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18.6. `asyncore` — Asynchronous socket handler¶

This module provides the basic infrastructure for writing asynchronous socket service clients and servers.

There are only two ways to have a program on a single processor do “more than one thing at a time.” Multi-threaded programming is the simplest and most popular way to do it, but there is another very different technique, that lets you have nearly all the advantages of multi-threading, without actually using multiple threads. It’s really only practical if your program is largely I/O bound. If your program is processor bound, then pre-emptive scheduled threads are probably what you really need. Network servers are rarely processor bound, however.

If your operating system supports the `select()` system call in its I/O library (and nearly all do), then you can use it to juggle multiple communication channels at once; doing other work while your I/O is taking place in the “background.” Although this strategy can seem strange and complex, especially at first, it is in many ways easier to understand and control than multi-threaded programming. The `asyncore` module solves many of the difficult problems for you, making the task of building sophisticated high-performance network servers and clients a snap. For “conversational” applications and protocols the companion `asynchat` module is invaluable.

The basic idea behind both modules is to create one or more network *channels*, instances of class `asyncore.dispatcher` and `asynchat.async_chat`. Creating the channels adds them to a global map, used by the `loop()` function if you do not provide it with your own *map*.

Once the initial channel(s) is(are) created, calling the `loop()` function activates channel service, which continues until the last channel (including any that have been added to the map during asynchronous service) is closed.

```
asyncore.loop([timeout[, use_poll[, map[, count]]]])¶
```

Enter a polling loop that terminates after count passes or all open channels have been closed. All arguments are optional. The *count* parameter defaults to None, resulting in the loop terminating only when all channels have been closed. The *timeout* argument sets the timeout parameter for the appropriate `select()` or `poll()` call, measured in seconds; the default is 30 seconds. The *use_poll* parameter, if true, indicates that `poll()` should be used in preference to `select()` (the default is False).

The *map* parameter is a dictionary whose items are the channels to watch. As channels are closed they are deleted from their map. If *map* is omitted, a global map is used. Channels (instances of `asyncore.dispatcher`, `asynchat.async_chat` and subclasses thereof) can freely be mixed in the map.

```
class asyncore.dispatcher¶
```

The `dispatcher` class is a thin wrapper around a low-level socket object. To make it more useful, it has a few methods for event-handling which are called from the asynchronous loop. Otherwise, it can be treated as a normal non-blocking socket object.

The firing of low-level events at certain times or in certain connection states tells the asynchronous loop that certain higher-level events have taken place. For example, if we have asked for a socket to connect to another host, we know that the connection has been made when the socket becomes writable for the first time (at this point you know that you may write to it with the expectation of success). The implied higher-level events are:

Event	Description
<code>handle_connect()</code>	implied by the first read or write event
<code>handle_close()</code>	implied by a read event with no data available
<code>handle_accept()</code>	implied by a read event on a listening socket

During asynchronous processing, each mapped channel’s `readable()` and `writable()` methods are used to determine whether the channel’s socket should be added to the list of channels `select()`ed or `poll()`ed for read and write events.

Thus, the set of channel events is larger than the basic socket events. The full set of methods that can be overridden in your subclass follows:

```
handle_read()¶
```

Called when the asynchronous loop detects that a `read()` call on the channel’s socket will succeed.

```
handle_write()¶
```

Called when the asynchronous loop detects that a writable socket can be written. Often this method will implement the necessary buffering for performance. For example:

```
def handle_write(self):
    sent = self.send(self.buffer)
    self.buffer = self.buffer[sent:]
```

`handle_expt()`

Called when there is out of band (OOB) data for a socket connection. This will almost never happen, as OOB is tenuously supported and rarely used.

`handle_connect()`

Called when the active opener's socket actually makes a connection. Might send a "welcome" banner, or initiate a protocol negotiation with the remote endpoint, for example.

`handle_close()`

Called when the socket is closed.

`handle_error()`

Called when an exception is raised and not otherwise handled. The default version prints a condensed traceback.

`handle_accept()`

Called on listening channels (passive openers) when a connection can be established with a new remote endpoint that has issued a [connect\(\)](#) call for the local endpoint.

`readable()`

Called each time around the asynchronous loop to determine whether a channel's socket should be added to the list on which read events can occur. The default method simply returns `True`, indicating that by default, all channels will be interested in read events.

`writable()`

Called each time around the asynchronous loop to determine whether a channel's socket should be added to the list on which write events can occur. The default method simply returns `True`, indicating that by default, all channels will be interested in write events.

In addition, each channel delegates or extends many of the socket methods. Most of these are nearly identical to their socket partners.

`create_socket(family, type)`

This is identical to the creation of a normal socket, and will use the same options for creation. Refer to the [socket](#) documentation for information on creating sockets.

`connect(address)`

As with the normal socket object, `address` is a tuple with the first element the host to connect to, and the second the port number.

`send(data)`

Send `data` to the remote end-point of the socket.

`recv(buffer_size)`

Read at most `buffer_size` bytes from the socket's remote end-point. An empty string implies that the channel has been closed from the other end.

`listen(backlog)`

Listen for connections made to the socket. The `backlog` argument specifies the maximum number of queued connections and should be at least 1; the maximum value is system-dependent (usually 5).

`bind(address)`

Bind the socket to `address`. The socket must not already be bound. (The format of `address` depends on the address family — see above.) To mark the socket as re-usable (setting the `SO_REUSEADDR` option), call the [dispatcher](#) object's `set_reuse_addr()` method.

`accept()`

Accept a connection. The socket must be bound to an address and listening for connections. The return value is a pair (`conn`, `address`) where `conn` is a *new* socket object usable to send and receive data on the connection, and `address` is the address bound to the socket on the other end of the connection.

`close()`

Close the socket. All future operations on the socket object will fail. The remote end-point will receive no more data (after queued data is flushed). Sockets are automatically closed when they are garbage-collected.

`class asyncio.file_dispatcher`

A `file_dispatcher` takes a file descriptor or file object along with an optional map argument and wraps it for use with the `poll()` or `loop()` functions. If provided a file object or anything with a `fileno()` method, that method will be called and passed to the [file_wrapper](#) constructor. Availability: UNIX.

`class asyncio.file_wrapper`

A `file_wrapper` takes an integer file descriptor and calls `os.dup()` to duplicate the handle so that the original handle may be closed independently of the `file_wrapper`. This class implements sufficient methods to emulate a socket for use by the [file_dispatcher](#) class. Availability: UNIX.

18.6.1. asyncio Example basic HTTP client

Here is a very basic HTTP client that uses the [dispatcher](#) class to implement its socket handling:

```
import asyncio, socket

class http_client(asyncio.dispatcher):

    def __init__(self, host, path):
        asyncio.dispatcher.__init__(self)
        self.create_socket(socket.AF_INET, socket.SOCK_STREAM)
        self.connect( (host, 80) )
        self.buffer = 'GET %s HTTP/1.0\r\n\r\n' % path

    def handle_connect(self):
```

```
pass

def handle_close(self):
    self.close()

def handle_read(self):
    print self.recv(8192)

def writable(self):
    return (len(self.buffer) > 0)

def handle_write(self):
    sent = self.send(self.buffer)
    self.buffer = self.buffer[sent:]

c = http_client('www.python.org', '/')

asyncore.loop()
```

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Last updated on Feb 26, 2010. Created using [Sphinx](#) 0.6.3.