Build Your First Open Source Python Project

A step-by-step guide to a working package

Jeff Hale Follow
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Every software developer and data scientist should go through the exercise of making a package. You'll learn so much along the way. Just make sure you have some time. 🕰

Making an open source Python package may sound daunting, but you don't need to be a grizzled veteran. You also don't need an elaborate product idea. You do need persistence and time. Hopefully this guide will help you need less of both. 😃

Build something beautiful 😃

In this article, we'll go through each step to make a basic Python package.

In future articles we'll set up automated tests and doc builds. We'll also integrate other helpful apps to improve your package development. You can then expand what you've built to suit your needs.

If you are looking to learn Python, check out my Memorable Python book.

This guide is for macOS with Python 3.7. Everything works now, but things change fast, so no guarantees if you're reading this in 2030. In the code below replace *my_package*, *my_file,* etc. with your own names.

Let's get to it! 🚀

Step 1: Make a Plan

We're eventually planning to make a very simple library for use in a Python program. The package will allow the user to easily convert a Jupyter notebook into an HTML file or a Python script.

The first iteration of our package will allow a user to call a function that will print a statement.

Now that we know what we want to make, we need to decide what to call the package.

Step 2: Name it

Naming things is tricky. Names should be unique, short, and memorable. They should also be all lowercase and definitely not have any dashes or other punctuation in them. Underscores are discouraged. When you're building your package, check that the name is available on GitHub, Google, and PyPI.

If you have high hopes that your package will some day have 10,000 GitHub stars, then you might want to check if the name is available on social networks. In this example, I'm going to name my package *notebookc* because it's available, short, and semi-descriptive. 😄

Step 3: Configure Environment

Make sure you have Python 3.7, GitHub, and Homebrew installed and configured. If you need any of those here are the details:

Python

Download Python 3.7 here and install it.

GitHub

If you don't have a GitHub account, go here and sign up for a free one. See how to install and configure Git here. You want the command line tool. Follow the links to download it, install it, set your username, and set your commit email address.

Homebrew

Homebrew is a Mac-specific package manager. Install instructions are here.

Venv

As of Python 3.6, it is recommended to use *venv* to create your virtual environment for package development. There are many ways to manage virtual environments with Python and the recommendations have evolved. See discussion here, but beware going down this rabbit hole.

venv comes installed with Python since Python 3.3. Note that *venv* installs *pip* and *setuptools* into the virtual environment since Python 3.4 .

Create a Python 3.7 virtual environment with the following command:

```
python3.7 -m venv my_env
```

Replace *my_env* with any name you like. Activate your virtual environment like this:

```
source my_env/bin/activate
```

You should now see `(my_env)` — or whatever you named your virtual environment— to the far left in your terminal prompt.

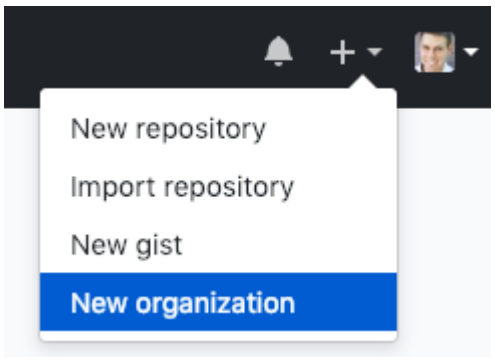
When you're finished with your development, deactivate your virtual environment with `deactivate`.

Now let's take care of setting up things on GitHub.

Step 4: Create Organization on GitHub

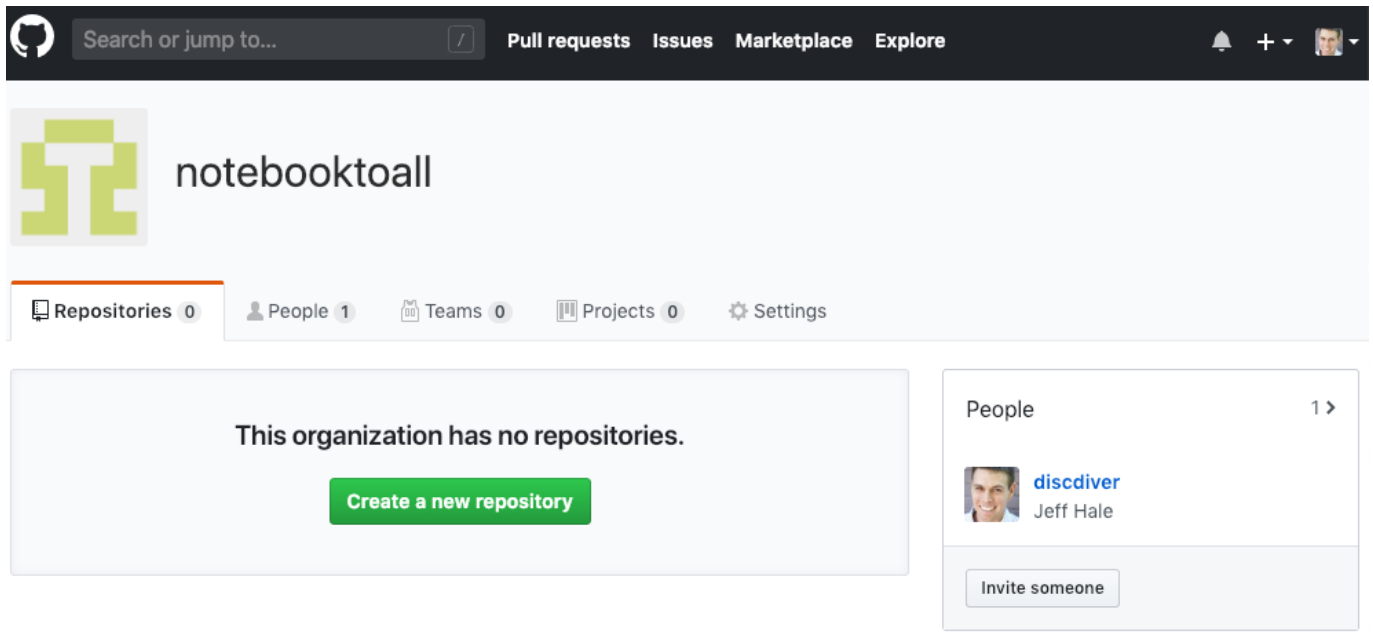
GitHub is the market leader in version control registries. GitLab and Bitbucket are other popular options. We'll be using GitHub in this guide.

- You'll use Git and GitHub a bunch, so if you aren't familiar, check out my article here.
- Create a new organization on Github. Follow the prompts. I named my organization *notebooktoall*. You could create the repo under your own personal account, but part of the goal is to learn how to setup an open source project for the larger community.



Step 5: Set up GitHub Repo

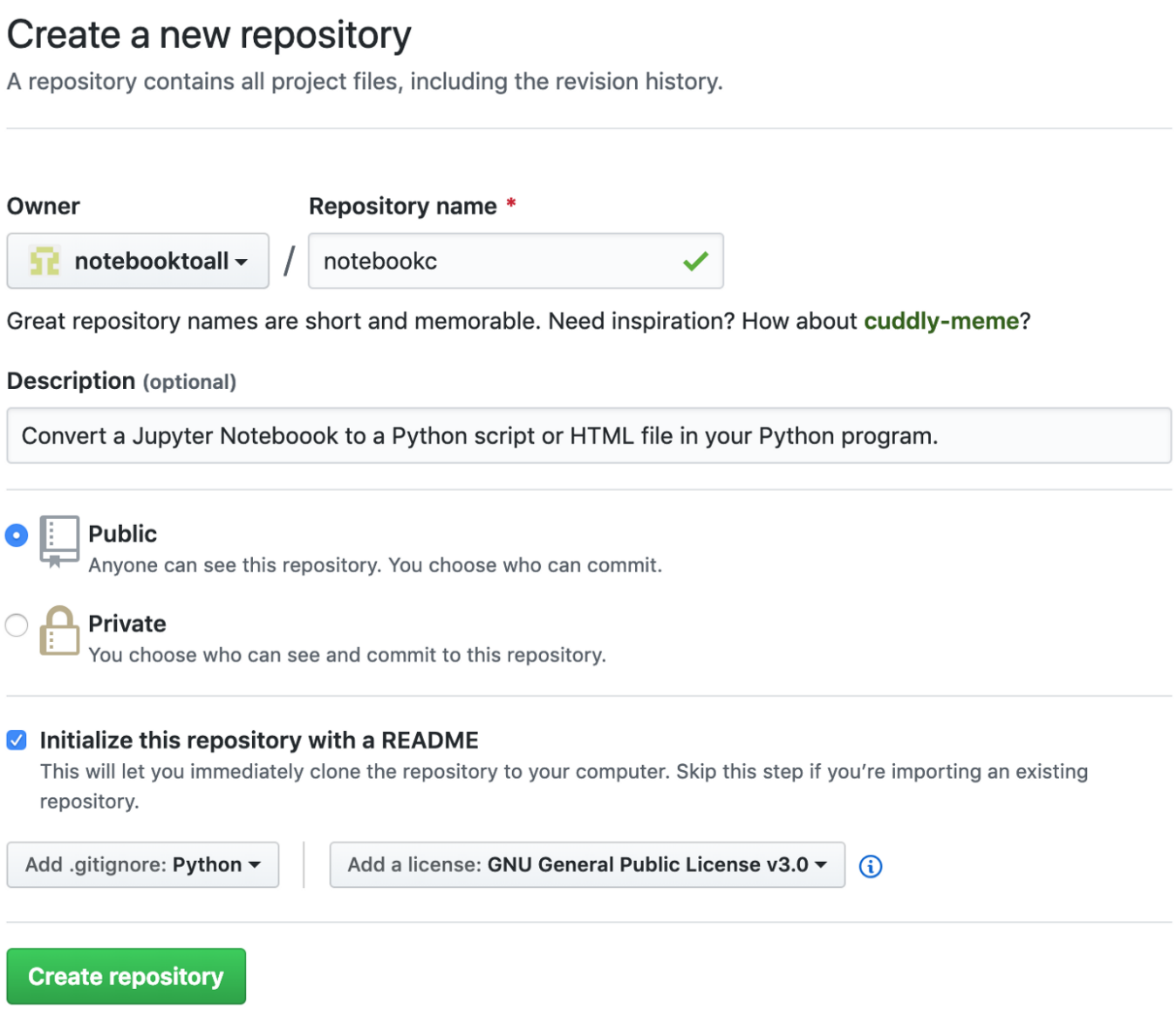
Create a new repository. I named my repo *notebookc*.



Add a *.gitignore* from the dropdown list. Choose *Python* for your repository. The contents of your *.gitignore* file will match folders and file types to exclude from your Git repo. You can alter your .gitignore later to exclude other unnecessary or sensitive files.

I suggest you choose a license from the *Add a license* dropdown. The license defines what users of your repository content can do. Some licenses are more permissive than others. Default copyright laws apply if no license is chosen. Learn more about licenses here.

For this project I chose the GNU General Public License v3.0 because it is popular, legit, and "guarantees end users the freedom to run, study, share and modify the software" — source.



Step 6: Clone and Add Directories

Choose where you want to clone your repo locally and run the following:

```
git clone https://github.com/notebooktoall/notebookc.git
```

Substitute your organization and repo.

Move into your project folder with your desktop GUI or code editor. Or use the command line with `cd my-project` and then view your files with `ls -A`. Your initial folders and files should look like this:

```
.git
.gitignore
LICENSE
README.rst
```

Create a subfolder for your primary project files. I suggest you name this primary subfolder the same name as your package. Make sure the name doesn't have any spaces in it.

Make a file named *__init__.py* in your primary subfolder. This file will remain empty for now. This file is necessary for the files in this folder to be imported.

Make another file with the same name as your primary subfolder with *.py* appended to it. My file is named *notebookc.py*. You could name this Python file whatever you like. Your package users will refer to the name of this file when importing your module.

My *notebookc* directory contents now look like this:

```
.git
.gitignore
LICENSE
README.rst

notebookc/__init__.py
notebookc/notebookc.py
```

Step 7: Create and Install requirements_dev.txt

In the top level of your project directory, create a *requirements_dev.txt* file. Often this file is named *requirements.txt*. Calling it requirements_dev.txt highlights that these packages are only installed by project developers.

In requirements_dev.txt, specify that pip and wheel should be installed.

```
pip==19.0.3
wheel==0.33.1
```

Notice that we specify exact versions of these packages with double equals signs and full major.minor.micro version numbers.

Pin your package versions in requirements_dev.txt

A collaborator who forks the project repo and installs the pinned requirements_dev.txt packages with pip will have the same package versions you did. You know they will work for them. Also, Read The Docs will use this file to install packages when it builds your documentation.

In your activated virtual environment, install the packages in requirements_dev.txt with the following command:

```
pip install -r requirements_dev.txt
```

You'll want to keep these packages updated as newer versions are released. For now, you can install whatever versions are newest by searching PyPI.

We'll install a tool to help with this process in a future article. Follow me to make sure you don't miss it.

Step 8: Code and Commit

Let's create a basic function for demonstration purposes. You can create your own awesome function later. 👍

Type the following into your primary file (for me that's *notebookc/notebookc/notebookc.py*):

```
def convert(my_name):
    """
    Print a line about converting a notebook.
    Args:
        my_name (str): person's name
    Returns:
        None
    """

    print(f"I'll convert a notebook for you some day, {my_name}.")
```

notebookc.py hosted with ♡ by GitHub view raw

That's our function in all its glory. 😃

The docstrings begin and end with three consecutive double quotes. They'll be used in later article to automatically create documentation.

Let's commit our changes. See this article if you'd like a Git workflow refresher.

Step 9: Create setup.py

The *setup.py* file is the build script for your package. The *setup* function from Setuptools will build your package for upload to PyPI. Setuptools includes information about your package, your version number, and which other packages are required for users.

Here's my example setup.py file:

```
from setuptools import setup, find_packages

with open("README.md", "r") as readme_file:
    readme = readme_file.read()

requirements = ["ipython>=6", "nbformat>=4", "nbconvert>=5", "requests>=2"]

setup(
    name="notebookc",
    version="0.0.1",
    author="Jeff Hale",
    author_email="jeffmshale@gmail.com",
    description="A package to convert your Jupyter Notebook",
    long_description=readme,
    long_description_content_type="text/markdown",
    url="https://github.com/your_package/homepage/",
    packages=find_packages(),
    install_requires=requirements,
    classifiers=[
        "Programming Language :: Python :: 3.7",
        "License :: OSI Approved :: GNU General Public License v3 (GPLv3)",
    ],
)
```

setup.py hosted with ♡ by GitHub view raw

Notice that *long_description* is set to the contents of your README.md file.

The *requirements* list specified in *setuptools.setup.install_requires* includes all necessary package dependencies for for your package to work.

Unlike the list of packages required for development in requirements_dev.txt, this list of packages should be as permissive as possible. Read more about why here.

Limit this *install_requires* list of packages to only what's needed — you don't want to make users install unnecessary packages. Note that you only need to list packages that aren't part of the Python standard library. Your user will have Python installed if they will be using your package. 😄

Our package doesn't require any external dependencies, so you can exclude the four packages listed in the example above.

A collaborator who forks the project repo and installs the pinned packages with pip will have the same package versions you used. This means they should work.

Change the other setuptools information to match your package information. There are many other optional keyword arguments and classifiers — see a list here. More in-depth guides to setup.py can be found here and here.

Commit your code to your local Git repo. Let's get ready to build a package!

Step 10: Build First Version

Twine is a collection of utilities for securely publishing Python packages on PyPI. Add the Twine package to the next blank line of *requirements_dev.txt* like so:

```
twine==1.13.0
```

Then install Twine into your virtual environment by reinstalling your requirements_dev.txt packages.

```
pip install -r requirements_dev.txt
```

Then run the following command to create your package files:

```
python setup.py sdist bdist_wheel
```

Multiple hidden folders should be created: *dist*, *build*, and — in my case — *notebookc.egg-info*. Let's look at the files in the *dist* folder. The .whl file is the Wheel file — the built distribution. The .tar.gz file is the a source archive.

Wheel

On a user's machine, pip will install packages as wheels whenever it can. Wheels are faster to install. When pip can't install a wheel, it falls back on the source archive.

Let's get ready to upload our wheel and source archive.

Step 11: Create TestPyPI Account

PyPI stands for Python Package Index. It's the official Python package manager. *pip* grabs files from PyPI when they aren't already installed locally.

PyPI

TestPyPI is a functioning test version of PyPI. Create a TestPyPI account here and confirm your email address. Note that you'll have separate passwords for uploading to the test site and official site.

Step 12: Publish to TestPyPI

Twine

Use Twine to securely publish your package to TestPyPI. Enter the following command — no modifications are necessary.

```
twine upload --repository-url https://test.pypi.org/legacy/ dist/*
```

You'll be prompted for your username and password. Remember, TestPyPI and PyPI have different passwords!

If needed, fix any errors, make a new version number in setup.py, and delete the old build artifacts: the *build*, *dist*, and *egg* folders. Rebuild with `python setup.py sdist bdist_wheel` and re-upload with Twine. Having version numbers on TestPyPI that don't signify anything isn't a big deal — you're the only one who will use those package versions. 😄

Once you've successfully uploaded your package, let's make sure you can install it and use it.

Step 13: Verify Installation and Use it

Create another tab in your terminal shell and make another virtual environment.

```
python3.7 -m venv my_env
```

Activate it.

```
source my_env/bin/activate
```

If you had uploaded your package to the official PyPI site you would then `pip install your-package`. We can retrieve the package from TestPypPI and install it with a modified command.

Here are the official instructions to install your package from TestPyPI:

> *You can tell pip to download packages from TestPyPI instead of PyPI by specifying the — index-url flag*
>
> *pip install --index-url https://test.pypi.org/simple/ my_package*
>
> *If you want to allow pip to also pull other packages from PyPI you can specify — extra-index-url to point to PyPI. This is useful when the package you're*

> *testing has dependencies:*
>
> ```
> pip install --index-url https://test.pypi.org/simple/ --extra-index-url https://pypi.org/simple my_package
> ```

If your package has dependencies, use the second command and substitute your package name.

You should see the latest version of your package installed in your virtual environment.

To verify you can use your package, start an IPython session in your terminal with:

```
python
```

Import your function and call your function with a string argument. Here's what my code looks like:

```
from notebookc.notebookc import convert
```

```
convert("Jeff")
```

I then see this output:

```
I'll convert a notebook for you some day, Jeff.
```

Sure you will. 😉

Step 14: Push to PyPI

Push your code to the real PyPI site so folks can download it with `pip install my_package`.

Here's you upload your code.

```
twine upload dist/*
```

Note that you need to update your version number in setup.py if you want to push a new version to PyPI.

Alright, let's upload our work to GitHub.

Step 15: Push to GitHub

Make sure you have your code committed.

My *notebookc* project folder looks like this:

```
.git
.gitignore
LICENSE
README.md
requirements_dev.txt
setup.py


notebookc/__init__.py
notebookc/notebookc.py
```

Exclude any virtual environments you don't want to upload. The Python .gitignore file that we chose when we made the repo should keep build artifacts from being indexed. You may need to delete your virtual environment folders.

Push your local branch to GitHub with `git push origin my_branch`.

Step 16: Create and Merge PR

From your browser, navigate to GitHub. You should see an option to make a pull request. Keep pressing the green buttons to create and merge your PR, and delete your remote feature branch.

Back in your terminal, delete your local feature branch with `git branch -d my_feature_branch`.

Step 17: Update Release Version on GitHub

Make a new release version on GitHub by clicking on *releases* on the repository's main page. Input the information about the release and save.

That's good for now! 🎉

We'll add many more files and folders in future articles.

Let's recap our steps.

Recap: 17 Steps to a Working Package

1. Make a Plan
2. Name it

3. Configure Environment
4. Create Organization on Github
5. Set up GitHub Repo
6. Clone and Add Directories
7. Create and Install *requirements_dev.txt*
8. Code and Commit
9. Create *setup.py*
10. Build First Version
11. Create TestPyPI Account
12. Push to TestPyPI
13. Verify Installation and Use
14. Push to PyPI
15. Push to GitHub
16. Create and Merge PR
17. Update Release Version on GitHub

Wrap

I hope you found this guide to making and releasing your first Python package useful. If you did, please share it on your favorite social media channels so others can find it too. 👏

In the next part in this series we'll add tests, continuous integration, code coverage, and more. Check it out here:

10 Steps to Set Up Your Python Project for Success

How to add tests, CI, code coverage, and more

towardsdatascience.com

I write about Python, Docker, data science, and other tech topics. If any of that's of interest to you, read more here and follow me on Medium. 😄

Happy building!

Thanks to Kathleen Hale.

Python Towards Data Science Software Development Programming Open Source