Tornado

Asbathou Biyalou-Sama
Jérémy Vienne
Franco Davy Irakoze

01 OVERVIEW

02 CONCEPTS

03 CODE WITH TORNADO

04 PRACTICE

05 FEED BACK

01. OVERVIEW

ORIGINES

- Created in 2009 by FriendFeed
  - Open Source (Licence Apache 2), written in Python
  - Acquired by Facebook

WHICH COMPANIES USE TORNADO?

02.
CONCEPTS

CONCEPTS

Tornado is based on the following major components:

- A Web Framework
- Asynchronous library
- Client / Server HTTP
- Coroutine library
- DIY Framework (Do It Yourself)

- Many simultaneous connections
- Performances
- Lightweight
- Ideal for app needing long time connection

- Tornado store upload files in memory
- Smaller community than Django
- Create all by yourself

PYTHON ALTERNATIVE TO TORNADO ?

- DIY Framework
- Back end Framework
- Lightweight

- DIY Framework
- Full Stack Framework
- Long polling and async app

- Complete Framework
- Full Stack Framework
- Big project

SIMILAR FRAMEWORK?

Tornado

- Asynchronous Framework
- Non-blocking I/O
- Real-time Web app

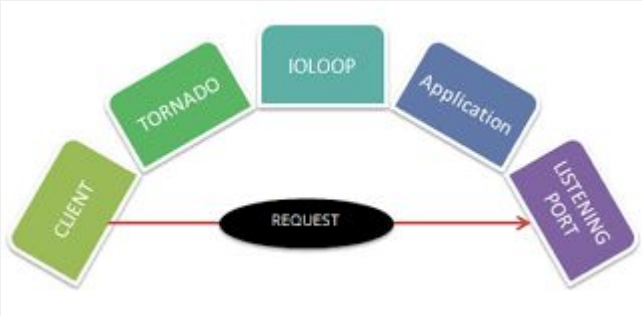
ONE KEY POINT : ASYNCHRONOUS IN TORNADO

- Python is natively single-threaded language
-

03. CODE WITH TORNADO

BASIC IMPLEMENTATION

- Application
  - Defines routes
  - Configures initial state (e.g: connexion to a database, others web services)
- HTTP Server
  - enables HTTP access to the application
- IO Loop
  - Needs to be started so that the web server remains listening
- Request Handlers



APPLICATION

```
from tornado.httpserver import HTTPServer
from tornado.ioloop import IOLoop
from tornado.options import define, options
from tornado.web import Application

define('port', default=8888, help='port to listen on')
def main():
    """Construct and serve the tornado application."""
    app = Application([
        (r"/", basicRequestHandler),
        (r"/blog", staticRequestHandler),
        (r"/isEven", queryStringRequestHandler),
        (r"/tweet/([0-9]+)", resourceRequestHandler)])
    http_server = HTTPServer(app)
    http_server.listen(options.port)
    print('Listening on http://localhost:%i' % options.port)
    IOLoop.current().start()
```

REQUEST HANDLER

```python
from tornado.web import RequestHandler

class basicRequestHandler(RequestHandler):
    """Print 'Hello, world!' as the response body."""

    def get(self):
        """Handle a GET request for saying Hello World!."""
        self.write("Hello, world!")
```

DEFINES ROUTES

```
(r"/", basicRequestHandler)
```

```
class basicRequestHandler(tornado.web.RequestHandler):
    def get(self):
```

```
(r"/id", queryStringRequestHandler)
```

```
class queryStringRequestHandler(tornado.web.RequestHandler):
    def get(self):
        n = int(self.get_argument("n"))
```

```
(r"/tweet/([0-9]+)", resourceRequestHandler)
```

```
class resourceRequestHandler(tornado.web.RequestHandler):
    def get(self, id):
```

HOW TO MANAGE VIEWS ?

- Templates are managed in the same way as in Django and Flask

Render Integration :

```python
class HomeHandler(tornado.web.RequestHandler):
    def get(self):
        entries = self.db.query("SELECT * FROM entries ORDER BY date DESC")
        self.render("home.html", entries=entries)
```

```python
app = tornado.web.Application(
    [

    ],
    cookie_secret="__TODO:_GENERATE_YOUR_OWN_RANDOM_VALUE_HERE__",
    template_path=os.path.join(os.path.dirname(__file__), "templates"),
    static_path=os.path.join(os.path.dirname(__file__), "static"),
    debug=options.debug,
)
app.listen(options.port)
```

Template view :

```
<html>
   <head>
      <title>{{ title }}</title>
   </head>
   <body>
     <ul>
       {% for item in items %}
         <li>{{ escape(item) }}</li>
       {% end %}
     </ul>
   </body>
 </html>
```

TEMPLATES POSSIBILITIES

Complex expression translated to Python :

```
{% for student in [p for p in people if p.student and p.age > 23] %}
  <li>{{ escape(student.name) }}</li>
{% end %}
```

Use method :

```
### Python code
def add(x, y):
   return x + y
template.execute(add=add)

### The template
{{ add(1, 2) }}
```

Useful Syntax :

```
{% set *x* = *y* %}
{% for *var* in *expr* %}...{% end %}
{% include *filename* %}
{% extends *filename* %}
{% block *name* %}...{% end %}
```

SYNC & ASYNC WITH TORNADO

Synchronous method :

```python
from tornado.httpclient import HTTPClient

def synchronous_fetch(url):
    http_client = HTTPClient()
    response = http_client.fetch(url)
    return response.body
```

ASynchronous method :

```python
from tornado.httpclient import AsyncHTTPClient

async def asynchronous_fetch(url):
    http_client = AsyncHTTPClient()
    response = await http_client.fetch(url)
    return response.body
```

COROUTINES

- Recommended for asynchronous code in tornado
- use the keywords : “await” or “yield”
- as simple as synchronous code
- easier concurrency : reduce the number of places where a context can switch

Decorated:

```
# Normal function declaration
# with decorator
@gen.coroutine
def a():
    # "yield" all async funcs
funcs
    b = yield c()
    # "return" and "yield"
    # cannot be mixed in
    # Python 2, so raise a
    # special exception.
     raise gen.Return(b)
```

Native:

```
 # "async def" keywords

 async def a():
     # "await" all async

     b = await c()


     # Return normally
      return b
```

HOW TO CALL COROUTINE

Bad way :

```
async def divide(x, y):
    return x / y

def bad_call():
    # This should raise a ZeroDivisionError, but it won't because
    # the coroutine is called incorrectly.
    divide(1, 0)
```

Good Way :

```
async def good_call():
    # await will unwrap the object returned by divide() and raise
    # the exception.
    await divide(1, 0)
```

Fire and forget method :

```
IOLoop.current().spawn_callback(divide, 1, 0)
```

COROUTINE PATTERNS

Parallelism :

```
from tornado.gen import multi

async def parallel_fetch(url1, url2):
    resp1, resp2 = await multi([http_client.fetch(url1),
                                http_client.fetch(url2)])

async def parallel_fetch_many(urls):
    responses = await multi ([http_client.fetch(url) for url in urls])
    # responses is a list of HTTPResponses in the same order

async def parallel_fetch_dict(urls):
    responses = await multi({url: http_client.fetch(url)
                             for url in urls})
    # responses is a dict {url: HTTPResponse}
```

COROUTINE PATTERNS

CALL BLOCKING METHOD :

```
async def call_blocking():
    await IOLoop.current().run_in_executor(None, blocking_func, args)
```

INTERLEAVING

```
async def get(self):
    # convert_yielded() starts the native coroutine in the background.
    # This is equivalent to asyncio.ensure_future() (both work in Tornado).
    fetch_future = convert_yielded(self.fetch_next_chunk())
    while True:
        chunk = yield fetch_future
        if chunk is None: break
        self.write(chunk)
        fetch_future = convert_yielded(self.fetch_next_chunk())
        yield self.flush()
```

COROUTINE PATTERNS

LOOPING :

```
db = motor.MotorClient().test

@gen.coroutine
def loop_example(collection):
    cursor = db.collection.find()
    while (yield cursor.fetch_next):
        doc = cursor.next_object()
```

RUNNING IN THE BACKGROUND :

```
async def minute_loop():
    while True:
        await do_something()
        await gen.sleep(60)

# Coroutines that loop forever are generally started with
# spawn_callback().
IOLoop.current().spawn_callback(minute_loop)
```

04. TP

06.
FEEDBACK

HOW TO RUN AND DEPLOY ?

BEGIN YOUR APP

DEPENDENCIES :

```
import tornado.ioloop
import tornado.web
```

RUNNING APP :

```
if __name__ == "__main__":
    app = make_app()
    app.listen(8888)
    tornado.ioloop.IOLoop.current().start()
```

CREATE SOME ROUTES

ROUTES :

```
app = tornado.web.Application([
    (r"/", basicRequestHandler),
    (r"/blog", staticRequestHandler),
    (r"/isEven", queryStringRequestHandler),
    (r"/tweet/([0-9]+)", resourceRequestHandler)
])
```

REQUEST HANDLERS :

```
class basicRequestHandler(tornado.web.RequestHandler):
    def get(self):
        self.write("Hello, world!!!!!!")

class resourceRequestHandler(tornado.web.RequestHandler):
    def get(self, id):
        self.write("Querying tweet with id " + id)

class queryStringRequestHandler(tornado.web.RequestHandler):
    def get(self):
        n = int(self.get_argument("n"))
        r = "odd" if n % 2 else "even"

        self.write("the number " + str(n) + " is " + r)
```