Django pt. 4: Rest Framework & APIs

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So far

- How web works, HTML, CSS, JS
- Django intro
  Setup, views, forms, templates, MVC
- Models, database, ORM, class-based views, Auth
- Custom models, migrations, CRUD views

This week

- Python projects and virtualenv
- Restful APIs

  VERY IMPORTANT: Project backend is all about it!
- APIViews, serializers, permissions

Python projects

- Packages should NOT be shared between projects
- Even Python itself should NOT
- Reason: package versions and dependencies conflict
- Each project must have an isolated environment

Virtual Environment

- A package called virtualenv

```
python3 -m pip install virtualenv
```

- Creates a directory with its own Python, pip, and packages

- Command:

```
python3 -m virtualenv –p /usr/bin/python3.9 venv
```

or use `` `which python3.9` `` instead of the full path

Virtual Environment

- Activate the environment
  `source venv/bin/activate`
- To test, type `which python` or `which pip`
- Packages will not be installed globally
- Easy to reset: just delete the entire `venv` folder
- Concise commands are now possible!
  `pip install` instead of `python3 -m pip install`
  `./manage.py` instead of `python3 manage.py`

Requirements file

- Create a file named requirements.txt at project's root
- Once you `pip install` anything, add it (with its version) to that file
- To install packages from file:

  `pip install -r requirements.txt`

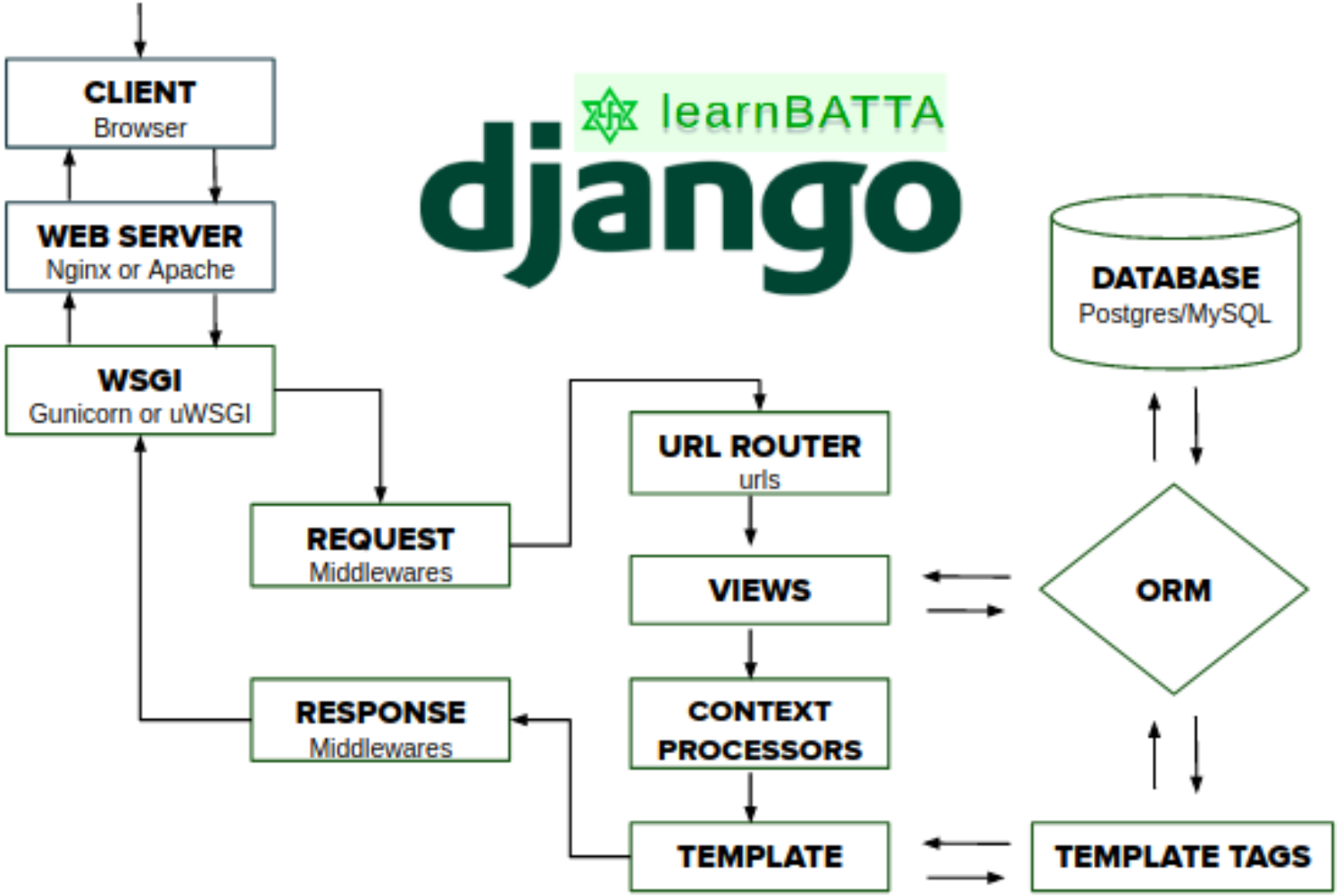
```
django==4.0.1
Pillow==9.0.1
djangorestframework==3.13.1
djangorestframework-simplejwt==5.0.0
```

Requirements file

- Packages get out of hand very soon!
- If someone clones your code, they will be very confused about what to install
- It's not only about the packages, but also their specific versions
  - Python projects are not backward-compatible

Restful APIs

Current way of building a website



request-response lifecycle in Django

Source: https://learnbatta.com/blog/understanding-request-response-lifecycle-in-django-29/

Caveats?

- Too backend-oriented
  All frontend logic is served as static files
- Django is backend framework but contains frontend codes
- Backend and frontend in the same place
  Can't use a dedicated frontend framework like React
- Frontend can't be as sophisticated
  Example: Single-page application

Why Separate backend and frontend?

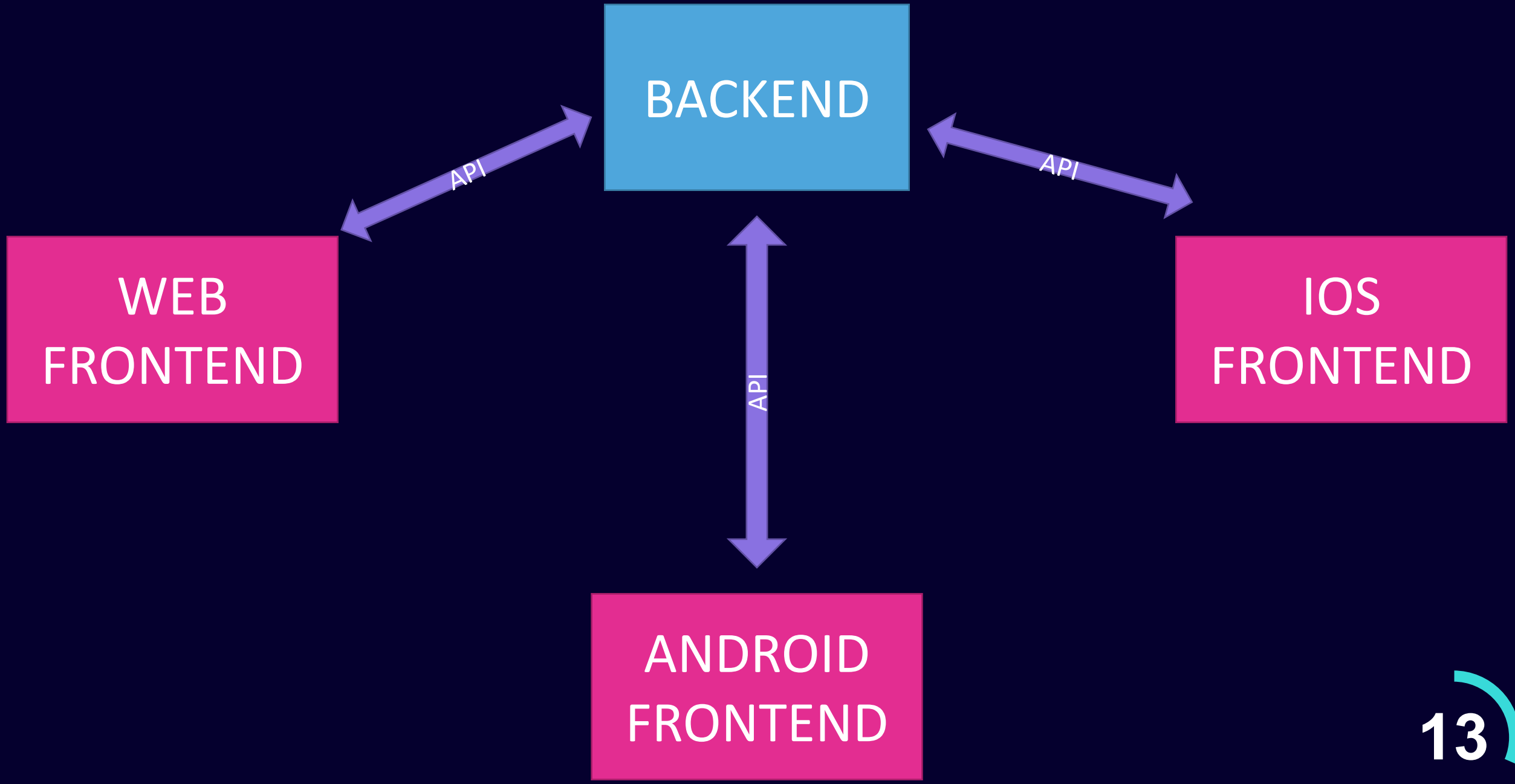
- Big projects are too big to contain both

- Modularity

  Changes in frontend will not affect backend and vice versa

- Consolidation

  One backend and multiple frontends (web, android, iOS)


BACKEND
API
API
API
WEB
FRONTEND
IOS
FRONTEND
ANDROID
FRONTEND

Modularity

- Different services/apps talk to each other with a protocol

- API: The way an application can be talked to
  Stands for Application Programming Interface

- Web applications: typically, a set of HTTP requests

Separate Backend and Frontend

- Backend views are only about data retrieval and manipulation
- Backend does not care about how data is shown, UI, or UX
- No templates, no static files

Response format

- HTML does not make sense anymore! WHY?
- A popular standard is JavaScript Object Notation or JSON
  Derived from Javascript syntax for defining objects
- Easy, human-readable, and fast
  Many languages (python, javascript, …) have built-in parsers and support

JSON

- Primitive types: number, string, boolean, null
- Array: ordered collection of elements
- Object: key-value pairs
  Keys are strings
- Array elements and object values can be of any type (string, null, array, object, etc.)

```
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 27,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ],
  "children": [],
  "spouse": null
}
```

Source: wikipedia

So far this session

- Big projects may require a separation of backend and frontend

- Communication done through APIs
  Data retrieval and manipulation

- Request/response follows JSON format

API architecture

- Representational State Transfer (REST)
- A set of URL endpoints that typically do a CRUD function
- Example: https://binancedocs.github.io/apidocs/spot/en

Django REST framework (DRF)

Django REST framework

- Makes writing Restful APIs easier
- Pre-written JSON parser, CRUD views, permissions, and serializers
- Still a Django project
  - Same models, urls, etc
  - Views are subclasses of DRF views

Setup

- Install via pip

```
pip install djangorestframework
```

- Add `'rest_framework'` to `INSTALLED_APPS`

- There is no front-end:
  - Install Postman to test APIs
  - Use DRF's browsable APIs at development

APIView

- Subclass of View
- Response gets a dictionary and returns an HTTP JSON reponse

```python
class StoreView(APIView):
    def get(self, request, *args, **kwargs):
        store = get_object_or_404(Store, id=kwargs['store_pk'])
        return Response({
            'name': store.name,
            'description': store.description,
            'url': store.url,
            'address': store.address,
            'avatar': store.avatar.url if store.avatar else None,
        })
```

Generic (CRUD) Views

- Rest framework CRUD Views:
  `CreateAPIView`
  `ListAPIView, RetrieveAPIView`
  `UpdateAPIView`
  `DestroyAPIView`

- Override `create, list, retrieve, update, destroy` (respectively)

- Need to implement a serializer

Serializer

- Model instances need to be serialized and deserialized for the end user
- Object is represented in a format that can be transferred or reconstructed later
- Dictionary (JSON) serializers in DRF
- Create serializers.py or serializers directory in your app

Serializers

```python
class StoreSerializer(ModelSerializer):
    class Meta:
        model = Store
        fields = ['name', 'description', 'url',
                  'email', 'address', 'avatar',
                  'create_date']
```

```python
class StoreView(RetrieveAPIView):
    serializer_class = StoreSerializer

    def get_object(self):
        return get_object_or_404(Store, id=self.kwargs['store_pk'])
```

More sophisticated fields

- Nested fields/properties can be accessed

- Should be defined in class body and then included in Meta fields

```
class StoreSerializer(ModelSerializer):
    owner_name = serializers.CharField(source='owner.get_full_name')

    class Meta:
        model = Store
        fields = ['name', 'description', 'url',
                  'email', 'address', 'avatar',
                  'create_date', 'owner', 'owner_name']
```

CRUD Views

- `ListAPIView`: Same as `RetrieveAPIView` but implements `get_queryset` instead
  - Same serializer can be used

- Same serializers can be used to deserialize as well
  - `CreateAPIView` and `UpdateAPIView`
  - In some cases, you might need to create a separate serializer
  - All field validations are done automatically

Deserialization

- Goal is to use the same serializer
- Many fields are shared
- Exception: `owner_name` is not applicable anymore
- Exception: `owner` should be inferred from request.user at creation

Solution

- Certain fields can be defined as `read_only` (or `write_only`)

- `request` is passed through `context`

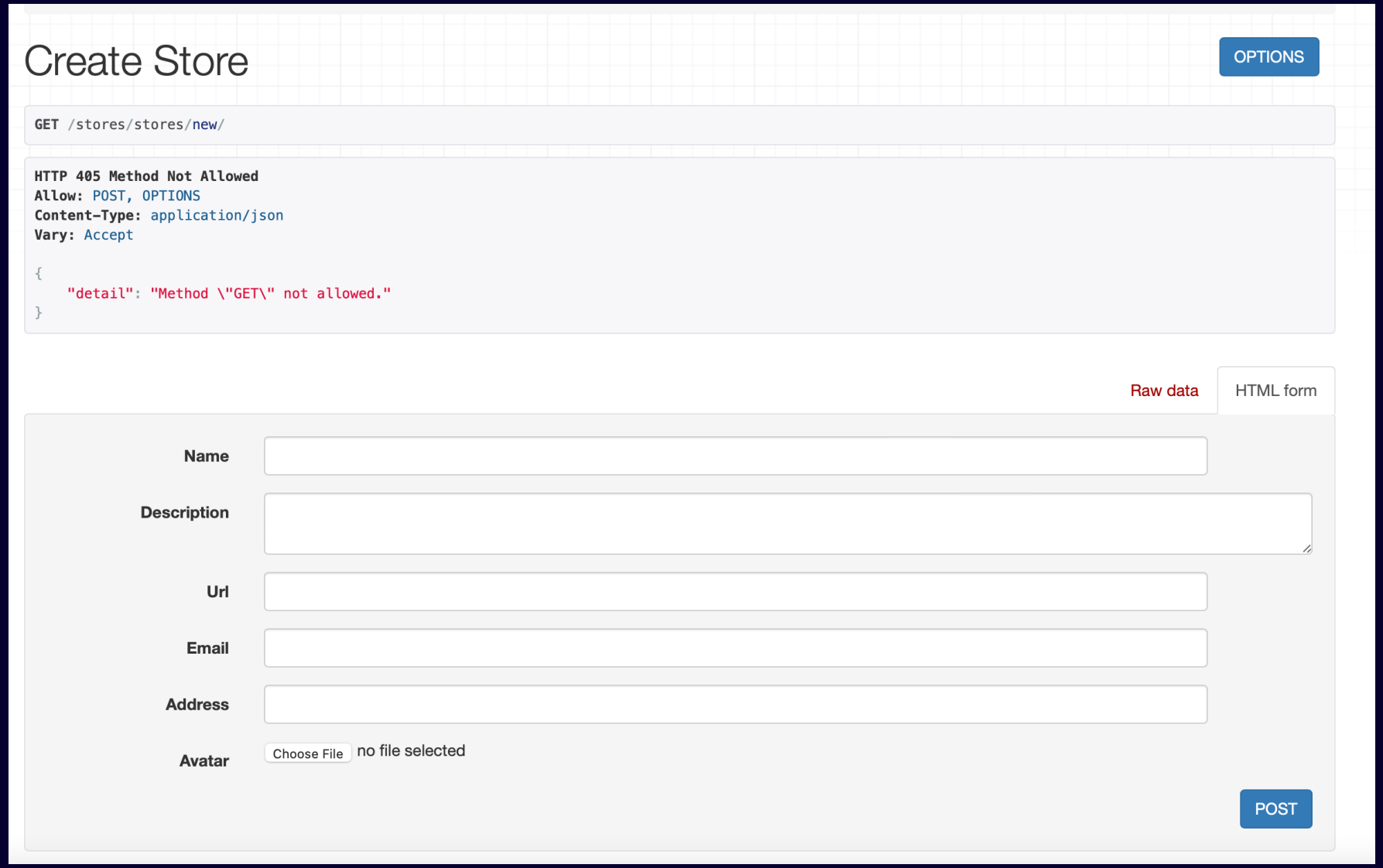
```python
class StoreSerializer(ModelSerializer):
    owner_name = serializers.CharField(source='owner.get_full_name', read_only=True)
    owner_id = serializers.ReadOnlyField()

    class Meta:
        model = Store
        fields = ['name', 'description', 'url',
                  'email', 'address', 'avatar',
                  'create_date', 'owner_id', 'owner_name']

    def create(self, validated_data):
        return super().create(validated_data | {'owner': self.context['request'].user})
```

Browsable API

Perfect way to test your code during development



Wait... what?

- Browsable API works with session auth, but there is no such a session in a real client

- Token auth is usually used instead

  Stateless tokens that are not stored in the server

- Install the JSON Web Token (JWT) package

  ```
  pip install djangorestframework-simplejwt
  ```

JWT Setup

Visit https://django-rest-framework-simplejwt.readthedocs.io/en/latest/getting_started.html

- Add JWT Auth to settings.py

```
REST_FRAMEWORK = {
    'DEFAULT_AUTHENTICATION_CLASSES': (
        'rest_framework_simplejwt.authentication.JWTAuthentication',
        'rest_framework.authentication.SessionAuthentication',
        'rest_framework.authentication.BasicAuthentication',
    ),
}
```

- There is a default login view that generates a token

```
path('api/token/', TokenObtainPairView.as_view(), name='token_obtain_pair'),
```

- Token is short-lived (five minutes)
  - Can be changed to other intervals in settings
  - A refresh token can be used as well

Obtain a token with Postman

POST localhost:8000/s... POST http://localhost:8... No Environment

http://localhost:8000/accounts/api/token/ Save

POST http://localhost:8000/accounts/api/token/ Send

Params Authorization Headers (8) Body Pre-request Script Tests Settings Cookies

none form-data x-www-form-urlencoded raw binary GraphQL

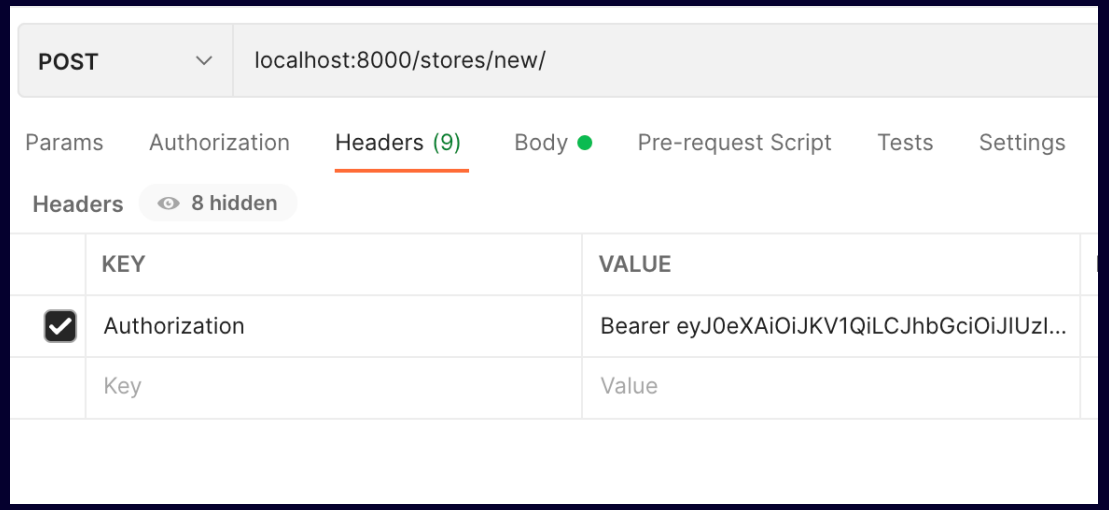
KEY	VALUE	DESCRIPTION	Bulk Edit
username	admin		
password	admin		
Key	Value	Description	

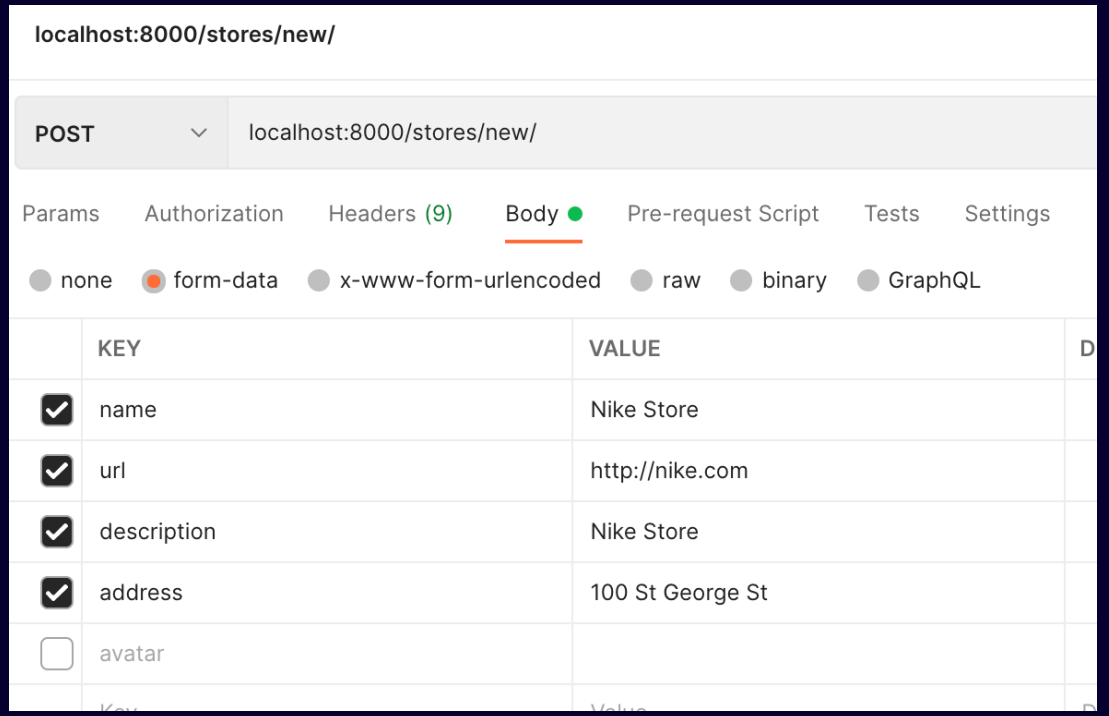
Body Cookies Headers (10) Test Results 200 OK 82 ms 793 B Save Response

Pretty Raw Preview Visualize JSON

```
{
    "refresh": "eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.
        eyJ0b2tlbl90eXBlIjoicmVmcmVzaCIsImV4cCI6MTY0NTE0MzI5OSwiaWF0IjoxNjQ1MDU2ODk5LCJqdGkiOiI2Nzg0ZjUyNT
    "access": "eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.
        eyJ0b2tlbl90eXBlIjoiYWNjZXNzIiwiZXhwIjoxNjQ1MTQzMjk5LCJpYXQiOjE2NDUwNTY4OTksImp0aSI6ImU0OTkyMmQzMj
        RlMzRmZDFiYjlhMmE0YWZiOGEzMjI4IiwidXNlcl9pZCI6NX0.dprkzDWzrjWS6yzvpMrn7fXzACd-5ekzHMsxCXC6N3I"
}
```

Request to CreateAPIView with token





UpdateAPIView

- Implements both PUT and PATCH methods
- PUT does a full update, PATCH does a partial one
- `get_object` must be implemented
- The same serializer can be used
  - Read-only fields are discarded for deserialization
  - Method `update` can be overridden for special behavior

Permissions

- A set of permissions can be applied to APIViews

  Example: `IsAuthenticated`

- Specify permissions at the view

  `permission_classes = [IsAuthenticated]`

- Custom permission classes can be created as well

  Subclass `BasePermission` and implement `has_permission`

This week

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- Restful APIs

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Next week

- Single-page applications
- Intro to React
- JSX
- Props, state, events