

Topic 9: Flask Applications

CITS3403 Agile Web Development

Adapted from the Flask Mega-Tutorial, by Miguel Grinberg:
<https://blog.miguelgrinberg.com/post/the-flask-mega-tutorial>

Semester 1, 2022

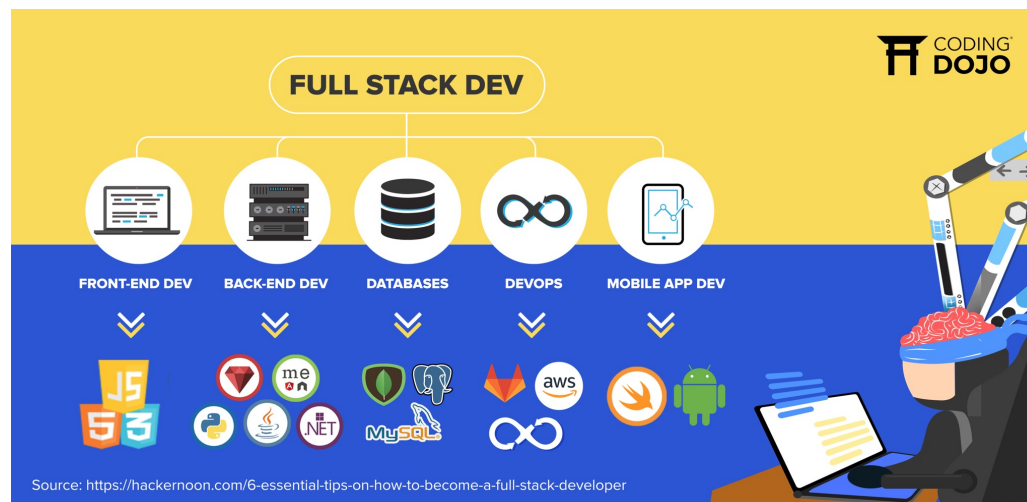
Full Stack Development?

- Full stack development refers to developing all parts of a web application: database, web server, application logic and front end.
- There are various “Full stacks” people use to develop:
 - LAMP (Linux, Apache, MySQL and PHP)
 - Ruby on Rails
 - Django (Python)
- We’re going to use a number of tools in this unit:
 - **Flask:** is a micro framework, that allows us to write our backend in Python. It contains its own lightweight webserver for development
 - **SQLite:** is a lightweight database management system
 - **AJAX** and **JQuery:** We have already seen these. We will use these for making responsive web pages.



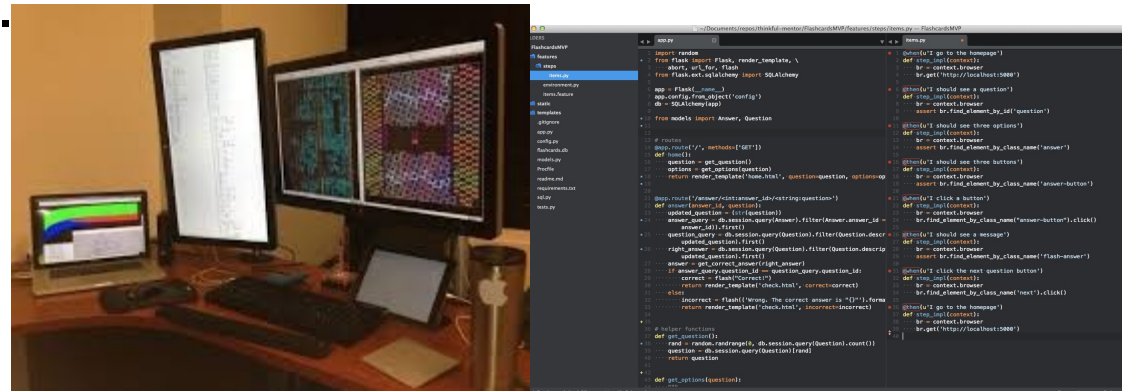
Full-stack development

- Fullstack development refers to developing every part of the web application.
- It involves knowing all the technologies used from mobile and front end, (HTML, CSS, javascript frameworks) though to the backend logic, security and database models used at the backend.
- Most developers are specialised in one part of the stack.



Development environment

- A lot of web development is done from the command line, since traditionally servers didn't need a graphical front end.
- We can use Git to develop on laptops and push code to the server, but we still rely heavily on command line tools.
- By now, every one should have a good text editor that does syntax highlighting etc, some tool to allow them to compile or run code with the command line, and a browser with developer tools to view source, and debug javascript.
- You should also have a Git client to regularly commit your code, and push to others.



Getting started with Flask

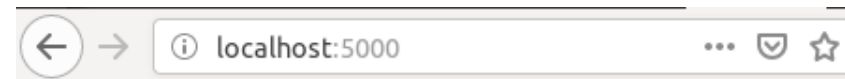
- Flask is a micro-framework to run on the server, but it will run on any machine, and has few dependencies.
- You will require python3 installed in your operating environment, with pip.
- Use pip to install venv (virtual environment) first and initialise the environment.
- Now install Flask. Any required modules will be preserved by the virtual-environment.
- You can now run flask by typing `flask run`, but the app doesn't know what to run.
- Write the following into `app.py`, run the program again.
- Use a browser to see your app in action! (`http://localhost:5000`)

```
drtnf@drtnf-ThinkPad:$ python3 -m venv tmp-env
drtnf@drtnf-ThinkPad:$ source tmp-env/bin/activate
(tmp-env) drtnf@drtnf-ThinkPad:$ pip install flask
Collecting flask
```

```
1 from flask import Flask
2 app = Flask(__name__)
3 @app.route("/")
4 def hello():
5     return "Hello world!"
6 if __name__ == "__main__":
7     app.run()
```

`app.py`

```
(tmp-env) drtnf@drtnf-ThinkPad:$ flask run
* Environment: production
  WARNING: Do not use the development server in a production environment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```



Hello world!

Application structure

- Our app.py file doesn't look like much. It has a method to return 'Hello world!' that is *decorated* with `@app.route('/')`.
- `app` is an instance of the class `Flask`. When it runs it listens for requests, and if the route matches a decorator, it executes the corresponding function. A request object is passed to the method.
- The return of the function becomes the response.
- But this structure doesn't scale well.

```
1 from flask import Flask
2 app = Flask(__name__)
3 @app.route("/")
4 def hello():
5     return "Hello world!"
6 if __name__ == "__main__":
7     app.run()
```

app.py

```
from flask import request

@app.route(...)
def login():
    username = request.args.get('username')
    password = request.args.get('password')
```

A better application structure

- A better structure is to create a package `app` that will contain all the code we need for the web app.
- It has an `__init__.py` file to create an instance of the `Flask` class.
- We can create a file `routes.py`, to contain the request handlers.
- Finally, we need a file at the top level to import the app. We set the system variable `FLASK_APP` to the name of this file, so flask knows what to run.
- Now the `app` package can contain files for handling routes, modules, templates, tests and anything else our application requires.

app/__init__.py: Flask application instance

```
from flask import Flask

app = Flask(__name__)

from app import routes
```

app/routes.py: Home page route

```
from app import app

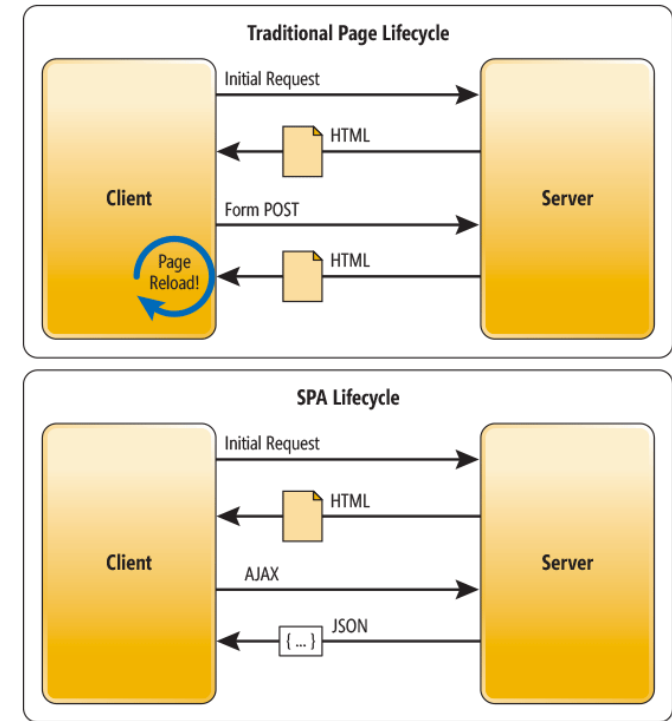
@app.route('/')
@app.route('/index')
def index():
    return "Hello, World!"
```

microblog.py: Main application module

```
from app import app
```

Server-side vs Client Side Rendering

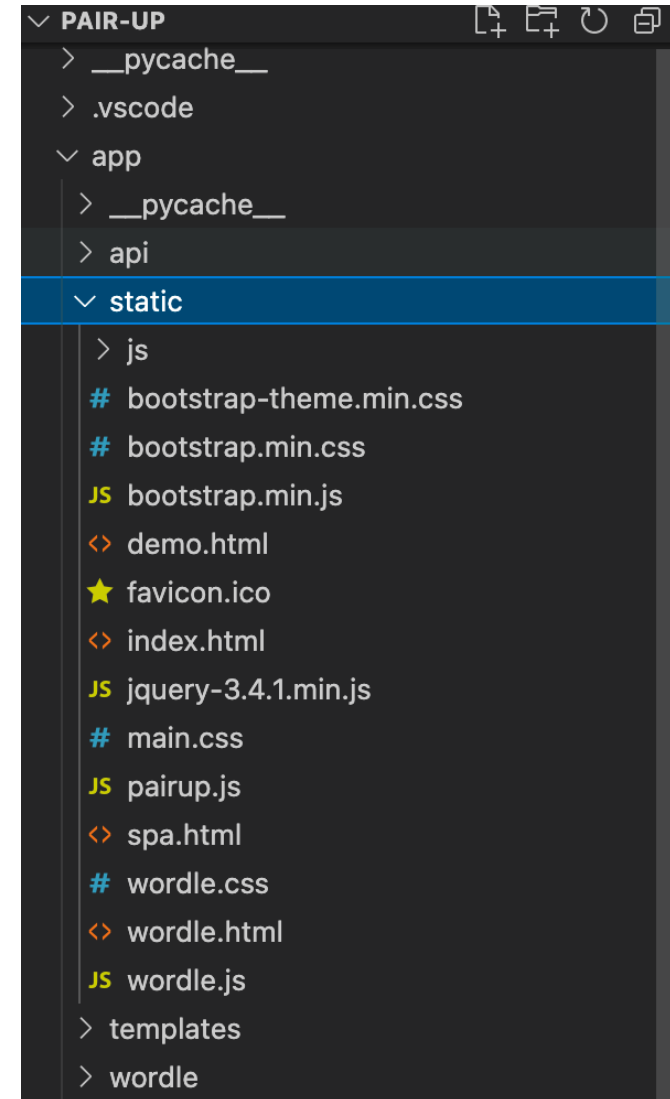
- There are two approaches to serving dynamic HTML:
 - The server can build the HTML when it receives the request and send to client.
 - The server can send JS and an HTML skeleton to the client, and the client can then request JSON and build the HTML using AJAX and JQuery.
- *Server Side Rendering* is the traditional approach.
- *Client Side Rendering* is more flexible and allows greater support for non-browser devices.
- Flask supports both forms very well.



Client Side Rendering

- For client side rendering, the client first needs to access a HTML template and some JS.
- Flask projects have a static directory to serve non-dynamic files, including HTML, CSS, JS and images.
- We can then have flask redirect all requests for a file to the static html we want to serve.
- We now need HTML and JS for the client

```
1 from flask import render_template, flash, redirect, url_for
2
3 @app.route('/speed_wordle')
4 def speed_wordle():
5     return redirect(url_for('static', filename='wordle.html'))
6
```



HTML and JS for the Client

```

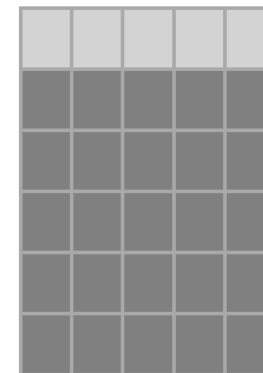
1 <!DOCTYPE HTML>
2 <html>
3   <head>
4     <meta charset="utf8">
5     <meta name="viewport" content="width=device-width, initial-scale=1">
6     <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
7     <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.6.0/jquery.min.js"></script>
8     <script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></script>
9     <script src="./wordle.js"></script>
10    <link rel="stylesheet" href="./wordle.css">
11  </head>
12
13  <body>
14    <div class="container">
15      <div class="jumbotron">
16        <h1>Wordle Clone</h1>
17
18        <p>This is a simple wordle clone demonstrating DOM manipulations and AJAX calls.</p>
19      </div>
20
21      <div class="container col-sm-4"></div>
22      <div class="container col-sm-4">
23        <h3> Enter your guess here. The word changes every 2 minutes so hurry up:
24        <span id="time_left"></span> seconds to go!</h3>
25
26        <table class='wordle' id="guesses"></table>
27      </div>
28      <div class="container col-sm-4"></div>
29    </div>
30
31    <!-- The Modal -->
32    <div class="modal" id="end_game" style="display: none;">
33      <div class="modal-dialog">
34        <div class="modal-content">
35
36          <!-- Modal Header -->
37          <div class="modal-header">
38            <h4 class="modal-title">Game Over</h4>
39            <button type="button" id="close" class="btn btn-default">Close</button>
40          </div>
41
42          <!-- Modal body -->
43          <div class="modal-body" id="congrats">
44
45          </div>
46
47        </div>
48      </div>
49    </div>
50
51    <div class="container">&nbsp;</div>
52
53  </body>
54 </html>

```

Wordle Clone

This is a simple wordle clone demonstrating DOM manipulations and AJAX calls.

Enter your guess here. The word changes every 2 minutes so hurry up: 50 seconds to go!



HTML and JS for the Client

```
1 let table_data = [];  
2 let current_guess = 0;  
3 let current_cell = 0;  
4  
5  
6 function init(){  
7   let table = document.getElementById("guesses");  
8   table.innerHTML="";  
9   let tbody = document.createElement("tbody");  
10  for(let i = 0; i<6; i++){  
11    let row_data = [];  
12    let row = document.createElement("TR");  
13    for(let j = 0; j<5; j++){  
14      let cell = document.createElement("TD");  
15      cell.innerHTML="&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;";  
16      row.appendChild(cell);  
17      row_data[j] = cell;  
18    }  
19    table_data[i] = row_data;  
20    tbody.appendChild(row);  
21  }  
22  tbody.children[0].classList.add("active");  
23  table.appendChild(tbody);  
24  current_guess = 0;  
25  current_cell = 0;  
26  getTimeLeft();  
27  document.getElementById("close").addEventListener("click", function(){  
28    document.getElementById("end_game").style.display = 'none';  
29  });  
30 }  
31  
32 function getTimeLeft(){  
33   const xhttp = new XMLHttpRequest();  
34   xhttp.open("GET", "https://drtnf.net/wordle_time_left", true);  
35   xhttp.onload = function(e) {  
36     time_left = JSON.parse(xhttp.responseText).time_left;  
37     let x = setInterval(function() {  
38       document.getElementById("time_left").innerHTML = time_left--;  
39       if(time_left<0){  
40         clearInterval(x);  
41         init();  
42       }  
43     }, 1000);  
44   };  
45   xhttp.send();  
46 }  
47  
48
```

```
50 function isAlpha(c){  
51   return /^[A-Z]$/i.test(c);  
52 }  
53  
54 document.addEventListener("keydown", evt =>{  
55   let key = evt.key;  
56   if(key.length==1 && isAlpha(key) && current_cell<5 && current_guess<6){  
57     table_data[current_guess][current_cell].innerHTML=key.toUpperCase();  
58     current_cell++;  
59   }  
60   else if((key=="Delete" || key == "Backspace") && current_cell>0 && current_guess<6){  
61     current_cell--;  
62     table_data[current_guess][current_cell].innerHTML="&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;";  
63   }  
64   else if(key == "Enter" && current_cell == 5 && current_guess<6){  
65     let guess="";  
66     for(let i = 0; i<5; i++){  
67       guess = guess + table_data[current_guess][i].innerHTML;  
68     }  
69     const xhttp = new XMLHttpRequest();  
70  
71     xhttp.open("GET", "https://drtnf.net/wordle_guess?guess="+guess, true);  
72     xhttp.onload = function(e) {  
73       let result = JSON.parse(xhttp.responseText).outcome;  
74       let sum = 0  
75       for(let i = 0; i<5; i++){  
76         if(result[i]==2){  
77           sum+=result[i];  
78           table_data[current_guess][i].classList.add('correct');  
79         }  
80         if(result[i]==1){  
81           table_data[current_guess][i].classList.add('misplaced');  
82         }  
83       }  
84       let tbody = document.getElementById("guesses").firstChild;  
85       tbody.children[current_guess++].classList.remove('active');  
86       if(sum==10){  
87         document.getElementById('end_game').style.display="block";  
88         document.getElementById('congrats').innerHTML="Congratulations!";  
89       }  
90       else{  
91         current_cell = 0;  
92         if(current_guess>5){  
93           document.getElementById('end_game').style.display="block";  
94           document.getElementById('congrats').innerHTML="Out of guesses!";  
95         }  
96         else tbody.children[current_guess].classList.add('active');  
97       }  
98     }  
99     xhttp.send();  
100 }  
101 });
```

And routes to service the AJAX request

```
app > wordle > wordle.py > ...
1  from app import app
2  from app.api.errors import bad_request, error_response
3  from flask import jsonify, url_for, request, g, abort
4  import time, random
5
6
7  update_delta = 120
8  words = []
9  with open('./app/wordle/fives.txt', 'r') as word_file:
10     for word in word_file:
11         words.append(word[:-1])
12
13
14  '''
15  Renews the selected word every update delta seconds
16  '''
17  def check_time():
18     f = open('./app/wordle/last_update.txt', 'r')
19     last_update = int(f.read())
20     f.close()
21     now = int(time.time())
22     if (now - last_update) > update_delta:
23         last_update = now
24         secret = words[random.randrange(len(words))]
25         f = open('./app/wordle/answer.txt', 'w')
26         f.write(secret)
27         f.close()
28         f = open('./app/wordle/last_update.txt', 'w')
29         f.write(str(last_update))
30         f.close()
31     return update_delta - (now - last_update)
32
33  '''
34  Gives time remaining for the current puzzle
35  '''
36  @app.route('/wordle_time_left', methods=['GET'])
37  def wordle_time_left():
38     response = jsonify({'time_left': check_time()})
39     response.status_code = 201
40     return response
41
```

```
42  '''
43  route for handling wordle guesses
44  '''
45  @app.route('/wordle_guess', methods=['POST', 'GET'])
46  def wordle_guess():
47     check_time()
48     data = request.args or {}
49     if 'guess' not in data or not data['guess'].isalpha() or len(data['guess']) != 5:
50         return bad_request('Guess must be a five letter word')
51     f = open('./app/wordle/answer.txt', 'r')
52     secret = f.read()
53     f.close()
54     response = jsonify({'outcome': wordle(data['guess'].upper(), secret.upper())})
55     response.status_code = 201
56     return response
57
58  '''
59  Wordle guess array
60  '''
61  def wordle(guess, target):
62     answer = [0]*5 #to return to user
63     target_free = [True]*5 #for handling multiple letters
64     for i in range(5):
65         if guess[i] == target[i]:
66             answer[i] = 2
67             target_free[i] = False
68     for i, c in enumerate(guess):
69         for j, d in enumerate(target):
70             if c == d and target_free[j] and answer[i] == 0:
71                 answer[i] = 1
72                 target_free[j] = False
73     return answer
74
75
76
```

<https://drtnf.net/static/wordle.html>

Server-side Rendering

- Our app will now listen for requests, and we can use python functions to build html pages to return as a response.
- However, this mixes the logic and the presentation.
- A typical pattern to use is to have a `template` or `views` directory to have some html that references objects and code, and a rendering function that will take a template and some data and builds the html dynamically.
- Flask uses jinja for this task, but there are many alternatives (pug, handlebars, typescript)

app/routes.py: Return complete HTML page from view function

```
from app import app

@app.route('/')
@app.route('/index')
def index():
    user = {'username': 'Miguel'}
    return '''

<html>
  <head>
    <title>Home Page - Microblog</title>
  </head>
  <body>
    <h1>Hello, ''' + user['username'] + '''!</h1>
  </body>
</html>'''
```

```
22 <h3>Registered project list</h3>
23 <table class='table table-striped table-bordered'>
24   <tr>
25     <th>Project Team</th>
26     <th>Project Description</th>
27     <th>Demo location</th>
28     <th>Demo time</th>
29     <th>Action</th>
30     {% if not current_user.is_anonymous %}
31     {% endif %}
32   </tr>
33   {% for p in projects%}
34     <tr>
35       <td>{{p['team']}}</td>
36       <td>{{p['description']}}</td>
37       <td>{{p['lab']}}</td>
38       <td>{{p['time']}}</td>
39       {% if not current_user.is_anonymous %}
40       <td>
41         {% if p['project_id']== current_user.project_id %}
42         <a href='{{url_for("delete_project") }}'>delete</a>
43         <a href='{{ url_for("edit_project") }}'>edit</a>
44         {% endif %}
45       </td>
46     {% endif %}
47   </tr>
48   {% endfor %}
49 </table>
```

Using Jinja

- We separate presentation and logic by having a template directory to contain annotated html, and specify a rendering function in the routes.py file
- When a request is received flask will look for the matching template (in the directory templates) and convert the template to pure html using named variables in the function.
- Two {{curly braces}} are used to distinguish html from python variables, and jinja does the substitution

app/templates/index.html: Main page template

```
<html>
  <head>
    <title>{{ title }} - Microblog</title>
  </head>
  <body>
    <h1>Hello, {{ user.username }}!</h1>
  </body>
</html>
```

app/routes.py: Use render_template() function

```
from flask import render_template
from app import app

@app.route('/')
@app.route('/index')
def index():
    user = {'username': 'Miguel'}
    return render_template('index.html', title='Home', user=user)
```


Jinja Loops and Conditionals

- Depending on the parameters passed, we may want to display the data differently.
- Jinja provides loops and conditionals to allow the display to adapt to data.
- For example, it is common to pass in an array of objects, and then present them in a table.
- Or we may want the display to vary depending on who is logged in.

```
22 <h3>Registered project list</h3>
23 <table class='table table-striped table-bordered'>
24   <tr>
25     <th>Project Team</th>
26     <th>Project Description</th>
27     <th>Demo location</th>
28     <th>Demo time</th>
29     {% if not current_user.is_anonymous %}
30     <th>Action</th>
31     {% endif %}
32   </tr>
33   {% for p in projects%}
34     <tr>
35       <td>{{p['team']}}</td>
36       <td>{{p['description']}}</td>
37       <td>{{p['lab']}}</td>
38       <td>{{p['time']}}</td>
39       {% if not current_user.is_anonymous %}
40       <td>
41         {% if p['project_id']== current_user.project_id %}
42         <a href='{{url_for("delete_project") }}'>delete</a>
43         <a href='{{ url_for("edit_project") }}'>edit</a>
44         {% endif %}
45       </td>
46       {% endif %}
47     </tr>
48   {% endfor %}
49 </table>
```

```
9 @app.route('/')
10 @app.route('/index')
11 def index():
12     print('index')
13     if current_user.is_authenticated:
14         projects = get_all_projects()
15     else:
16         projects = []
17     return render_template('index.html', projects=projects)
```

Jinja Control Statements

- The syntax for control statements is to use `{% braces %}`.
- Conditionals use `if`, `else`, `elif`, as well as `endif`, since whitespace scoping doesn't work for html.
- We can also use `for` and `while` loops for iterating through collections.

app/templates/index.html: Conditional statement in template

```
<html>
  <head>
    {% if title %}
    <title>{{ title }} - Microblog</title>
    {% else %}
    <title>Welcome to Microblog!</title>
    {% endif %}
  </head>
  <body>
    <h1>Hello, {{ user.username }}!</h1>
  </body>
</html>
```

app/routes.py: Fake posts in view function

```
from flask import render_template
from app import app

@app.route('/')
@app.route('/index')
def index():
    user = {'username': 'Miguel'}
    posts = [
        {
            'author': {'username': 'John'},
            'body': 'Beautiful day in Portland!'
        },
        {
            'author': {'username': 'Susan'},
            'body': 'The Avengers movie was so cool!'
        }
    ]
    return render_template('index.html', title='Home', user=user, posts=posts)
```

app/templates/index.html: for-loop in template

```
<html>
  <head>
    {% if title %}
    <title>{{ title }} - Microblog</title>
    {% else %}
    <title>Welcome to Microblog</title>
    {% endif %}
  </head>
  <body>
    <h1>Hi, {{ user.username }}!</h1>
    {% for post in posts %}
    <div><p>{{ post.author.username }} says: <b>{{ post.body }}</b></p></div>
    {% endfor %}
  </body>
</html>
```

Jinja Inheritance

- Since we often want the titles, menus, footers in an application to be the same, we can have the templates inherit from each other.
- The `block xxxx` is left unspecified for other templates to fill in, and they can extend the base template by just specifying how they would fill in `xxxx`

app/templates/base.html: Base template with navigation bar

```
<html>
  <head>
    {% if title %}
      <title>{{ title }} - Microblog</title>
    {% else %}
      <title>Welcome to Microblog</title>
    {% endif %}
  </head>
  <body>
    <div>Microblog: <a href="/index">Home</a></div>
    <hr>
    {% block content %}{% endblock %}
  </body>
</html>
```

- This principle is referred to as DRY: *don't repeat yourself*

app/templates/index.html: Inherit from base template

```
{% extends "base.html" %}

{% block content %}
  <h1>Hi, {{ user.username }}!</h1>
  {% for post in posts %}
    <div><p>{{ post.author.username }} says: <b>{{ post.body }}</b></p></div>
  {% endfor %}
{% endblock %}
```

Forms

- To build PUT requests, we typically use forms. Flask uses the WTForms module to validate Post Requests
- Install `flask-wtf` with pip and create a new file in app, `forms.py`
- There are three parts to the form: the form class, the template containing the form, and the route for processing the form.

```
app = Flask(__name__)  
app.config['SECRET_KEY'] = 'you-will-never-guess'  
# ... add more variables here as needed
```

Flask apps should have a secret key to protect against cross site request forgery (CSRF). You can set in `app.py`, but there are better ways.

app/forms.py: Login form

```
from flask_wtf import FlaskForm  
from wtforms import StringField, PasswordField, BooleanField, SubmitField  
from wtforms.validators import DataRequired  
  
class LoginForm(FlaskForm):  
    username = StringField('Username', validators=[DataRequired()])  
    password = PasswordField('Password', validators=[DataRequired()])  
    remember_me = BooleanField('Remember Me')  
    submit = SubmitField('Sign In')
```

Rendering Forms

- Jinja works with flask-wtf to put the appropriate input elements in the page.
- The `form.hidden_tag()` is used to protect against CSRF attacks
- The form elements are defined by the `forms.py` class
- Attributes can be appended to the elements in brackets.
- If a form doesn't validate, the errors are accessible in a list, but are rendered server side. Faster client side validation can be applied using javascript.
- The `url_for()` maps back from the function name to the route.

```

1 {% extends "base.html" %}
2
3 {% block content %}
4 <h2>Login</h2>
5
6 <form name='login' action='' method='post'>
7   <div class='form-group'>
8     {{form.hidden_tag()}}
9     <p>
10      {{ form.student_number.label }}<br>
11      {{ form.student_number(size=8) }}
12      {% for error in form.student_number.errors %}
13      <span style="color:red;">[{{ error}}]</span>
14      {% endfor %}
15    </p>
16    <p>
17      {{ form.pin.label }}<br>
18      {{ form.pin(size=4) }}
19      {% for error in form.pin.errors %}
20      <span style="color:red;">[{{ error}}]</span>
21      {% endfor %}
22    </p>
23    <p> {{form.remember_me() }} {{form.remember_me.label }}</p>
24    <p> {{ form.submit() }}</p>
25  </div>
26 </form>
27 <p>To register <a href={{ url_for('register') }}>click here</a></p>
28 {% endblock %}

```

```

37 <h2>Login</h2>
38
39 <form name='login' action='' method='post'>
40   <div class='form-group'>
41     <input id="csrf_token" name="csrf_token" type="hidden" value="ImU2NzU5ODlhMDg2YWE3NzE4ZW"
42     <p>
43     <label for="student_number">Student Number</label><br>
44     <input id="student_number" name="student_number" required size="8" type="text" value=""
45   </p>
46   <p>
47   <label for="pin">Pin Code</label><br>
48   <input id="pin" name="pin" size="4" type="password" value=""
49   </p>
50   <p>
51   <input id="remember_me" name="remember_me" type="checkbox" value="y"> <label for="ren
52   <input id="submit" name="submit" type="submit" value="Sign In"></p>
53   </div>
54 </form>
55
56 <p>To register <a href=/register>click here</a></p>

```


Processing Forms

- To process a form, we configure a route for the POST method.
- We define an instance of the form class, for both rendering and wrapping posted data.
- A GET request won't validate, so it will jump to the last line, and render the page.
- If a POST request validates, a flash message is created, and the page is redirected to the index.
- The flash messages are just a list that can be accessed by other pages.
- To actually check a users passwords, we need a database (next lecture).

app/routes.py: Receiving login credentials

```
from flask import render_template, flash, redirect

@app.route('/login', methods=['GET', 'POST'])
def login():
    form = LoginForm()
    if form.validate_on_submit():
        flash('Login requested for user {}, remember_me={}'.format(
            form.username.data, form.remember_me.data))
        return redirect('/index')
    return render_template('login.html', title='Sign In', form=form)
```

```
<body>
  <div>
    Microblog:
    <a href="/index">Home</a>
    <a href="/login">Login</a>
  </div>
  <hr>
  {% with messages = get_flashed_messages() %}
  {% if messages %}
  <ul>
    {% for message in messages %}
    <li>{{ message }}</li>
    {% endfor %}
  </ul>
  {% endif %}
  {% endwith %}
```


App Configuration

- Storing the secret key in a source file isn't a good idea. Secret keys and user credentials should always be manually configured, and never part of the repository. Setting them as system variables is a good approach.
- Create a configuration file to store all configuration variables. This can then be loaded when the app runs.
- The environment variables can also store database locations and credentials, and keys for third party services

config.py: Secret key configuration

```
import os

class Config(object):
    SECRET_KEY = os.environ.get('SECRET_KEY')
```

app/__init__.py: Flask configuration

```
from flask import Flask
from config import Config

app = Flask(__name__)
app.config.from_object(Config)

from app import routes
```

```
(virtual-environment) drtnf@drtnf-ThinkPad:$ export SECRET_KEY='poor_secret'
(virtual-environment) drtnf@drtnf-ThinkPad:$ echo $SECRET_KEY
poor_secret
(virtual-environment) drtnf@drtnf-ThinkPad:$ flask shell
Python 3.6.7 (default, Oct 22 2018, 11:32:17)
[GCC 8.2.0] on linux
App: app [production]
Instance: /Dropbox/ArePricks/Dropbox/Tim/teaching/2019/CITS3403/pair-up/instance
>>> print(app.config['SECRET_KEY'])
poor_secret
>>> 
```



Debugging and the Flask Shell

- The Flask shell is a useful way to test small functions and their integration with flask, without using a browser.
- It loads the flask app, and all the dependencies, but doesn't need the server running. You can set the shell context to have variables predefined when you start the shell.
- Debug mode is also very useful. Set the system variable `FLASK_DEBUG=1` to get a trace of the errors when the server crashes.

```
1 from app import app, db
2 from app.models import Student, Project, Lab
3
4 @app.shell_context_processor
5 def make_shell_context():
6     return {'db':db, 'Student':Student, 'Project':Project, 'Lab':Lab}
```

```
(virtual-environment) drtnf@drtnf-ThinkPad:~$ export SECRET_KEY='poor_secret'
(virtual-environment) drtnf@drtnf-ThinkPad:~$ echo $SECRET_KEY
poor_secret
(virtual-environment) drtnf@drtnf-ThinkPad:~$ flask shell
Python 3.6.7 (default, Oct 22 2018, 11:32:17)
[GCC 8.2.0] on linux
App: app [production]
Instance: /Dropbox/ArePricks/Dropbox/Tim/teaching/2019/CITS3403/pair-up/instance
>>> print(app.config['SECRET_KEY'])
poor_secret
>>>
```

builtins.NameError

NameError: name 'FlaskForm' is not defined

Traceback (most recent call last):

```
File "/Dropbox/ArePricks/Dropbox/Tim/teaching/2019/CITS3403/pair-up/virtual-environment/lib/python3.6/site-packages/flask/_compat.py", line 35, in reraise
    raise value
File "/Dropbox/ArePricks/Dropbox/Tim/teaching/2019/CITS3403/pair-up/pair-up.py", line 1, in <module>
    from app import app, db
File "/Dropbox/ArePricks/Dropbox/Tim/teaching/2019/CITS3403/pair-up/app/__init__.py", line 14, in <module>
    from app import routes, models
File "/Dropbox/ArePricks/Dropbox/Tim/teaching/2019/CITS3403/pair-up/app/routes.py", line 4, in <module>
    from app.forms import LoginForm, RegistrationForm, ProjectForm
File "/Dropbox/ArePricks/Dropbox/Tim/teaching/2019/CITS3403/pair-up/app/forms.py", line 7, in <module>
    class LoginForm(FlaskForm):
```

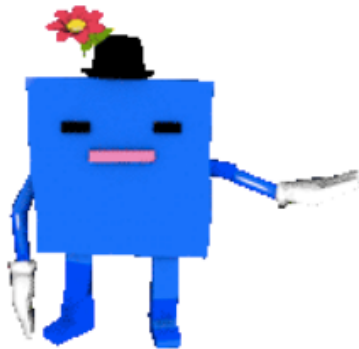
NameError: name 'FlaskForm' is not defined

```
(venv) $ export FLASK_DEBUG=1
```

Suggested Reading

Read “What is Code” by Paul Ford:

<http://www.bloomberg.com/graphics/2015-paul-ford-what-is-code/>



There are bugs in your code! Click the line of code that looks like it's bug-free. But be careful: Any time you don't fix a bug, a new one is born.



```
var salesPlusFour = 4 + sales;
```

```
var salesPlusFour = "4" + sales;
```



```
for (var i = 0; i < 10; i++)
```

```
for (var i = 0; i < 10 i++)
```