Cornice Documentation

Release 1.2.1

Mozilla Services

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Contents

Cornice provides helpers to build & document REST-ish Web Services with Pyramid, with decent default behaviors. It takes care of following the HTTP specification in an automated way where possible.

We designed and implemented cornice in a really simple way, so it is easy to use and you can get started in a matter of minutes.

CHAPTER 1

Show me some code!

A **full** Cornice WGSI application looks like this (this example is taken from the demoapp project):

```
from collections import defaultdict

from pyramid.exceptions import Forbidden
from pyramid.security import authenticated_userid, effective_principals
from pyramid.view import view_config

from cornice import Service


info_desc = """\
This service is useful to get and set data for a user.
"""


user_info = Service(name='users', path='/{username}/info',
                    description=info_desc)

_USERS = defaultdict(dict)


@user_info.get()
def get_info(request):
    """Returns the public information about a **user**.

    If the user does not exists, returns an empty dataset.
    """
    username = request.matchdict['username']
    return _USERS[username]


@user_info.post()
def set_info(request):
    """Set the public information for a **user**.

    You have to be that user, and *authenticated*.

    Returns *True* or *False*.
    """
    username = authenticated_userid(request)
    if request.matchdict["username"] != username:
        raise Forbidden()
```

```
    _USERS[username] = request.json_body
    return {'success': True}


@view_config(route_name="whoami", permission="authenticated", renderer="json")
def whoami(request):
    """View returning the authenticated user's credentials."""
    username = authenticated_userid(request)
    principals = effective_principals(request)
    return {"username": username, "principals": principals}
```

What Cornice will do for you here is:

- automatically raise a 405 if a DELETE or a PUT is called on **/{username}/info**
- automatically generate your doc via a Sphinx directive.
- provide a validation framework that will return a nice JSON structure in Bad Request 400 responses explaining what's wrong.
- provide an acceptable **Content-Type** whenever you send an HTTP "Accept" header to it, resulting in a *406 Not Acceptable* with the list of acceptable ones if it can't answer.

Please follow up with Exhaustive list of the validations provided by Cornice to get the picture.

CHAPTER 2

Documentation content

2.1 QuickStart for people in a hurry

You are in a hurry, so we'll assume you are familiar with Pyramid, Paster, and Pip ;)

To use Cornice, install it:

```
$ pip install cornice
```

That'll give you a Paster template to use:

```
$ pcreate -t cornice project
...
```

The template creates a working Cornice application.

If you want to add cornice support to an already existing project, you'll need to include cornice in your project *includeme*:

```
config.include("cornice")
```

You can then start poking at the `views.py` file that has been created.

For example, let's define a service where you can **GET** and **POST** a value at **/values/{value}**, where *value* is an ascii value representing the name of the value.

The `views` module can look like this:

```
from cornice import Service

values = Service(name='foo', path='/values/{value}',
                 description="Cornice Demo")

_VALUES = {}


@values.get()
def get_value(request):
    """Returns the value.
    """
    key = request.matchdict['value']
    return _VALUES.get(key)


@values.post()
```

```
def set_value(request):
    """Set the value.

    Returns *True* or *False*.
    """
    key = request.matchdict['value']
    try:
        # json_body is JSON-decoded variant of the request body
        _VALUES[key] = request.json_body
    except ValueError:
        return False
    return True
```

Note: By default, Cornice uses a Json renderer.

Run your Cornice application with:

```
$ pserve project.ini --reload
```

Set a key-value using Curl:

```
$ curl -X POST http://localhost:6543/values/foo -d '{"a": 1}'
```

Check out what is stored in a foo values, open http://localhost:6543/values/foo

2.2 Full tutorial

Let's create a full working application with **Cornice**. We want to create a light messaging service.

You can find its whole source code at https://github.com/mozilla-services/cornice/blob/master/examples/messaging

Features:

- users can register to the service
- users can list all registered users
- users can send messages
- users can retrieve the latest messages
- messages have three fields: sender, content, color (red or black)
- adding a message is done through authentication

Limitations:

- there's a single channel for all messages.
- if a user with the same name is already registered, he cannot register.
- all messages and users are kept in memory.

2.2.1 Design

The application provides two services:

- **users**, at **/users**: where you can list all users or register a new one

- **messages**, at **/**: where you can read the messages or add new ones

On the server, the data is kept in memory.

We'll provide a single CLI client in Python, using Curses.

2.2.2 Setting up the development environment

To create this application, we'll use Python 2.7. Make sure you have it on your system, then install **virtualenv** (see http://pypi.python.org/pypi/virtualenv).

Create a new directory and a virtualenv in it:

```
$ mkdir messaging
$ cd messaging
$ virtualenv --no-site-packages .
```

Once you have it, install Cornice in it with Pip:

```
$ bin/pip install cornice
```

Cornice provides a Paster Template you can use to create a new application:

```
$ bin/pcreate -t cornice messaging
Creating directory <...path ...>/messaging
  Recursing into +package+
    Creating <...path ...>/messaging/messaging/
    Copying __init__.py_tmpl to <...path ...>/messaging/messaging/__init__.py
    Copying views.py_tmpl to <...path ...>/messaging/messaging/views.py
  Copying +package+.ini_tmpl to <...path ...>/messaging/messaging.ini
  Copying README.rst_tmpl to <...path ...>/messaging/README.rst
  Copying setup.py_tmpl to <...path ...>/messaging/setup.py

================================================================================
Tutorials: http://docs.pylonsproject.org/projects/pyramid_tutorials
Documentation: http://docs.pylonsproject.org/projects/pyramid

Twitter (tips & updates): http://twitter.com/pylons
Mailing List: http://groups.google.com/group/pylons-discuss

Welcome to Pyramid.  Sorry for the convenience.
================================================================================
```

Once your application is generated, go there and call *develop* against it:

```
$ cd messaging
$ ../bin/python setup.py develop
...
```

The application can now be launched via embedded Pyramid pserve, it provides a default "Hello" service check:

```
$ ../bin/pserve messaging.ini
Starting server in PID 7618.
serving on 0.0.0.0:6543 view at http://127.0.0.1:6543
```

Once the application is running, visit http://127.0.0.1:6543 in your browser and make sure you get:

```
{'Hello': 'World'}
```

You should also get the same results calling the URL via Curl:

```
$ curl -i http://0.0.0.0:6543/
```

This will result:

```
HTTP/1.1 200 OK
Content-Length: 18
Content-Type: application/json; charset=UTF-8
Date: Tue, 12 May 2015 13:23:32 GMT
Server: waitress

{"Hello": "World"}
```

2.2.3 Defining the services

Let's open the file in `messaging/views.py`, it contains all the Services:

```
from cornice import Service

hello = Service(name='hello', path='/', description="Simplest app")

@hello.get()
def get_info(request):
    """Returns Hello in JSON."""
    return {'Hello': 'World'}
```

Users management

We're going to get rid of the Hello service, and change this file in order to add our first service - the users management

```
from cornice import Service

_USERS = {}
users = Service(name='users', path='/users', description="User registration")

@users.get(validators=valid_token)
def get_users(request):
    """Returns a list of all users."""
    return {'users': _USERS.keys()}

@users.post(validators=unique)
def create_user(request):
    """Adds a new user."""
    user = request.validated['user']
    _USERS[user['name']] = user['token']
    return {'token': '%s-%s' % (user['name'], user['token'])}

@users.delete(validators=valid_token)
def del_user(request):
    """Removes the user."""
    name = request.validated['user']
    del _USERS[name]
    return {'Goodbye': name}
```

What we have here is 3 methods on **/users**:

- **GET**: returns the list of users names – the keys of _USERS

- **POST**: adds a new user and returns a unique token
- **DELETE**: removes the user.

Remarks:

- **POST** uses the **unique** validator to make sure that the user name is not already taken. That validator is also in charge of generating a unique token associated with the user.
- **GET** users the **valid_token** to verify that a **X-Messaging-Token** header is provided in the request, with a valid token. That also identifies the user.
- **DELETE** also identifies the user then removes it.

Validators are filling the **request.validated** mapping, the service can then use.

Here's their code:

```
import os
import binascii
import json

from webob import Response, exc
from cornice import Service

users = Service(name='users', path='/users', description="Users")
_USERS = {}


#
# Helpers
#
def _create_token():
    return binascii.b2a_hex(os.urandom(20))


class _401(exc.HTTPError):
    def __init__(self, msg='Unauthorized'):
        body = {'status': 401, 'message': msg}
        Response.__init__(self, json.dumps(body))
        self.status = 401
        self.content_type = 'application/json'


def valid_token(request):
    header = 'X-Messaging-Token'
    htoken = request.headers.get(header)
    if htoken is None:
        raise _401()
    try:
        user, token = htoken.split('-', 1)
    except ValueError:
        raise _401()

    valid = user in _USERS and _USERS[user] == token
    if not valid:
        raise _401()

    request.validated['user'] = user
```

```
def unique(request):
    name = request.body
    if name in _USERS:
        request.errors.add('url', 'name', 'This user exists!')
    else:
        user = {'name': name, 'token': _create_token()}
        request.validated['user'] = user


#
# Services - User Management
#
@users.get(validators=valid_token)
def get_users(request):
    """Returns a list of all users."""
    return {'users': _USERS.keys()}


@users.post(validators=unique)
def create_user(request):
    """Adds a new user."""
    user = request.validated['user']
    _USERS[user['name']] = user['token']
    return {'token': '%s-%s' % (user['name'], user['token'])}


@users.delete(validators=valid_token)
def del_user(request):
    """Removes the user."""
    name = request.validated['user']
    del _USERS[name]
    return {'Goodbye': name}
```

When the validator finds errors, it adds them to the **request.errors** mapping, and that will return a 400 with the errors.

Let's try our application so far with CURL:

```
$ curl http://localhost:6543/users
{"status": 401, "message": "Unauthorized"}

$ curl -X POST http://localhost:6543/users -d 'tarek'
{"token": "tarek-a15fa2ea620aac8aad3e1b97a64200ed77dc7524"}

$ curl http://localhost:6543/users -H "X-Messaging-Token:tarek-a15fa2ea620aac8aad3e1b97a64200ed77dc75
{"users": ["tarek"]}

$ curl -X DELETE http://localhost:6543/users -H "X-Messaging-Token:tarek-a15fa2ea620aac8aad3e1b97a642
{"Goodbye": "tarek"}
```

Messages management

Now that we have users, let's post and get messages. This is done via two very simple functions we're adding in the `views.py` file:

```
messages = Service(name='messages', path='/', description="Messages")

_MESSAGES = []
```

```
@messages.get()
def get_messages(request):
    """Returns the 5 latest messages"""
    return _MESSAGES[:5]


@messages.post(validators=(valid_token, valid_message))
def post_message(request):
    """Adds a message"""
    _MESSAGES.insert(0, request.validated['message'])
    return {'status': 'added'}
```

The first one simply returns the five first messages in a list, and the second one inserts a new message in the beginning of the list.

The **POST** uses two validators:

- `valid_token()`: the function we used previously that makes sure the user is registered
- `valid_message()`: a function that looks at the message provided in the POST body, and puts it in the validated dict.

Here's the `valid_message()` function:

```
def valid_message(request):
    try:
        message = json.loads(request.body)
    except ValueError:
        request.errors.add('body', 'message', 'Not valid JSON')
        return

    # make sure we have the fields we want
    if 'text' not in message:
        request.errors.add('body', 'text', 'Missing text')
        return

    if 'color' in message and message['color'] not in ('red', 'black'):
        request.errors.add('body', 'color', 'only red and black supported')
    elif 'color' not in message:
        message['color'] = 'black'

    message['user'] = request.validated['user']
    request.validated['message'] = message
```

This function extracts the json body, then checks that it contains a text key at least. It adds a color or use the one that was provided, and reuse the user name provided by the previous validator with the token control.

2.2.4 Generating the documentation

Now that we have a nifty web application, let's add some doc.

Go back to the root of your project and install Sphinx:

```
$ bin/pip install Sphinx
```

Then create a Sphinx structure with **sphinx-quickstart**:

```
$ mkdir docs
$ bin/sphinx-quickstart
```

```
Welcome to the Sphinx 1.0.7 quickstart utility.

..

Enter the root path for documentation.
> Root path for the documentation [.]: docs
...
> Separate source and build directories (y/N) [n]: y
...
> Project name: Messaging
> Author name(s): Tarek
...
> Project version: 1.0
...
> Create Makefile? (Y/n) [y]:
> Create Windows command file? (Y/n) [y]:
```

Once the initial structure is created, we need to declare the Cornice extension, by editing the `source/conf.py` file. We want to change **extensions = []** into:

```
import cornice   # makes sure cornice is available
extensions = ['cornice.ext.sphinxext']
```

The last step is to document your services by editing the `source/index.rst` file like this:

```
Welcome to Messaging's documentation!
=====================================

.. services::
   :modules: messaging.views
```

The **services** directive is told to look at the services in the **messaging** package. When the documentation is built, you will get a nice output of all the services we've described earlier.

2.2.5 The Client

A simple client to use against our service can do three things:

1. let the user register a name
2. poll for the latest messages
3. let the user send a message !

Without going into great details, there's a Python CLI against messaging that uses Curses.

See https://github.com/mozilla-services/cornice/blob/master/examples/messaging/messaging/client.py

2.3 How to configure cornice

In addition to be configurable when defining the services, it's possible to change some behavior of Cornice via a configuration file.

Here are some of the options you can tweak:

Setting name (default value)	What does it do?
route_prefix (‘‘)	Sets a prefix for all your routes. For instance, if you want to prefix all your URIs by /1.0/, you can set it up here.

2.4 Defining resources

Cornice is also able to handle rest “resources” for you. You can declare a class with some put, post, get etc. methods (the HTTP verbs) and they will be registered as handlers for the appropriate methods / services.

Here is how you can register a resource:

```
from cornice.resource import resource, view

_USERS = {1: {'name': 'gawel'}, 2: {'name': 'tarek'}}

@resource(collection_path='/users', path='/users/{id}')
class User(object):

    def __init__(self, request):
        self.request = request

    def collection_get(self):
        return {'users': _USERS.keys()}

    @view(renderer='json')
    def get(self):
        return _USERS.get(int(self.request.matchdict['id']))

    @view(renderer='json', accept='text/json')
    def collection_post(self):
        print(self.request.json_body)
        _USERS[len(_USERS) + 1] = self.request.json_body
        return True
```

Here is an example of how to define cornice resources in an imperative way:

```
from cornice import resource

class User(object):

    def __init__(self, request):
        self.request = request

    def collection_get(self):
        return {'users': _USERS.keys()}

    def get(self):
        return _USERS.get(int(self.request.matchdict['id']))

resource.add_view(User.get, renderer='json')
user_resource = resource.add_resource(User, collection_path='/users', path='/users/{id}')

def includeme(config):
    config.add_cornice_resource(user_resource)
    # or
    config.scan("PATH_TO_THIS_MODULE")
```

As you can see, you can define methods for the collection (it will use the **path** argument of the class decorator. When defining collection_* methods, the path defined in the **collection_path** will be used.

2.4.1 validators and filters

You also can register validators and filters that are defined in your *@resource* decorated class, like this:

```
@resource(path='/users/{id}')
class User(object):

    def __init__(self, request):
        self.request = request

    @view(validators=('validate_req',))
    def get(self):
        # return the list of users

    def validate_req(self, request):
        # validate the request
```

2.4.2 Registered routes

Cornice uses a default convention for the names of the routes it registers.

When defining resources, the pattern used is *collection_<service_name>* (it prepends `collection_` to the service name) for the collection service.

2.5 Validation features

Cornice provides a way to to control the request before it's passed to the code. A validator is a simple callable that gets the request object and fills **request.errors** in case the request isn't valid.

Validators can also convert values and saves them so they can be reused by the code. This is done by filling the **request.validated** dictionary.

Once the request had been sent to the view, you can filter the results using so called filters. This document describe both concepts, and how to deal with them.

2.5.1 Disabling or adding filters/validators

Some validators and filters are activated by default, for all the services. In case you want to disable them, or if you

You can register a filter for all the services by tweaking the *DEFAULT_FILTER* parameter:

```
from cornice.validators import DEFAULT_FILTERS

def includeme(config):
    DEFAULT_FILTERS.append(your_callable)
```

(this also works for validators)

You also can add or remove filters and validators for a particular service. To do that, you need to define its *default_validators* and *default_filters* class parameters.

2.5.2 Dealing with errors

When validating inputs using the different validation mechanisms (described in this document), Cornice can return errors. In case it returns errors, it will do so in JSON by default.

The default returned JSON object is a dictionary of the following form:

```
{
    'status': 'error',
    'errors': errors
}
```

With `errors` being a JSON dictionary with the keys "location", "name" and "description".

- **location** is the location of the error. It can be "querystring", "header" or "body"
- **name** is the eventual name of the value that caused problems
- **description** is a description of the problem encountered.

You can override the default JSON error handler for a view with your own callable. The following function, for instance, returns the error response with an XML document as its payload:

```
def xml_error(errors):
    lines = ['<errors>']
    for error in errors:
        lines.append('<error>'
                     '<location>%(location)s</location>'
                     '<type>%(name)s</type>'
                     '<message>%(description)s</message>'
                     '</error>' % error)
    lines.append('</errors>')
    return HTTPBadRequest(body=''.join(lines),
                          content_type='application/xml')
```

Configure your views by passing your handler as `error_handler`:

```
@service.post(validators=my_validator, error_handler=xml_error)
def post(request):
    return {'OK': 1}
```

2.5.3 Validators

Schema validation

You can do schema validation using either libraries or custom code. However, Cornice integrates better when using Colander for instance, and will be able to generate the documentation and describe the variables needed if you use it.

Using Colander

Colander (http://docs.pylonsproject.org/projects/colander/en/latest/) is a validation framework from the Pylons project that can be used with Cornice's validation hook to control a request and deserialize its content into objects.

To describe a schema, using Colander and Cornice, here is how you can do:

```
from cornice import Service
from cornice.schemas import CorniceSchema
from colander import MappingSchema, SchemaNode, String, drop
```

```
foobar = Service(name="foobar", path="/foobar")


class FooBarSchema(MappingSchema):
    # foo and bar are required in the body (json), baz is optional
    # yeah is required, but in the querystring.
    foo = SchemaNode(String(), location="body", type='str')
    bar = SchemaNode(String(), location="body", type='str')
    baz = SchemaNode(String(), location="body", type='str', missing=drop)
    yeah = SchemaNode(String(), location="querystring", type='str')


@foobar.post(schema=FooBarSchema)
def foobar_post(request):
    return {"test": "succeeded"}
```

You can even use Schema-Inheritance as introduced by Colander 0.9.9.

If you want to access the `request` within the schema nodes during validation, you can use the deferred feature of Colander, since Cornice binds the schema with the current request:

```
from colander import deferred

@deferred
def deferred_validator(node, kw):
    request = kw['request']
    if request['x-foo'] == 'version_a':
        return OneOf(['a', 'b'])
    else:
        return OneOf(['c', 'd'])

class FooBarSchema(MappingSchema):
    choice = SchemaNode(String(), validator=deferred_validator)
```

Note: Since binding on request has a cost, it can be disabled by specifying `bind_request` as `False`:

```
@property
def schema(self):
    return CorniceSchema.from_colander(FooBarSchema(),
                                       bind_request=False)
```

If you want the schema to be dynamic, i.e. you want to choose which one to use per request, you can define it as a property on your class and it will be used instead. For example:

```
@property
def schema(self):
    if self.request.method == 'POST':
        schema = foo_schema
    elif self.request.method == 'PUT':
        schema = bar_schema
    schema = CorniceSchema.from_colander(schema)
    # Custom additional context
    schema = schema.bind(context=self.context)
    return schema
```

Cornice provides built-in support for JSON and HTML forms (`application/x-www-form-urlencoded`) in-

put validation using Colander. If you need to validate other input formats, such as XML, you can provide callable objects taking a `request` argument and returning a Python data structure that Colander can understand:

```
def dummy_deserializer(request):
    return parse_my_input_format(request.body)
```

You can then instruct a specific view to use with the `deserializer` parameter:

```
@foobar.post(schema=FooBarSchema, deserializer=dummy_deserializer)
def foobar_post(request):
    return {"test": "succeeded"}
```

If you'd like to configure deserialization globally, you can use the `add_cornice_deserializer` configuration directive in your app configuration code to tell Cornice which deserializer to use for a given content type:

```
config = Configurator(settings={})
# ...
config.add_cornice_deserializer('text/dummy', dummy_deserializer)
```

With this configuration, when a request comes with a Content-Type header set to `text/dummy`, Cornice will call `dummy_deserializer` on the `request` before passing the result to Colander.

View-specific deserializers have priority over global content-type deserializers.

To enable localization of Colander error messages, you must set available_languages in your settings. You may also set pyramid.default_locale_name.

Using formencode

FormEncode (http://www.formencode.org/en/latest/index.html) is yet another validation system that can be used with Cornice.

For example, if you want to make sure the optional query option **max** is an integer, and convert it, you can use FormEncode in a Cornice validator like this:

```
from cornice import Service
from formencode import validators

foo = Service(name='foo', path='/foo')
validator = validators.Int()

def validate(request):
    try:
        request.validated['max'] = validator.to_python(request.GET['max'])
    except formencode.Invalid, e:
        request.errors.add('url', 'max', e.message)

@foo.get(validators=(validate,))
def get_value(request):
    """Returns the value.
    """
    return 'Hello'
```

Validation using custom callables

Let's take an example: we want to make sure the incoming request has an **X-Verified** header. If not, we want the server to return a 400:

```
from cornice import Service

foo = Service(name='foo', path='/foo')


def has_paid(request):
    if not 'X-Verified' in request.headers:
        request.errors.add('header', 'X-Verified', 'You need to provide a token')

@foo.get(validators=has_paid)
def get_value(request):
    """Returns the value.
    """
    return 'Hello'
```

Notice that you can chain the validators by passing a sequence to the **validators** option.

When using validation, Cornice will try to extract information coming from the validation functions and use them in the generated documentation. Refer to Sphinx integration for more information about automatic generated documentation.

Changing the status code from validators

You also can change the status code returned from your validators. Here is an example of this:

```
def user_exists(request):
    if not request.POST['userid'] in userids:
        request.errors.add('body', 'userid', 'The user id does not exist')
        request.errors.status = 404
```

Doing validation and filtering at class level

If you want to use class methods to do validation, you can do so by passing the *klass* parameter to the *hook_view* or *@method* decorators, plus a string representing the name of the method you want to invoke on validation.

Take care, though, because this only works if the class you are using has an *__init__* method which takes a *request* as the first argument.

This means something like this:

```
class MyClass(object):
    def __init__(self, request):
        self.request = request

    def validate_it(request):
        # pseudo-code validation logic
        if whatever is wrong:
            request.errors.add('something')

@service.get(klass=MyClass, validators=('validate_it',))
def view(request):
    return "ok"
```

2.5.4 Media type validation

There are two flavors of media/content type validations Cornice can apply to services:

- *Content negotiation* checks if Cornice is able to respond with an appropriate **response body** content type requested by the client sending an `Accept` header. Otherwise it will croak with a `406 Not Acceptable`.
- *Request media type* validation will match the `Content-Type` **request header** designating the **request body** content type against a list of allowed content types. When failing on that, it will croak with a `415 Unsupported Media Type`.

Content negotiation

Validate the `Accept` header in http requests against a defined or computed list of internet media types. Otherwise, signal `406 Not Acceptable` to the client.

Basics

By passing the *accept* argument to the service definition decorator, we define the media types we can generate http **response** bodies for:

```
@service.get(accept="text/html")
def foo(request):
    return 'Foo'
```

When doing this, Cornice automatically deals with egress content negotiation for you.

If services don't render one of the appropriate response body formats asked for by the requests HTTP **Accept** header, Cornice will respond with a http status of `406 Not Acceptable`.

The *accept* argument can either be a string or a list of accepted values made of internet media type(s) or a callable returning the same.

Using callables

When a callable is specified, it is called *before* the request is passed to the destination function, with the *request* object as an argument.

The callable obtains the request object and returns a list or a single scalar value of accepted media types:

```
def _accept(request):
    # interact with request if needed
    return ("text/xml", "text/json")

@service.get(accept=_accept)
def foo(request):
    return 'Foo'
```

See also:

https://developer.mozilla.org/en-US/docs/HTTP/Content_negotiation

Error responses

When requests are rejected, an appropriate error response is sent to the client using the configured *error_handler*. To give the service consumer a hint about the valid internet media types to use for the `Accept` header, the error response contains a list of allowed types.

When using the default json *error_handler*, the response might look like this:

```
{
    'status': 'error',
    'errors': [
        {
            'location': 'header',
            'name': 'Accept',
            'description': 'Accept header should be one of ["text/xml", "text/json"]'
        }
    ]
}
```

Request media type

Validate the `Content-Type` header in http requests against a defined or computed list of internet media types. Otherwise, signal `415 Unsupported Media Type` to the client.

Basics

By passing the *content_type* argument to the service definition decorator, we define the media types we accept as http **request** bodies:

```
@service.post(content_type="application/json")
def foo(request):
    return 'Foo'
```

All requests sending a different internet media type using the HTTP **Content-Type** header will be rejected with a http status of `415 Unsupported Media Type`.

The *content_type* argument can either be a string or a list of accepted values made of internet media type(s) or a callable returning the same.

Using callables

When a callable is specified, it is called *before* the request is passed to the destination function, with the *request* object as an argument.

The callable obtains the request object and returns a list or a single scalar value of accepted media types:

```
def _content_type(request):
    # interact with request if needed
    return ("text/xml", "application/json")

@service.post(content_type=_content_type)
def foo(request):
    return 'Foo'
```

The match is done against the plain internet media type string without additional parameters like `charset=utf-8` or the like.

See also:

WebOb documentation: Return the content type, but leaving off any parameters

Error responses

When requests are rejected, an appropriate error response is sent to the client using the configured *error_handler*. To give the service consumer a hint about the valid internet media types to use for the `Content-Type` header, the error response contains a list of allowed types.

When using the default json *error_handler*, the response might look like this:

```
{
    'status': 'error',
    'errors': [
        {
            'location': 'header',
            'name': 'Content-Type',
            'description': 'Content-Type header should be one of ["text/xml", "application/json"]'
        }
    ]
}
```

2.5.5 Managing ACLs

You can also specify a way to deal with ACLs: pass in a function that takes a request and returns an ACL, and that ACL will be applied to all views in the service:

```
foo = Service(name='foo', path='/foo', acl=_check_acls)
```

2.5.6 Filters

Cornice can also filter the response returned by your views. This can be useful if you want to add some behaviour once a response has been issued.

Here is how to define a validator for a service:

```
foo = Service(name='foo', path='/foo', filters=your_callable)
```

You can just add the filter for a specific method:

```
@foo.get(filters=your_callable)
def foo_get(request):
    """some description of the validator for documentation reasons"""
    pass
```

In case you would like to register a filter for all the services but one, you can use the *exclude* parameter. It works either on services or on methods:

```
@foo.get(exclude=your_callable)
```

2.6 Built-in validators & filters

Here is a list of all the cornice built-in validators / filters. Cornice wants to provide some tools so you don't mess up when making web services, so some of them are activated by default.

If you need to add custom decorators to the list of default ones, or want to disable some of them, please refer to Validation features.

2.6.1 Built-in filters

JSON XSRF filter

The *cornice.validators.filter_json_xsrf* filter checks out the views response, looking for json objects returning lists.

It happens that json lists are subject to cross request forgery attacks (XSRF) when returning lists (see http://wiki.pylonshq.com/display/pylonsfaq/Warnings), so cornice will drop a warning in case you're doing so.

2.6.2 Built-in validators

Schema validation

Cornice is able to do schema validation for you. It is able to use colander schemas with some annotation in them. Here is an example of a validation schema, taken from the cornice test suite:

```
class FooBarSchema(MappingSchema):
    # foo and bar are required, baz is optional
    foo = SchemaNode(String(), type='str')
    bar = SchemaNode(String(), type='str', validator=validate_bar)
    baz = SchemaNode(String(), type='str', missing=None)
    yeah = SchemaNode(String(), location="querystring", type='str')
    ipsum = SchemaNode(Integer(), type='int', missing=1,
                       validator=Range(0, 3))
    integers = Integers(location="body", type='list', missing=())

foobar = Service(name="foobar", path="/foobar")

@foobar.post(schema=FooBarSchema)
def foobar_post(request):
    return {"test": "succeeded"}
```

We are passing the schema as another argument (than the *validators* one) so that cornice can do the heavy lifting for you. Another interesting thing to notice is that we are passing a *location* argument which specifies where cornice should look in the request for this argument.

2.6.3 Route factory support

When defining a service or a resource, you can provide a route factory, just like when defining a pyramid route. Cornice will then pass its result into the `__init__` of your service.

For example:

```
@resource(path='/users', factory=user_factory)
class User(object):

    def __init__(self, context, request):
        self.request = request
        self.user = context
```

2.7 Sphinx integration

Maintaining documentation while the code is evolving is painful. Avoiding information duplication is also quite a challenge.

Cornice tries to reduce a bit the pain by providing a Sphinx (http://sphinx.pocoo.org/) directive that scans the web services and build the documentation using:

- the description provided when a Service instance is created
- the docstrings of all functions involved in creating the response: the web services function itself and the validators.

The assumption made is that maintaining those docstrings while working on the code is easier.

2.7.1 Activate the extension

To activate Cornice's directive, you must include it in your Sphinx project `conf.py` file:

```
import cornice

sys.path.insert(0, os.path.abspath(cornice.__file__))
extensions = ['cornice.ext.sphinxext']
```

Of course this may vary if you have other extensions.

2.7.2 The service directive

Cornice provides a **cornice-autodoc** directive you can use to inject the Web Services documentation into Sphinx.

The directive has the following options:

- **modules**: a comma-separated list of the python modules that contain Cornice Web services. Cornice will scan it and look for the services.
- **app**: set the path to you app needed for imperative registering services.
- **services**: a comma-separated list of services, as you named them when using the cornice *Service* directive. **optional**
- **service**: if you have only one name, then you can use *service* rather than *services*. **optional**
- **ignore**: a comma separated list of services names to ignore. **optional**

  module or **app** are **mandatory**

You can use info fields (see Info field lists) in your functions, methods and validators.

Note: This directive used to be named "services" and had been renamed for something more consistant with the Sphinx ecosystem.

2.7.3 Full example

Let's say you have a **quote** project with a single service where you can **POST** and **GET** a quote.

The service makes sure the quote starts with a majuscule and ends with a dot !

Here's the **full** declarative app:

```python
from cornice import Service
from pyramid.config import Configurator
import string

desc = """\
Service that maintains a quote.
"""

quote = Service(name='quote', path='/quote', description=desc)


def check_quote(request):
    """Makes sure the quote starts with a majuscule and ends with a dot"""
    quote = request.body
    if quote[0] not in string.ascii_uppercase:
        request.errors.add('body', 'quote', 'Does not start with a majuscule')

    if quote[-1] not in ('.', '?', '!'):
        request.errors.add('body', 'quote', 'Does not end properly')

    if len(request.errors) == 0:
        request.validated['quote'] = quote


_quote = {}
_quote['default'] = "Not set, yet !"


@quote.get()
def get_quote(request):
    """Returns the quote"""
    return _quote['default']


@quote.post(validators=check_quote)
def post_quote(request):
    """Update the quote"""
    _quote['default'] = request.validated['quote']


def main(global_config, **settings):
    config = Configurator(settings={})
    config.include("cornice")
    config.scan("coolapp")
    return config.make_wsgi_app()

if __name__ == '__main__':
    from wsgiref.simple_server import make_server
    app = main({})
    httpd = make_server('', 6543, app)
    print("Listening on port 6543....")
    httpd.serve_forever()
```

And here's the **full** Sphinx doc example:

```
Welcome to coolapp's documentation!
==================================
```

```
My **Cool** app provides a way to send cool quotes to the server !

.. cornice-autodoc::
   :modules: coolapp
   :service: quote
```

Here's the **full** imperative app:

```
from cornice import Service
from pyramid.config import Configurator
import string


def check_quote(request):
    """Makes sure the quote starts with a majuscule and ends with a dot"""
    quote = request.body
    if quote[0] not in string.ascii_uppercase:
        request.errors.add('body', 'quote', 'Does not start with a majuscule')

    if quote[-1] not in ('.', '?', '!'):
        request.errors.add('body', 'quote', 'Does not end properly')

    if len(request.errors) == 0:
        request.validated['quote'] = quote


_quote = {}
_quote['default'] = "Not set, yet !"


def get_quote(request):
    """Returns the quote"""
    return _quote['default']


def post_quote(request):
    """Update the quote"""
    _quote['default'] = request.validated['quote']


def main(global_config, **settings):
    config = Configurator(settings={})
    config.include("cornice")
    desc = "Service that maintains a quote."
    quote = Service(name='quote', path='/quote', description=desc)
    quote.add_view("GET", get_quote)
    quote.add_view("POST", post_quote, validators=check_quote)
    config.add_cornice_service(quote)
    return config.make_wsgi_app()

if __name__ == '__main__':
    from wsgiref.simple_server import make_server
    app = main({})
    httpd = make_server('', 6543, app)
    print("Listening on port 6543....")
    httpd.serve_forever()
```

Client calls:

```
$ curl -X POST http://localhost:6543/quote -d Hansolohat.
null
$ curl -X GET http://localhost:6543/quote
"Hansolohat."
```

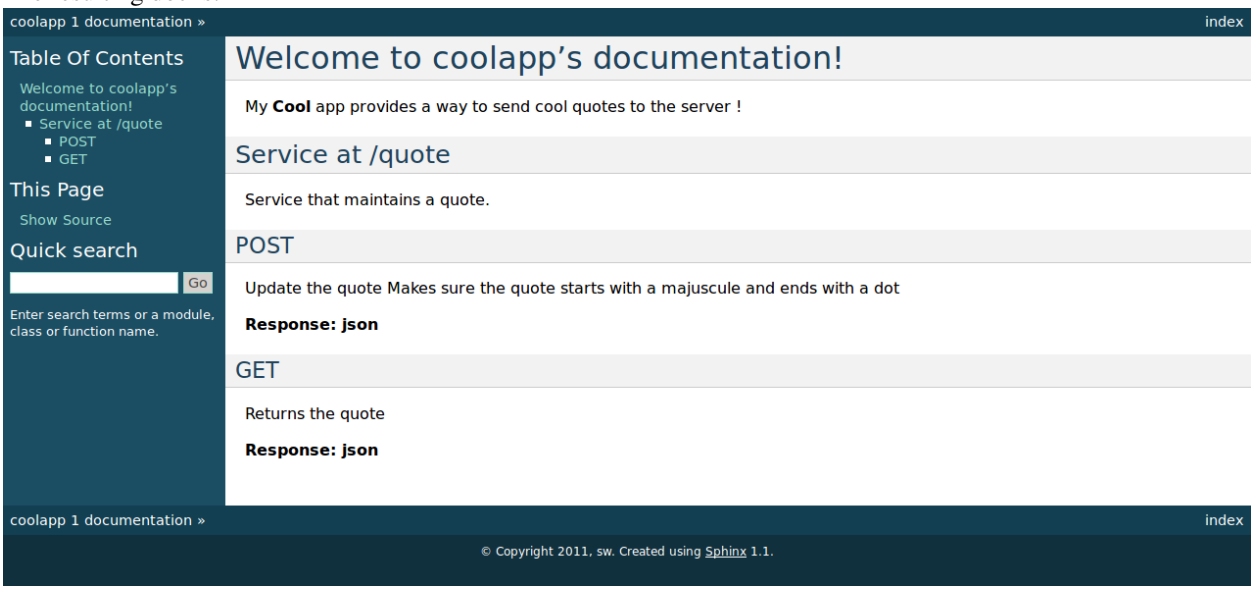
And here's the **full** Sphinx doc example:

```
Welcome to coolapp's documentation!
==================================

My **Cool** app provides a way to send cool quotes to the server !

.. cornice-autodoc::
   :app: coolapp
   :service: quote
```

The resulting doc is:



2.8 Testing

2.8.1 Running tests

To run all tests in all Python environments configured in `tox.ini`, just setup `tox` and run it inside the toplevel project directory:

```
tox
```

To run a single test inside a specific Python environment, do e.g.:

```
tox -e py27 cornice/tests/test_validation.py:TestServiceDefinition.test_content_type_missing
```

or:

```
tox -e py27 cornice.tests.test_validation:TestServiceDefinition.test_content_type_missing
```

2.8.2 Testing cornice services

Testing is nice and useful. Some folks even said it helped saving kittens. And childs. Here is how you can test your Cornice's applications.

Let's suppose you have this service definition:

```
from pyramid.config import Configurator

from cornice import Service
from cornice.tests.support import CatchErrors

service = Service(name="service", path="/service")


def has_payed(request):
    if not 'paid' in request.GET:
        request.errors.add('body', 'paid', 'You must pay!')


@service.get(validators=has_payed)
def get1(request):
    return {"test": "succeeded"}


def includeme(config):
    config.include("cornice")
    config.scan("absolute.path.to.this.service")


def main(global_config, **settings):
    config = Configurator(settings={})
    config.include(includeme)
    return CatchErrors(config.make_wsgi_app())
```

We have done three things here:

- setup a service, using the *Service* class and define our services with it
- register the app and cornice to pyramid in the *includeme* function
- define a *main* function to be used in tests

To test this service, we will use **webtest**, and the *TestApp* class:

```
from webtest import TestApp
import unittest

from yourapp import main

class TestYourApp(unittest.TestCase):

    def test_case(self):
        app = TestApp(main({}))
        app.get('/service', status=400)
```

2.9 Exhaustive list of the validations provided by Cornice

As you may have noticed, Cornice does some validation for you. This document aims at documenting all those behaviours so you are not surprised if Cornice does it for you without noticing.

2.9.1 Errors

When validating contents, cornice will automatically throw a 400 error if the data is invalid. Along with the 400 error, the body will contain a JSON dict which can be parsed to know more about the problems encountered.

2.9.2 Method not allowed

In cornice, one path equals one service. If you call a path with the wrong method, a *405 Method Not Allowed* error will be thrown (and not a 404), like specified in the HTTP specification.

2.9.3 Authorization

Authorization can be done using the *acl* parameter. If the authentication or the authorization fails at this stage, a 401 or 403 error is returned, depending on the cases.

2.9.4 Content negotiation

This relates to **response body** internet media types aka. egress content types.

Each method can specify a list of internet media types it can **respond** with. Per default, *text/html* is assumed. In the case the client requests an invalid media type via *Accept* header, cornice will return a *406 Not Acceptable* with an error message containing the list of available response content types for the particular URI and method.

2.9.5 Request media type

This relates to **request body** internet media types aka. ingress content types.

Each method can specify a list of internet media types it accepts as **request** body format. Per default, any media type is allowed. In the case the client sends a request with an invalid *Content-Type* header, cornice will return a *415 Unsupported Media Type* with an error message containing the list of available request content types for the particular URI and method.

2.9.6 Warning when returning JSON lists

JSON lists are subject to security threats, as defined in this document. In case you return a javascript list, a warning will be thrown. It will not however prevent you from returning the array.

This behaviour can be disabled if needed (it can be removed from the list of default filters)

2.10 Example documentation

This is an example of what you can get with the Cornice auto documentation feature:

Below is the result of this directive:

```
.. services::
   :modules: cornice.tests.validationapp
```

2.10.1 Service service at /service

GET

Response: json

POST

The request body should be a JSON object.

Response: json

2.10.2 Service2 service at /service2

GET

Accepted content types:

- **text/plain**

Response: string

GET

Accepted content types:

- **application/json**
- **text/json**

Response: json

2.10.3 Service3 service at /service3

PUT

Accepted content types:

- **<function <lambda> at 0x7f10a81bfcf8>**

Response: json

GET

Accepted content types:

- **<function <lambda> at 0x7f10a81bfb90>**

Response: json

2.10.4 Service4 service at /service4

POST

Response: json

2.10.5 Filtered service at /filtered

POST

Response: json

GET

Response: json

2.10.6 Service5 service at /service5

PUT

Response: json

POST

Response: json

GET

Response: json

2.10.7 Service6 service at /service6

PUT

Response: json

POST

Response: json

2.10.8 Service7 service at /service7

PUT

Accepted content types:

- **text/xml**
- **text/plain**

Response: json

POST

Accepted content types:

- **text/xml**

Response: json

2.11 Cornice API

This document describes the methods proposed by cornice. It is automatically generated from the source code.

class `cornice.service.`**`Service`**(*name*, *path*, *description=None*, *cors_policy=None*, *depth=1*, ***kw*)

Contains a service definition (in the definition attribute).

A service is composed of a path and many potential methods, associated with context.

All the class attributes defined in this class or in children are considered default values.

Parameters

- **`name`** – The name of the service. Should be unique among all the services.
- **`path`** – The path the service is available at. Should also be unique.
- **`renderer`** – The renderer that should be used by this service. Default value is 'simplejson'.
- **`description`** – The description of what the webservice does. This is primarily intended for documentation purposes.
- **`validators`** – A list of callables to pass the request into before passing it to the associated view.
- **`filters`** – A list of callables to pass the response into before returning it to the client.
- **`accept`** – A list of `Accept` header values accepted for this service (or method if overwritten when defining a method). It can also be a callable, in which case the values will be discovered at runtime. If a callable is passed, it should be able to take the request as a first argument.
- **`content_type`** – A list of `Content-Type` header values accepted for this service (or method if overwritten when defining a method). It can also be a callable, in which case the values will be discovered at runtime. If a callable is passed, it should be able to take the request as a first argument.
- **`factory`** – A factory returning callables which return boolean values. The callables take the request as their first argument and return boolean values. This param is exclusive with the 'acl' one.

- **acl** – A callable defining the ACL (returns true or false, function of the given request). Exclusive with the 'factory' option.
- **permission** – As for pyramid.config.Configurator.add_view. Note: *acl* and *permission* can also be applied to instance method decorators such as `get()` and `put()`.
- **klass** – The class to use when resolving views (if they are not callables)
- **error_handler** – A callable which is used to render responses following validation failures. Defaults to 'json_error'.
- **traverse** – A traversal pattern that will be passed on route declaration and that will be used as the traversal path.

There are also a number of parameters that are related to the support of CORS (Cross Origin Resource Sharing). You can read the CORS specification at http://www.w3.org/TR/cors/

Parameters

- **cors_enabled** – To use if you especially want to disable CORS support for a particular service / method.
- **cors_origins** – The list of origins for CORS. You can use wildcards here if needed, e.g. ('list', 'of', '*.domain').
- **cors_headers** – The list of headers supported for the services.
- **cors_credentials** – Should the client send credential information (False by default).
- **cors_max_age** – Indicates how long the results of a preflight request can be cached in a preflight result cache.
- **cors_expose_all_headers** – If set to True, all the headers will be exposed and considered valid ones (Default: True). If set to False, all the headers need be explicitly mentioned with the cors_headers parameter.
- **cors_policy** – It may be easier to have an external object containing all the policy information related to CORS, e.g:

```
>>> cors_policy = {'origins': ('*',), 'max_age': 42,
...                'credentials': True}
```

You can pass a dict here and all the values will be unpacked and considered rather than the parameters starting by *cors_* here.

See http://readthedocs.org/docs/pyramid/en/1.0-branch/glossary.html#term-acl for more information about ACLs.

Service cornice instances also have methods `get()`, `post()`, `put()`, `options()` and `delete()` are decorators that can be used to decorate views.

2.12 Cornice internals

Internally, Cornice doesn't do a lot of magic. The logic is mainly split in two different locations: the *services.py* module and the *pyramid_hook.py* module.

That's important to understand what they are doing in order to add new features or tweak the existing ones.

2.12.1 The Service class

The cornice.service.Service class is a container for all the definition information for a particular service. That's what you use when you use the Cornice decorators for instance, by doing things like *@myservice.get(**kwargs)*. Under the hood, all the information you're passing to the service is stored in this class. Into other things you will find there:

- the *name* of the registered service.
- the *path* the service is available at.
- the *description* of the service, if any.
- the *defined_methods* for the current service. This is a list of strings. It shouldn't contain more than one time the same item.

That's for the basic things. The last interesting part is what we call the "definitions". When you add a view to the service with the *add_view* method, it populates the definitions list, like this:

```
self.definitions.append((method, view, args))
```

where *method* is the HTTP verb, *view* is the python callable and *args* are the arguments that are registered with this definition. It doesn't look this important, but this last argument is actually the most important one. It is a python dict containing the filters, validators, content types etc.

There is one thing I didn't talk about yet: how we are getting the arguments from the service class. There is a handy *get_arguments* method, which returns the arguments from another list of given arguments. The goal is to fallback on instance-level arguments or class-level arguments if no arguments are provided at the add_view level. For instance, let's say I have a default service which renders to XML. I set its renderer in the class to "XML".

When I register the information with add_view, *renderer='XML'* will be added automatically in the args dict.

2.12.2 Registering the definitions into the pyramid routing system

Okay, so once you added the services definition using the Service class, you might need to actually register the right routes into pyramid. The *pyramidhook* module takes care of this for you.

What it does is that it checks all the services registered and call some functions of the pyramid framework on your behalf.

What's interesting here is that this mechanism is not really tied to pyramid. for instance, we are doing the same thing to do the sphinx automatic documentation generation: use the APIs that are exposed in the Service class and do something from it.

To keep close to the flexibility of pyramid's routing system, a *traverse* argument can be provided on service creation. It will be passed to the route declaration. This way you can combine URL Dispatch and traversal to build an hybrid application.

2.13 SPORE support

Cornice has support for SPORE. SPORE is a way to describe your REST web services, as WSDL is for WS-* services. This allows to ease the creation of generic SPORE clients, which are able to consume any REST API with a SPORE endpoint.

Here is how you can let cornice describe your web service for you:

```
from cornice.ext.spore import generate_spore_description
from cornice.service import Service, get_services

spore = Service('spore', path='/spore', renderer='jsonp')
@spore.get()
def get_spore(request):
    services = get_services()
    return generate_spore_description(services, 'Service name', request.application_url, '1.0')
```

And you'll get a definition of your service, in SPORE, available at */spore*.

Of course, you can use it to do other things, like generating the file locally and exporting it wherever it makes sense to you, etc.

2.14 Frequently Asked Questions (FAQ)

Here is a list of frequently asked questions related to Cornice.

2.14.1 Cornice registers exception handlers, how do I deal with it?

Cornice registers its own exception handlers so it's able to behave the right way in some edge cases (it's mostly done for CORS support).

Sometimes, you will need to register your own exception handlers, and Cornice might get on your way.

You can disable the exception handling by using the *handle_exceptions* setting in your configuration file or in your main app:

```
config.add_settings(handle_exceptions=False)
```

CHAPTER 3

Contribution & Feedback

Cornice is a project initiated at Mozilla Services, where we build Web Services for features like Firefox Sync. All of what we do is built with open source, and this is one brick of our stack.

We welcome Contributors and Feedback!

- Developers Mailing List: https://mail.mozilla.org/listinfo/services-dev
- Repository: https://github.com/mozilla-services/cornice

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