18.4. `selectors` — High-level I/O multiplexing

New in version 3.4.

Source code: Lib/selectors.py

18.4.1. Introduction

This module allows high-level and efficient I/O multiplexing, built upon the `select` module primitives. Users are encouraged to use this module instead, unless they want precise control over the OS-level primitives used.

It defines a `BaseSelector` abstract base class, along with several concrete implementations (`KqueueSelector`, `EpollSelector`...), that can be used to wait for I/O readiness notification on multiple file objects. In the following, "file object" refers to any object with a `fileno()` method, or a raw file descriptor. See file object.

`DefaultSelector` is an alias to the most efficient implementation available on the current platform: this should be the default choice for most users.

Note: The type of file objects supported depends on the platform: on Windows, sockets are supported, but not pipes, whereas on Unix, both are supported (some other types may be supported as well, such as fifos or special file devices).

See also:

`select`
Low-level I/O multiplexing module.

18.4.2. Classes

Classes hierarchy:

```
BaseSelector
+-- SelectSelector
+-- PollSelector
+-- EpollSelector
+-- DevpollSelector
+-- KqueueSelector
```

In the following, *events* is a bitwise mask indicating which I/O events should be waited for on a given file object. It can be a combination of the modules constants below:

Constant	Meaning
`EVENT_READ`	Available for read
`EVENT_WRITE`	Available for write

class `selectors.`**`SelectorKey`**

A `SelectorKey` is a `namedtuple` used to associate a file object to its underlying file descriptor, selected event mask and attached data. It is returned by several `BaseSelector` methods.

`fileobj`

File object registered.

`fd`

Underlying file descriptor.

`events`

Events that must be waited for on this file object.

`data`

Optional opaque data associated to this file object: for example, this could be used to store a per-client session ID.

class `selectors.`**`BaseSelector`**

A `BaseSelector` is used to wait for I/O event readiness on multiple file objects. It supports file stream registration, unregistration, and a method to wait for I/O events on those streams, with an optional timeout. It's an abstract base class, so cannot be instantiated. Use `DefaultSelector` instead, or one of `SelectSelector`, `KqueueSelector` etc. if you want to specifically use an implementation, and your platform supports it. `BaseSelector` and its concrete implementations support the context manager protocol.

abstractmethod **`register`**(*fileobj*, *events*, *data=None*)

Register a file object for selection, monitoring it for I/O events.

fileobj is the file object to monitor. It may either be an integer file descriptor or an object with a `fileno()` method. *events* is a bitwise mask of events to monitor. *data* is an opaque object.

This returns a new `SelectorKey` instance, or raises a `ValueError` in case of invalid event mask or file descriptor, or `KeyError` if the file object is already registered.

abstractmethod **unregister**(*fileobj*)

Unregister a file object from selection, removing it from monitoring. A file object shall be unregistered prior to being closed.

fileobj must be a file object previously registered.

This returns the associated `SelectorKey` instance, or raises a `KeyError` if *fileobj* is not registered. It will raise `ValueError` if *fileobj* is invalid (e.g. it has no `fileno()` method or its `fileno()` method has an invalid return value).

modify(*fileobj*, *events*, *data=None*)

Change a registered file object's monitored events or attached data.

This is equivalent to `BaseSelector.unregister(fileobj)()` followed by `BaseSelector.register(fileobj, events, data)()`, except that it can be implemented more efficiently.

This returns a new `SelectorKey` instance, or raises a `ValueError` in case of invalid event mask or file descriptor, or `KeyError` if the file object is not registered.

abstractmethod **select**(*timeout=None*)

Wait until some registered file objects become ready, or the timeout expires.

If `timeout > 0`, this specifies the maximum wait time, in seconds. If `timeout <= 0`, the call won't block, and will report the currently ready file objects. If *timeout* is `None`, the call will block until a monitored file object becomes ready.

This returns a list of `(key, events)` tuples, one for each ready file object.

key is the `SelectorKey` instance corresponding to a ready file object. *events* is a bitmask of events ready on this file object.

> **Note:** This method can return before any file object becomes ready or the timeout has elapsed if the current process receives a signal: in this case, an empty list will be returned.

Changed in version 3.5: The selector is now retried with a recomputed timeout when interrupted by a signal if the signal handler did not raise an exception (see **PEP 475** for the rationale), instead of returning an empty list of events before the timeout.

close()

Close the selector.

This must be called to make sure that any underlying resource is freed. The selector shall not be used once it has been closed.

get_key(*fileobj*)

Return the key associated with a registered file object.

This returns the `SelectorKey` instance associated to this file object, or raises `KeyError` if the file object is not registered.

abstractmethod **get_map**()

Return a mapping of file objects to selector keys.

This returns a `Mapping` instance mapping registered file objects to their associated `SelectorKey` instance.

class `selectors.`**DefaultSelector**

The default selector class, using the most efficient implementation available on the current platform. This should be the default choice for most users.

class `selectors.`**SelectSelector**

`select.select()`-based selector.

class `selectors.`**PollSelector**

`select.poll()`-based selector.

class `selectors.`**EpollSelector**

`select.epoll()`-based selector.

fileno()

This returns the file descriptor used by the underlying `select.epoll()` object.

class `selectors.`**DevpollSelector**

`select.devpoll()`-based selector.

fileno()

This returns the file descriptor used by the underlying `select.devpoll()` object.

New in version 3.5.

class `selectors.`**`KqueueSelector`**

`select.kqueue()`-based selector.

`fileno`()

This returns the file descriptor used by the underlying `select.kqueue()` object.

18.4.3. Examples

Here is a simple echo server implementation:

```
import selectors
import socket

sel = selectors.DefaultSelector()

def accept(sock, mask):
    conn, addr = sock.accept()  # Should be ready
    print('accepted', conn, 'from', addr)
    conn.setblocking(False)
    sel.register(conn, selectors.EVENT_READ, read)

def read(conn, mask):
    data = conn.recv(1000)  # Should be ready
    if data:
        print('echoing', repr(data), 'to', conn)
        conn.send(data)  # Hope it won't block
    else:
        print('closing', conn)
        sel.unregister(conn)
        conn.close()

sock = socket.socket()
sock.bind(('localhost', 1234))
sock.listen(100)
sock.setblocking(False)
sel.register(sock, selectors.EVENT_READ, accept)

while True:
    events = sel.select()
    for key, mask in events:
        callback = key.data
        callback(key.fileobj, mask)
```