Six: Python 2 and 3 Compatibility Library

Six provides simple utilities for wrapping over differences between Python 2 and Python 3. It is intended to support codebases that work on both Python 2 and 3 without modification. six consists of only one Python file, so it is painless to copy into a project.

Six can be downloaded on PyPi. Its bug tracker and code hosting is on BitBucket.

The name, “six”, comes from the fact that 2*3 equals 6. Why not addition? Multiplication is more powerful, and, anyway, “five” has already been snatched away by the (admittedly now moribund) Zope Five project.

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Package contents

six.**PY2**
A boolean indicating if the code is running on Python 2.

six.**PY3**
A boolean indicating if the code is running on Python 3.

Constants

Six provides constants that may differ between Python versions. Ones ending `_types` are mostly useful as the second argument to `isinstance` or `issubclass`.

six.**class_types**
Possible class types. In Python 2, this encompasses old-style and new-style classes. In Python 3, this is just new-styles.

six.**integer_types**
Possible integer types. In Python 2, this is `long` and `int`, and in Python 3, just `int`.

six.**string_types**
Possible types for text data. This is `basestring()` in Python 2 and `str` in Python 3.

six.**text_type**
Type for representing (Unicode) textual data. This is `unicode()` in Python 2 and `str` in Python 3.

six.**binary_type**
Type for representing binary data. This is `str` in Python 2 and `bytes` in Python 3.

six.**MAXSIZE**

The maximum size of a container like `list` or `dict`. This is equivalent to `sys.maxsize` in Python 2.6 and later (including 3.x). Note, this is temptingly similar to, but not the same as `sys.maxint` in Python 2. There is no direct equivalent to `sys.maxint` in Python 3 because its integer type has no limits aside from memory.

Here's example usage of the module:

```
import six

def dispatch_types(value):
    if isinstance(value, six.integer_types):
        handle_integer(value)
    elif isinstance(value, six.class_types):
        handle_class(value)
    elif isinstance(value, six.string_types):
        handle_string(value)
```

Object model compatibility

Python 3 renamed the attributes of several intepreter data structures. The following accessors are available. Note that the recommended way to inspect functions and methods is the stdlib `inspect` module.

six.**get_unbound_function**(*meth*)
Get the function out of unbound method *meth*. In Python 3, unbound methods don't exist, so this function just returns *meth* unchanged. Example usage:

```
from six import get_unbound_function

class X(object):
    def method(self):
        pass
method_function = get_unbound_function(X.method)
```

six.**get_method_function**(*meth*)
Get the function out of method object *meth*.

six.**get_method_self**(*meth*)
Get the `self` of bound method *meth*.

six.**get_function_closure**(*func*)
Get the closure (list of cells) associated with *func*. This is equivalent to `func.__closure__` on Python 2.6+ and `func.func_closure` on Python 2.5.

six.**get_function_code**(*func*)
Get the code object associated with *func*. This is equivalent to `func.__code__` on Python 2.6+ and `func.func_code` on Python 2.5.

six.**get_function_defaults**(*func*)
Get the defaults tuple associated with *func*. This is equivalent to `func.__defaults__` on Python

2.6+ and `func.func_defaults` on Python 2.5.

six.**get_function_globals**(*func*)
Get the globals of *func*. This is equivalent to `func.__globals__` on Python 2.6+ and `func.func_globals` on Python 2.5.

six.**next**(*it*)
six.**advance_iterator**(*it*)
Get the next item of iterator *it*. `StopIteration` is raised if the iterator is exhausted. This is a replacement for calling `it.next()` in Python 2 and `next(it)` in Python 3.

six.**callable**(*obj*)
Check if *obj* can be called. Note `callable` has returned in Python 3.2, so using six's version is only necessary when supporting Python 3.0 or 3.1.

six.**iterkeys**(*dictionary*, ***kwargs*)
Returns an iterator over *dictionary*'s keys. This replaces `dictionary.iterkeys()` on Python 2 and `dictionary.keys()` on Python 3. *kwargs* are passed through to the underlying method.

six.**itervalues**(*dictionary*, ***kwargs*)
Returns an iterator over *dictionary*'s values. This replaces `dictionary.itervalues()` on Python 2 and `dictionary.values()` on Python 3. *kwargs* are passed through to the underlying method.

six.**iteritems**(*dictionary*, ***kwargs*)
Returns an iterator over *dictionary*'s items. This replaces `dictionary.iteritems()` on Python 2 and `dictionary.items()` on Python 3. *kwargs* are passed through to the underlying method.

six.**iterlists**(*dictionary*, ***kwargs*)
Calls `dictionary.iterlists()` on Python 2 and `dictionary.lists()` on Python 3. No builtin Python mapping type has such a method; this method is intended for use with multi-valued dictionaries like Werkzeug's. *kwargs* are passed through to the underlying method.

six.**viewkeys**(*dictionary*)
Return a view over *dictionary*'s keys. This replaces `dict.viewkeys()` on Python 2.7 and `dict.keys()` on Python 3.

six.**viewvalues**(*dictionary*)
Return a view over *dictionary*'s values. This replaces `dict.viewvalues()` on Python 2.7 and `dict.values()` on Python 3.

six.**viewitems**(*dictionary*)
Return a view over *dictionary*'s items. This replaces `dict.viewitems()` on Python 2.7 and `dict.items()` on Python 3.

six.**create_bound_method**(*func*, *obj*)
Return a method object wrapping *func* and bound to *obj*. On both Python 2 and 3, this will return a `types.MethodType` object. The reason this wrapper exists is that on Python 2, the

`MethodType` constructor requires the *obj*'s class to be passed.

`six.`**`create_unbound_method`**(*func*, *cls*)

Return an unbound method object wrapping *func*. In Python 2, this will return a **`types.MethodType`** object. In Python 3, unbound methods do not exist and this wrapper will simply return *func*.

class `six.`**`Iterator`**

A class for making portable iterators. The intention is that it be subclassed and subclasses provide a `__next__` method. In Python 2, `Iterator` has one method: `next`. It simply delegates to `__next__`. An alternate way to do this would be to simply alias `next` to `__next__`. However, this interacts badly with subclasses that override `__next__`. `Iterator` is empty on Python 3. (In fact, it is just aliased to `object`.)

`@six.`**`wraps`**(*wrapped*, *assigned=functools.WRAPPER_ASSIGNMENTS*, *updated=functools.WRAPPER_UPDATES*)

This is exactly the `functools.wraps()` decorator, but it sets the `__wrapped__` attribute on what it decorates as `functools.wraps()` does on Python versions after 3.2.

Syntax compatibility

These functions smooth over operations which have different syntaxes between Python 2 and 3.

`six.`**`exec_`**(*code*, *globals=None*, *locals=None*)

Execute *code* in the scope of *globals* and *locals*. *code* can be a string or a code object. If *globals* or *locals* are not given, they will default to the scope of the caller. If just *globals* is given, it will also be used as *locals*.

> **Note:** Python 3's `exec()` doesn't take keyword arguments, so calling `exec()` with them should be avoided.

`six.`**`print_`**(**args*, ***, *file=sys.stdout*, *end="\n"*, *sep=" "*, *flush=False*)

Print *args* into *file*. Each argument will be separated with *sep* and *end* will be written to the file after the last argument is printed. If *flush* is true, `file.flush()` will be called after all data is written.

> **Note:** In Python 2, this function imitates Python 3's `print()` by not having softspace support. If you don't know what that is, you're probably ok. :)

`six.`**`raise_from`**(*exc_value*, *exc_value_from*)

Raise an exception from a context. On Python 3, this is equivalent to `raise exc_value from exc_value_from`. On Python 2, which does not support exception chaining, it is equivalent to `raise exc_value`.

`six.`**`reraise`**(*exc_type*, *exc_value*, *exc_traceback=None*)

Reraise an exception, possibly with a different traceback. In the simple case,

`reraise(*sys.exc_info())` with an active exception (in an except block) reraises the current exception with the last traceback. A different traceback can be specified with the *exc_traceback* parameter. Note that since the exception reraising is done within the `reraise()` function, Python will attach the call frame of `reraise()` to whatever traceback is raised.

`six.`**`with_metaclass`**(*metaclass*, **bases*)

Create a new class with base classes *bases* and metaclass *metaclass*. This is designed to be used in class declarations like this:

```
from six import with_metaclass

class Meta(type):
    pass

class Base(object):
    pass

class MyClass(with_metaclass(Meta, Base)):
    pass
```

Another way to set a metaclass on a class is with the `add_metaclass()` decorator.

`@six.`**`add_metaclass`**(*metaclass*)

Class decorator that replaces a normally-constructed class with a metaclass-constructed one. Example usage:

```
@add_metaclass(Meta)
class MyClass(object):
    pass
```

That code produces a class equivalent to

```
class MyClass(object, metaclass=Meta):
    pass
```

on Python 3 or

```
class MyClass(object):
    __metaclass__ = MyMeta
```

on Python 2.

Note that class decorators require Python 2.6. However, the effect of the decorator can be emulated on Python 2.5 like so:

```
class MyClass(object):
    pass
MyClass = add_metaclass(Meta)(MyClass)
```

Binary and text data

Python 3 enforces the distinction between byte strings and text strings far more rigoriously than

Python 2 does; binary data cannot be automatically coerced to or from text data. six provides several functions to assist in classifying string data in all Python versions.

six.**b**(*data*)

A “fake” bytes literal. *data* should always be a normal string literal. In Python 2, `b()` returns a 8-bit string. In Python 3, *data* is encoded with the latin-1 encoding to bytes.

> **Note:** Since all Python versions 2.6 and after support the `b` prefix, `b()`, code without 2.5 support doesn’t need `b()`.

six.**u**(*text*)

A “fake” unicode literal. *text* should always be a normal string literal. In Python 2, `u()` returns unicode, and in Python 3, a string. Also, in Python 2, the string is decoded with the `unicode-escape` codec, which allows unicode escapes to be used in it.

> **Note:** In Python 3.3, the `u` prefix has been reintroduced. Code that only supports Python 3 versions of 3.3 and higher thus does not need `u()`.

> **Note:** On Python 2, `u()` doesn’t know what the encoding of the literal is. Each byte is converted directly to the unicode codepoint of the same value. Because of this, it’s only safe to use `u()` with strings of ASCII data.

six.**unichr**(*c*)

Return the (Unicode) string representing the codepoint *c*. This is equivalent to `unichr()` on Python 2 and `chr()` on Python 3.

six.**int2byte**(*i*)

Converts *i* to a byte. *i* must be in `range(0, 256)`. This is equivalent to `chr()` in Python 2 and `bytes((i,))` in Python 3.

six.**byte2int**(*bs*)

Converts the first byte of *bs* to an integer. This is equivalent to `ord(bs[0])` on Python 2 and `bs[0]` on Python 3.

six.**indexbytes**(*buf*, *i*)

Return the byte at index *i* of *buf* as an integer. This is equivalent to indexing a bytes object in Python 3.

six.**iterbytes**(*buf*)

Return an iterator over bytes in *buf* as integers. This is equivalent to a bytes object iterator in Python 3.

six.**StringIO**

This is an fake file object for textual data. It’s an alias for `StringIO.StringIO` in Python 2 and `io.StringIO` in Python 3.

six.**BytesIO**
: This is a fake file object for binary data. In Python 2, it's an alias for `StringIO.StringIO`, but in Python 3, it's an alias for `io.BytesIO`.

@six.**python_2_unicode_compatible**
: A class decorator that takes a class defining a `__str__` method. On Python 3, the decorator does nothing. On Python 2, it aliases the `__str__` method to `__unicode__` and creates a new `__str__` method that returns the result of `__unicode__()` encoded with UTF-8.

unittest assertions

Six contains compatibility shims for unittest assertions that have been renamed. The parameters are the same as their aliases, but you must pass the test method as the first argument. For example:

```
import six
import unittest

class TestAssertCountEqual(unittest.TestCase):
    def test(self):
        six.assertCountEqual(self, (1, 2), [2, 1])
```

Note these functions are only available on Python 2.7 or later.

six.**assertCountEqual**()
: Alias for `assertCountEqual()` on Python 3 and `assertItemsEqual()` on Python 2.

six.**assertRaisesRegex**()
: Alias for `assertRaisesRegex()` on Python 3 and `assertRaisesRegexp()` on Python 2.

six.**assertRegex**()
: Alias for `assertRegex()` on Python 3 and `assertRegexpMatches()` on Python 2.

Renamed modules and attributes compatibility

Python 3 reorganized the standard library and moved several functions to different modules. Six provides a consistent interface to them through the fake `six.moves` module. For example, to load the module for parsing HTML on Python 2 or 3, write:

```
from six.moves import html_parser
```

Similarly, to get the function to reload modules, which was moved from the builtin module to the `imp` module, use:

```
from six.moves import reload_module
```

For the most part, `six.moves` aliases are the names of the modules in Python 3. When the new Python 3 name is a package, the components of the name are separated by underscores. For

example, `html.parser` becomes `html_parser`. In some cases where several modules have been combined, the Python 2 name is retained. This is so the appropiate modules can be found when running on Python 2. For example, `BaseHTTPServer` which is in `http.server` in Python 3 is aliased as `BaseHTTPServer`.

Some modules which had two implementations have been merged in Python 3. For example, `cPickle` no longer exists in Python 3; it was merged with `pickle`. In these cases, fetching the fast version will load the fast one on Python 2 and the merged module in Python 3.

The `urllib`, `urllib2`, and `urlparse` modules have been combined in the `urllib` package in Python 3. The `six.moves.urllib` package is a version-independent location for this functionality; its structure mimics the structure of the Python 3 `urllib` package.

Note: In order to make imports of the form:

```
from six.moves.cPickle import loads
```

work, six places special proxy objects in in `sys.modules`. These proxies lazily load the underlying module when an attribute is fetched. This will fail if the underlying module is not available in the Python interpreter. For example, `sys.modules["six.moves.winreg"].LoadKey` would fail on any non-Windows platform. Unfortunately, some applications try to load attributes on every module in `sys.modules`. six mitigates this problem for some applications by pretending attributes on unimportable modules don't exist. This hack doesn't work in every case, though. If you are encountering problems with the lazy modules and don't use any from imports directly from `six.moves` modules, you can workaround the issue by removing the six proxy modules:

```
d = [name for name in sys.modules if name.startswith("six.moves.")]
for name in d:
    del sys.modules[name]
```

Supported renames:

Name	Python 2 name	Python 3 name
builtins	__builtin__	builtins
configparser	ConfigParser	configparser
copyreg	copy_reg	copyreg
cPickle	cPickle	pickle
cStringIO	cStringIO.StringIO()	io.StringIO
dbm_gnu	gdbm	dbm.gnu
_dummy_thread	dummy_thread	_dummy_thread
email_mime_multipart	email.MIMEMultipart	email.mime.multipart
email_mime_nonmultipart	email.MIMENonMultipart	email.mime.nonmultipart
email_mime_text	email.MIMEText	email.mime.text
email_mime_base	email.MIMEBase	email.mime.base
filter	itertools.ifilter()	filter()
filterfalse	itertools.ifilterfalse()	itertools.filterfalse()
getcwd	os.getcwdu()	os.getcwd()
getcwdb	os.getcwd()	os.getcwdb()
http_cookiejar	cookielib	http.cookiejar
http_cookies	Cookie	http.cookies
html_entities	htmlentitydefs	html.entities

html_parser	HTMLParser	html.parser
http_client	httplib	http.client
BaseHTTPServer	BaseHTTPServer	http.server
CGIHTTPServer	CGIHTTPServer	http.server
SimpleHTTPServer	SimpleHTTPServer	http.server
input	raw_input()	input()
intern	intern()	sys.intern()
map	itertools.imap()	map()
queue	Queue	queue
range	xrange()	range
reduce	reduce()	functools.reduce()
reload_module	reload()	imp.reload(), importlib.reload() on Python 3.4+
reprlib	repr	reprlib
shlex_quote	pipes.quote	shlex.quote
socketserver	SocketServer	socketserver
_thread	thread	_thread
tkinter	Tkinter	tkinter
tkinter_dialog	Dialog	tkinter.dialog
tkinter_filedialog	FileDialog	tkinter.FileDialog
tkinter_scrolledtext	ScrolledText	tkinter.scrolledtext
tkinter_simpledialog	SimpleDialog	tkinter.simpledialog
tkinter_ttk	ttk	tkinter.ttk
tkinter_tix	Tix	tkinter.tix
tkinter_constants	Tkconstants	tkinter.constants
tkinter_dnd	Tkdnd	tkinter.dnd
tkinter_colorchooser	tkColorChooser	tkinter.colorchooser
tkinter_commondialog	tkCommonDialog	tkinter.commondialog
tkinter_tkfiledialog	tkFileDialog	tkinter.filedialog
tkinter_font	tkFont	tkinter.font
tkinter_messagebox	tkMessageBox	tkinter.messagebox
tkinter_tksimpledialog	tkSimpleDialog	tkinter.simpledialog
urllib.parse	See six.moves.urllib.parse	urllib.parse
urllib.error	See six.moves.urllib.error	urllib.error
urllib.request	See six.moves.urllib.request	urllib.request
urllib.response	See six.moves.urllib.response	urllib.response
urllib.robotparser	robotparser	urllib.robotparser
urllib_robotparser	robotparser	urllib.robotparser
UserDict	UserDict.UserDict	collections.UserDict
UserList	UserList.UserList	collections.UserList
UserString	UserString.UserString	collections.UserString
winreg	_winreg	winreg
xmlrpc_client	xmlrpclib	xmlrpc.client
xmlrpc_server	SimpleXMLRPCServer	xmlrpc.server
xrange	xrange()	range
zip	itertools.izip()	zip()
zip_longest	itertools.izip_longest()	itertools.zip_longest()

urllib parse

Contains functions from Python 3's `urllib.parse` and Python 2's:

`urlparse`:

- `urlparse.ParseResult`
- `urlparse.SplitResult`
- `urlparse.urlparse()`
- `urlparse.urlunparse()`
- `urlparse.parse_qs()`
- `urlparse.parse_qsl()`
- `urlparse.urljoin()`
- `urlparse.urldefrag()`
- `urlparse.urlsplit()`
- `urlparse.urlunsplit()`
- `urlparse.splitquery`
- `urlparse.uses_fragment`
- `urlparse.uses_netloc`
- `urlparse.uses_params`
- `urlparse.uses_query`
- `urlparse.uses_relative`

and `urllib`:

- `urllib.quote()`
- `urllib.quote_plus()`
- `urllib.splittag`
- `urllib.splituser`
- `urllib.unquote()`
- `urllib.unquote_plus()`
- `urllib.urlencode()`

urllib error

Contains exceptions from Python 3's `urllib.error` and Python 2's:

`urllib`:

- `urllib.ContentTooShortError`

and `urllib2`:

- `urllib2.URLError`
- `urllib2.HTTPError`

urllib request

Contains items from Python 3's `urllib.request` and Python 2's:

`urllib`:

- `urllib.pathname2url()`
- `urllib.url2pathname()`

- `urllib.getproxies()`
- `urllib.urlretrieve()`
- `urllib.urlcleanup()`
- `urllib.URLopener`
- `urllib.FancyURLopener`
- `urllib.proxy_bypass`

and `urllib2`:

- `urllib2.urlopen()`
- `urllib2.install_opener()`
- `urllib2.build_opener()`
- `urllib2.Request`
- `urllib2.OpenerDirector`
- `urllib2.HTTPDefaultErrorHandler`
- `urllib2.HTTPRedirectHandler`
- `urllib2.HTTPCookieProcessor`
- `urllib2.ProxyHandler`
- `urllib2.BaseHandler`
- `urllib2.HTTPPasswordMgr`
- `urllib2.HTTPPasswordMgrWithDefaultRealm`
- `urllib2.AbstractBasicAuthHandler`
- `urllib2.HTTPBasicAuthHandler`
- `urllib2.ProxyBasicAuthHandler`
- `urllib2.AbstractDigestAuthHandler`
- `urllib2.HTTPDigestAuthHandler`
- `urllib2.ProxyDigestAuthHandler`
- `urllib2.HTTPHandler`
- `urllib2.HTTPSHandler`
- `urllib2.FileHandler`
- `urllib2.FTPHandler`
- `urllib2.CacheFTPHandler`
- `urllib2.UnknownHandler`
- `urllib2.HTTPErrorProcessor`

urllib response

Contains classes from Python 3's `urllib.response` and Python 2's:

`urllib`:

- `urllib.addbase`
- `urllib.addclosehook`
- `urllib.addinfo`
- `urllib.addinfourl`

Advanced - Customizing renames

It is possible to add additional names to the `six.moves` namespace.

`six.`**`add_move`**(*item*)
: Add *item* to the `six.moves` mapping. *item* should be a `MovedAttribute` or `MovedModule` instance.

`six.`**`remove_move`**(*name*)
: Remove the `six.moves` mapping called *name*. *name* should be a string.

Instances of the following classes can be passed to `add_move()`. Neither have any public members.

class `six.`**`MovedModule`**(*name*, *old_mod*, *new_mod*)
: Create a mapping for `six.moves` called *name* that references different modules in Python 2 and 3. *old_mod* is the name of the Python 2 module. *new_mod* is the name of the Python 3 module.

class `six.`**`MovedAttribute`**(*name*, *old_mod*, *new_mod*, *old_attr=None*, *new_attr=None*)
: Create a mapping for `six.moves` called *name* that references different attributes in Python 2 and 3. *old_mod* is the name of the Python 2 module. *new_mod* is the name of the Python 3 module. If *new_attr* is not given, it defaults to *old_attr*. If neither is given, they both default to *name*.