Python for Practice

Web applications

Overview

- WSGI
  - Web Server Gateway Interface
  - a standard interface between web servers and Python web application frameworks
  - WSGI makes it possible to write portable Python web code that can be deployed in any WSGI-compliant web server
- Python web-frameworks
  - Django
    - a “batteries included” web application framework
    - for complex, database-backed web applications quickly
  - Flask
    - a “microframework” for Python
    - for building smaller applications, APIs, and web services
  - …

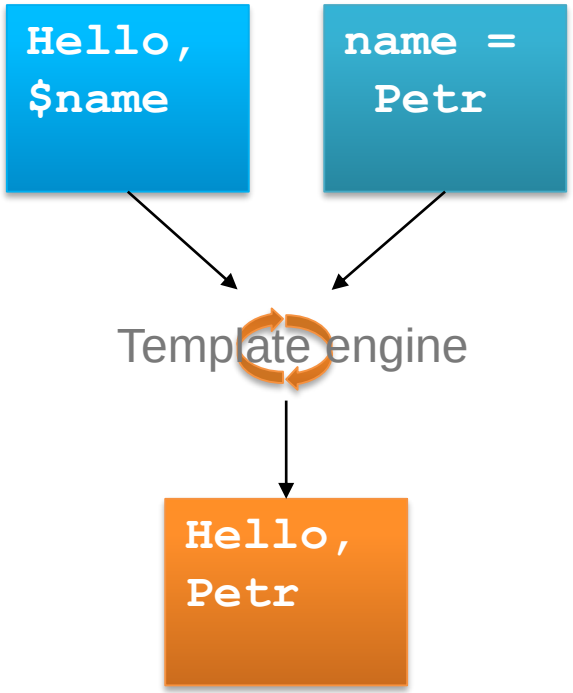
Web applications (common structure)

- URL Routing
  - incoming request to a particular piece of code
- Request and Response Objects
  - Information from a user browser to object(s)
  - Object(s) to user browser
- Template Engine
  - separating logic (code) from presentation
- Web Server

Template engines

Overview

- Separating logic from presentation
  - “user interface” can be developed separately
  - the same logic for different views
  - no need for “escaping” in code
  - ….
- General overview
  - template + data => final document
- Template engines in Python
  - Jinja2
  - Mako
  - Chameleon
  - …



Jinja2

- https://palletsprojects.com/p/jinja/
- General usage

```
from jinja2 import Template
template = Template('Hello {{ name }}!')
template.render(name='John Doe')
```

See e01_jinja.py

Jinja2

- Environment
  - configuration for the engine
  - if not created manually, it creates automatically

```
env = Environment(
    loader=PackageLoader('yourapplication',
                         'templates'),
    autoescape=select_autoescape(['html',
                                  'xml'])
)
```

  - methods
    - get_template(name)
    - list_templates()
    - …

Jinja2

- Loaders
  - FileSystemLoader(searchpath)
  - PackageLoader(package_name, package_path)
  - DictLoader(mapping)
  - ChoiceLoader(loaders)
  - …
  - BaseLoader

Jinja2

- Template
  - render(context)
  - generate(context)
  - render_async(context)
  - …

Jinja2

- Template language

```
<!DOCTYPE html>
<html lang="en">
<head>
    <title>My Webpage</title>
</head>
<body>
    <ul id="navigation">
    {% for item in navigation %}
        <li><a href="{{ item.href }}">
                                    {{ item.caption }}</a></li>
    {% endfor %}
    </ul>

    <h1>My Webpage</h1>
    {{ a_variable }}

    {# a comment #}
</body>
</html>
```

Jinja2

- Template language
  - {% ... %} statements
  - {{ ... }} expressions
  - {# ... #} comments
  - # ... line statements

Jinja2

- Template inheritance

```
<!DOCTYPE html>
<html lang="en">
<head>
    {% block head %}
    <link rel="stylesheet" href="style.css" />
    <title>{% block title %}{% endblock %} -
                                        My Webpage</title>
    {% endblock %}
</head>
<body>
    <div id="content">{% block content %}{% endblock %}</div>
    <div id="footer">
        {% block footer %}
        &copy; Copyright 2008 by <a
                        href="http://domain.invalid/">you</a>.
        {% endblock %}
    </div>
</body>
</html>
```

Jinja2

- Template inheritance

```
{% extends "base.html" %}
{% block title %}Index{% endblock %}
{% block head %}
    {{ super() }}
    <style type="text/css">
        .important { color: #336699; }
    </style>
{% endblock %}
{% block content %}
    <h1>Index</h1>
    <p class="important">
      Welcome to my awesome homepage.
    </p>
{% endblock %}
```

Jinja2

- Template language statements

```
{% for row in rows %}
    <li class="{{ loop.cycle('odd', 'even') }}">
                                            {{ row }}</li>
{% endfor %}


{% if kenny.sick %}
    Kenny is sick.
{% elif kenny.dead %}
    You killed Kenny!  You bastard!!!
{% else %}
    Kenny looks okay --- so far
{% endif %}


{% macro input(name, value='', type='text', size=20) -%}
    <input type="{{ type }}" name="{{ name }}" value="{{
        value|e }}" size="{{ size }}">
{%- endmacro %}
<p>{{ input('username') }}</p>
```

Flask

Overview

- https://palletsprojects.com/p/flask/

```
from flask import Flask, escape, request

app = Flask(__name__)

@app.route('/')
def hello():
    name = request.args.get("name", "World")
    return f'Hello, {escape(name)}!'
```

See e02_hello.py

```
$ env FLASK_APP=e02_hello.py flask run
```

Department of Distributed and Dependable Systems D3S

Deployment

- CGI

```
from wsgiref.handlers import CGIHandler
from yourapplication import app

CGIHandler().run(app)
```

- FastCGI

```
#!/usr/bin/python
from flup.server.fcgi import WSGIServer
from yourapplication import app

if __name__ == '__main__':
    WSGIServer(app).run()
```

- mod_wsgi (Apache)
- …

Routing

```
@app.route('/')
def index():
    return 'Index Page'

@app.route('/hello')
def hello():
    return 'Hello, World'
```

Routing

```
@app.route('/user/<username>')
def show_user_profile(username):
    return 'User %s' % escape(username)

@app.route('/post/<int:post_id>')
def show_post(post_id):
    return 'Post %d' % post_id

@app.route('/path/<path:subpath>')
def show_subpath(subpath):
    return 'Subpath %s' % escape(subpath)
```

- string (default) accepts any text without a slash
- int accepts positive integers
- float accepts positive floating point values
- path like string but also accepts slashes
- uuid accepts UUID strings

Routing

- Building URLs

```
@app.route('/')
def index():
    return 'index'

@app.route('/login')
def login():
    return 'login'

@app.route('/user/<username>')
def profile(username):
    return escape(username)

with app.test_request_context():
    print(url_for('index'))
    print(url_for('login'))
    print(url_for('login', next='/'))
    print(url_for('profile', username='John Doe'))
```

HTTP method

```
@app.route('/login', methods=['GET', 'POST'])
def login():
    if request.method == 'POST':
        return do_the_login()
    else:
        return show_the_login_form()
```

Static files and templates

- Static files

```
url_for('static', filename='style.css')
```

  - have to be stored in static/ subdirectory
- Templates
  - Jinja2 preconfigured
  - directory templates/

See e03_templete.py

```
@app.route('/hello/')
@app.route('/hello/<name>')
def hello(name=None):
    return render_template('hello.html', name=name)
```

Important objects

- request
  - represents request for a browser
  - fields
    - path
    - full_path
    - script_root
    - url
    - base_url
    - url_root
    - host
    - args
    - form
    - method
    - scheme
    - cookies
    - …

See e04_request.py

```
@app.route('/login')
def login():
  u = request.form['username'],
  p = request.form['password']):
  ...
```

File uploads

```
@app.route('/upload', methods=['GET', 'POST'])
def upload_file():
  if request.method == 'POST':
    f = request.files['the_file']
    f.save('/var/www/uploads/uploaded_file.txt')
```

- HTML form must have the enctype="multipart/form-data" attribute

Errors and redirects

```
@app.route('/')
def index():
    return redirect(url_for('login'))

@app.route('/login')
def login():
    abort(401)
    this_is_never_executed()

@app.errorhandler(404)
def page_not_found(error):
    return render_template(
                        'page_not_found.html'), 404
```

HTTP error code (default 200)

See e05_redirect.py

Response

```
@app.route('/')
def index():
    resp = make_response(render_template(...))
    return resp
```

- returning
  - string -> default response
  - dict -> json

See e06_response.py

Sessions

- session object
  - to store information specific to a user from one request to the next
  - implemented via cookies

See e07_session.py

Extensions

- Huge amount of extensions
  - search on PyPI

Assignment

- Create a weather service
  - methods for obtaining
    - a list of cities
    - weather for a city
  - methods return json

Assignment

- Create a web app for managing users on a unix system (i.e., an app that manipulates /etc/passwd)
  - create own copy of the passwd file
  - operations for listing, adding and removing users
- Updated the app to require a login
  - session needed

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