

An introduction to Python virtual environments

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Source and extended notes at <https://github.com/tibs/venv-intro>

Where we're going today

- ▶ A discussion of *why*
- ▶ We all work through using `python3 -m venv`
- ▶ Wrappers around virtual environments
- ▶ IDEs
- ▶ Other stuff

Why do we need virtual environments?

Why do we need virtual environments?

My reasons:

- ▶ Shouldn't alter the system Python
- ▶ *Can't* alter the Python provided
- ▶ You need packages with conflicting dependencies
- ▶ Being explicit about dependencies of a project
- ▶ Being tidy
- ▶ License compliance

and maybe a bit of help when upgrading Python (and "losing" installed packages)

Unix, Windows, and so on

When I say "unix" I mean Linux, the BSDs and also Mac OS.

- ▶ I assume your shell is something like bash, zsh or even fish.

When I say "windows" I mean Windows 10.

- ▶ I assume your shell is CMD.EXE or Powershell.

If you're using the Linux subsystem on Windows, then I think you're "unix".

First, the official way

Since Python 3.3, it has been possible to create virtual environments with just Python itself.

So that's what we'll look at first.

Somewhere to work

```
tibs ~$ mkdir temp  
tibs ~$ cd temp  
tibs ~/temp$
```

Check what Python(s) we have available

```
tibs ~/temp$ python --version
Python 2.7.17
tibs ~/temp$ python3 --version
Python 3.7.6
```

and being specific:

```
tibs ~/temp$ which python
/usr/local/bin/python
tibs ~/temp$ which python3
/usr/local/bin/python3
```

(on Windows, use where instead of which)

Create a virtual environment

```
tibs ~/temp$ python3 -m venv venv
```

```
python3 -m venv venv
```

python3 is the Python I want to use to create the new virtual environment. If I wanted to be specific about exactly which Python I wanted, and assuming I've got them both installed, I could do:

```
$ python3.6 -m venv venv
```

or:

```
$ python3.7.1 -m venv venv
```

```
python3 -m venv venv
```

`-m venv` tells Python to load the `venv` module and run it.

The Python standard library comes with several modules that you can run in this way. They all end with code like:

```
if __name__ == '__main__':  
    do_something()
```

In the case of `venv.py`, that "do something" is to create the setup for a virtual environment for this particular Python.

```
python3 -m venv venv
```

That last `venv` is the name of the directory to create which will hold the "workings" of the virtual environment.

And that got us

```
tibs ~/temp$ ls -F  
venv/
```

Activating the virtual environments

Creating the directory doesn't put into the virtual environment.

We need to activate it:

- ▶ Bash shell: `source venv/bin/activate`
- ▶ CShell: `source venv/bin/activate.csh`
- ▶ Fish shell: `source venv/bin/activate.fish`
- ▶ Windows CMD.EXE: `venv\Scripts\activate.bat`
- ▶ Windows Powershell: `venv\Scripts\Activate.ps1`

```
tibs ~/temp$ source venv/bin/activate.fish  
(venv) tibs ~/temp$
```

```
C:\Users\Tibs\temp>venv\Scripts\activate.bat  
(venv) C:\Users\Tibs\temp>
```

Note how the prompt has changed.

What has changed? (apart from the prompt)

```
(venv) tibs ~/temp$ python3 --version  
Python 3.7.6
```

```
(venv) tibs ~/temp$ python --version  
Python 3.7.6
```

```
(venv) tibs ~/temp$ which python3  
/Users/tibs/temp/venv/bin/python3
```

```
(venv) tibs ~/temp$ which python  
/Users/tibs/temp/venv/bin/python
```

(remember, on Windows use where instead of which)

Let's install requests

```
(venv) tibs ~/temp$ pip install requests
Collecting requests
...
Collecting idna<2.9,>=2.5 (from requests)
...
Collecting urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 (from requests)
...
Collecting certifi>=2017.4.17 (from requests)
...
Collecting chardet<3.1.0,>=3.0.2 (from requests)
...
Installing collected packages: idna, urllib3, certifi, chardet, requests
Successfully installed certifi-2019.11.28 chardet-3.0.4 idna-2.8 requests-2.22.0
WARNING: You are using pip version 19.2.3, however version 20.0.2 is available.
You should consider upgrading via the 'pip install --upgrade pip' command.
```

That last bit said:

```
WARNING: You are using pip version 19.2.3, however  
version 20.0.2 is available.  
You should consider upgrading via the 'pip install  
--upgrade pip' command.
```

Let's upgrade pip

```
(venv) tibs ~/temp$ pip install --upgrade pip
Collecting pip
...
Installing collected packages: pip
  Found existing installation: pip 19.2.3
    Uninstalling pip-19.2.3:
      Successfully uninstalled pip-19.2.3
Successfully installed pip-20.0.2
```

And now

```
(venv) tibs ~/temp$ python
Python 3.7.6 (default, Jan 28 2020, 22:16:20)
[Clang 11.0.0 (clang-1100.0.33.16)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import requests
>>> exit()
```

```
(venv) tibs ~/temp$ pip --version
pip 20.0.2 from /Users/tibs/temp/venv/lib/python3.7/site-packages/pip (pyt
```

Deactivating

```
(venv) tibs ~/temp$ deactivate  
tibs ~/temp$
```

After deactivation

```
tibs ~/temp$ python --version
Python 2.7.17
```

```
tibs ~/temp$ pip --version
pip 19.3.1 from /usr/local/lib/python2.7/site-packages/pip (python 2.7)
```

```
tibs ~/temp$ python3
Python 3.7.6 (default, Jan 28 2020, 22:16:20)
[Clang 11.0.0 (clang-1100.0.33.8)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import requests
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ModuleNotFoundError: No module named 'requests'
>>> exit()
```

Let's look at the virtual environment directory

```
tibs ~/temp$ ls -F venv  
bin/          include/      lib/          pyvenv.cfg
```

```
tibs ~/temp$ more venv/pyvenv.cfg  
home = /usr/local/bin  
include-system-site-packages = false  
version = 3.7.6
```

On Windows

```
C:\Users\Tibs\temp>dir venv
Volume in drive C has no label.
Volume Serial Number is 0CBE-2433

Directory of C:\Users\Tibs\temp\venv

26/01/2020  10:25    <DIR>          .
26/01/2020  10:25    <DIR>          ..
26/01/2020  10:25    <DIR>          Include
26/01/2020  10:25    <DIR>          Lib
26/01/2020  10:25                163 pyvenv.cfg
26/01/2020  10:26    <DIR>          Scripts
                1 File(s)                163 bytes
                5 Dir(s)  33,705,447,424 bytes free
```

Scripts instead of bin

The bin directory

```
tibs ~/temp$ ls -F venv/bin/
activate          easy_install*      pip3.7*
activate.csh      easy_install-3.7*   python@
activate.fish     pip*                python3@
chardetect*       pip3*
```

[illegible]

The lib directory just after creating a venv

```
tibs ~/temp$ ls -F venv2/lib/python3.7/site-packages/  
__pycache__/  
easy_install.py  
pip/  
pip-19.2.3.dist-info/  
pkg_resources/  
setuptools/  
setuptools-41.2.0.dist-info/
```

The lib directory after installing requests

```
tibs ~/temp$ ls -F venv/lib/python3.7/site-packages
__pycache__/_      pip-20.0.2.dist-info/
certifi/_           pkg_resources/
certifi-2019.11.28.dist-info/ requests/
chardet/_           requests-2.22.0.dist-info/
chardet-3.0.4.dist-info/ setuptools/
easy_install.py     setuptools-41.2.0.dist-info/
idna/_              urllib3/
idna-2.8.dist-info/ urllib3-1.25.8.dist-info/
pip/
```

Finding out what is installed: 1

```
tibs ~/temp$ source venv/bin/activate.fish
```

```
(venv) tibs ~/temp$ pip freeze
```

```
certifi==2019.11.28
```

```
chardet==3.0.4
```

```
idna==2.8
```

```
requests==2.22.0
```

```
urllib3==1.25.8
```

Finding out what is installed: 2

```
tibs ~/temp$ source venv/bin/activate.fish
(venv) tibs ~/temp$ pip install pipdeptree
...
```

and then:

```
(venv) tibs ~/temp$ pipdeptree
pipdeptree==0.13.2
  - pip [required: >=6.0.0, installed: 20.0.2]
requests==2.22.0
  - certifi [required: >=2017.4.17, installed: 2019.11.28]
  - chardet [required: >=3.0.2,<3.1.0, installed: 3.0.4]
  - idna [required: >=2.5,<2.9, installed: 2.8]
  - urllib3 [required: >=1.21.1,<1.26,!1.25.1,!1.25.0, installed: 1.25.8]
setuptools==41.2.0
```

Where to put the venv directory?

- ▶ "project" - one venv per directory tree

At the top of the directory tree for this project

- ▶ "environment" - one venv per purpose

Generally, somewhere central, with a name related to the purpose

python3 -m venv help

```
$ python3 -m venv --help
```

```
usage: venv [-h] [--system-site-packages] [--symlinks | --copies] [--clear]
           [--upgrade] [--without-pip] [--prompt PROMPT]
           ENV_DIR [ENV_DIR ...]
```

Creates virtual Python environments in one or more target directories.

positional arguments:

ENV_DIR A directory to create the environment in.

optional arguments:

-h, --help show this help message and exit

--system-site-packages

Give the virtual environment access to the system site-packages dir.

--symlinks

Try to use symlinks rather than copies, when symlinks are not the default for the platform.

Wrappers to make it easier

- ▶ virtualenv
- ▶ virtualenvwrapper
- ▶ pipenv
- ▶ poetry
- ▶ conda

virtualenv

virtualenv is essentially where Python virtual environments all started.

If you want virtual environments for Python2 or early versions of Python 3, this is still the package to use.

virtualenv example: 1

```
tibs ~/temp$ virtualenv -p python3.7 VENV
Running virtualenv with interpreter /usr/local/bin/python3.7
Already using interpreter /usr/local/opt/python/bin/python3.7
Using base prefix '/usr/local/Cellar/python/3.7.6_1/Frameworks/Python.framework/Versions/3.7'
New python executable in /Users/tibs/temp/ENV/bin/python3.7
Also creating executable in /Users/tibs/temp/ENV/bin/python
Installing setuptools, pip, wheel...
done.
```

virtualenv example: 2

```
tibs ~/temp$ ls -F VENV  
bin/      include/ lib/
```

There is also a "hidden" file in there, a link:

```
tibs ~/temp$ ls -l VENV/.Python  
lrwxr-xr-x 1 tibs staff 80 1 Feb 16:43 VENV/.Python -> /usr/local/Cellar
```

Note that there is no `pyenv.cfg` file - that's a later invention.

virtualenvwrapper

virtualenvwrapper is a wrapper for virtualenv (well, it's in the name!) that aims to make it easier to use, by providing some extra commands.

Once you've installed it, there's a degree of manual setup, although it's reasonable clearly explained in the documentation.

Once you've set it up, it will:

1. Allow you to keep all of your virtual environment directories under one single directory - typically something like `$HOME/.virtualenvs`.
2. Provide a new command, `mkvirtualenv` to create new virtual environments.
3. Provide a command `workon` that lets you change to a (different) virtual environment.

virtualenvwrapper example

```
tibs ~/temp$ mkvirtualenv use-requests
```

which would create me a virtual environment directory:

```
/Users/tibs/.virtualenvs/use-requests
```

To use it:

```
tibs ~/temp$ workon use-requests  
(use-requests) tibs ~/temp$
```

pipenv

pipenv aims to make using virtual environments easier, but also to help with package management for a project as well.

pipenv example

```
tibs ~/temp$ cd ~/temp
tibs ~/temp$ pipenv install --python 3.7
Creating a virtualenv for this project...
Pipfile: /Users/tibs/temp/Pipfile
Using /usr/local/bin/python3 (3.7.6) to create virtualenv...
? Creating virtual environment...Already using interpreter /usr/local/opt/pyenv/bin/python
Using base prefix '/usr/local/Cellar/python/3.7.6_1/Frameworks/Python.framework/Versions/3.7/Resources/Python.framework/Versions/3.7/bin'
New python executable in /Users/tibs/.local/share/virtualenvs/temp--1EXmzE1/bin/python3
Also creating executable in /Users/tibs/.local/share/virtualenvs/temp--1EXmzE1/bin/python
Installing setuptools, pip, wheel...
done.
Running virtualenv with interpreter /usr/local/bin/python3
```

pipenv example, continued

```
? Successfully created virtual environment!
Virtualenv location: /Users/tibs/.local/share/virtualenvs/temp--1EXmzEU
Creating a Pipfile for this project...
Pipfile.lock not found, creating...
Locking [dev-packages] dependencies...
Locking [packages] dependencies...
Updated Pipfile.lock (a65489)!
Installing dependencies from Pipfile.lock (a65489)...
? ||||| 0/0 - 00:00:00
To activate this project's virtualenv, run pipenv shell.
Alternatively, run a command inside the virtualenv with
pipenv run.
```


pipenv virtual environment

If we look in the virtual environment directory:

```
(temp) tibs ~/temp$ ls -aF \  
    ~/.local/share/virtualenvs/temp--1EXmzEU/  
./      .Python@  bin/      lib/  
../     .project  include/
```

it is a virtualenv style virtual environment, not a venv style.

pipenv files

pipenv also creates two files in the current directory:

```
tibs ~/temp$ ls -F
Pipfile      Pipfile.lock
```

pipenv Pipfile

```
[[source]]
name = "pypi"
url = "https://pypi.org/simple"
verify_ssl = true

[dev-packages]

[packages]

[requires]
python_version = "3.7"
```

pipenv Pipfile.lock

```
{
  "_meta": {
    "hash": {
      "sha256": "7e7ef69da7248742e869378f8421880cf8f0017f96d94d086813baa518",
    },
    "pipfile-spec": 6,
    "requires": {
      "python_version": "3.7"
    },
    "sources": [
      {
        "name": "pypi",
        "url": "https://pypi.org/simple",
        "verify_ssl": true
      }
    ]
  },
}
```

pipenv: entering the virtual environment

The normal way to use the virtual environment is then (as it suggests) to do:

```
tibs ~/temp$ pipenv shell
Launching subshell in virtual environment...
Welcome to fish, the friendly interactive shell
tibs ~/temp$ source /Users/tibs/.local/share/virtualenvs/temp--1EXmzEU/bin/
(temp) tibs ~/temp$
```

This actually starts a new shell with the virtual environment enabled in it.

pipenv: installing requests

We use `pipenv install` (and not `pip`) to install new packages:

```
(temp) tibs ~/temp$ pipenv install requests
Installing requests...
Adding requests to Pipfile's [packages]...
? Installation Succeeded
Pipfile.lock (444a6d) out of date, updating to (a65489)...
Locking [dev-packages] dependencies...
Locking [packages] dependencies...
? Success!
Updated Pipfile.lock (444a6d)!
Installing dependencies from Pipfile.lock (444a6d)...
? ||||| 5/5 - 00:00:00
```

pipenv: after installing requests

Now the Pipfile and Pipfile.lock have been updated - the Pipfile to:

```
[[source]]
name = "pypi"
url = "https://pypi.org/simple"
verify_ssl = true

[dev-packages]

[packages]
requests = "*"

[requires]
python_version = "3.7"
```

and the Pipfile.lock to something rather longer and more complicated, but which basically uniquely identifies the packages that were installed.

poetry

I built Poetry because I wanted a single tool to manage my Python projects from start to finish. I wanted something reliable and intuitive that the community could use and enjoy.

-- Sébastien Eustace

poetry new

If you want to create a new project, then the `poetry new` command will create the project directory and a sensible starting layout.

I don't really want to go quite that far (although actually it's a good idea in general), so I shall just use `poetry init` to get started.

poetry init

This takes the user through some questions to generate the `pyproject.toml` file that poetry requires:

```
tibs ~/temp$ poetry init
```

```
This command will guide you through creating your  
  pyproject.toml config.
```

```
Package name [temp]:
```

```
Version [0.1.0]:
```

```
Description []:
```

```
Author [Tibs <tibs@tonyibbs.co.uk>, n to skip]:
```

```
License []: MIT
```

```
Compatible Python versions [^3.7]:
```

poetry init, continued

```
Would you like to define your main dependencies  
interactively? (yes/no) [yes] no
```

```
Would you like to define your dev dependencies  
(require-dev) interactively (yes/no) [yes] no
```

Generated file

```
[tool.poetry]  
name = "temp"  
version = "0.1.0"  
description = ""  
authors = ["Tibs <tibs@tonyibbs.co.uk>"]  
license = "MIT"
```

poetry init, continued some more

```
[tool.poetry.dependencies]
python = "^3.7"

[tool.poetry.dev-dependencies]

[build-system]
requires = ["poetry>=0.12"]
build-backend = "poetry.masonry.api"

Do you confirm generation? (yes/no) [yes]
```

pyproject.toml file

The pyproject.toml file is indeed as described:

```
[tool.poetry]
name = "temp"
version = "0.1.0"
description = ""
authors = ["Tibs <tibs@tonyibbs.co.uk>"]
license = "MIT"

[tool.poetry.dependencies]
python = "^3.7"

[tool.poetry.dev-dependencies]

[build-system]
requires = ["poetry>=0.12"]
build-backend = "poetry.masonry.api"
```

poetry install

```
tibs ~/temp$ poetry install
Creating virtualenv temp-PD0d5gaI-py3.7 in
  /Users/tibs/Library/Caches/pypoetry/virtualenvs
Updating dependencies
Resolving dependencies... (0.1s)

Writing lock file

No dependencies to install or update
```

Where the virtual environment directory goes is dependent on the operating system. On a Mac, ~/Library/Caches is a fairly traditional sort of place.

poetry: the virtual environment directory

```
tibs ~/temp$ pushd /Users/tibs/Library/Caches/pypoetry
```

```
tibs ~/temp$ ls -aF virtualenvs/temp-PD0d5gaI-py3.7/
./          bin/          lib/          src/
../         include/     pyvenv.cfg
```

```
tibs ~/temp$ popd
```

which tells us we've created a (modern) `venv` virtual environment.

The name of the virtual environment includes our starting directory name, a hash, and the version of Python.

poetry: in the current directory

Meanwhile, in the current directory, we have:

```
tibs ~/temp$ ls -F
poetry.lock      pyproject.toml
```

The pyproject.toml hasn't changed, and the poetry.lock contains:

```
package = []

[metadata]
content-hash = "669741988c507fb04697bdb0c9077fa1b2342c356df6ae6c96baa3119a"
python-versions = "^3.7"

[metadata.files]
```


poetry: starting the virtual environment

We get into our virtual environment by starting a new shell using `poetry shell`:

```
tibs ~/temp$ poetry shell
Spawning shell within /Users/tibs/Library/Caches/pypoetry/virtualenvs/temp-
Welcome to fish, the friendly interactive shell
tibs ~/temp$ source /Users/tibs/Library/Caches/pypoetry/virtualenvs/temp-P
(temp-PD0d5gaI-py3.7) tibs ~/temp$
```

poetry add requests

```
(temp-PD0d5gaI-py3.7) tibs ~/temp$ poetry add requests
```

```
Using version ^2.22.0 for requests
```

```
Updating dependencies
```

```
Resolving dependencies... (1.0s)
```

```
Writing lock file
```

```
Package operations: 0 installs, 5 updates, 0 removals
```

- Updating certifi (2019.11.28 /usr/local/Cellar/poetry/1.0.3/libexec/vendor/certifi)
- Updating chardet (3.0.4 /usr/local/Cellar/poetry/1.0.3/libexec/vendor/chardet)
- Updating idna (2.8 /usr/local/Cellar/poetry/1.0.3/libexec/vendor/lib/python3.7/site-packages/idna)
- Updating urllib3 (1.25.8 /usr/local/Cellar/poetry/1.0.3/libexec/vendor/lib/python3.7/site-packages/urllib3)
- Updating requests (2.22.0 /usr/local/Cellar/poetry/1.0.3/libexec/vendor/lib/python3.7/site-packages/requests)

pyproject.toml after adding requests

```
[tool.poetry]
name = "temp"
version = "0.1.0"
description = ""
authors = ["Tibs <tibs@tonyibbs.co.uk>"]
license = "MIT"

[tool.poetry.dependencies]
python = "^3.7"
requests = "^2.22.0"

[tool.poetry.dev-dependencies]

[build-system]
requires = ["poetry>=0.12"]
build-backend = "poetry.masonry.api"
```

poetry.lock after adding requests

...specifies the dependencies for `requests`, the exact versions of packages, and various other things.

conda

conda comes out of the Anaconda project, which started as a means of providing easy installation of scientific/numeric Python on Windows. It's now a lot more than that, but still aimed at the scientific / big data worlds.

- ▶ if you've got anaconda, you're already using this - so just keep doing so
- ▶ support for many different languages
- ▶ there is miniconda which is conda without *all* of the packages - this is closer to just using pip.

Summary: Which wrapper to use?

You don't *have* to use any of these

- ▶ virtualenv - if you must work with Python < 3.3
- ▶ virtualenvwrapper - nice if you're using virtualenv
- ▶ pipenv
- ▶ poetry - if you want something that manages more project details
- ▶ conda - if you're already using it or Anaconda

IDEs

This is going to be a brief summary, since I don't use any of these.

VS Code

VS Code (Visual Studio Code) supports Python virtual environments.

If you are editing a Python file, the Python interpreter being used is shown at the bottom left of the screen.

The VS Code documentation explains how it decides where to look.

If you are working with a VS Code "workspace", then it will automatically find a `.venv` directory in that workspace.

Also, VS Code understands the locations that `virtualenvwrapper` and `pipenv` use to store virtual environments, and its simple to use with `poetry` as well.

PyCharm

PyCharm: always thinks in terms of "projects".

Configure a virtual environment explains how to use and create virtual environments in PyCharm, and Conda virtual environment explains how to use conda virtual environments.

When setting up the Python interpreter for use in a PyCharm project, you need to specify the full path to the Python executable. So, for instance:

```
~/tibs/temp/venv/bin/python3
```

Atom

There appear to be multiple packages that support virtual environments for Python in atom. I'm assuming that if you use atom you know your way around the package system.

Jupyter notebook

Jupyter notebook isn't really an IDE, but virtual environments are still relevant when using it.

The simplest thing to do is to create your virtual environment, then install jupyter notebook within it. When you run that jupyter notebook, it will automatically use the Python it was installed for.

For instance:

```
$ source .venv/bin/activate  
$ pip install jupyter  
$ jupyter notebook
```

It *is* possible to run multiple Python "backends" for Jupyter notebook, but that's a bit beyond this document.

Awkward questions

- ▶ What happens if I activate a virtual environment while I've got one activated?
- ▶ Can I (deliberately) create a virtual environment that depends on another?
- ▶ How do I stop pip from installing outside a virtual environment?
- ▶ Do I *need* to activate the virtual environment?
- ▶ What happens when I upgrade Python?
- ▶ What about an existing requirements.txt?

What happens if I activate a virtual environment while I've got one activated?

The new activation will "take over".

In particular, the old virtual environment binary directory is removed from the PATH and the new one is added instead.

However, I don't know if anything *promises* that this will work, so it's perhaps best not to rely on it.

Can I (deliberately) create a virtual environment that depends on another?

Yes. Simply do `python -m venv <name>` inside an already activated virtual environment.

If you inspect the `bin/python` entry (on unix, at least) you will see it links to the Python from the earlier virtual environment.

Why you might want to do that, and how useful it might be, is another discussion.

How do I stop pip from installing outside a virtual environment?

It's not very well documented, but the simplest way to do this is to set the environment variable:

```
PIP_REQUIRE_VIRTUALENV=true
```

For instance, in your `.bashrc` you would add:

```
export PIP_REQUIRE_VIRTUALENV=true
```

and that would then take effect when you open a new shell.

When that is set, any attempt to use `pip install <something>` outside a virtual environment will give the error message:

```
ERROR: Could not find an activated virtualenv (required).
```

Do I *need* to activate the virtual environment?

Well, actually, no. It just makes things more convenient. If you run the Python in the virtual environment bin directory (Scripts for Windows) explicitly, then that Python will "look around itself" and use the virtual environment.

So:

```
(venv) tibs ~/temp$ deactivate
tibs ~/temp$ venv/bin/python
Python 3.7.6 (default, Jan 28 2020, 22:16:20)
[Clang 11.0.0 (clang-1100.0.33.16)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import requests
>>> exit()
```


That *also* means that if you install a Python program to the virtual environment bin directory, and run it directly (using its full path) then it too will know what environment to use, without your needing to activate the virtual environment.

For example:

```
tibs ~/temp$ python3 -m venv pydep
tibs ~/temp$ source pydep/bin/activate.fish
(pydep) tibs ~/temp$ pip install pipdeptree
Collecting pipdeptree
  Using cached https://files.pythonhosted.org/packages/12/64/26c7df3ad833c...
Requirement already satisfied: pip>=6.0.0 in ./pydep/lib/python3.7/site-pa...
Installing collected packages: pipdeptree
Successfully installed pipdeptree-0.13.2
(pydep) tibs ~/temp$ ls pydep/bin/pipdeptree
pydep/bin/pipdeptree
(pydep) tibs ~/temp$ deactivate
tibs ~/temp$ pydep/bin/pipdeptree --version
0.13.2
```

What happens when I upgrade Python?

That is, if the older Python "disappears" (as will generally happen with a `homebrew` upgrade on a Mac, for instance), do my virtual environments just stop working?

Well, generally, yes, but...

- ▶ `pipenv`: edit the `Pipfile` and change the version of Python, and then:

```
pipenv --rm  
pipenv shell
```

- ▶ `poetry`: edit the `pyproject.toml` and change the version of Python, and then:

```
poetry env remove python3.7  
poetry shell
```

What about an existing requirements.txt?

If you get the source code for a package, it may come with a requirements.txt file (probably output using `pip freeze`) that you want to use to setup your virtual environment.

If you're just using a normal virtual environment, you can just install the packages from that file using `pip install -r requirements.txt`

If you're using pipenv, then when you do `pipenv install` it will notice that there is a requirements.txt file (but no Pipfile) and read one to create the other. Or you can be explicit: `pipenv install -r requirements.txt`.

If you're using poetry, then you currently need to add the contents of the requirements.txt file to the pyproject.toml file by hand (in the `[tool.poetry.dependencies]` or `[tool.poetry.dev-dependencies]` sections, as appropriate).

Poetry issue 46 talks about this, and some workarounds.

End of *awkward* questions

The venv directory and version control systems

Broadly, don't commit the `venv` directory to your version control system. It doesn't contain anything portable (by definition).

The `--system-site-packages` switch

Normally, when I create a new virtual environment, it starts without anything installed (except `pip` and other basic infrastructure). So if the Python I used to create the virtual environment (the `python3` in `python3 -m venv`) had (for instance) `docutils` installed, the new virtual environment would not.

The `--system-site-packages` switch lets the new virtual environment "see" the packages in the original Python.

```
tibs ~/temp$ python3 -m venv secondary
tibs ~/temp$ source secondary/bin/activate.fish
(secondary) tibs ~/temp$ python
Python 3.7.6 (default, Jan 28 2020, 22:16:20)
[Clang 11.0.0 (clang-1100.0.33.16)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import docutils
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ModuleNotFoundError: No module named 'docutils'
>>> exit()
(secondary) tibs ~/temp$ deactivate
```

```
tibs ~/temp$ python3 -m venv tertiary \
--system-site-packages
tibs ~/temp$ cat tertiary/pyvenv.cfg
home = /usr/local/bin
include-system-site-packages = true
version = 3.7.6
tibs ~/temp$ source tertiary/bin/activate.fish
(tertiary) tibs ~/temp$ python
Python 3.7.6 (default, Jan 28 2020, 22:16:20)
[Clang 11.0.0 (clang-1100.0.33.16)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import docutils
>>> exit()
```


Multiple Pythons

Sometimes you need more than one version of Python - for instance, to test that a new version of Python is still compatible with existing code.

System package managers cannot always help with this - they typically only support a subset of the possible versions (homebrew on the Mac supports one Python per major version), and it can take some time for a new version to be provided (particularly a problem with some enterprise linuxes).

The solution is to use pyenv, which makes it easy to build Python at different versions.

(For Windows, you may want to look at pyenv-win instead)

Remember that this is *not* the same as virtual environments, but is complementary.

Some other tools

- ▶ `venv_manager` is intended for `bash` and `zsh` users, and detects and activates virtual environments as you `cd` into the directories that contain them (by default it looks for `.venv` directories).
- ▶ `direnv` is a more powerful tool that takes actions when you `cd` into a directory, and it too can be used to activate virtual environments. I confess that its documentation intimidates me.
- ▶ `upm` is a "universal package manager", which is meant to act as a consistent front end (command line tool) for various different programming languages. For Python it wraps `poetry`.
- ▶ `DepHell` is a project management tool for Python that is meant to be an all-in-one solution that can (for instance) work with `pip`, `pipenv` and `poetry`. If you're needing to convert between tools, or work with multiple tools, it may be a good solution.

Fin

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Source and extended notes at <https://github.com/tibs/venv-intro>