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How to use PostgreSQL with Django

Developer Tools | Python | Django

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This article covers how to use PostgreSQL together with the Python web application framework Django. After walking through the Django installation process it shows how to get started creating a simple Django application.

In the early days of web development, the framework of choice was LAMP, or Linux+Apache+MySQL+PHP. While PHP is still a great language for coding, Python has picked up a lot of popularity. With its clean syntax and use in a variety of industries, Python becomes a natural choice for any budding coder. In this article, we'll show you how to get Postgres connected with Django, a popular web application framework for Python.

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Getting started

When working with Python, it's highly recommended to use a virtual environment. This prevents dependency collisions and undesired behaviors that would otherwise arise from premature or unintended version changes. As such, we highly encourage you to use "virtualenv," along with Python v. 3.x. Obtaining and installing Python v. 3.x is a task outside the scope of this article, but there are many resources out there that provide instructions on how to do this.

We will also assume that you've got a Postgres instance up and running somewhere. If you need help with that, we've got articles that you can refer to.

Creating a virtual environment

We'll create a project folder called "myproject" in the "/var" directory:

```
mkdir /var/myproject

cd /var/myproject
```

Then, you will need to use "virtualenv" to create a place for the environment-specific dependencies to be installed:

```
[root@pga /]# virtualenv /var/myproject/myprojectenv

Using base prefix '/opt/rh/rh-python36/root/usr'

New python executable in /var/myproject/myprojectenv/bin/python3

Also creating executable in /var/myproject/myprojectenv/bin/python

Installing setuptools, pip, wheel...done.

[root@pga /]# ls /var/myproject/myprojectenv/

bin  include  lib  lib64
```

Then, activate the environment:

```
[root@pga /]# python --version

Python 2.7.5

[root@pga /]# source /var/myproject/myprojectenv/bin/activate

(myprojectenv) [root@pga /]# python --version

Python 3.6.3
```

To get Python working with Postgres, you will need to install the "psycopg2" module. However, you must first have pg_config installed on your OS:

```
[root@pga /]# pg_config

bash: pg_config: command not found

[root@pga /]# export PATH=/usr/pgsql-12/bin/:${PATH}

[root@pga /]# which pg_config

/usr/pgsql-12/bin/pg_config
```

If you can't find pg_config on your OS, you will need to install a Postgres client first. After you ensure pg_config is available on your system, go ahead and install "psycopg2":

```
# pip install psycopg2
```

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Installing Django

Once we've activated the virtual environment, we can install Django into that environment, so as to keep things in your project from interfering with the host OS:

```
# pip install django
```

```
(myprojectenv) [root@pga bin]# pwd

/var/myproject/myprojectenv/bin

(myprojectenv) [root@pga bin]# django-admin.py startproject myproject .
```

By default, Django is configured to use SQLite as its backend. To use Postgres instead, “myproject/settings.py” needs to be updated:

```
# cat myproject/settings.py

. . .

DATABASES = {

    'default': {

        'ENGINE': 'django.db.backends.postgresql_psycopg2',

        'NAME': ‘<db_name>’,

        'USER': '<db_username>',

        'PASSWORD': '<password>',

        'HOST': '<db_hostname_or_ip>',

        'PORT': '<db_port>',

    }

}

. . .
```

Once you’ve got things pointed to the Postgres database, you can build the default schema. If you didn’t know already, Django was designed with user access in mind, so by default a Django application will create a database schema involving users, groups, and permissions. To create the schema, generate a migration and run it:

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```
(myprojectenv) [root@pga bin]# python manage.py makemigrations

No changes detected

(myprojectenv) [root@pga bin]# python manage.py migrate

Operations to perform:

  Apply all migrations: admin, auth, contenttypes, sessions

Running migrations:

  Applying contenttypes.0001_initial... OK

  Applying auth.0001_initial... OK

  Applying admin.0001_initial... OK

  Applying admin.0002_logentry_remove_auto_add... OK

  Applying admin.0003_logentry_add_action_flag_choices... OK

  Applying contenttypes.0002_remove_content_type_name... OK

  Applying auth.0002_alter_permission_name_max_length... OK

  Applying auth.0003_alter_user_email_max_length... OK

  Applying auth.0004_alter_user_username_opts... OK

  Applying auth.0005_alter_user_last_login_null... OK

  Applying auth.0006_require_contenttypes_0002... OK

  Applying auth.0007_alter_validators_add_error_messages... OK

  Applying auth.0008_alter_user_username_max_length... OK

  Applying auth.0009_alter_user_last_name_max_length... OK

  Applying auth.0010_alter_group_name_max_length... OK

  Applying auth.0011_update_proxy_permissions... OK

  Applying sessions.0001_initial... OK

(myprojectenv) [root@pga bin]#
```

After creating the default schema, create the default superuser:

```
(myprojectenv) [root@pga bin]# python manage.py createsuperuser

Username (leave blank to use 'root'): richyen

Email address: support@enterprisedb.com

Password:

Password (again):

Superuser created successfully.

(myprojectenv) [root@pga bin]#
```

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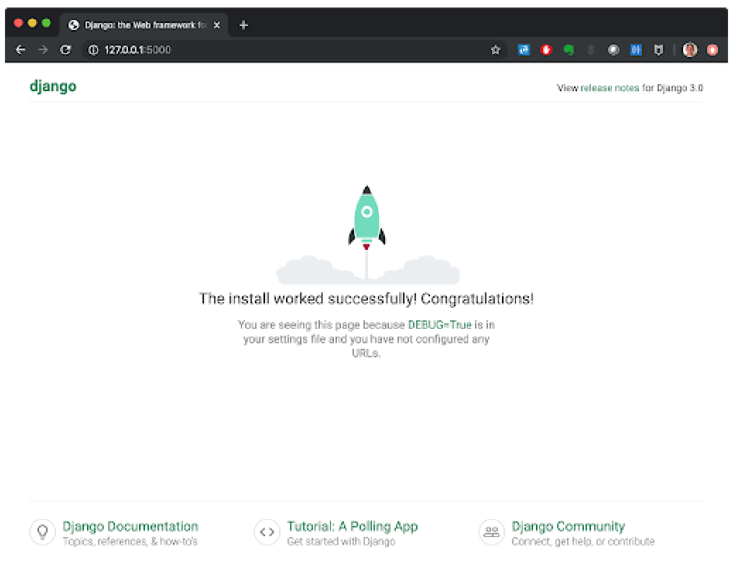
Now, the moment of truth! Start the application up, and point your browser to the corresponding port:

```
(myprojectenv) [root@pga bin]# python manage.py runserver 0.0.0.0:5000

Watching for file changes with StatReloader

Performing system checks...



System check identified no issues (0 silenced).

December 06, 2019 - 07:06:22

Django version 3.0, using settings 'myproject.settings'

Starting development server at http://0.0.0.0:5000/

Quit the server with CONTROL-C.
```


Django: the Web framework fo
127.0.0.1:5000
django
View release notes for Django 3.0

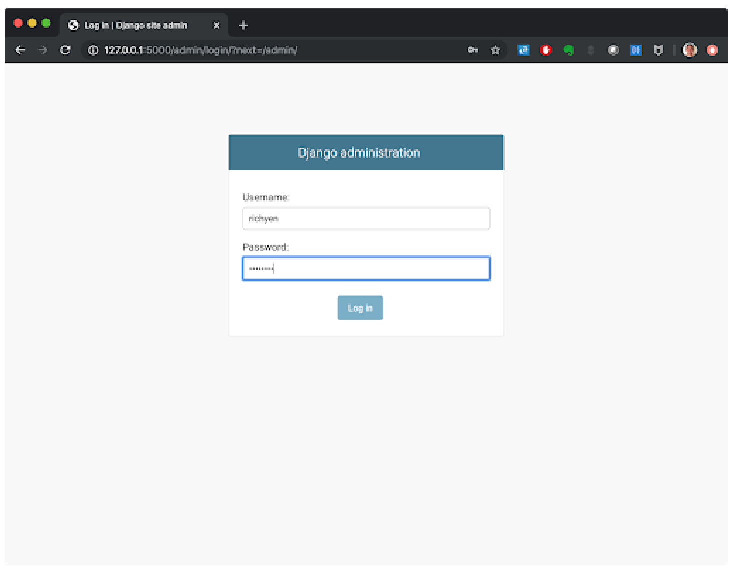
The install worked successfully! Congratulations!

You are seeing this page because DEBUG=True is in your settings file and you have not configured any URLs.

Django Documentation
Topics, references, & how-to's
Tutorial: A Polling App
Get started with Django
Django Community
Connect, get help, or contribute

Hooray! We're in business!

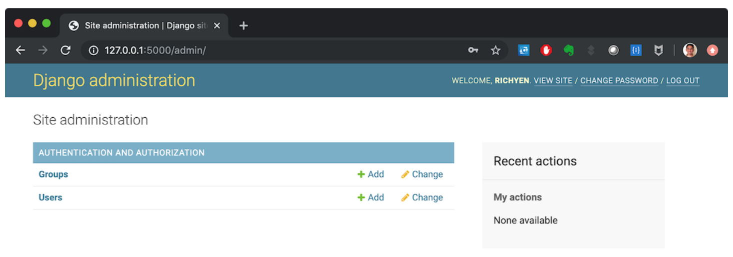
To verify that your superuser works, go to the "/admin" page:


Log in | Django site admin
127.0.0.1:5000/admin/login/?next=/admin/
Django administration

Username: richyen

Password: ••••••••

Enter the password, and we're in!


Site administration | Django sit
127.0.0.1:5000/admin/
Django administration
WELCOME, RICHYEN. VIEW SITE / CHANGE PASSWORD / LOG OUT

Site administration

AUTHENTICATION AND AUTHORIZATION		
Groups	+ Add	Change
Users	+ Add	Change

Recent actions

My actions

None available

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Let's make the app display a relationship between cars and their owners:

```
(myprojectenv) [root@pga bin]# python manage.py startapp cars
```

This creates a folder called "cars", which consists of the following important files:

```
(myprojectenv) [root@pga bin]# cd cars/

(myprojectenv) [root@pga cars]# ls -l

total 24

-rw-r--r-- 1 root root   63 Dec  6 07:29 admin.py

-rw-r--r-- 1 root root   94 Dec  6 07:29 apps.py

-rw-r--r-- 1 root root    0 Dec  6 07:29 __init__.py

drwxr-xr-x 2 root root 4096 Dec  6 07:29 migrations

-rw-r--r-- 1 root root   57 Dec  6 07:29 models.py

-rw-r--r-- 1 root root   60 Dec  6 07:29 tests.py

-rw-r--r-- 1 root root   63 Dec  6 07:29 views.py
```

Let's tell the framework what a Car and a Driver look like, by defining them in "models.py":

```
(myprojectenv) [root@pga bin]# cat cars/models.py

from django.db import models



class Driver(models.Model):

    name = models.TextField()

    license = models.TextField()

class Car(models.Model):

    make = models.TextField()

    model = models.TextField()

    year = models.IntegerField()

    vin = models.TextField()

    owner = models.ForeignKey("Driver", on_delete=models.SET_NULL, null=True)
```

Then, make the migration to build the tables in the database, and run it:

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```
(myprojectenv) [root@pga bin]# python manage.py makemigrations cars

Migrations for 'cars':

  cars/migrations/0001_initial.py

    - Create model Driver

    - Create model Car

(myprojectenv) [root@pga bin]# python manage.py migrate cars

Operations to perform:

  Apply all migrations: cars

Running migrations:

  Applying cars.0001_initial... OK
```

Take a look in the database, and you'll see that the table has been created with the format "<project_name>_<object_name>":

```
postgres=# \d

                     List of relations

 Schema |             Name             |   Type   |  Owner

--------+-----------------------------+----------+----------

 public | auth_group                   | table    | postgres

 public | auth_group_id_seq            | sequence | postgres

<...>

 public | cars_car                     | table    | postgres

 public | cars_car_id_seq              | sequence | postgres

 public | cars_driver                  | table    | postgres

 public | cars_driver_id_seq           | sequence | postgres
```

I also created some random data for the purposes of this tutorial:

```
postgres=# select * from cars_driver;

 id |   name   | license

----+----------+----------

  1 | John Doe | Z1234567

  2 | Jane Doe | Z9876543

(2 rows)



postgres=# select * from cars_car;

 id |  make  | model  | year |               vin                | owner_id

----+--------+--------+------+----------------------------------+----------

  1 | Ford   | F-150  | 2004 | 01083da2df15d6ebfe62186418a76863 |        1

  2 | Toyota | Sienna | 2014 | 53092a17afa460689ca931f0d459e399 |        1
```

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We need to tell Django how to pull stuff out of the database and display it. By editing the "cars/views.py" file, we can accomplish this:

```
(myprojectenv) [root@pga cars]# cat views.py

from django.shortcuts import render

from cars.models import Car, Driver



def car_detail(request, pk):

    owner_obj = Driver.objects.get(pk=pk)

    car_objs = Car.objects.filter(owner_id=owner_obj.id)

    context = {

        "vehicles": car_objs,

        "drivers": owner_obj,

    }

    return render(request, "car_detail.html", context)
```

We also need to define a template so that the "views.py" procedures have a place to send the data. First, we create a "cars/template/base.html" file that contains the more generic elements of an HTML page:

```
(myprojectenv) [root@pga cars]# cat templates/base.html

<!doctype html>

<html>

    <head>

        <meta charset="utf-8">

        <meta name="viewport" content="width=device-width, initial-scale=1">



        <title>Contacts</title>

        <link rel="stylesheet"
href="https://unpkg.com/tachyons@4.10.0/css/tachyons.min.css"/>

    </head>

    <body>

{% block page_content %}{% endblock %}

    </body>

</html>
```

Then, we define how the "car_detail.html" template will look:

```
(myprojectenv) [root@pga cars]# cat templates/car_detail.html

{% extends "base.html" %}

{% block page_content %}

        <div class="mw6 center pa3 sans-serif">

            <h1 class="mb4">Driver: {{ drivers.name | linebreaks }}</h1>

            <header class="b mb2">License: {{ drivers.license }}</header>

        {% for v in vehicles %}

            <div class="pa2 mb3 striped--near-white">

                <div class="pl2">

                    <p class="mb2">Make/Model: {{ v.make }} {{ v.model }}</p>

                    <p class="mb2">Year: {{ v.year }}</p>

                    <p class="mb2">Vin: {{ v.vin }}</p>

                </div>

            </div>

        {% endfor %}

        </div>

{% endblock %}
```

Finally, we need to tell the webserver how to route the traffic. First, in "cars/urls.py", we define how the REST behavior works:

```
(myprojectenv) [root@pga cars]# cat urls.py

from django.urls import path

from . import views



urlpatterns = [

    path("<int:pk>/", views.car_detail, name="car_detail"),

]
```

Note that this will allow us to retrieve Car and Driver objects based on the ID provided in the URL.

Then, in "myproject/urls.py," we define the root URL for the "cars" application:

```
from django.contrib import admin

from django.urls import path, include



urlpatterns = [

    path('admin/', admin.site.urls),

    path("cars/", include("cars.urls")),

]
```

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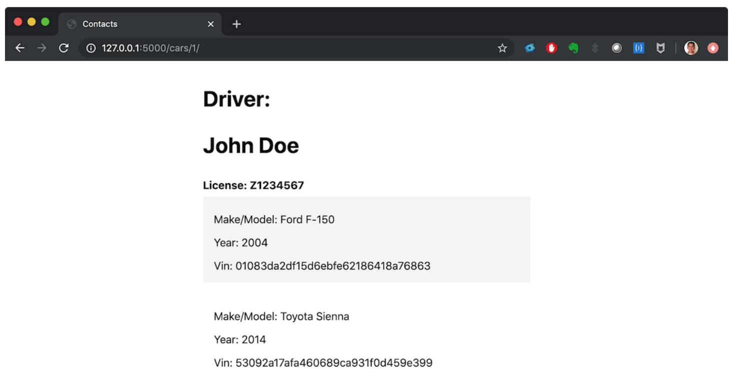
Spin up the webserver:

```
(myprojectenv) [root@pga bin]# python manage.py runserver 0.0.0.0:5000

Watching for file changes with StatReloader

Performing system checks...



System check identified no issues (0 silenced).

December 09, 2019 - 23:53:09

Django version 3.0, using settings 'myproject.settings'

Starting development server at http://0.0.0.0:5000/

Quit the server with CONTROL-C.
```

And visit http://127.0.0.1:5000/cars/1/:



Driver:

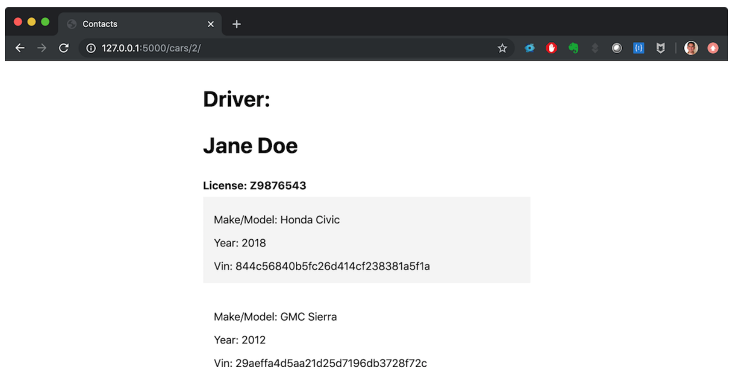
John Doe

License: Z1234567

Make/Model: Ford F-150
Year: 2004
Vin: 01083da2df15d6ebfe62186418a76863

Make/Model: Toyota Sienna
Year: 2014
Vin: 53092a17afa460689ca931f0d459e399

Change the “1” to a “2” in the URL, and we will get the Driver with `id=2` and the Cars owned by that Driver:



Driver:

Jane Doe

License: Z9876543

Make/Model: Honda Civic
Year: 2018
Vin: 844c56840b5fc26d414cf238381a5f1a

Make/Model: GMC Sierra
Year: 2012
Vin: 29aeffa4d5aa21d25d7196db3728f72c

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This is a very simple example of how Django can be used to serve up web pages with data from PostgreSQL. More information about how to define relationships between Django and PostgreSQL (many-to-many relationships, complex joins, complex filtering, etc.) can be found at the Django documentation.

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