# The Future of Python Dependency Management

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Hi.

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python SOFTWARE FOUNDATION

Requests

*http for humans*

# Requests

## HTTP for Humans

```
>>> r = requests.get('https://api.github.com/user', auth=('user', 'pass'))
>>> r.status_code
200
>>> r.headers['content-type']
'application/json; charset=utf-8'
>>> r.encoding
'utf-8'
>>> r.text
u'{"type":"User"...'
>>> r.json
{u'private_gists': 419, u'total_private_repos': 77, ...}
```

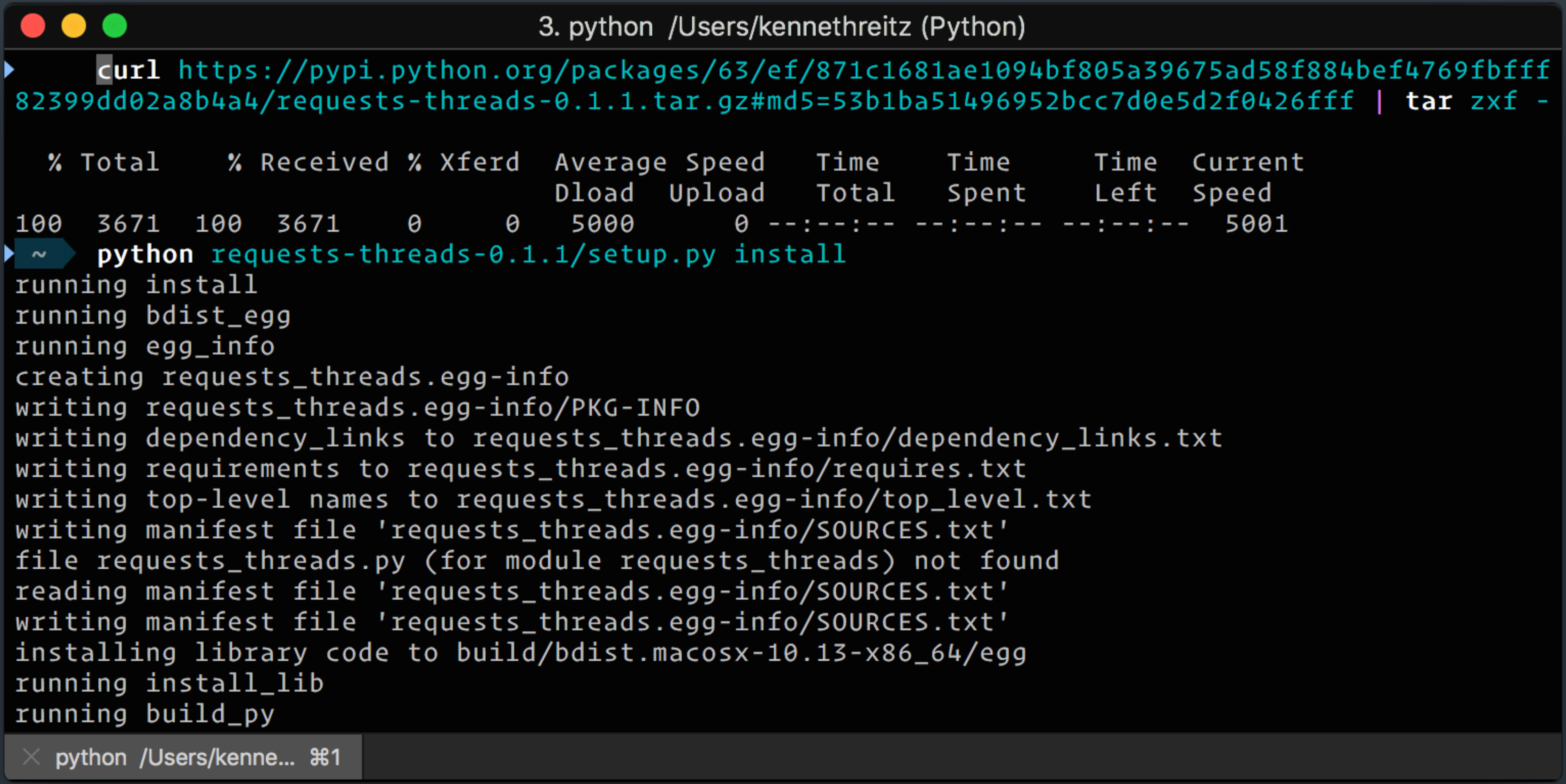
# github.com/kennethreitz

- Requests
- Responder
- Maya
- Records
- Tablib
- httpbin.org

- Python-Guide.org
- SayThanks.io
- 'Import This' Podcast
- Em Keyboard
- Certifi
- Autoenv

## Packaging: History

# The Past…



3. python  /Users/kennethreitz (Python)

```
     curl https://pypi.python.org/packages/63/ef/871c1681ae1094bf805a39675ad58f884bef4769fbfff
82399dd02a8b4a4/requests-threads-0.1.1.tar.gz#md5=53b1ba51496952bcc7d0e5d2f0426fff | tar zxf -

  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  3671  100  3671    0     0   5000      0 --:--:-- --:--:-- --:--:--  5001
 ~  python requests-threads-0.1.1/setup.py install
running install
running bdist_egg
running egg_info
creating requests_threads.egg-info
writing requests_threads.egg-info/PKG-INFO
writing dependency_links to requests_threads.egg-info/dependency_links.txt
writing requirements to requests_threads.egg-info/requires.txt
writing top-level names to requests_threads.egg-info/top_level.txt
writing manifest file 'requests_threads.egg-info/SOURCES.txt'
file requests_threads.py (for module requests_threads) not found
reading manifest file 'requests_threads.egg-info/SOURCES.txt'
writing manifest file 'requests_threads.egg-info/SOURCES.txt'
installing library code to build/bdist.macosx-10.13-x86_64/egg
running install_lib
running build_py
```

python  /Users/kenne…  ⌘1

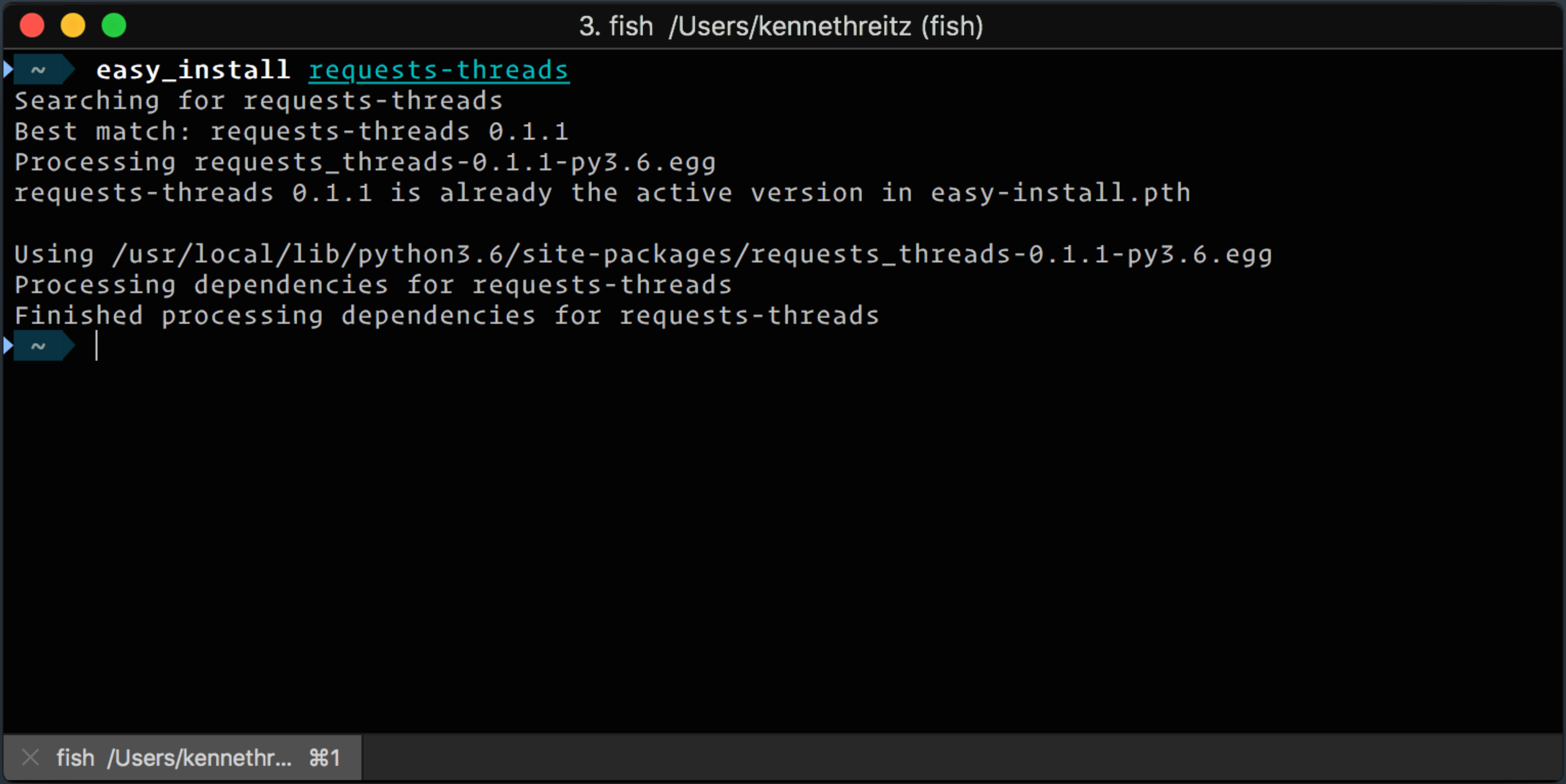
## Problems with this

- “The Cheeseshop” (e.g. PyPi) was merely an index of packages, not a sole package host.
- Packages were often hosted elsewhere.
- It was running on a single server in Sweden, serving the entire Python community.
- Its use wasn’t a fraction of what it is

## More Obvious Problems

- Very manual process; Not good for automation.
- Globally installed packages, impossible to have two versions of the same library installed.
- People often just copied things into site-packages, manually.

## Next Iteration


3. fish /Users/kennethreitz (fish)
fish /Users/kennethr... ⌘1

```
~  easy_install requests-threads
Searching for requests-threads
Best match: requests-threads 0.1.1
Processing requests_threads-0.1.1-py3.6.egg
requests-threads 0.1.1 is already the active version in easy-install.pth

Using /usr/local/lib/python3.6/site-packages/requests_threads-0.1.1-py3.6.egg
Processing dependencies for requests-threads
Finished processing dependencies for requests-threads
~
```

# Improvements!

- Much better user experience for installation.
- Most packages were installed from PyPi.
- Easier to automate programatically.
- But, no easy_uninstall.

## Today’s World

# 2010 Onward…

- Pip became the de-facto replacement for easy_install, for managing packages.
- Virtualenv became common practice.
- Pinned requirements.txt files passed around.

## Virtualenv

- Creates isolated “Python Homes” for packages to be installed in, one for each project.
- Very powerful concept, allows for extreme flexibility. Unique to the Python community.
- This is less important for Ruby, because multiple versions of Gems can be installed at the same time on the same

## Pip: Package Manager

- Resolves, Downloads, Installs & Uninstalls Python packages from Package Indexes or arbitrary URLs.
- Utilizes requirements.txt files.
- Manipulates virtual environments.

This practice continues todav.

## Other Communities

- Node.js: yarn & npm (lockfile)
- PHP: Composer (lockfile)
- Rust: Cargo (lockfile)
- Ruby: Bundler (lockfile)
- Python: pip + virtualenv (no lockfile?)

## The Problem

## Venv: Downsides

- Difficult to understand abstraction layer.
- Headache for new–comers, increasing the barrier to entry.
- Very manual process, easy to automate, but unnatural to use manually.
- Tools like virtualenv-wrapper exist to ease this process.

## requirements.txt

- $ pip freeze > requirements.txt
- Impedance mismatch: “what you want installed” vs. “what you need” installed.
- A pre-flattened dependency tree is required in order to establish deterministic builds.

# requirements.txt

```
$ cat requirements.txt


click==6.7
Flask==0.12.2
itsdangerous==0.24
Jinja2==2.10
MarkupSafe==1.0
Werkzeug==0.14.1
```

- Deterministic.
- Result of “pip freeze”.
- All-inclusive of transitive dependencies.
- Difficult to know “what’s going on”.

# requirements.txt

```
$ cat requirements.txt

Flask
```

- Non–deterministic.
- A representation of the actual requirements.
- Human readable/ understandable.
- Does function “properly”.

What you want?

vs.

What you need.

## No Lockfile!

## The Solution

## The Lockfile!

## Two Types of Deps…

- What you want: unpinned dependencies, highest level deps only (e.g. “Flask”).
- What you need: pinned dependencies, all-inclusive of transitive dependencies (e.g. all the things).

# Two Requirements Files

- One with “what you want”, e.g. unpinned dependencies, highest level deps only.
- One with “what you need”, e.g. pinned dependencies, all-inclusive of transitive dependencies.

# Two Requirements Files

```
$ cat requirements-to-freeze.txt


Flask
```

```
$ cat requirements.txt


click==6.7
Flask==0.12.2
itsdangerous==0.24
Jinja2==2.10
MarkupSafe==1.0
Werkzeug==0.14.1
```

**See also: pip-tools (requirements.in, requirements.txt)**

Not a real solution.

## The Real Solution

## Pipfile

## Pipfile: New Standard

- Pipfile is the new standard, replacing requirements.txt, in the future.
- TOML, so easy to read/write manually.
- Two groups: [packages] & [dev-packages].
- Will eventually land in pip proper.

## Example Pipfile

```
$ cat Pipfile


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


[packages]
flask = "*"


[dev-packages]
pytest = "*"
```

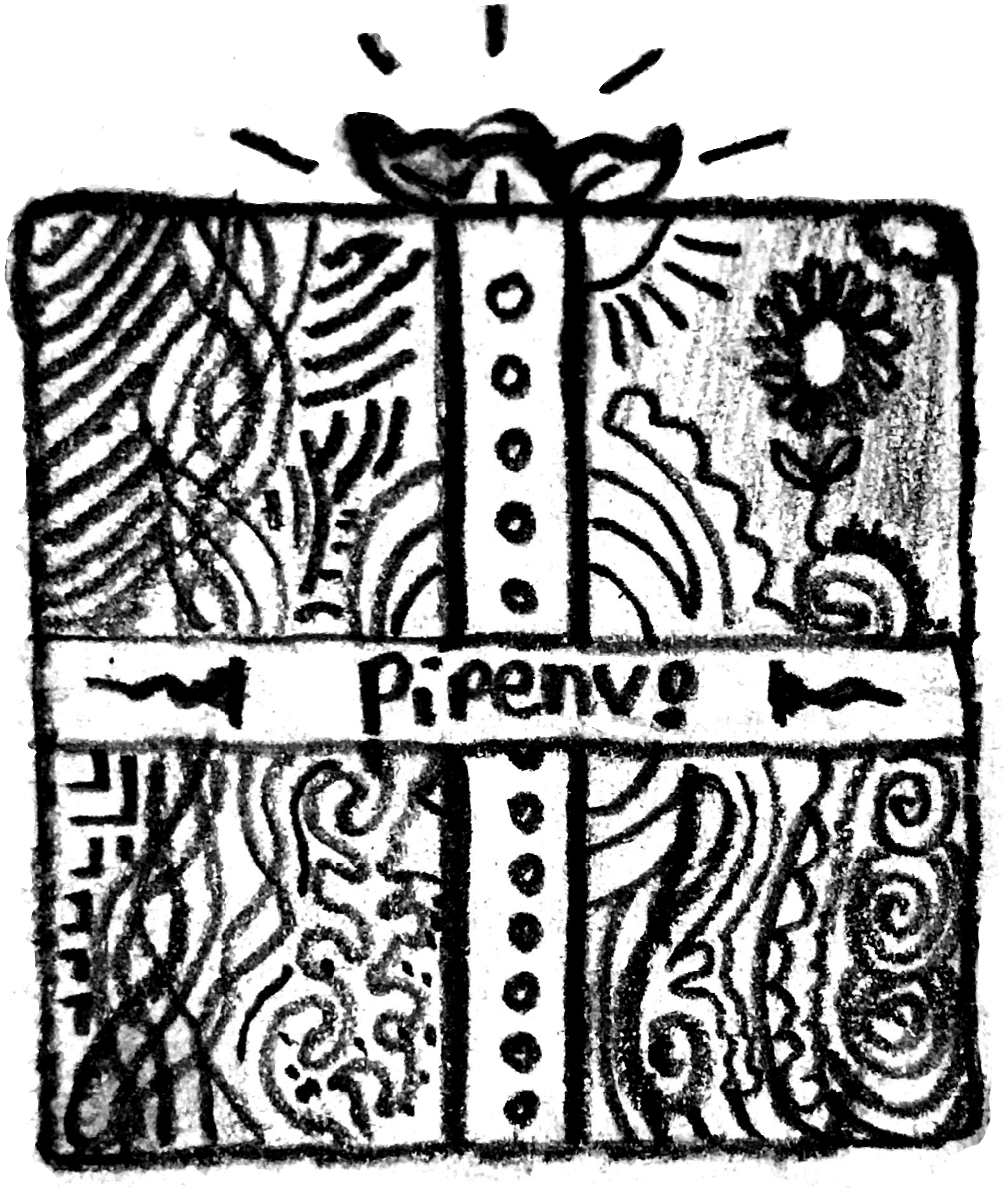
## Resulting Pipfile.lock

- JSON, so easily machine-parsable.
- Contains all transitive dependencies, pinned, with all acceptable hashes for each release.
- Two groups: “default” & “develop”.

```
$ cat Pipfile.lock
{
    "_meta": {
        "hash": {
            "sha256": "bdf5339d86cd6b5cc71e6293cbd509572776e1e1957b109fe8963a9bc5bbaf41"
        },
        ...
    "default": {
        "click": {
            "hashes": [
                "sha256:29f99fc6125fbc931b758dc053b3114e55c77a6e4c6c3a2674a2dc986016381d",
                "sha256:f15516df478d5a56180fbf80e68f206010e6d160fc39fa508b65e035fd75130b"
            ],
            "version": "==6.7"
        },
        "flask": {
            "hashes": [
                "sha256:0749df235e3ff61ac108f69ac178c9770caeaccad2509cb762ce1f65570a8856",
                "sha256:49f44461237b69ecd901cc7ce66feea0319b9158743dd27a2899962ab214dac1"
            ],
            "version": "==0.12.2"
        },
        "itsdangerous": {
            "hashes": [
                "sha256:cbb3fcf8d3e33df861709ecaf89d9e6629cff0a217bc2848f1b41cd30d360519"
```

## Pipfile: Problems

- Pipfile is not yet integrated into pip, and it will likely take quite a long time for this to happen, due to resource constraints.
- But, you can use it today, with…


Pipenv!

# Pipenv Sales Pitch

- Officially recommended tool from python.org.
- Lets you use Pipfile/Pipfile.lock today.
- Automates away virtualenv entirely.
- Ensures deterministic builds, *including* hash check verification upon installation.

*Pipenv* is the porcelain I always wanted to build for pip. It fits my brain and mostly replaces virtualenvwrapper and manual pip calls for me. Use it.

— Jannis Leidel (former pip maintainer)

Pipenv is finally an abstraction meant to engage the mind instead of merely the filesystem.

— Justin Myles Holmes

## DEMO (Q&A)

## Thank you!

*kennethreitz.org/values*