
Django-tornado-websockets Documentation

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Hugo ALLIAUME

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Django-tornado-websockets is a useful solution to provide an easy way to use [Tornado WebSockets](#) with a [Django](#) application.

Important: Django-tornado-websockets is actually in **alpha version**!

Architecture

Fig. 1.1: Example of an architecture using Tornado as WSGI server, Django and django-tornado-websockets

To use django-tornado-websockets's WebSockets, you should use **Tornado as a WSGI server** where you will define handlers to *handle* an incoming request. Since we already have a WSGI server, it's probably useless to try running **Gunicorn** or **uWSGI** as WSGI server. You can try to wrap Tornado **WSGI server** into Gunicorn/uWSGI **WSGI server** but... It's a bit retarded I think (_...

Let's explain this diagram:

1. The client make a request to our web server with his web browser,
2. Our web server (**nginx**, **Apache**, ...) pass this WSGI or WebSocket request to Tornado ¹,
3. If it is a *WebSocket request*, we pass it to `tornado.websocket`, otherwise it's Django that will handle this request,
4. We wait for a *WebSocket response* or a Django response,
5. and 6. Then we return this response to the client.

¹ I forgot it on the diagram, but nginx or Apache has the job to deliver static files, it's not Tornado's work

Documentation

2.1 Installation

2.1.1 Automatic installation

```
$ pip install django-tornado-websockets
```

2.1.2 Manual installation

Clone this repo and run installation with `pip` or `setup.py` install:

```
$ git clone --recursive https://github.com/Kocal/django-tornado-websockets.git
$ cd django-tornado-websockets
# Installation with pip
$ pip install -e .
# or with setup.py
$ python setup.py install
```

2.2 Django integration and configuration

- *Integration*
- *Configuration*
 - *Basic configuration*
 - *Django support*
 - *Static files support*
 - *Additional settings*

2.2.1 Integration

In your `settings.py` file, you need to add `tornado_websockets` to your Django `INSTALLED_APPS` :

```
INSTALLED_APPS = [
    # ...
    'tornado_websockets',
]
```

2.2.2 Configuration

Since we use Tornado as a replacement of a WSGI server (Gunicorn, uWSGI, ...), you need to configure it a bit before using `django-tornado-websockets`.

Basic configuration

You can provide a Tornado configuration in your `settings.py` file like this:

```
# At the end of settings.py file

TORNADO = {
    'port': 1337,      # 8000 by default
    'handlers': [],   # [] by default
    'settings': {},   # {} by default
}
```

1. `port` is the port which Tornado main loop will listen for its `HTTPServer`,
2. `handlers` is a list of tuples where you can make a link between a route and an handler,
3. `settings` is a dictionary used to customize various aspects of Tornado (autoreload, debug, ...).

Read more about Tornado handlers and settings in the Tornado documentation: [Application configuration](#)

Django support

To makes Django work with Tornado, you need to add a new handler to Tornado configuration. Tornado can [runs WSGI apps](#) (like Django) by using `tornado.wsgi.WSGIContainer`, and we provide an already defined Django WSGI app that you can easily use.

You can also make your own Django WSGI app using the `tornado_websockets/__init__.py` file.

```
import tornado_websockets

# ...

TORNADO = {
    # ...
    'handlers': [
        # ...
        tornado_websockets.django_app,  # django_app is using a "wildcard" route, so it should be the
    ],
}
```

Static files support

If you need static files support during your development (so you are not running a configured nginx/Apache for static files), you can add another handler to your configuration:

```
import tornado.web

# ...
```

```
# Django specific configuration about static files
STATIC_URL = '/static/'
STATIC_ROOT = os.path.join(BASE_DIR, 'static')

TORNADO = {
    # ...
    'handlers': [
        (r'%s(.*)' % STATIC_URL, tornado.web.StaticFileHandler, {'path': STATIC_ROOT}),
        # ...
    ]
}
```

Additional settings

You can pass additional settings to Tornado with `TORNADO['settings']` dictionary. For example, it can be useful to set `'debug': True` if you are still in a development phase:

```
TORNADO = {
    # ...
    'settings': {
        'debug': True,
    }
}
```

2.3 Usage

- *Run Tornado server*
- *Using WebSockets (server side)*
 - *Create a WebSocket application*
 - *Receive an event from a client*
 - *Send an event to a client*
- *Using WebSockets (client side)*
 - *Linking JS wrapper into your Django template*
 - *Create a WebSocket connection*
 - *Receive an event from the server*
 - *Send an event to the server*

2.3.1 Run Tornado server

Django-tornado-websockets provides an easy solution to run your Tornado server. When you add `tornado_websockets` to your `INSTALLED_APPS`, you obtain a new management command called `runornado`:

```
$ python manage.py runornado
```

2.3.2 Using WebSockets (server side)

It's preferable to write your WebSocket applications in your `views.py` file, or import these in `views.py`.

Create a WebSocket application

You should use the `WebSocket` class to use... WebSockets . It takes only one parameter and it's the path. This path should be unique because it's automatically adding a new handler to Tornado handlers (`your_path <=> your_websocket`):

```
from tornado_websockets.websocket import WebSocket

# Make a new instance of WebSocket and automatically add handler '/ws/my_ws' to Tornado handlers
my_ws = WebSocket('/my_ws')
```

Note: If you are using this decorator on a class method (a wild `self` parameter appears!), you need to define a context for the `WebSocket` instance because `@my_ws.on` decorator can not know by itself what value `self` should take (or maybe I am doing it wrong?):

```
class MyClass(object):

    def __init__(self):
        my_ws.context = self
```

Receive an event from a client

To listen an incoming event, you should use the `@my_ws.on` decorator (where `my_ws` is an instance of `WebSocket`) on a function or a class method.

Functions and class methods **should take two named parameters**:

- `socket`: client who sent the event (instance of `WebSocketHandler`),
- `data`: data sent by the client (dictionary).

Usage example:

```
# On a function
@my_ws.on
def my_event(socket, data):
    print('Catch "my_event" event from a client')
    print('But I know this client, it is the one using this websocket connection: %s' % socket)

# On a class method
class MyClass(object):

    def __init__(self):
        # Do not forget the context, otherwise the `self` value for all class methods decorated by `@my_ws.on`
        # decorator will be `None`
        my_ws.context = self

    @my_ws.on
    def my_other_event(self, socket, data):
        # `self` value is a MyClass instance due to `my_ws.context = self` in `__init__()` method
        print('Catch "my_other_event" from a client')
        print('And same as before, I know that this client is using this websocket connection: %s' % socket)
```

Send an event to a client

Warning: You can only emit an event in a function or method decorated by `@my_ws.on` decorator.

There is three ways to emit an event:

1. For **all clients connected to your WebSocket application**, you should use `my_ws.emit` method,
2. For **the client who just sent an event**, you should use `socket.emit` method,
3. For **a specific client**, it's not officially implemented but you can take a look at `my_ws.handlers`. It's a `WebSocketHandler` list and represents all clients connected to your application, so you can use `my_ws.handlers[0].emit` method.

Usage example (echo server):

```
from tornado_websockets.websocket import WebSocket

ws_echo = WebSocket('/echo')

@ws_echo.on
def open(socket):
    # Notify all clients about a new connection
    ws_echo.emit('new_connection')

@ws_echo.on
def message(socket, data):
    # Reply to the client
    socket.emit('message', data)

    # Wow we got a spammer, let's inform the first client :^)
    if 'spam' in data.message:
        # wow
        ws_echo[0].emit('got_spam', {
            'message': data.get('message'),
            'socket': socket
        })
```

For more examples, you can read `testapp/views.py` file.

2.3.3 Using WebSockets (client side)

Django-tornado-websockets uses its own wrapper for using JavaScript WebSocket in client-side: `django-tornado-websockets-client`. By using this wrapper, you will be able to write:

```
var ws = new TornadoWebSocket(...);

ws.on('open', () => {
    ws.emit('my_event', { foo: 'bar' });
});

// instead of
var ws = new WebSocket(...);

ws.onopen = () => {
    ws.send({ event: 'my_event', data: { foo: 'bar' } });
};
```

But you can simply ignore this wrapper and use raw `WebSocket` if you want. Just remember that data passed by Django-tornado-websockets are in JSON: `{event: 'evt', data: {}}`.

Linking JS wrapper into your Django template

Link `django-tornado-websockets-client.js` (symbolic link to `main.min.js`) file in your Django template:

```
{% load static %}
<script src="{% static 'tornado_websockets/client.js' %}"></script>
```

Create a WebSocket connection

There is three ways to create a `WebSocket` connection:

```
var ws = new TornadoWebSocket(path, options);
var ws = TornadoWebSocket(path, options); // shortcut to new TornadoWebSocket(path, options)
var ws = tws(path, options); // shortcut to new TornadoWebSocket(path, options)
```

class `TornadoWebSocket` (*String path, Object options*)

Initialize a new `WebSocket` object with given options.

Parameters:

- `path`: same value than `path` parameter from `WebSocket`, see [create websocket application](#),
- `options.host`: host used for connection (default: `'localhost'`, but soon `window.location`)
- `options.port`: port used for connection (default: 8000)
- `options.secure`: true for using a secure connection (default: false)

Receive an event from the server

You can listen to `WebSocket`'s events `onopen`, `onclose` and `onerror` (`onmessage` too but you will rewrite a core part). You can also listen to your own events like `my_event`, `user_joined`, etc...

`TornadoWebSocket.on` (*String event, Function callback*)

Bind a function to an event.

Parameters:

- `event`: Event name
- `callback`: Function to execute when event event is received

```
// Bind to WebSocket.onopen
ws.on('open', event => {
  console.log('Connection: OPEN', event);

  // Add an event/callback combination into TornadoWebSocket.events private object.
  // Will be called when we receive a JSON like that: {event: 'my_event', data: {...}}
  ws.on('my_event', data => {
    console.log('Got data from « my_event »', data);
  });
});

// Bind to WebSocket.onclose
```

```
ws.on('close', event => {
    console.log('Connection: ERROR', event);
});

// Bind to WebSocket.onerror
ws.on('error', event => {
    console.log('Connection: CLOSED', event);
});
```

Send an event to the server

TornadoWebSocket.**emit** (*String event, Object|* data*)

Send a pair event/data to the server.

Parameters:

- event: Event name
- data: Data to send, can be an Object, not an Object (will be replaced by { data: { message: data } }, or undefined (will be replaced by {})

```
ws.on('open', event => {
    ws.emit('my_event'); // will send {}

    ws.emit('my_event', 'My message'); // will send {message: 'My message'}

    ws.emit('my_event', {my: 'data'}); // will send {my: 'data'}
});
```

2.4 Modules

2.4.1 Progress bar

Provide an interface to easily handle a progress bar on both server and client sides.

Example

Server-side

```
import time
import threading
from tornado_websockets.modules.progress_bar import ProgressBar

ws_pb = ProgressBar('/my_progress_bar', min=0, max=100)

# Client emitted ``start_progression`` event
@ws_pb.on
def start_progression():

    def my_func():
        for value in range(ws_pb.min, ws_pb.max):
            time.sleep(.1) # Emulate a slow task :^)
            ws_pb.tick(label="[%d/%d] Task #%d is done" % (ws_pb.value, ws_pb.max, value))
```

```
threading.Thread(None, my_func, None).start()
```

Client-side

Read client-side documentation on <https://docs.kocal.fr/dtws-client-module-progressbar>.

Usage

Construction

class `tornado_websockets.modules.progress_bar.ProgressBar` (*path*, *min=0*, *max=100*, *add_to_handlers=True*)

Initialize a new ProgressBar module instance.

If *min* and *max* values are equal, this progress bar has its indeterminate state set to `True`.

Parameters

- **path** (*str*) – WebSocket path, see `tornado_websockets.websocket.WebSocket`
- **min** (*int*) – Minimum *_value*
- **max** (*int*) – Maximum *_value*

Methods

`ProgressBar.reset()`

Reset progress bar's progression to its minimum value.

`ProgressBar.tick` (*label=None*)

Increments progress bar's *_value* by 1 and emit update event. Can also emit done event if progression is done.

Call `emit_update()` method each time this method is called. Call `emit_done()` method if progression is done.

Parameters **label** (*str*) – A label which can be displayed on the client screen

`ProgressBar.is_done()`

Return `True` if progress bar's progression is done, otherwise `False`.

Returns `False` if progress bar is indeterminate, returns `True` if progress bar is determinate and current value is equals to *max* value. Returns `False` by default.

Return type `bool`

Events

`ProgressBar.on` (*callback*)

Shortcut for `tornado_websockets.websocket.WebSocket.on()` decorator.

Parameters **callback** (*Callable*) – Function or a class method.

Returns *callback* parameter.

`ProgressBar.emit_init()`

Emit `before_init`, `init` and `after_init` events to initialize a client-side progress bar.

If progress bar is not indeterminate, `min`, `max` and `value` values are sent with `init` event.

`ProgressBar.emit_update(label=None)`

Emit `before_update`, `update` and `after_update` events to update a client-side progress bar.

Parameters `label` (*str*) – A label which can be displayed on the client screen

`ProgressBar.emit_done()`

Emit done event when progress bar's progression `is_done()`.

2.5 API

2.5.1 WebSocket

class `tornado_websockets.websocket.WebSocket` (*path*, *add_to_handlers=True*)

Class that you should to make WebSocket applications .

`WebSocket.on` (*callback*)

Execute a callback when an event is received from a client, should be used as a decorator for a function or a class method.

Event name is determined by function/method `__name__` attribute.

Parameters `callback` (*Callable*) – Function or a class method.

Returns `callback` parameter.

Example

```
>>> ws = WebSocket('/example')
>>> @ws.on
... def my_event(socket, data):
...     print('Received "my_event" event from a client.')
```

`WebSocket.emit` (*event*, *data=None*)

Send an event/data dictionary to all clients connected to your WebSocket instance. To see all ways to emit an event, please read « [Send an event to a client](#) » section.

Parameters

- **event** (*str*) – event name
- **data** (*dict or str*) – a dictionary or a string which will be converted to `{'message': data}`

Raise `EmitHandlerError` if not used inside `@WebSocket.on()` decorator.

Raise `tornado.websocket.WebSocketClosedError` if connection is closed.

Warning: `WebSocket.emit()` method should be used inside a function or a class method decorated by `@WebSocket.on()` decorator, otherwise it will raise a `EmitHandlerError` exception.

2.5.2 WebSocketHandler

class `tornado_websockets.websockethandler.WebSocketHandler` (*application*, *request*, ***kwargs*)

Represents a WebSocket connection, wrapper of `tornado.websocket.WebSocketHandler` class.

This class should not be instantiated directly; use the `WebSocket` class instead.

`WebSocketHandler.initialize` (*websocket*)

Called when class initialization, makes a link between a `WebSocket` instance and this object.

Parameters `websocket` (`WebSocket`) – instance of `WebSocket`.

`WebSocketHandler.on_message` (*message*)

Handle incoming messages on the `WebSocket`.

Parameters `message` (*str*) – JSON string

`WebSocketHandler.on_close` ()

Called when the `WebSocket` is closed, delete the link between this object and its `WebSocket`.

`WebSocketHandler.emit` (*event*, *data*)

Sends a given event/data combinaison to the client of this `WebSocket`.

Wrapper for `tornado.websocket.WebSocketHandler.write_message` method.

Parameters

- **event** (*str*) – event name to emit
- **data** (*dict*) – associated data

2.5.3 TornadoWrapper

class `tornado_websockets.tornadowrapper.TornadoWrapper`

Wrapper for Tornado application and server handling.

It let you access to Tornado app, handlers and settings everywhere in your code (it's really useful when you run `run tornado` management command and WebSockets management).

classmethod `TornadoWrapper.add_handlers` (*handlers*)

Add an handler to Tornado app if it's defined, otherwise it add this handler to the `TornadoWrapper.tornado_handlers` list.

Parameters `handlers` (*list/tuple*) – Handler(s) to add

Returns Tornado application handlers

Return type list

classmethod `TornadoWrapper.start_app` (*tornado_handlers=None*, *tornado_settings=None*)

Initialize the Tornado web application with given handlers and settings.

Parameters

- **tornado_handlers** (*list*) – Handlers (routes) for Tornado
- **tornado_settings** (*dict*) – Settings for Tornado

Returns None

classmethod `TornadoWrapper.loop` ()

Run Tornado main loop and display configuration about Tornado handlers and settings.

Returns None

classmethod `TornadoWrapper.listen(tornado_port)`

Start the Tornado HTTP server on given port.

Parameters `tornado_port` (*int*) – Port to listen

Returns None

Todo

Add support for HTTPS server.

2.5.4 Exceptions

exception `tornado_websockets.exceptions.TornadoWebSocketsError`

Base exception of all django-tornado-websockets exceptions.

exception `tornado_websockets.exceptions.EmitHandlerError(event, path)`

Exception thrown when an user try to emit an event without being in a function or class method decorated by `@WebSocket.on()` decorator.

- `event` - name of the event under investigation.
- `path` - path where the offence have taken place.

exception `tornado_websockets.exceptions.InvalidInstanceError(actual_instance, expected_instance_name)`

Exception thrown when an instance is not the expected one.

- `actual_instance` - actual instance which is trying to appear as `expected_instance_name`.
- `expected_instance_name` - name of expected instance.

exception `tornado_websockets.exceptions.NotCallableError(thing)`

Exception thrown when an user try to use a decorator on a non-callable thing.

- `thing` - « The Thing ».

exception `tornado_websockets.exceptions.WebSocketEventAlreadyBinded(event, path)`

Exception thrown when an user try to bind an already existing event for a given path.

- `event` - name of the event under investigation.
- `path` - path where the offence have taken place.

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