Django pt. 1: Intro, Setup, and Views

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So far

- How web works
  - Client/server – request/response - HTTP
- Front-end
  - HTML Tags: headers, inputs, etc.
  - CSS Styles: Selectors, spacing, layout
  - JavaScript: DOM, elements, Ajax, Fetch API

This week

- Back-end development & frameworks
- Django

  Setup, simple views, forms, templates
- MVC Design patterns

Back-end development

- What user can’t see
  What does it even mean?
- All logic and processes that happen behind the scene
- At the server-side!
- Processing the requests, creating responses, data management

Web server

- Listens on specified port(s)
- Handles incoming connections
  - Generates a response
  - Fetches a file
  - Forwards them to corresponding applications
- Load balancing, security, file serving, etc
- Examples: Apache, Nginx

Backend frameworks

- Doing everything from scratch?

  Listen on a port, process http requests (path, method, headers, body), retrieve data from storage, process data, create the response

- Not really a good idea!

- A lot of frameworks are out there!

  A lot of things are pre-implemented

Backend frameworks

- PHP: Laravel, CodeIgniter
- Python: Django, Flask, FastAPI
- Javascript: ExpressJS, Spring
- Ruby: Ruby on Rails

Concept is more important than framework!

Django: a backend framework with Python

Source: www.geeksforgeeks.org

Python projects

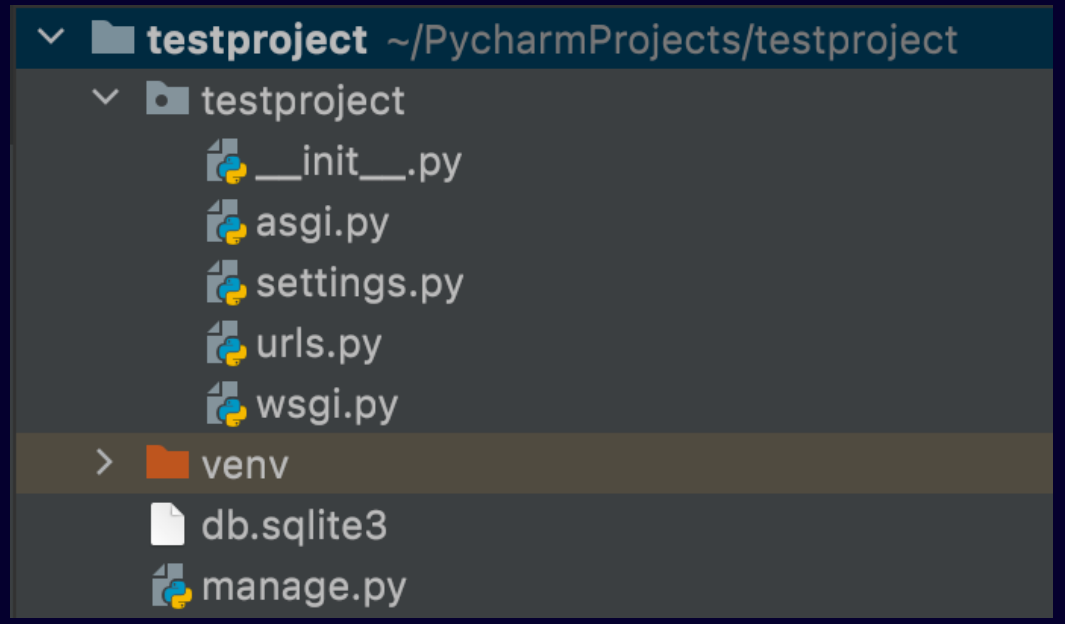
- A big project needs several different packages!
- Python's package manager: pip
- Command: `python3 -m pip install Django`

Creating a Django project

- Create the folder, environment, and install Django
- Command: `django-admin startproject <name> .`
- Creates the skeleton for your work
- https://docs.djangoproject.com/en/3.2/intro/tutorial01

Project structure

- Run the project
  ```
  python3 manage.py runserver
  ```
- Access the website from http://localhost:8000
- Django has a small development server



Taking requests

- View: a piece of code that runs upon a request to a specific endpoint (URL)
- Can be a function or a class
- How to create a new view?

  First, you need to create an app

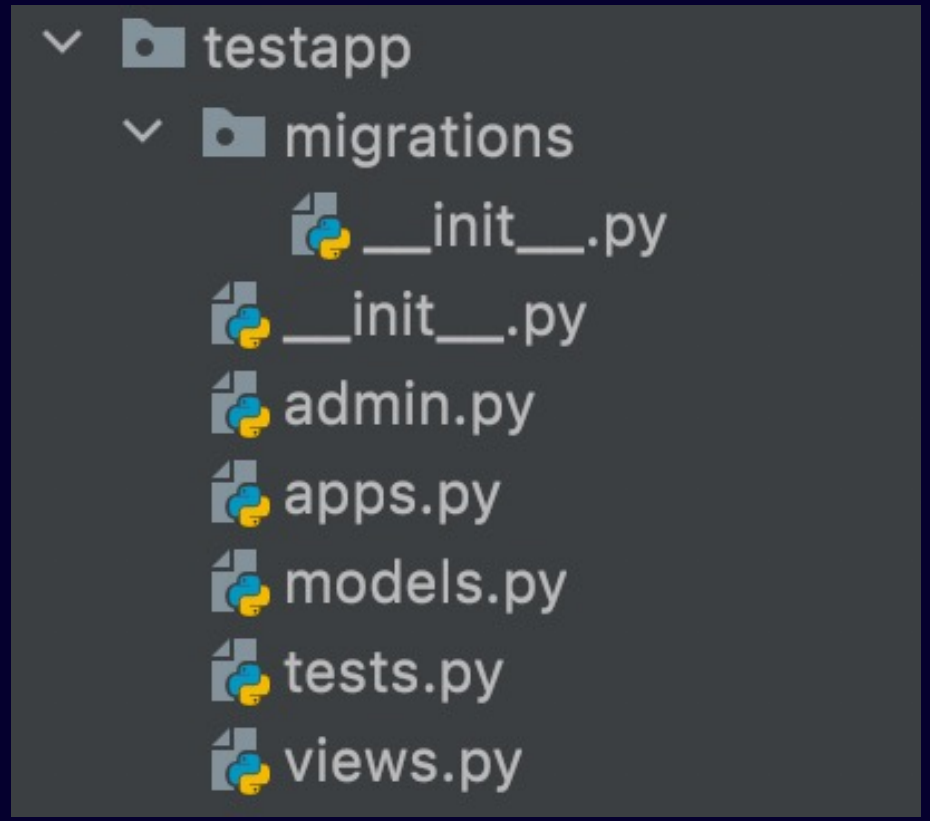
Django apps

- Django is intended for big projects
  Where tens or hundreds of views could exist
- Project's logic is organized by apps
- Each app takes care of a set of related views, urls, or models
- Example: one app for accounts, one for transactions, one for products, etc.
- Create a new app: `python3 manage.py startapp <name>`
  Most times you can do `./manage.py` instead of `python3 manage.py`

App structure

- models.py, migrations, admin.py: next session

- ALWAYS add the app name to the end of INSTALLED_APPS in project's settings.py



Create a new view

- Just write a function in `views.py` that takes an argument: `request`

- Return an `HttpResponse` instance

```python
from django.http import HttpResponse


def hello(request):
    return HttpResponse("Hello")
```

Map a URL to the view

- Add a path to urlpatterns

```
path('your/path', hello)
```

- Defining all urls in a single file is a terrible idea
  - Makes the urls so messy and disorganized
- Solution: hierarchical urls based on apps

Hierarchical URL system

- Create a urls.py for each app
- Make a namespace for each app
- Main urls.py:
  ```
  path('accounts/', include('accounts.urls'))
  ```
- App's urls.py:
  ```
  path('', hello)
  ```
- Now access the page through http://localhost:8000/accounts/

More sophisticated views

- Receive arguments through the URL

```
path('hello/<str:name>', hello)
```

- At the view function

```
def hello(request, name):
```

- Extract request data

```
request.method, request.GET, request.POST, request.headers
```

Exercise: Create a simple signup form

Form validation

- Email should be valid
- Password must be at least 8 characters
- Username must consist of lowercase letters and digits

- Can be checked at the front-end (a good UX)

- But it must always be checked at the backend as well

- User can always bypass front-end restrictions
  - Inspect element
  - Manual request

Form validation

- If data is invalid, an error can be returned
- Error 400: `HttpResponseBadRequest`
- Error 403: `HttpResponseForbidden`
- Error 404: `HttpResponseNotFound`

Form success

- On success, a redirect is often returned
  Redirect to profile page or index page after log in
- Use `HttpResponseRedirect`
- Putting raw URLs is a very bad practice
- Django offers URL names

HTML Response

- Create a templates folder inside the app's directory
- Add an html file there: hello.html
- At view, return `TemplateResponse(request, 'hello.html')`
- Django standard: create a subdirectory with the same name as the app and put html files there
  Template address would be `'<appname>/hello.html'`

Exercise: Serve the signup form from the Django server

Flow of forms

- The form and submission share the same endpoint
- If request's method is GET, the form itself is returned
- It it's POST, the submission is validated
  Don't forget to add `{% csrf_token %}` to the form
- If form is valid, a redirect is returned
- Otherwise, the form with errors will be returned!
  Not just a simple 400 error, which is a bad UX

Form errors

- Django templates are so dynamic!
  Data can be passed from the view to the template

- The context argument of TemplateResponse
  ```
  context={'error': 'form is invalid’}
  ```

- Access the variables at the template (html file)
  ```
  <h3> {{ error }} </h3>
  ```

Django template language

- Data passed through context

```
context={'errors': ['err1', 'err2']}
```

- For loop

```
{% for error in errors %}
   <h3> {{ error }} </h3>
{% endfor %}
```

- Attribute, method, dictionary lookup, or index access

```
{{ errors.0 }} {{ request.GET }} {{ mydict.items }}
```

Django template language

- If statement

```
{% if errors %}
   <h3> There has been errors </h3>
{% endif %}
```

- Filters

```
{{ errors|length }} {{ name|default="TBD" }}
```

- More tags (technically functions)

```
{% url 'accounts:hello' %} {% csrf_token %}
```

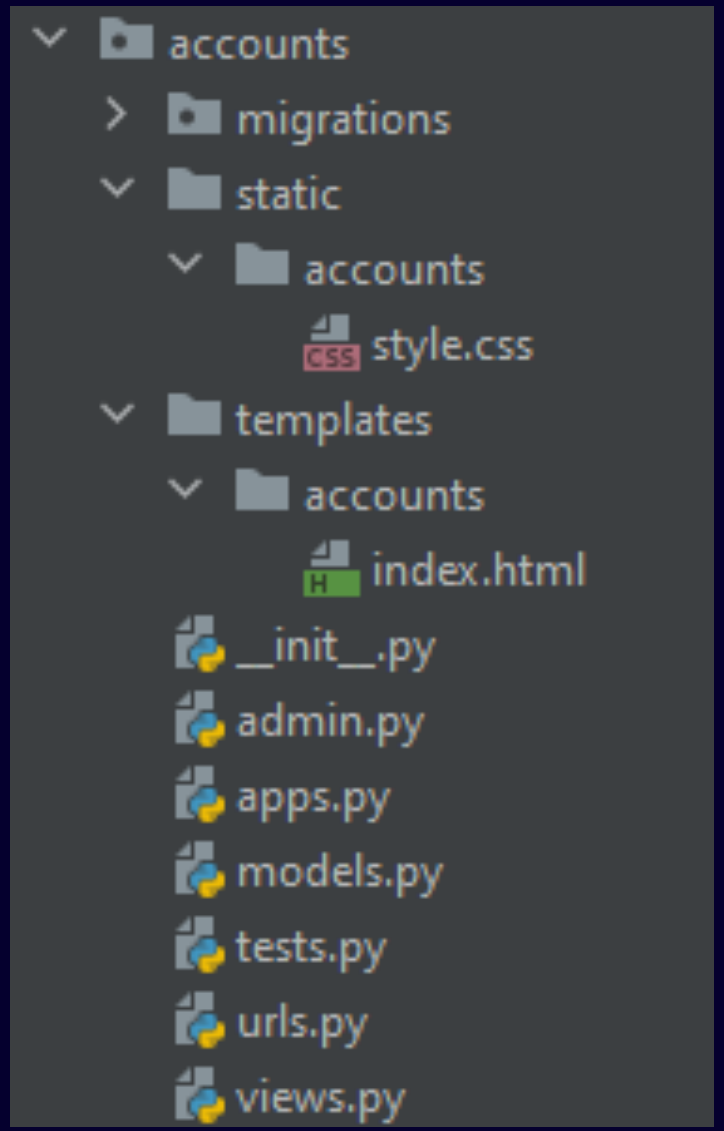
Static files

Visit https://docs.djangoproject.com/en/3.2/howto/static-files/

- The html response is dynamic
  - Created at each request, after template language is compiled

- Other files are static
  - CSS, JavaScript, images

- Put static files under static directory of each app
  Standard is to put them under a subdirectory with the app's name
- separate css, js, img
- Access them at template
  … `href="{% static 'accounts/style.css' %}"`
  Add `{% load static %}` to the top
- Translated to /static/accounts/style.css



Static files

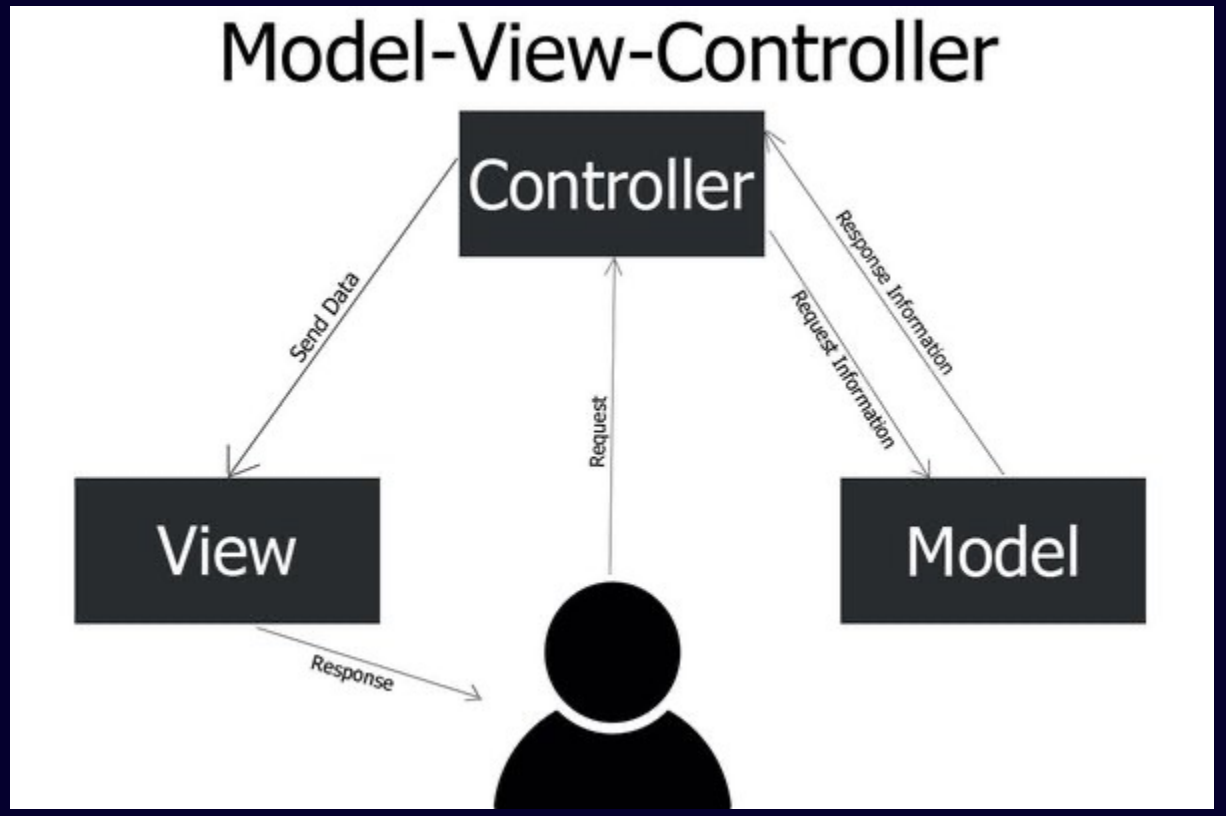
- Some static files don't really belong to an app
  Global style, bootstrap, font, etc.

- Custom directories for static files
  Usually a root static folder in the project

- At settings.py

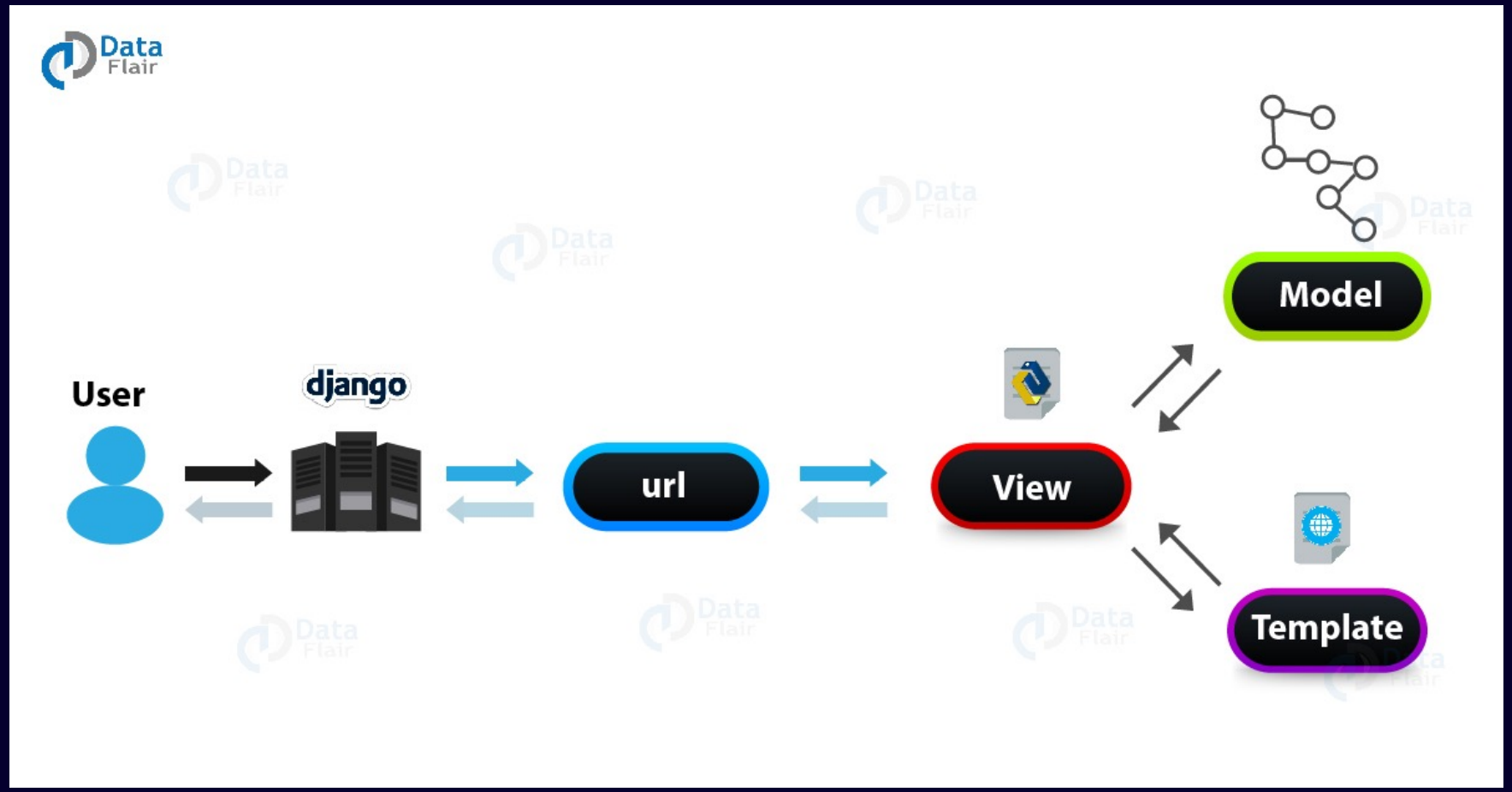
```
STATICFILES_DIRS = [
    BASE_DIR / "static"
]
```

MVC



Source: https://www.quora.com/Is-Django-an-MVC-or-an-MVT-framework

Django's architecture



Source: https://data-flair.training/blogs/django-architecture/

Django's architecture

- Almost an MVC framework
- Naming differences
  - Django's view: MVC's controller
  - Django's template: MVC's view
- Parts of controller already implemented by framework
  - URL dispatcher
- Django templates are more than just presentation
  - Capable of adding some logic

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Next week

- Working with a database
  ORM and models
- Authentication
  User model, sessions, login
- Class-based views
- Admin panel