# Django-tornado-websockets Documentation

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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**!

CHAPTER 1

# 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

CHAPTER 2

# Documentation

## 2.1 Installation

### 2.1.1 Automatic installation

```
$ pip install django-tornado-websockets

# In your Django project
$ python manage.py collectstatic
```

### 2.1.2 Manual installation

```
$ git clone --recursive https://github.com/Kocal/django-tornado-websockets.git
$ cd django-tornado-websockets
$ python setup.py install

# In your Django project
$ python manage.py collectstatic
```

## 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 t
    ],
}
```

#### 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` row 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 `runtornado`:

```
$ python manage.py runtornado
```

### 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 `
        # decorator will be `None`
        my_ws.context = self

    @wy_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' %
```

### 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 Module

**class** `tornado_websockets.modules.`**`Module`**(*name=''*)

### 2.4.2 Progress bar

The module « ProgressBar » facilitate the communication between the server-side and client-side of a progression bar.

**Server-side**:

- An easier communication with client-side ProgressBar module
- Handle *init*, *update* and *done* events,
- Update current progression value with *`tick()`* or *`reset()`*

**Client-side**:

- An easier communication with server-side ProgressBar module,

- Handle *init*, *update* and *done* events,
- Rendering a progression bar by using *HTML5* or *Bootstrap* rendering.

### Server-side

#### Construction

**class** `tornado_websockets.modules.`**`ProgressBar`**(*name='', min=0, max=100, indeterminate=False*)

Initialize a new ProgressBar module instance.

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

**Parameters**

- **`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 _current 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, but with a specific prefix for each module.

**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()`.

#### Example

```
from tornado import gen

from tornado_websockets.modules import ProgressBar
from tornado_websockets.websocket import WebSocket

ws = WebSocket('module_progressbar')
progressbar = ProgressBar('foo', min=0, max=100)

ws.bind(progressbar)


@progressbar.on
def reset():
    progressbar.reset()


@progressbar.on
@gen.engine  # Make this function asynchronous for Tornado's IOLoop
def start():
    for value in range(0, progressbar.max):
        yield gen.sleep(.1)  # like time.sleep(), but asynchronous with @gen.engine
        progressbar.tick(label="[%d/%d] Tâche %d terminée" % (progressbar.current + 1, progressbar.ma
```

#### Client-side

Read documentation about ProgressBar client-side module here.

## 2.5 API

### 2.5.1 WebSocket

**class** `tornado_websockets.websocket.WebSocket`(*path*)

Class that you should to make WebSocket applications .

`WebSocket.on`(*callback*)

Should be used as a decorator.

It will execute the decorated function when *`WebSocketHandler`* will receive an event where its name correspond to the function (by using `__name__` magic attribute).

**Parameters** **callback** (*callable*) – Function to decorate.

**Raises** **tornado_websockets.exceptions.NotCallableError** –

**Example**

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

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

Send an event/data dictionnary 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 `runtornado` management command and WebSockets management).

**classmethod** `TornadoWrapper.`**`add_handler`**(*handler*)

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

**Parameters** **`handler`** (*`list|tuple`*) – An handler which conforms

**classmethod** `TornadoWrapper.`**`start_app`**(*handlers=None*, *settings=None*)

Initialize the Tornado web application with given handlers and settings.

**Parameters**

- **`handlers`** (*`list`*) – Handlers (routes) for 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

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**Todo**

Add support for HTTPS server.

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