Abdul Karim (keyring patch)
- Yann Leboulanger (handle `ERRSIG` and `NO_PUBKEY` while verifying, get subkeys)
- Kirill Yakovenko (RSA and IDEA support)
- Robert Leftwich (handle `INV_SGMR`, `KEY_NOT_CREATED`)
- Michal Niklas (Trust levels for signature verification)
- David Noël (`search_keys`, `send_keys` functionality)
- David Andersen (handle `UNEXPECTED` during verification)
- Jannis Leidel (output signature to a file)
- Venzen Khaosan (`scan_keys` functionality)
- Marcel Pörner (handle `EXPORTED`, `EXPORT_RES`)
- K  vin Bernard-Allies (handle filename encoding under Windows)
- Daniel Kahn Gillmor (various improvements which were released in 0.4.1)
- William Foster (`trust_key` patch)

and Google Code / BitBucket users

- dprovins (ListKeys handle\_status)
- ernest0x (improved support for non-ASCII input)
- eyepulp (additional options for encryption/decryption)
- hysterix.is.slackin (symmetric encryption support)
- natureshadow (improved status handling when smart cards in use)
- SunDwarf (storing signatures against keys)

(If I've missed anyone from this list, please let me know.)

## CHAPTER 3

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### Before you Start

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GnuPG works on the basis of a “home directory” which is used to store public and private keyring files as well as a trust database. You need to identify in advance which directory on the end-user system will be used as the home directory, as you will need to pass this information to `gnupg`.



## CHAPTER 4

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### Getting Started

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You interface to the GnuPG functionality through an instance of the GPG class:

```
>>> gpg = gnupg.GPG(gnupghome='/path/to/home/directory')
```

If the home directory does not exist, a `ValueError` will be raised. Thereafter, all the operations available are accessed via methods of this instance. If the `gnupghome` parameter is omitted, GnuPG will use whatever directory is the default (consult the GnuPG documentation for more information on what this might be).

The `GPG()` constructor also accepts the following additional optional keyword arguments:

**gpgbinary (defaults to “gpg”)** The path to the `gpg` executable.

**verbose (defaults to `False`)** Print information (e.g. the `gpg` command lines, and status messages returned by `gpg`) to the console. You don’t generally need to set this option, since the module uses Python’s `logging` package to provide more flexible functionality. The status messages from GPG are quite voluminous, especially during key generation.

**use\_agent (defaults to `False`)** If specified as `True`, the `--use-agent` parameter is passed to GPG, asking it to use any in-memory GPG agent (which remembers your credentials).

**keyring (defaults to `None`)** If specified, the value is used as the name of the keyring file. The default keyring is not used. A list of paths to keyring files can also be specified.

**options (defaults to `None`)** If specified, the value should be a list of additional command-line options to pass to GPG.

**secret\_keyring (defaults to `None`)** If specified, the value is used as the name of the secret keyring file. A list of paths to secret keyring files can also be specified. *Note that these files are not used by GnuPG >= 2.1.*

**env (defaults to `None`)** If specified, the value is used as the environment variables used when calling the GPG

Changed in version 0.3.4: The `keyring` argument can now also be a list of keyring filenames.

New in version 0.3.4: The `secret_keyring` argument was added. *Note that this argument is not used when working with GnuPG >= 2.1.*

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**Note:** If you specify values in `options`, make sure you don’t specify values which will conflict with other values added by `python-gnupg`. You should be familiar with GPG command-line arguments and how they affect GPG’s

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operation.

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Changed in version 0.3.7: The default encoding was changed to `latin-1`. In earlier versions, it was either `locale.getpreferredencoding()` or, failing that, `sys.stdin.encoding`, and failing that, `utf-8`.

If the `gpgbinary` executable cannot be found, a `ValueError` is raised in `GPG.__init__()`.

The low-level communication between the `gpg` executable and `python-gnupg` is in terms of bytes, and `python-gnupg` tries to convert `gpg`'s `stderr` stream to text using an encoding. The default value of this is `latin-1`, but you can override this by setting the encoding name in the `GPG` instance's `encoding` attribute after instantiation, like this:

```
>>> gpg = gnupg.GPG(gnupghome='/path/to/home/directory')
>>> gpg.encoding = 'utf-8'
```

---

**Note:** If you use the wrong encoding, you may get exceptions. The `'latin-1'` encoding leaves bytes as-is and shouldn't fail with encoding/decoding errors, though it may not decode text correctly (so you may see odd characters in the decoding output). The `gpg` executable will use an output encoding based on your environment settings (e.g. environment variables, code page etc.) but defaults to `latin-1`.

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## Key Management

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The module provides functionality for generating (creating) keys, listing keys, deleting keys, and importing and exporting keys.

### 5.1 Generating keys

The first thing you typically want to do when starting with a PKI framework is to generate some keys. You can do this as follows:

```
>>> key = gpg.gen_key(input_data)
```

where `input_data` is a special command string which tells GnuPG the parameters you want to use when creating the key. To make life easier, a helper method is provided which takes keyword arguments which allow you to specify individual parameters of the key, as in the following example:

```
>>> input_data = gpg.gen_key_input(key_type="RSA", key_length=1024)
```

Sensible defaults are provided for parameters which you don't specify, as shown in the following table:

Parameter	Keyword Argument	Default value	Example values	Meaning of parameter
Key-Type	<code>key_type</code>	"RSA"	"RSA", "DSA"	The type of the primary key to generate. It must be capable of signing.
Key-Length	<code>key_length</code>	1024	1024, 2048	The length of the primary key in bits.
Name-Real	<code>name_real</code>	"Autogenerated Key"	"Fred Bloggs"	The real name of the user identity which is represented by the key.
Name-Comment	<code>name_comment</code>	"Generated by gnupg.py"	"A test user"	A comment to attach to the user id.
Name-Email	<code>name_email</code>	<user-name>@<hostname>	"fred.bloggs@domain.com"	An email address for the user.

If you don't specify any parameters, the values in the table above will be used with the defaults indicated. There is a whole set of other parameters you can specify; see [this GnuPG document](#) for more details. While use of RSA keys is common (they can be used for both signing and encryption), another popular option is to use a DSA primary key (for signing) together with a secondary El-Gamal key (for encryption). For this latter option, you could supply the following additional parameters:

Parameter	Keyword Argument	Example values	Meaning of parameter
Subkey Type	<code>subkey_type</code>	"RSA", "ELG-E"	The type of the secondary key to generate.
Subkey Length	<code>subkey_length</code>	1024, 2048	The length of the secondary key in bits.
Expiration Date	<code>expire_date</code>	"2009-12-31", "365d", "3m", "6w", "5y", "seconds=<epoch>", 0	The expiration date for the primary and any secondary key. You can specify an ISO date, A number of days/weeks/months/years, an epoch value, or 0 for a non-expiring key.
Passphrase	<code>passphrase</code>	"secret"	The passphrase to use. If this parameter is not specified, no passphrase is needed to access the key. <i>Passphrases using newlines are not supported.</i> <b>Note that for GnuPG versions &gt;= 2.1, a passphrase must be provided, unless extra steps are taken:</b> see the <code>no_protection</code> argument, below.
%no-protection	<code>no_protection</code>	<code>False</code> (the default), <code>True</code>	If no passphrase is wanted for a key (which might be the default for tests, say), or if you want to use an empty string as a passphrase, then you should specify <code>True</code> for this parameter. Otherwise, and if you don't use <code>pinentry</code> to enter a passphrase, then GnuPG >= 2.1 will not allow this. It doesn't make sense to specify <code>True</code> if a non-empty passphrase is being supplied.

A complete list of key generation parameters can be found in the GnuPG documentation [here](#).

New in version 0.4.7: The `no_protection` keyword argument was added.

Whatever keyword arguments you pass to `gen_key_input()` (other than `no_protection`) will be converted to the parameters expected by GnuPG by replacing underscores with hyphens and title-casing the result. You can of course construct the parameters in your own dictionary `params` and then pass it as follows:

```
>>> input_data = gpg.gen_key_input(**params)
```

The `no_protection` argument, if `True`, will be used to generate a `%no-protection` line which tells GnuPG that no protection with a passphrase is desired.

The return value from `gen_key()` is an object whose `type` and `fingerprint` attributes indicate the type and fingerprint of the created key. If no key was created, these will be `None`.

New in version 0.4.9: There is now also a `status` attribute to the returned object which will be `'ok'` if a key was created, `'key not created'` if that was reported by `gpg`, or `None` in other cases.

### 5.1.1 Generating subkeys

To generate a subkey for an already generated key use the `add_subkey()` method:



```
>>> subkey = gpg.add_subkey(master_key) # same as gpg.add_subkey(master_key, None)
>>> subkey = gpg.add_subkey(master_key, master_key_password)
```

The `add_subkey` method has some additional keyword arguments:

- `algorithm` (defaulting to `rsa`)
- `usage` (defaulting to `encrypt`)
- `expire` (defaulting to `-`)

The parameters are explained with every possible value in [this GnuPG documentation](#) under `quick-add-key`.

If you use the default algorithm, you'll get the default key size, which is dependent upon the version of GnuPG that's used. If you want to specify the key size explicitly, you can use values for `algorithm` incorporating both the algorithm itself and the key size, as in the following examples.

```
gpg.add_subkey(..., algorithm='rsa2048')
gpg.add_subkey(..., algorithm='rsa3072')
gpg.add_subkey(..., algorithm='rsa4096')
```

New in version 0.4.9: The `add_subkey` method was added.

### 5.1.2 Specifying key usages

Keys can be used for some or all of encryption, signing or authentication. These usages map onto flags assigned to a key - one or more of `'encrypt'`, `'sign'` and `'auth'`. By default, nothing is specified, which assigns all flags to a key. But sometimes you may want to depart from this behaviour. For example, if you create a subkey for encryption, then you probably don't want encryption to be enabled for the master key. You can specify the flags associated with a key by passing a `key_usage` keyword argument which provides one or more of the above flags in a space or comma-separated string, as in these example:

```
gpg.gen_key_input(..., key_usage='sign')
gpg.gen_key_input(..., key_usage='sign encrypt')
gpg.gen_key_input(..., key_usage='sign, auth')
```

This corresponds to the `usage` parameter of `add_subkey()`, described earlier. Note that you still need to ensure that the key type of the key being created is appropriate for the usages.

### 5.1.3 Generating elliptic curve keys

To generate keys with elliptic curves, pass a `key_curve` keyword parameter to `gen_key_input()` and omit `key_length`. For example, `key_curve='cv25519'` or `key_type='ECDSA', key_curve='nistp384'`. Refer to [GnuPG resources](#) to see which options are supported. Note that you'll need GnuPG `>= 2.1` for this to work.

Supplemental information on the aliases used for key types and curves is given [here](#). You can use the curve type alias in the `algorithm` argument to `add_subkey()`, as in the following example.

```
input_data = gpg.gen_key_input(key_type='EDDSA', key_curve='ed25519' ...)
master_key = gpg.gen_key(input_data)
subkey = gpg.add_subkey(master_key.fingerprint, algorithm='cv25519' ...)
```

### 5.1.4 Performance Issues

Key generation requires the system to work with a source of random numbers. Systems which are better at generating random numbers than others are said to have higher *entropy*. This is typically obtained from the system hardware; the GnuPG documentation recommends that keys be generated *only* on a local machine (i.e. not one being accessed across a network), and that keyboard, mouse and disk activity be maximised during key generation to increase the entropy of the system.

Unfortunately, there are some scenarios - for example, on virtual machines which don't have real hardware - where insufficient entropy causes key generation to be *extremely* slow. If you come across this problem, you should investigate means of increasing the system entropy. On virtualised Linux systems, this can often be achieved by installing the `rng-tools` package. This is available at least on RPM-based and APT-based systems (Red Hat/Fedora, Debian, Ubuntu and derivative distributions).

## 5.2 Exporting keys

To export keys, use the `export_keys()` method:

```
>>> ascii_armored_public_keys = gpg.export_keys(keyids) # same as gpg.export_
↳keys(keyids, False)
>>> ascii_armored_private_keys = gpg.export_keys(keyids, True) # True => private keys
```

For the `keyids` parameter, you can use a sequence of anything which GnuPG itself accepts to identify a key - for example, the keyid or the fingerprint could be used. If you want to pass a single keyid, then you can just pass in a string which identifies the key.

The `export_keys` method has some additional keyword arguments:

- `armor` (defaulting to `True`) - when `True`, passes `--armor` to `gpg`.
- `minimal` (defaulting to `False`) - when `True`, passes `--export-options export-minimal` to `gpg`.
- `passphrase` - if specified, sends the specified passphrase to `gpg`. For GnuPG  $\geq 2.1$ , exporting secret keys requires a passphrase to be provided.
- `expect_passphrase` - defaults to `True` for backward compatibility. If the passphrase is to be passed to `gpg` via `pinentry`, you wouldn't pass it here - so specify `expect_passphrase=False` in that case. If you don't do that, and don't pass a passphrase, a `ValueError` will be raised.

New in version 0.3.7: The `armor` and `minimal` keyword arguments were added.

New in version 0.4.0: The `passphrase` keyword argument was added.

New in version 0.4.2: The `expect_passphrase` keyword argument was added.

## 5.3 Importing and receiving keys

To import keys, get the key data as an ASCII string, say `key_data`. Then:

```
>>> import_result = gpg.import_keys(key_data)
```

This will import all the keys in `key_data`. The number of keys imported will be available in `import_result.count` and the fingerprints of the imported keys will be in `import_result.fingerprints`.

In addition, `extra_args` and `passphrase` keyword parameter can be specified. If provided, `extra_args` is treated as a list of additional arguments to pass to the `gpg` executable. If `passphrase` is specified, it is passed to `gpgg` for when an imported secret key has a passphrase.

New in version 0.4.5: The `extra_args` keyword argument.

New in version 0.4.7: The `passphrase` keyword argument.

To import keys from a file, use:

```
>>> import_result = gpg.import_keys_file(key_path)
```

This also takes the keyword arguments specified for `import_keys()`.

New in version 0.5.0: The `import_keys_file()` method.

To receive keys from a keyserver, use:

```
>>> import_result = gpg.recv_keys('server-name', 'keyid1', 'keyid2', ...)
```

This will fetch keys with all specified keyids and import them. Note that on Windows, you may require helper programs such as `gpg_hkp.exe`, distributed with GnuPG, to successfully run `recv_keys`. On Jython, security permissions may lead to failure of `recv_keys`.

Note that when you import keys, you may get spurious “key expired” / “signature expired” messages which are sent by `gpg` and collected by `python-gnupg`. This may happen, for example, if there are subkey expiry dates which have been extended, so that the keys haven’t actually expired, even when `gpg` sends messages that they have. Make sure you just look at the `count` and `fingerprints` attributes to identify the keys that were imported.

## 5.4 Listing keys

Now that we’ve seen how to generate, import and export keys, let’s move on to finding which keys we have in our keyrings. This is fairly straightforward:

```
>>> public_keys = gpg.list_keys() # same as gpg.list_keys(False)
>>> private_keys = gpg.list_keys(True) # True => private keys
```

The returned value from `list_keys()` is a subclass of Python’s `list` class. Each entry represents one key and is a Python dictionary which contains useful information about the corresponding key.

The following entries are in the returned dictionary. Some of the key names are not ideal for describing the values, but they have been left as is for backward compatibility reasons. As [GnuPG documentation](#) has improved, a better understanding is possible of the information returned by `gpg`.

dict key	dict value (all string values)
type	Type of key
trust	The validity of the key
length	The length of the key in bits
algo	Public key algorithm
keyid	The key ID
date	The creation date of the key in UTC as a Unix timestamp
expires	The expiry date of the key in UTC as a timestamp, if specified
dummy	Certificate serial number, UID hash or trust signature info
ownertrust	The level of owner trust for the key
uid	The user ID
sig	Signature class
cap	Key capabilities
issuer	Issuer information
flag	A flag field
token	Token serial number
hash	Hash algorithm
curve	Curve name for elliptic curve cryptography (ECC) keys
compliance	Compliance flags
updated	Last updated timestamp
origin	Origin of keys
keygrip	Keygrip of keys (Note that you'll need GnuPG >= 2.1 for this to work.)
subkeys	A list containing [keyid, type, fingerprint, keygrip] elements for each subkey
subkey_info	A dictionary of subkey information keyed on subkey id

Depending on the version of `gpg` used, some of these keys may have the value `'unavailable'`. The last two keys are provided by `python-gnupg` rather than `gpg`.

For more information about the values in this dictionary, refer to the GnuPG documentation linked above. (Note that that documentation is not terribly user-friendly, but nevertheless it should be usable.)

New in version 0.3.8: The returned value from `list_keys()` now has a new attribute, `key_map`, which is a dictionary mapping key and subkey fingerprints to the corresponding key's dictionary. With this change, you don't need to iterate over the (potentially large) returned list to search for a key with a given fingerprint - the `key_map` dict will take you straight to the key info, whether the fingerprint you have is for a key or a subkey.

New in version 0.3.8: You can also list a subset of keys by specifying a `keys=` keyword argument to `list_keys()` whose value is either a single string matching a key, or a list of strings matching multiple keys. In this case, the return value only includes matching keys.

New in version 0.3.9: A new `sigs=` keyword argument has been added to `list_keys()`, defaulting to `False`. If you specify `true`, the `sigs` entry in the key information returned will contain a list of signatures which apply to the key. Each entry in the list is a 3-tuple of (`keyid`, `user-id`, `signature-class`) where the `signature-class` is as defined by [RFC-4880](#).

It doesn't make sense to supply both `secret=True` and `sigs=True` (people can't sign your secret keys), so in case `secret=True` is specified, the `sigs=` value has no effect.

New in version 0.4.1: Instances of the `GPG` class now have an additional `on_data` attribute, which defaults to `None`. It can be set to a callable which will be called with a single argument - a binary chunk of data received from the `gpg` executable. The callable can do whatever it likes with the chunks passed to it - e.g. write them to a separate stream. The callable should not raise any exceptions (unless it wants the current operation to fail).

New in version 0.4.2: Information on keys returned by `list_keys()` or `scan_keys()` now includes a `subkey_info` dictionary, which contains any returned information on subkeys such as creation and expiry dates.

The dictionary is keyed on the subkey ID. The following additional keys are present in key information dictionaries: `cap`, `issuer`, `flag`, `token`, `hash`, `curve`, `compliance`, `updated` and `origin`.

New in version 0.4.4: Instances of the `GPG` class now have an additional `check_fingerprint_collisions` attribute, which defaults to `False`. If set to a truthy value, fingerprint collisions are checked for (and a `ValueError` raised if a collision is detected) when listing or scanning keys. It appears that `gpg` is quite lenient about allowing duplicated keys in keyrings, which would lead to collisions.

Changed in version 0.4.4: The `on_data` callable will now be called with an empty chunk when the data stream from `gpg` is exhausted. It can now also return a value: if the value `False` is returned, the chunk will *not* be buffered within `python-gnupg`. This might be useful if you want to do your own buffering or avoid buffering altogether. If any other value is returned (including the value `None`, for backward compatibility) the chunk will be buffered as normal by `python-gnupg`.

New in version 0.4.6: Instances of the `GPG` class now have an additional `error_map` attribute, which defaults to `None`. If you set this, the value should be a dictionary mapping error codes to error messages. The source distribution includes a file `messages.json` which contains such a mapping, gleaned from the GnuPG library `libgpg-error`, version 1.37. The test suite shows how to convert that JSON to a form suitable for converting to an `error_map` value (basically, converting the string keys in the JSON to integers using base 16).

New in version 0.4.9: Information on keys returned by `list_keys()` now includes the `keygrip` attribute. The `subkeys` attribute now also consist of 4 values with the `keygrip` being the 4th. Note that you'll need GnuPG `>= 2.1` for this to work.

## 5.5 Setting the trust level for imported keys

You can set the trust level for imported keys as follows:

```
>>> gpg.trust_keys(fingerprints, trustlevel)
```

where the `fingerprints` are a list of fingerprints of keys for which the trust level is to be set, and `trustlevel` is one of the string values `'TRUST_UNDEFINED'`, `'TRUST_NEVER'`, `'TRUST_MARGINAL'`, `'TRUST_FULLY'` or `'TRUST_ULTIMATE'`.

You can also specify a single fingerprint for the `fingerprints` parameter.

New in version 0.4.2: The `trust_keys` method was added.

## 5.6 Scanning keys

We can also scan keys in files without importing them into a local keyring, as follows:

```
>>> keys = gpg.scan_keys(key_file_name)
```

The returned value from `scan_keys()` has the same format as for `list_keys()`.

New in version 0.3.7: The `scan_keys` method was added.

## 5.7 Deleting keys

To delete keys, their key identifiers must be specified. If a public/private keypair has been created, a private key needs to be deleted before the public key can be deleted:

```
>>> key = gpg.gen_key(gpg.gen_key_input())
>>> fp = key.fingerprint
>>> str(gpg.delete_keys(fp)) # same as gpg.delete_keys(fp, False)
'Must delete secret key first'
>>> str(gpg.delete_keys(fp, True)) # True => private keys
'ok'
>>> str(gpg.delete_keys(fp))
'ok'
>>> str(gpg.delete_keys("nosuchkey"))
'No such key'
```

The argument you pass to `delete_keys()` can be either a single key identifier (e.g. `keyid` or `fingerprint`) or a sequence of key identifiers.

The `delete_keys` method has some additional keyword arguments:

- `passphrase` - if specified, sends the specified passphrase to `gpg`. For GnuPG  $\geq 2.1$ , exporting secret keys requires a passphrase to be provided.
- `expect_passphrase` - defaults to `True` for backward compatibility. If the passphrase is to be passed to `gpg` via `pinentry`, you wouldn't pass it here - so specify `expect_passphrase=False` in that case. If you don't do that, and don't pass a passphrase, a `ValueError` will be raised.
- `exclamation_mode` - defaults to `False` for backward compatibility. If the exclamation mode is set, and a fingerprint of a subkey is passed only that subkey will be deleted. If the fingerprint is of a primary key the entire key will be deleted.

New in version 0.4.0: The `passphrase` keyword argument was added.

New in version 0.4.2: The `expect_passphrase` keyword argument was added.

New in version 0.4.9: The `exclamation_mode` keyword argument was added.

## 5.8 Searching for keys

You can search for keys by passing a search query and optionally a keyserver name. If no keyserver is specified, `gpg.mit.edu` is used. A list of dictionaries describing keys that were found is returned (this list could be empty). For example:

```
>>> gpg.search_keys('vinay_sajip@hotmail.com', 'keyserver.ubuntu.com')
[{'keyid': u'92905378', 'uids': [u'Vinay Sajip <vinay_sajip@hotmail.com>'], 'expires': u'', 'length': u'1024', 'algo': u'17', 'date': u'1221156445', 'type': u'pub'}]
```

New in version 0.3.5: The `search_keys` method was added.

## 5.9 Sending keys

You can send keys to a keyserver by passing its name and some key identifiers. For example:

```
>>> gpg.send_keys('keyserver.ubuntu.com', '6E4D5A2B')
<gnupg.SendResult object at 0xb74d55ac>
```

New in version 0.3.5: The `send_keys` method was added.

---

## Encryption and Decryption

---

Data intended for some particular recipients is encrypted with the public keys of those recipients. Each recipient can decrypt the encrypted data using the corresponding private key.

### 6.1 Encryption

To encrypt a message, use the following approach:

```
>>> encrypted_ascii_data = gpg.encrypt(data, recipients)
```

If you want to encrypt data in a file (or file-like object), use:

```
>>> encrypted_ascii_data = gpg.encrypt_file(stream, recipients) # e.g. after stream =   
↳ open(filename, 'rb')
```

These methods both return an object such that:

- If encryption succeeded, the returned object's `ok` attribute is set to `True` and the `data` attribute holds the encrypted data. Otherwise, the returned object's `ok` attribute is set to `False` and its `status` attribute (a message string) provides more information as to the reason for failure (for example, 'invalid recipient' or 'key expired').
- `str(encrypted_ascii_data)` gives the encrypted data in a non-binary format.

In both cases, `recipients` is a list of key fingerprints for those recipients. For your convenience, if there is a single recipient, you can pass the fingerprint rather than a 1-element array containing the fingerprint. Both methods accept the following optional keyword arguments:

**sign (defaults to `None`)** Either the Boolean value `True`, or the fingerprint of a key which is used to sign the encrypted data. If `True` is specified, the default key is used for signing. When not specified, the data is not signed.

**always\_trust (defaults to `False`)** Skip key validation and assume that used keys are always fully trusted.

**passphrase (defaults to `None`)** A passphrase to use when accessing the keyrings.

**extra\_args (defaults to `None`)** A list of additional arguments to pass to the `gpg` executable. For example, you could pass `extra_args=['-z', '0']` to disable compression, or you could pass `extra_args=['--set-filename', 'name-to-embed-in-encrypted-file.txt']` to embed a specific file name in the encrypted message.

**symmetric (defaults to `False`)** If specified, symmetric encryption is used. In this case, specify recipients as `None`. If `True` is specified, then the default cipher algorithm (CAST5) is used. Starting with version 0.3.5, you can also specify the cipher-algorithm to use (for example, 'AES256'). Check your `gpg` command line help to see what symmetric cipher algorithms are supported. Note that the default (CAST5) may not be the best available.

Changed in version 0.3.5: A string can be passed for the `symmetric` argument, as well as `True` or `False`. If a string is passed, it should be a symmetric cipher algorithm supported by the `gpg` you are using.

New in version 0.4.1: The `extra_args` keyword argument was added.

The `encrypt_file` method takes the following additional keyword arguments:

**armor (defaults to `True`)** Whether to use ASCII armor. If `False`, binary data is produced.

**output (defaults to `None`)** The name of an output file to write to. If a name is specified, the encrypted output is written directly to the file.

---

**Note:** Any public key provided for encryption should be trusted, otherwise encryption fails but without any warning. This is because `gpg` just prints a message to the console, but does not provide a specific error indication that the Python wrapper can use.

---

Changed in version 0.5.0: The `stream` argument to `encrypt_file()` can be a pathname to an existing file as well as text or a file-like object. In the pathname case, `python-gnupg` will open and close the file for you.

---

**Note:** `python-gnupg` assumes that any object with a `read` attribute is a file-like object. Otherwise, if it corresponds to an existing file, then it is taken as a filename, and otherwise it must be the actual data to be processed.

---

## 6.2 Decryption

To decrypt a message, use the following approach:

```
>>> decrypted_data = gpg.decrypt(data)
```

If you want to decrypt data in a file (or file-like object), use:

```
>>> decrypted_data = gpg.decrypt_file(stream) # e.g. after stream = open(filename, 'rb')
↳ )
```

These methods both return an object such that `str(decrypted_data)` gives the decrypted data in a non-binary format. If decryption succeeded, the returned object's `ok` attribute is set to `True` and the `data` attribute holds the decrypted data. Otherwise, the returned object's `ok` attribute is set to `False` and its `status` attribute (a message string) provides more information as to the reason for failure (for example, 'bad passphrase' or 'decryption failed').

Both methods accept the following optional keyword arguments:

**always\_trust (defaults to `False`)** Skip key validation and assume that used keys are always fully trusted.

**passphrase (defaults to `None`)** A passphrase to use when accessing the keyrings.



**extra\_args (defaults to None)** A list of additional arguments to pass to the `gpg` executable.

New in version 0.4.1: The `extra_args` keyword argument was added.

New in version 0.4.2: Upon a successful decryption, the `keyid` of the decrypting key is stored in the `key_id` attribute of the result, if this information is provided by `gpg`.

The `decrypt_file` method takes the following additional keyword argument:

**output (defaults to None)** The name of an output file to write to. If a name is specified, the decrypted output is written directly to the file.

Changed in version 0.5.0: The `stream` argument to `decrypt_file()` can be a pathname to an existing file as well as text or a file-like object. In the pathname case, `python-gnupg` will open and close the file for you.

**Warning: Passphrase caching:** By default, `gpg-agent` caches passphrases, and this can lead to unexpected results such as successfully decrypting messages even when passing the wrong passphrase. To avoid this, disable caching by putting the following two lines in `gpg-agent.conf`:

- `default-cache-ttl 0` and either
- `maximum-cache-ttl 0` for GnuPG < 2.1, or
- `max-cache-ttl 0` for GnuPG >= 2.1.

For more information, see the [GnuPG documentation on agent configuration](#).

## 6.3 Using signing and encryption together

If you want to use signing and encryption together, use the following approach:

```
>>> encrypted_data = gpg.encrypt(data, recipients, sign=signer_fingerprint,
↳ passphrase=signer_passphrase)
```

The resulting encrypted data contains the signature. When decrypting the data, upon successful decryption, signature verification is also performed (assuming the relevant public keys are available at the recipient end). The results are stored in the object returned from the `decrypt` call:

```
>>> decrypted_data = gpg.decrypt(data, passphrase=recipient_passphrase)
```

At this point, if a signature is verified, signer information is held in attributes of `decrypted_data`: `username`, `key_id`, `signature_id`, `fingerprint`, `trust_level` and `trust_text`. If the message wasn't signed, these attributes will all be set to `None`.

The trust levels are (in increasing order) `TRUST_UNDEFINED`, `TRUST_NEVER`, `TRUST_MARGINAL`, `TRUST_FULLY` and `TRUST_ULTIMATE`. If verification succeeded, you can test the trust level against known values as in the following example:

```
decrypted_data = gpg.decrypt(data, passphrase=recipient_passphrase)
if decrypted_data.trust_level is not None and decrypted_data.trust_level >= decrypted_
↳ data.TRUST_FULLY:
    print('Trust level: %s' % decrypted_data.trust_text)
```

New in version 0.3.1: The `trust_level` and `trust_text` attributes were added.

## 6.4 Finding the recipients for an encrypted message

Sometimes, it's desirable to find the recipients for an encrypted message, without actually performing decryption. You can do this using the `get_recipients()` or `get_recipients_file()` methods:

```
>>> ids = gpg.get_recipients(data)
```

or, with a file or file-like object:

```
>>> ids = gpg.get_recipients_file(stream) # e.g. after stream = open(filename, 'rb')
```

New in version 0.4.8: The `get_recipients` and `get_recipients_file` methods were added.

Changed in version 0.5.0: The *stream* argument to `get_recipients_file()` can be a pathname to an existing file as well as text or a file-like object. In the pathname case, `python-gnupg` will open and close the file for you.

---

## Signing and Verification

---

Data intended for digital signing is signed with the private key of the signer. Each recipient can verify the signed data using the corresponding public key.

### 7.1 Signing

To sign a message, do the following:

```
>>> signed_data = gpg.sign(message)
```

or, for data in a file (or file-like object), you can do:

```
>>> signed_data = gpg.sign_file(stream) # e.g. after stream = open(filename, "rb")
```

These methods both return an object such that `str(signed_data)` gives the signed data in a non-binary format. They accept the following optional keyword arguments:

**keyid (defaults to `None`)** The id for the key which will be used to do the signing. If not specified, the first key in the secret keyring is used.

**passphrase (defaults to `None`)** A passphrase to use when accessing the keyrings.

**clearsign (defaults to `True`)** Returns a clear text signature, i.e. one which can be read without any special software.

**detach (defaults to `False`)** Returns a detached signature. If you specify `True` for this, then the detached signature will not be clear text, i.e. it will be as if you had specified a `False` value for *clearsign*. This is because if both are specified, `gpg` ignores the request for a detached signature.

**binary (defaults to `False`)** If `True`, a binary signature (rather than armored ASCII) is created.

**output (defaults to `None`)** If specified, this is used as the file path where GPG outputs the signature. Convention dictates a `.asc` or `.sig` file extension for this.

**extra\_args (defaults to `None`)** A list of additional arguments to pass to the `gpg` executable.

Note: If the data being signed is binary, calling `str(signed_data)` may raise exceptions. In that case, use the fact that `signed_data.data` holds the binary signed data. Usually the signature itself is ASCII; it's the message itself which may cause the exceptions to be raised. (Unless a detached signature is requested, the result of signing is the message with the signature appended.)

The hash algorithm used when creating the signature can be found in the `signed_data.hash_algo` attribute.

New in version 0.2.5: The `detach` keyword argument was added in version 0.2.5.

New in version 0.2.6: The `binary` keyword argument was added in version 0.2.6.

New in version 0.3.7: The `output` keyword argument was added in version 0.3.7.

New in version 0.4.1: The `extra_args` keyword argument was added.

New in version 0.4.2: The `keyid` and `username` of the signing key are stored in the `key_id` and `username` attributes of the result, if this information is provided by `gpg` (which should happen if you specify `extra_args=['--verbose']`).

Changed in version 0.5.0: The `stream` argument to `sign_file()` can be a pathname to an existing file as well as text or a file-like object. In the pathname case, `python-gnupg` will open and close the file for you.

## 7.2 Verification

To verify some data which you've received, do the following:

```
>>> verified = gpg.verify(data)
```

To verify data in a file (or file-like object), use:

```
>>> verified = gpg.verify_file(stream) # e.g. after stream = open(filename, "rb")
```

You can use the returned value in a Boolean context:

```
>>> if not verified: raise ValueError("Signature could not be verified!")
```

### 7.2.1 Verifying detached signatures on disk

If you want to verify a detached signature, use the following approach:

```
>>> verified = gpg.verify_file(stream, path_to_data_file)
```

Note that in this case, the `stream` contains the *signature* to be verified. The data that was signed should be in a separate file whose path is indicated by `path_to_data_file`.

New in version 0.2.5: The second argument to `verify_file` (`data_filename`) was added.

New in version 0.4.1: An optional keyword argument to `verify_file` (`close_file`) was added. This defaults to `True`, but if set to `False`, the signature stream is not closed. It's then left to the caller to close it when appropriate.

An optional keyword argument `extra_args` was added. This defaults to `None`, but if a value is specified, it should be a list of extra arguments to pass to the `gpg` executable.

New in version 0.4.4: When signature verification is performed, multiple signatures might be present. Information about all signatures is now captured in a `sig_info` attribute of the value returned from `verify`. This is a dictionary keyed by the signature ID and whose values are dictionaries containing the following information (note - all are string values):

- `fingerprint` - the fingerprint of the signing key. \* `pubkey_fingerprint` - this is usually the same as `fingerprint`, but it might be different if a subkey was used for the signing.
- `keyid` - the key id.
- `username` - user information for the signing key.
- `status` - this indicates the status of the signature.
- `creation_date` - the creation date of the signature in text format, YYYY-MM-DD.
- `timestamp` - the signature creation time as a timestamp.
- `expiry` - the signature expiry time as a timestamp, or '0' to indicate no expiry.
- `trust_level` - the trust level, see below.
- `trust_text` - the text corresponding to the trust level.

When a signature is verified, signer information is held in attributes of `verified`: `username`, `key_id`, `signature_id`, `fingerprint`, `trust_level` and `trust_text`. If the message wasn't signed, these attributes will all be set to `None`. If there were multiple signatures, the last values seen will be shown.

The trust levels are (in increasing order) `TRUST_UNDEFINED`, `TRUST_NEVER`, `TRUST_MARGINAL`, `TRUST_FULLY` and `TRUST_ULTIMATE`. If verification succeeded, you can test the trust level against known values as in the following example:

```
verified = gpg.verify(data)
if verified.trust_level is not None and verified.trust_level >= verified.TRUST_FULLY:
    print('Trust level: %s' % verified.trust_text)
```

New in version 0.3.1: The `trust_level` and `trust_text` attributes were added.

Note that even if you have a valid signature, you may want to not rely on that validity, if the key used for signing has expired or was revoked. If this information is available, it will be in the `key_status` attribute =, and the result will still be `False` in a Boolean context. If there is no problem detected with the signing key, the `key_status` attribute will be `None`.

New in version 0.3.3: The `key_status` attribute was added.

New in version 0.4.2: The `keyid` and `username` of the signing key are stored in the `key_id` and `username` attributes of the result, if this information is provided by `gpg`.

Changed in version 0.5.0: The `stream` argument to `verify_file()` can be a pathname to an existing file as well as text or a file-like object. In the pathname case, `python-gnupg` will open and close the file for you.

## 7.2.2 Verifying detached signatures in memory

You can also verify detached signatures where the data is in memory, using:

```
>>> verified = gpg.verify_data(path_to_signature_file, data)
```

where `data` should be a byte string of the data to be verified against the signature in the file named by `path_to_signature_file`. The returned value is the same as for the other verification methods.

In addition, an `extra_args` keyword parameter can be specified. If provided, this is treated as a list of additional arguments to pass to the `gpg` executable.

New in version 0.3.6: The `verify_data` method was added.

New in version 0.4.1: The `extra_args` keyword argument was added.



---

### Accessing gpg's Return Code

---

Starting with version 0.4.8, return values to all calls which implement `gpg` operations, other than `export_keys()`, will have a `returncode` attribute which is the return code returned by the `gpg` invocation made to perform the operation (the result of `export_keys()` is the set of exported keys and doesn't have this attribute).

New in version 0.4.8: The `returncode` attribute was added to result instances.





## CHAPTER 9

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### Passphrases

---

Passphrases provided to `python-gnupg` are not stored persistently, and just passed through to the `GnuPG` executable through a pipe. The user of `python-gnupg` is responsible for taking care not to store passphrases where they may become available to malicious code or malicious users, as well as the physical and security aspects of managing their private keys.



## CHAPTER 10

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### Logging

---

The module makes use of the facilities provided by Python's `logging` package. A single logger is created with the module's `__name__`, hence `gnupg` unless you rename the module. A `NullHandler` instance is added to this logger, so if you don't use logging in your application which uses this module, you shouldn't see any logging messages. If you do use logging in your application, just configure it in the normal way.



---

## Test Harness

---

The distribution includes a test harness, `test_gnupg.py`, which contains unit tests covering the functionality described above. You can invoke `test_gnupg.py` with one or more optional command-line arguments. If no arguments are provided, all tests are run. If arguments are provided, they collectively determine which of the tests will be run:

**import** Run tests relating to key import

**crypt** Run tests relating to encryption and decryption

**sign** Run tests relating to signing and verification

**key** Run tests relating to key management

**basic** Run basic tests relating to environment setup, or which don't fit into one of the above categories



## CHAPTER 12

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Download

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The latest version is available from the [PyPI](#) page.

The source code repository can be found [here](#).





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### Status and Further Work

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The `gnupg` module, being based on proven earlier versions, is quite usable, and comes packaged with Linux distributions such as Debian, Ubuntu and Fedora. However, there may be some features of GnuPG which this module does not take advantage of, or provide access to. How this module evolves will be determined by feedback from its user community.

Support for GnuPG 2.1 is limited, because that version of GnuPG does not provide the ability to prevent pinentry popups in all cases. This package sends passphrases to the `gpg` executable via pipes, which is only possible under GnuPG 2.1 under limited conditions and requiring end-users to edit GnuPG configuration files.

At present, functionality that requires interacting with the `gpg` executable (e.g. for key editing) is not available. This is because it requires essentially a state machine which manages the interaction - moreover, a state machine which varies according to the specific version of the `gpg` executable being used.

If you find bugs and want to raise issues, please do so via the [project issue tracker](#).

All feedback will be gratefully received; please send it to the [discussion group](#).



## CHAPTER 14

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