Third-Party Packages

May 16, 2017

Overview

Overview

Package Management

Third Party Packages

Package Management

Python Package Management

Python Package Management

PyPI

`pip`

Python Package Index (PyPI)

Repository of software for the Python programming language

Python Package Index (PyPI)

Python Package Index (PyPI)

Python 3 Packages

Python Package Index (PyPI)

23,000+

Python 3 Packages

Python Package Index (PyPI)

Top 360 packages ported to Python 3

Python Package Index (PyPI)

343/360

Top 360 packages ported to Python 3

Python Package Index (PyPI)

Python Files

Python Package Index (PyPI)

500,000+

Python Files

TL;DR: If you want it, PyPI probably has it

Python Package Index (PyPI)

`pip`
the Python package manager

Installing Python Packages

Installing Python Packages

`pip` is the preferred Python package manager

Use `pip`!

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When you can, use `pip` instead of:

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`easy_install` - the old way to install packages

Installing Python Packages

`pip` is the preferred Python package manager

Use `pip`!

When you can, use `pip` instead of:

`conda` - less flexible, less supported by the community

`easy_install` - the old way to install packages

`python setup.py install` - build package from source

Using `pip` - common commands

Using `pip` - common commands

```
# Install/Uninstall a package
$ pip install package_name
$ pip uninstall package_name
```

Using `pip` - common commands

```
# Install/Uninstall a package
$ pip install package_name
$ pip uninstall package_name

# Upgrade an existing package to the newest version
$ pip install --upgrade package_name
```

Using `pip` - common commands

```
# Install/Uninstall a package
$ pip install package_name
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# Upgrade an existing package to the newest version
$ pip install --upgrade package_name

# Install from requirements file
$ pip freeze > requirements.txt
$ pip install -r requirements.txt
```

Using `pip` - common commands

```
# Install/Uninstall a package
$ pip install package_name
$ pip uninstall package_name

# Upgrade an existing package to the newest version
$ pip install --upgrade package_name

# Install from requirements file
$ pip freeze > requirements.txt
$ pip install -r requirements.txt
```

```
# File: requirements.txt
...
ipython==4.2.0
matplotlib==1.5.1
numpy==1.11.0
pandas==0.18.0
pep8==1.7.0
Pillow==3.2.0
requests==2.9.1
scipy==0.17.0
...
```

Using `pip` - uncommon commands

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```
# Install to Python user-specific install directory
$ pip install --user package_name
```

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# Require specific versions to be installed
$ pip install "package_name==4.1.0"
$ pip install "package_name >= 1.0, != 1.4.0, < 2.0"
```

Using `pip` - uncommon commands

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$ pip install --user package_name

# Require specific versions to be installed
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# Show information about a particular package
$ pip show package_name
```

Using `pip` - uncommon commands

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# Show information about a particular package
$ pip show package_name

# Search PyPI for matching packages
$ pip search query
```

Time-Out for Announcements

Assignment 2

Assignment 2

The Quest for the Holy Grail has finished!

Assignment 2

The Quest for the Holy Grail has finished!

Many knights trained dragons and concocted potions.

Assignment 2

The Quest for the Holy Grail has finished!

Many knights trained dragons and concocted potions.

In total, 11 valiant knights recovered the missing grail.

Assignment 3

Assignment 3

Stylize – Recipe Book

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Starter code is 100% functional, but terribly written

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Your goal: fix the Python style and program design

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The starter code is ✓+/– for functionality/style

Assignment 3

Stylize – Recipe Book

Starter code is 100% functional, but terribly written

Your goal: fix the Python style and program design

The starter code is ✓+/– for functionality/style

Released tonight

Assignment 3

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Stylize – Alternate Challenge

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Find poorly written, functional Python code in the wild

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- Other courses, open source projects, existing tools

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With owner's permission, rewrite codebase for style

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Stylize – Alternate Challenge

Find poorly written, functional Python code in the wild

- Other courses, open source projects, existing tools

With owner's permission, rewrite codebase for style

Unusual – must check with course staff, IP law, etc.

Assignment 3

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Stylize – Bonus Challenge (Code Golf)

Assignment 3

Stylize – Bonus Challenge (Code Golf)

How short can you make the Recipe Book?

Assignment 3

Stylize – Bonus Challenge (Code Golf)

How short can you make the Recipe Book?

Toss style out the window – the fewer letters, the better

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Must maintain all functionality as before

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Stylize – Bonus Challenge (Code Golf)

How short can you make the Recipe Book?

Toss style out the window – the fewer letters, the better

Must maintain all functionality as before

Beat us, and immediately get a ✓+/✓+ on the assignment

Assignment 4

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Final Project (Preview)

Assignment 4

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Groups of up to three

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Incorporate Python in some meaningful way

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Proposal (Google Form) by EOD Thursday + Final Project

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Can be a final project for another class / thesis (with OK)

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Final Project (Preview)

Groups of up to three

Incorporate Python in some meaningful way

Proposal (Google Form) by EOD Thursday + Final Project

Can be a final project for another class / thesis (with OK)

- But we'll grade you on Python-specific practices

Back to Python!

The Very Best*
Third-Party Packages

Disclaimer

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Absurd number of Python packages

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Some broadly applicable, some narrowly applicable

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As before, assume all required imports are performed

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As before, assume all required imports are performed

"Show-and-tell" slides - up to you to dive into the tools!

requests: HTTP for Humans

Quick Start

Requests

Requests

```
# A simple GET request
response = requests.get('https://api.example.com/users')
```

Requests

```
# A simple GET request
response = requests.get('https://api.example.com/users')
if response.ok:
    raw_data = response.content
    json_data = response.json()  # If server response is in JSON format
```

Requests

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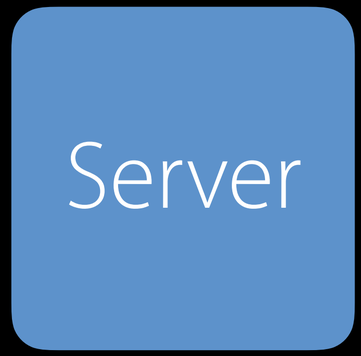

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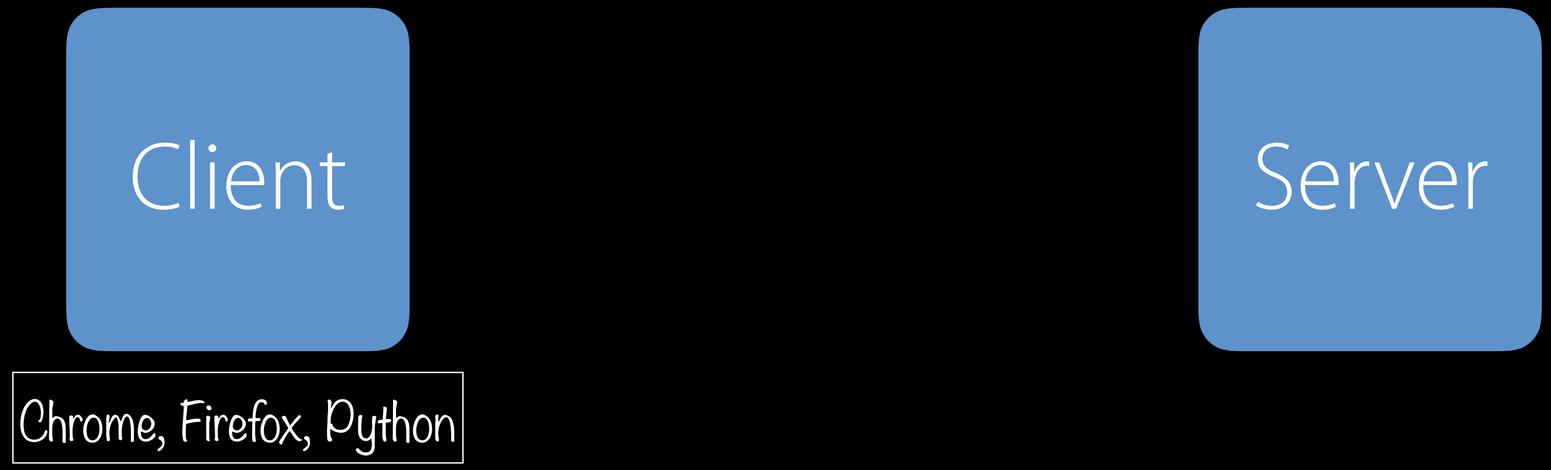

Requests

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response = requests.get('https://api.example.com/users')
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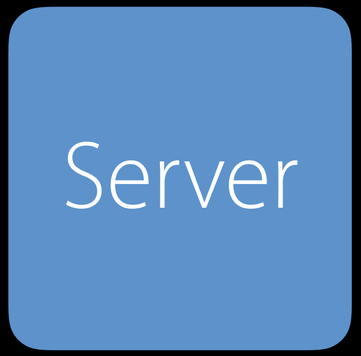
Chrome, Firefox, Python



facebook.com, google.com, stanford.edu

Requests

```
# A simple GET request
response = requests.get('https://api.example.com/users')
if response.ok:
    raw_data = response.content
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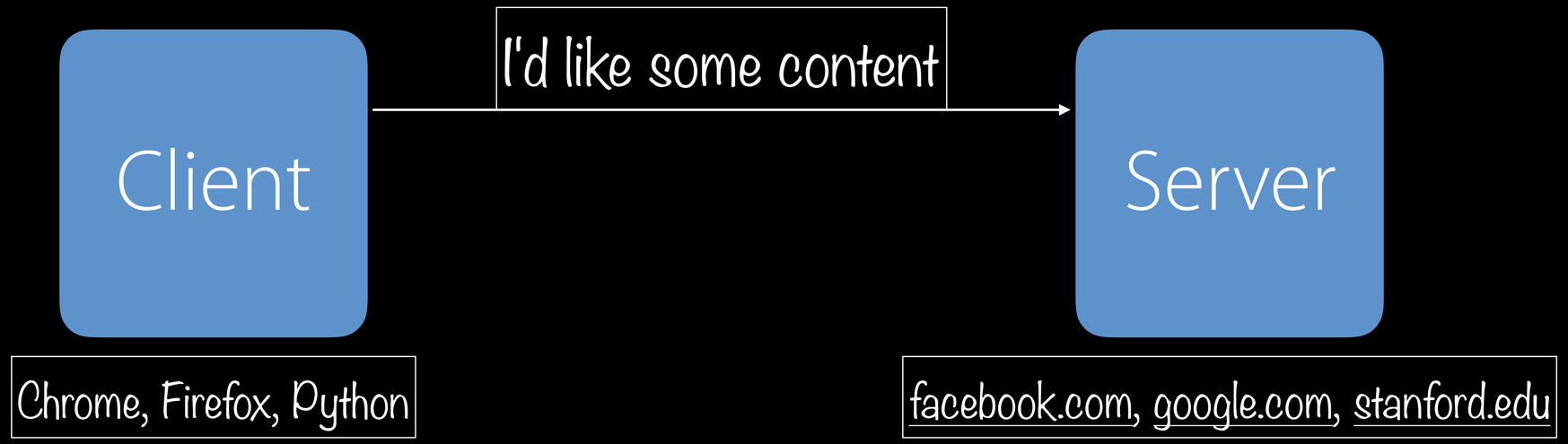
```



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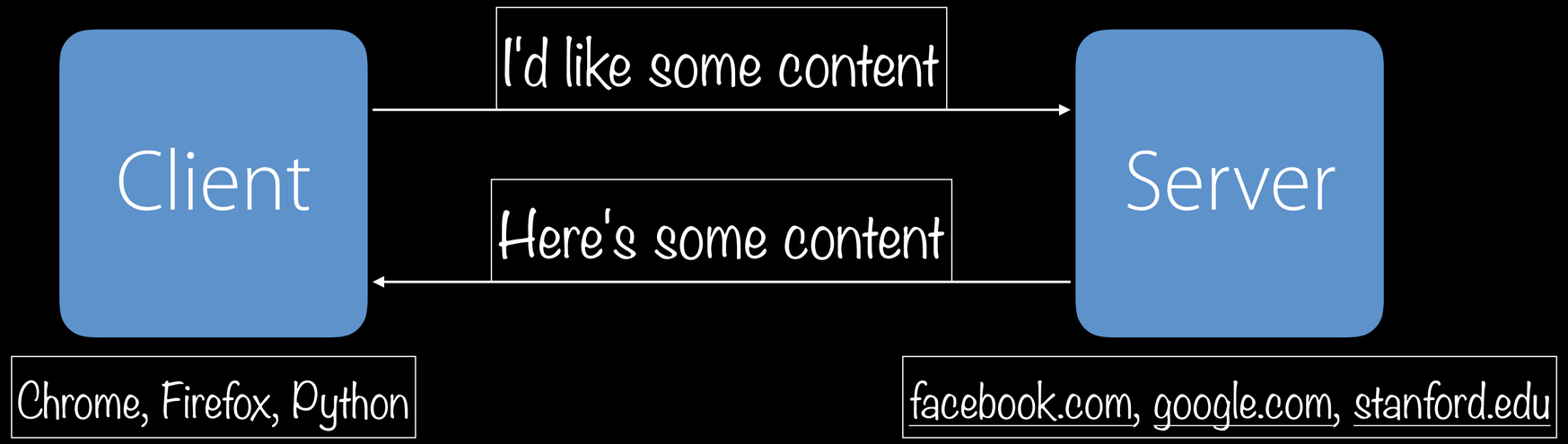


Requests

Requests

```
# GET with params
payload = {'name': 'sredmond', 'field': ['email', 'org']}
```

Requests

```
# GET with params
payload = {'name': 'sredmond', 'field': ['email', 'org']}
response = requests.get('https://api.example.com/users', params=payload)
```

Requests

```
# GET with params
payload = {'name': 'sredmond', 'field': ['email', 'org']}
response = requests.get('https://api.example.com/users', params=payload)
print(response.url)
# => https://api.example.com/users?name=sredmond&field=email&field=org
```

Requests

```
# GET with params
payload = {'name': 'sredmond', 'field': ['email', 'org']}
response = requests.get('https://api.example.com/users', params=payload)
print(response.url)
# => https://api.example.com/users?name=sredmond&field=email&field=org

# POST with params
payload = {'username': 'sredmond', 'password': 'pyth0n'}
```

Requests

```
# GET with params
payload = {'name': 'sredmond', 'field': ['email', 'org']}
response = requests.get('https://api.example.com/users', params=payload)
print(response.url)
# => https://api.example.com/users?name=sredmond&field=email&field=org

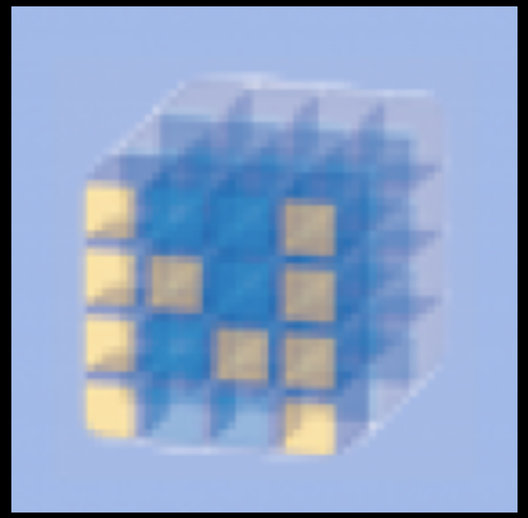
# POST with params
payload = {'username': 'sredmond', 'password': 'pyth0n'}
response = requests.post('https://api.example.com/login', data=payload)
```

Example: /r/sneks

Intro to Scientific Python

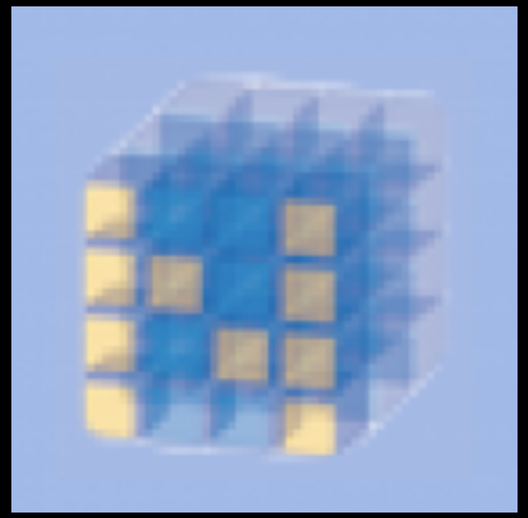
CME 193 for more

NumPy (Numerical Python)



NumPy (Numerical Python)

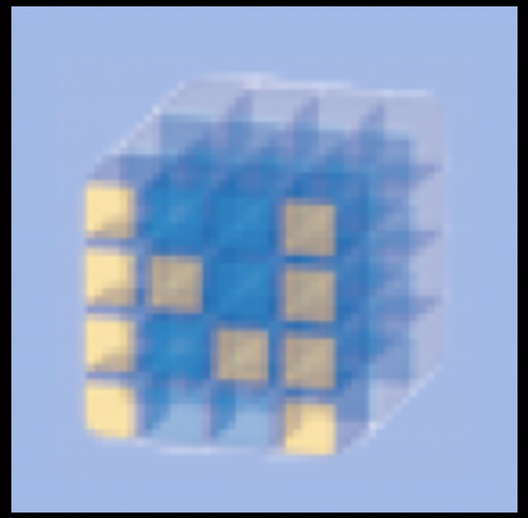
N-dimensional array object



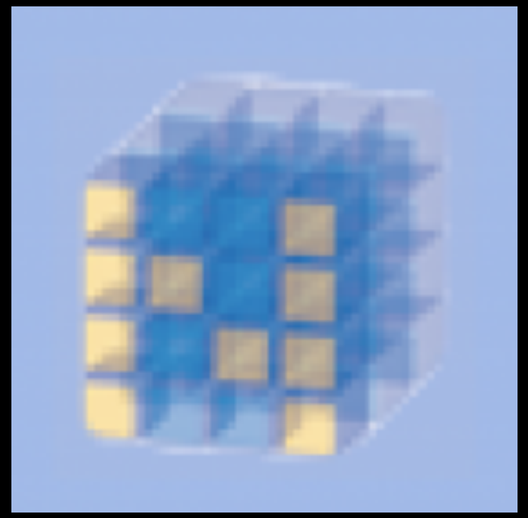
NumPy (Numerical Python)

N-dimensional array object

Sophisticated functions



NumPy (Numerical Python)



- N-dimensional array object
- Sophisticated functions
- Capabilities
  - Linear algebra
  - Fourier transform
  - Random sampling
- Docs

Using **numpy**

Using **numpy**

```
a = np.arange(15).reshape(3, 5)
```

Using **numpy**

```
a = np.arange(15).reshape(3, 5)
print(a)
# array([[ 0,  1,  2,  3,  4],
#        [ 5,  6,  7,  8,  9],
#        [10, 11, 12, 13, 14]])
```

Using **numpy**

```
a = np.arange(15).reshape(3, 5)
print(a)
# array([[ 0,  1,  2,  3,  4],
#        [ 5,  6,  7,  8,  9],
#        [10, 11, 12, 13, 14]])

a.shape  # => (3, 5)
a.ndim  # => 2
a.dtype.name  # => 'int64'
type(a)  # => numpy.ndarray
```

Using **numpy**

```
a = np.arange(15).reshape(3, 5)
print(a)
# array([[ 0,  1,  2,  3,  4],
#        [ 5,  6,  7,  8,  9],
#        [10, 11, 12, 13, 14]])

a.shape  # => (3, 5)
a.ndim  # => 2
a.dtype.name  # => 'int64'
type(a)  # => numpy.ndarray

print(a[:, 1])  # => array([ 1,  6, 11])
```

Using **numpy**

Using **numpy**

```
a = np.array([3, 4, 5])
a + 4  # => array([7, 8, 9])
a * 1.5  # => array([ 4.5,  6. ,  7.5])
```

Using **numpy**

```
a = np.array([3, 4, 5])
a + 4  # => array([7, 8, 9])
a * 1.5  # => array([ 4.5,  6. ,  7.5])

b = np.array([4, -1, 0])
np.dot(a, b)  # => 8 (= 3 * 4 + 4 * -1 + 5 * 0)
a.sum()  # => 12
```

Using **numpy**

```
a = np.array([3, 4, 5])
a + 4  # => array([7, 8, 9])
a * 1.5  # => array([ 4.5,  6. ,  7.5])

b = np.array([4, -1, 0])
np.dot(a, b)  # => 8 (= 3 * 4 + 4 * -1 + 5 * 0)
a.sum()  # => 12

space = np.linspace(0, 2 * np.pi, 100)
sinusoid = np.sin(b)
```

SciPy (Scientific Python)

SciPy (Scientific Python)

Everything you need for mathematics, science, and engineering.

Docs

```
from scipy import spatial, linalg
```

```
from scipy import spatial, linalg

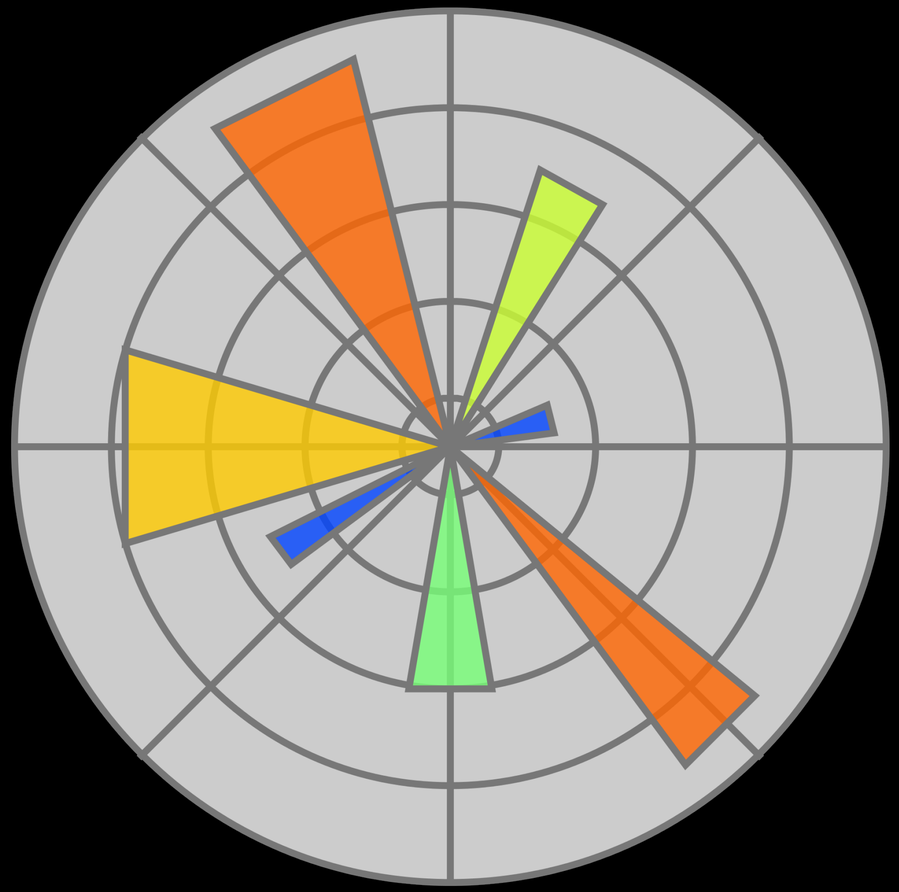
# Build a KD Tree
points = np.array([[0, 0], [0, 1], [1, 0], [1, 1]])
tree = spatial.KDTree(points)
tree.query([0.1, 0.1])  # => (0.14142135623730953, 0)
```

```
from scipy import spatial, linalg

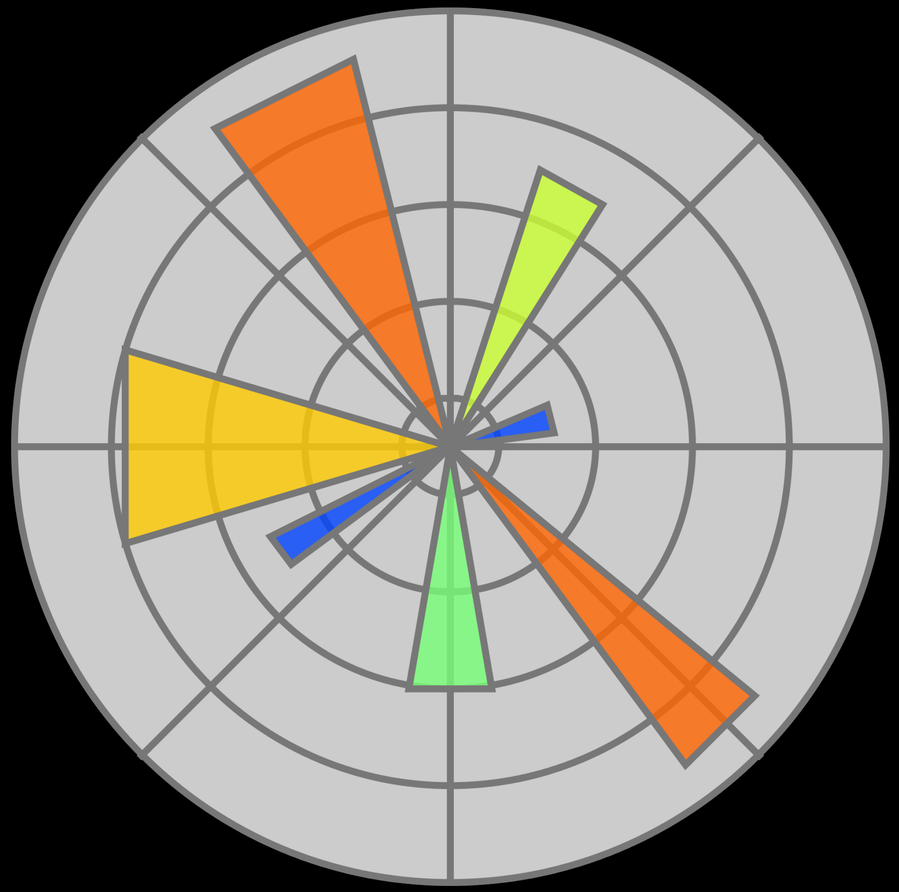
# Build a KD Tree
points = np.array([[0, 0], [0, 1], [1, 0], [1, 1]])
tree = spatial.KDTree(points)
tree.query([0.1, 0.1])  # => (0.14142135623730953, 0)

# Invert a matrix
A = np.array([[1, 2], [3, 4]])
print(linalg.inv(A))
# array([[-2. ,  1. ],
#        [ 1.5, -0.5]])
```

MatPlotLib + PyPlot



MatPlotLib + PyPlot



Python 2D Plotting Library

Think MATLAB + Python

Examples

Gallery

Using `pyplot`

Using `pyplot`

```
import numpy as np
import matplotlib.pyplot as plt
```

Using pyplot

```
import numpy as np
import matplotlib.pyplot as plt

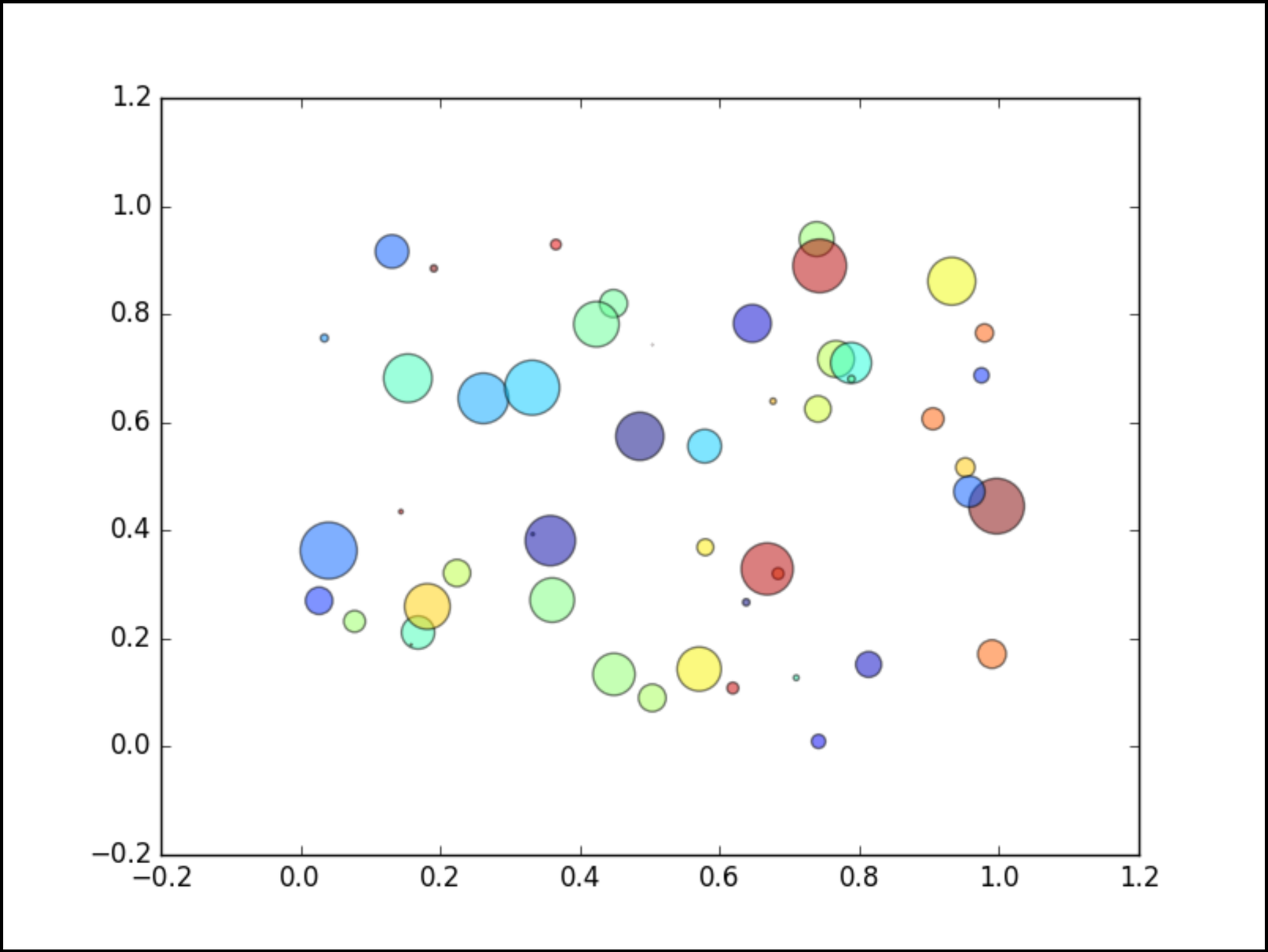
N = 50
x = np.random.rand(N)
y = np.random.rand(N)
colors = np.random.rand(N)
area = np.pi * (15 * np.random.rand(N))**2
```

Using pyplot

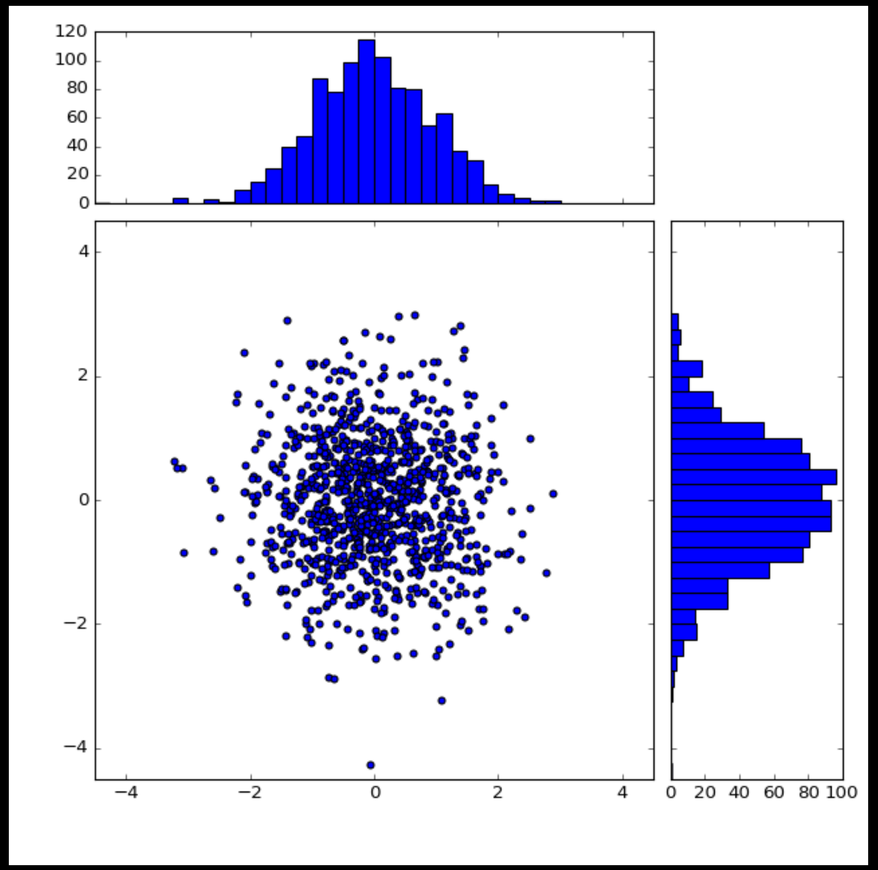
```
import numpy as np
import matplotlib.pyplot as plt

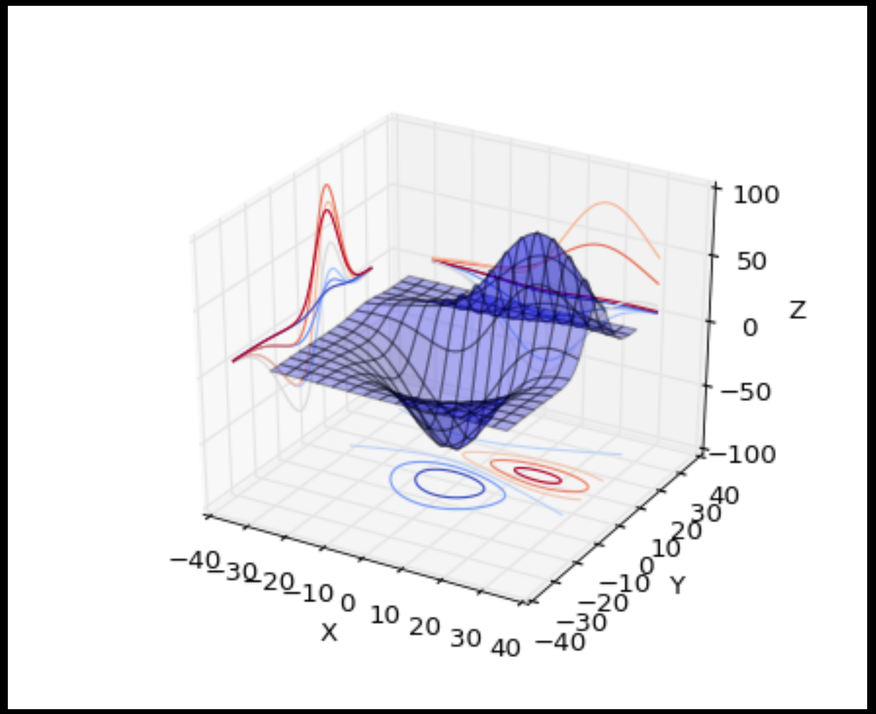
N = 50
x = np.random.rand(N)
y = np.random.rand(N)
colors = np.random.rand(N)
area = np.pi * (15 * np.random.rand(N))**2

plt.scatter(x, y, s=area, c=colors, alpha=0.5)
plt.show()
```


1.2
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.2
0.0
0.2
0.4
0.6
0.8
1.0
1.2

And Many More!





Shoutouts

Shoutouts

tensorflow (MI)

keras (Deep Learning)

scikit-learn (ML)

nltk (Natural Language)

Development Tools

PEP8 and AutoPEP8

Style Enforcers for PEP8 – Python's Style Guide

- PEP8 identifies errors
- AutoPEP8 fixes errors

PEP8 Intro

AutoPEP8 Source

Using PEP8 and AutoPEP8

Using PEP8 and AutoPEP8

```
# Print PEP8 errors
$ pep8 mystery.py
```

Using PEP8 and AutoPEP8

```
# Print PEP8 errors
$ pep8 mystery.py
mystery.py:18:1: E302 expected 2 blank lines, found 1
mystery.py:22:19: E231 missing whitespace after ':'
...
```

Using PEP8 and AutoPEP8

```
# Print PEP8 errors
$ pep8 mystery.py
mystery.py:18:1: E302 expected 2 blank lines, found 1
mystery.py:22:19: E231 missing whitespace after ':'
...

# Overwrites file.py for PEP8 compliance
$ autopep8 --in-place --aggressive --aggressive file.py
$
```

Web Frameworks

Flask

Lightweight

Beginner-friendly

WSGI by Werkzeug

Templating by Jinja2

Documentation

Flask Mega-Tutorial

Flask Hello World

File: hello.py

Flask Hello World

```
from flask import Flask
app = Flask(__name__)
```

File: hello.py

Flask Hello World

```
from flask import Flask
app = Flask(__name__)

@app.route("/")
def hello():
    return "Hello World!"
```

File: hello.py

Flask Hello World

```
from flask import Flask
app = Flask(__name__)

@app.route("/")
def hello():
    return "Hello World!"

if __name__ == "__main__":
    app.run(debug=True)
```

File: hello.py

Flask Hello World

Flask Hello World

```
# Run a local server
```

Flask Hello World

```
# Run a local server
$ python hello.py
```

Flask Hello World

```
# Run a local server
$ python hello.py
* Running on http://localhost:5000/
```

Django

"Batteries-included"

Heavily-configurable

Industry-standard

Overview

Tutorial

Django Hello World

Django Hello World

```
# polls/views.py
```

Django Hello World

```
# polls/views.py
from django.http import HttpResponse
```

Django Hello World

```
# polls/views.py
from django.http import HttpResponse
def index(request):
    return HttpResponse("Hello, world. You're at the polls index.")
```

Django Hello World

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# polls/views.py
from django.http import HttpResponse
def index(request):
    return HttpResponse("Hello, world. You're at the polls index.")

# polls/urls.py
```

Django Hello World

```
# polls/views.py
from django.http import HttpResponse
def index(request):
    return HttpResponse("Hello, world. You're at the polls index.")

# polls/urls.py
from django.conf.urls import url
from . import views
urlpatterns = [
    url(r'^$', views.index, name='index'),
]
```

Django Hello World

```
# polls/views.py
from django.http import HttpResponse
def index(request):
    return HttpResponse("Hello, world. You're at the polls index.")

# polls/urls.py
from django.conf.urls import url
from . import views
urlpatterns = [
    url(r'^$', views.index, name='index'),
]

# mysite/urls.py
from django.conf.urls import include, url
from django.contrib import admin

urlpatterns = [
    url(r'^polls/', include('polls.urls')),
    url(r'^admin/', include(admin.site.urls)),
]
```

Django Hello World

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```
$ python manage.py runserver
```

Twisted

Asynchronous, event-driven

Networking engine

Fast, but complicated

Echo Server

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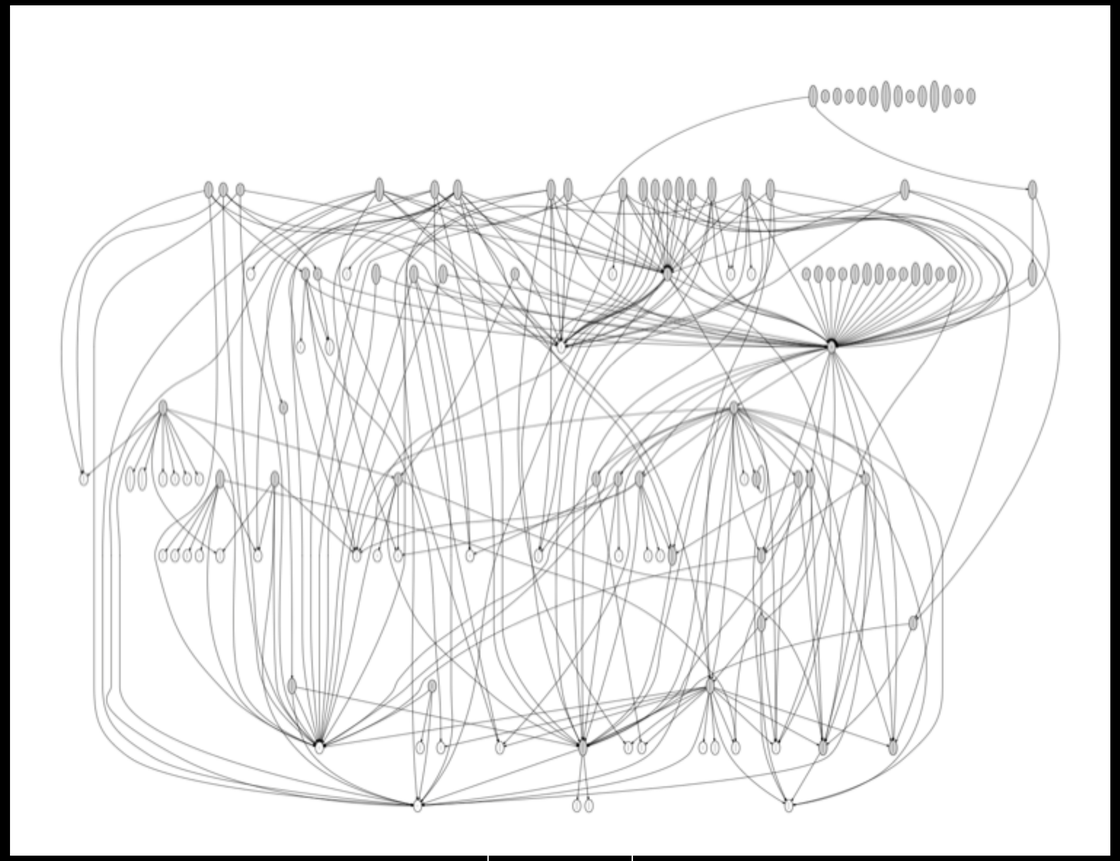
reactor.run()
```

Codebase Complexity

Codebase Complexity - `snakefood`

Module Dependencies

Codebase Complexity - `snakefood`



Flask

Module Dependencies

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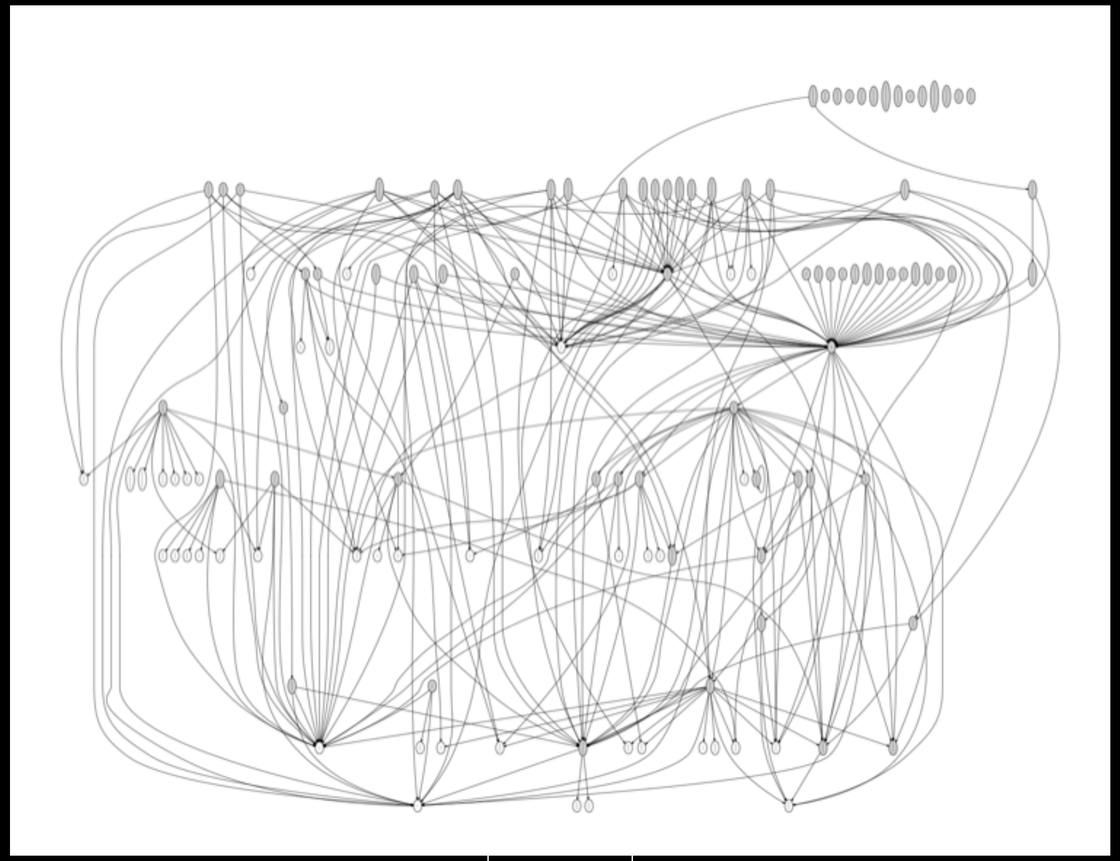
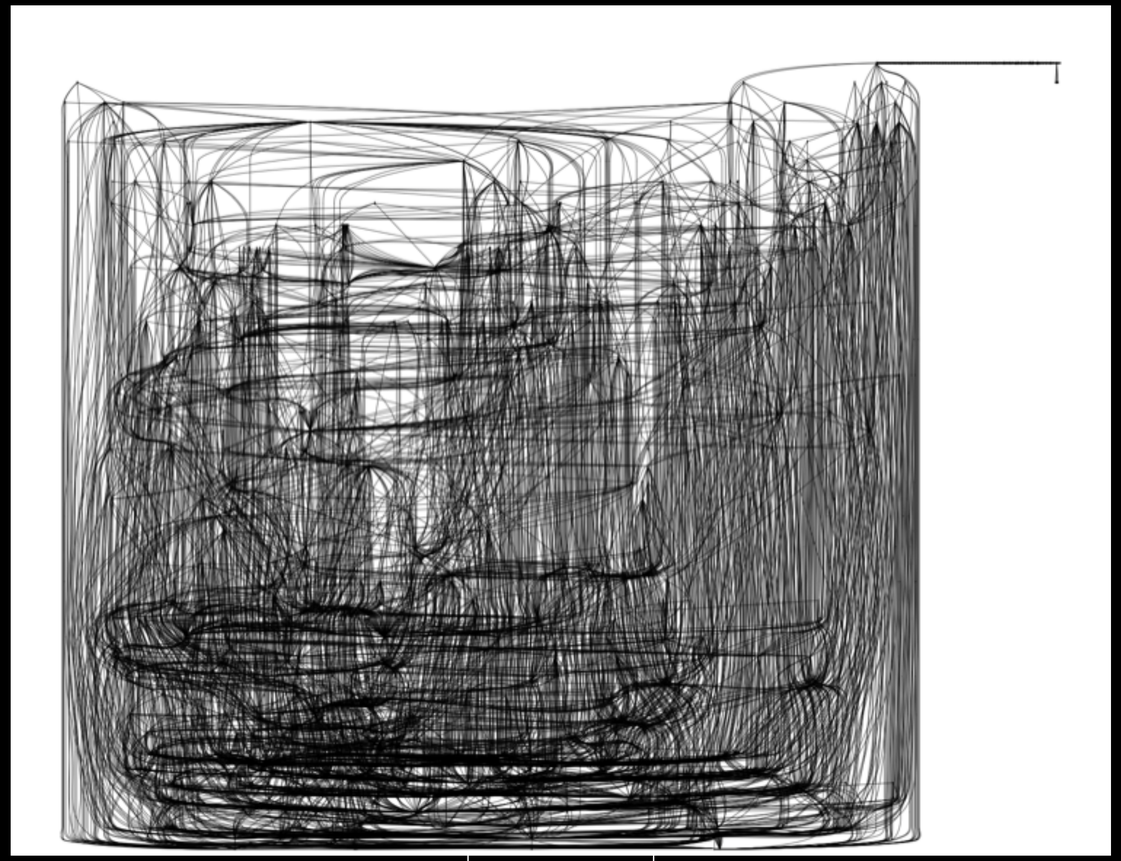


Flask



Django

Module Dependencies

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Complex

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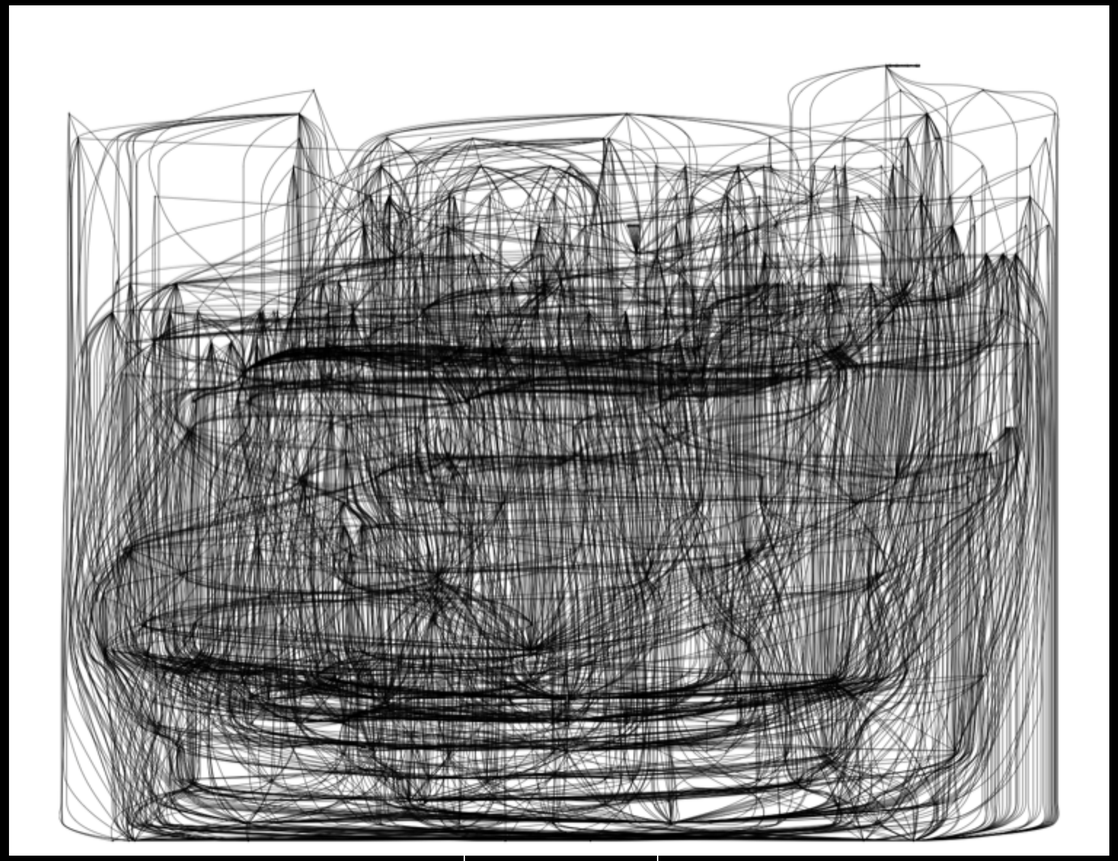

Twisted

Complex

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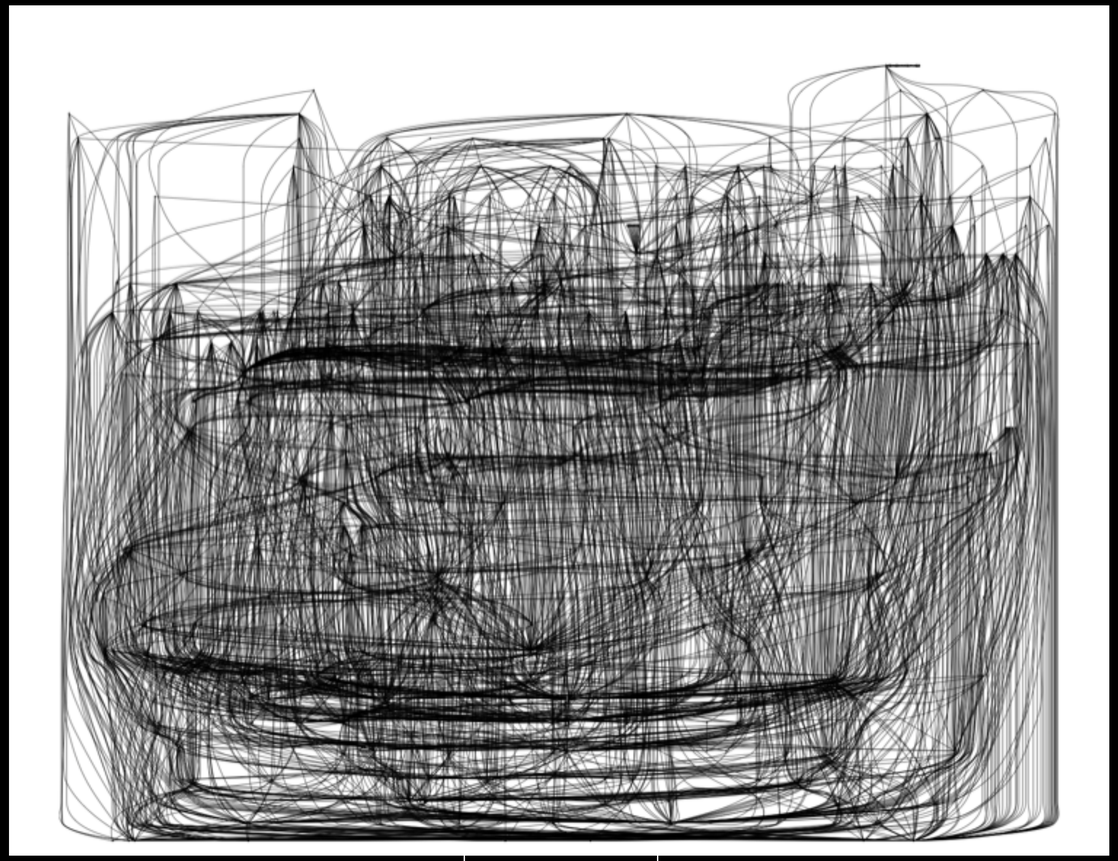

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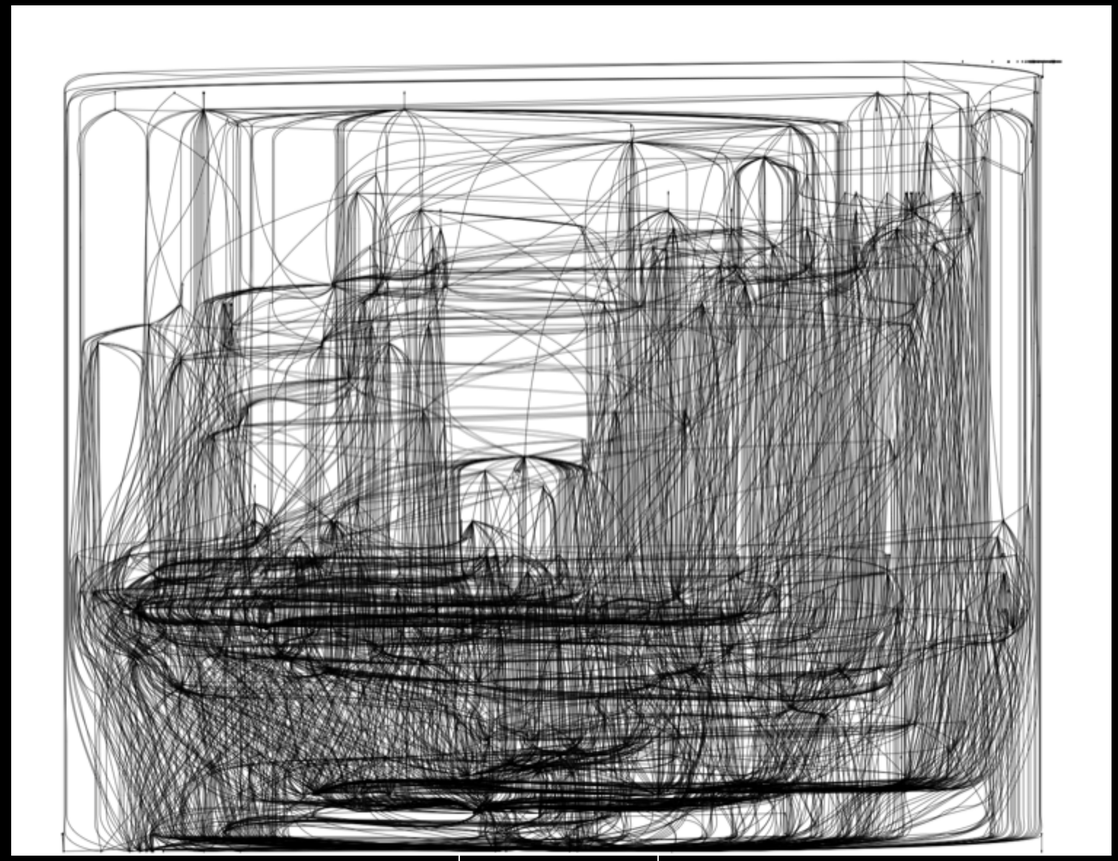

iPython

Complex

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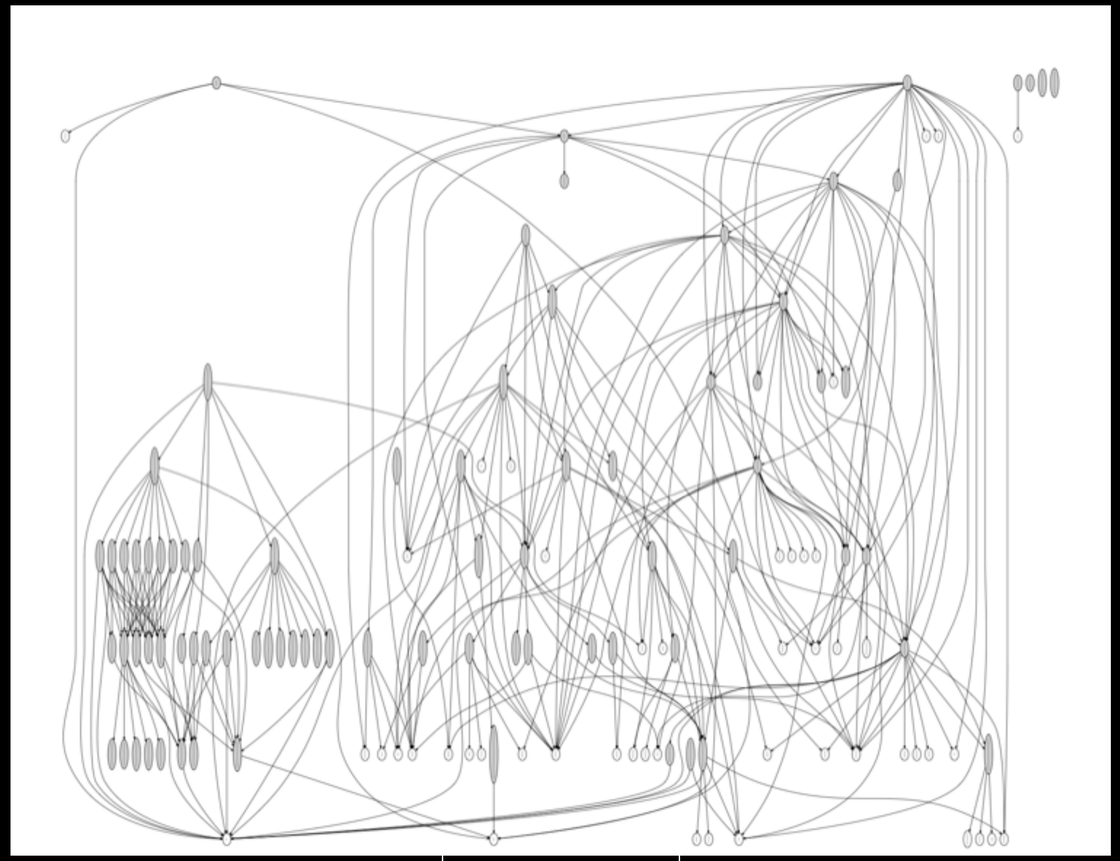

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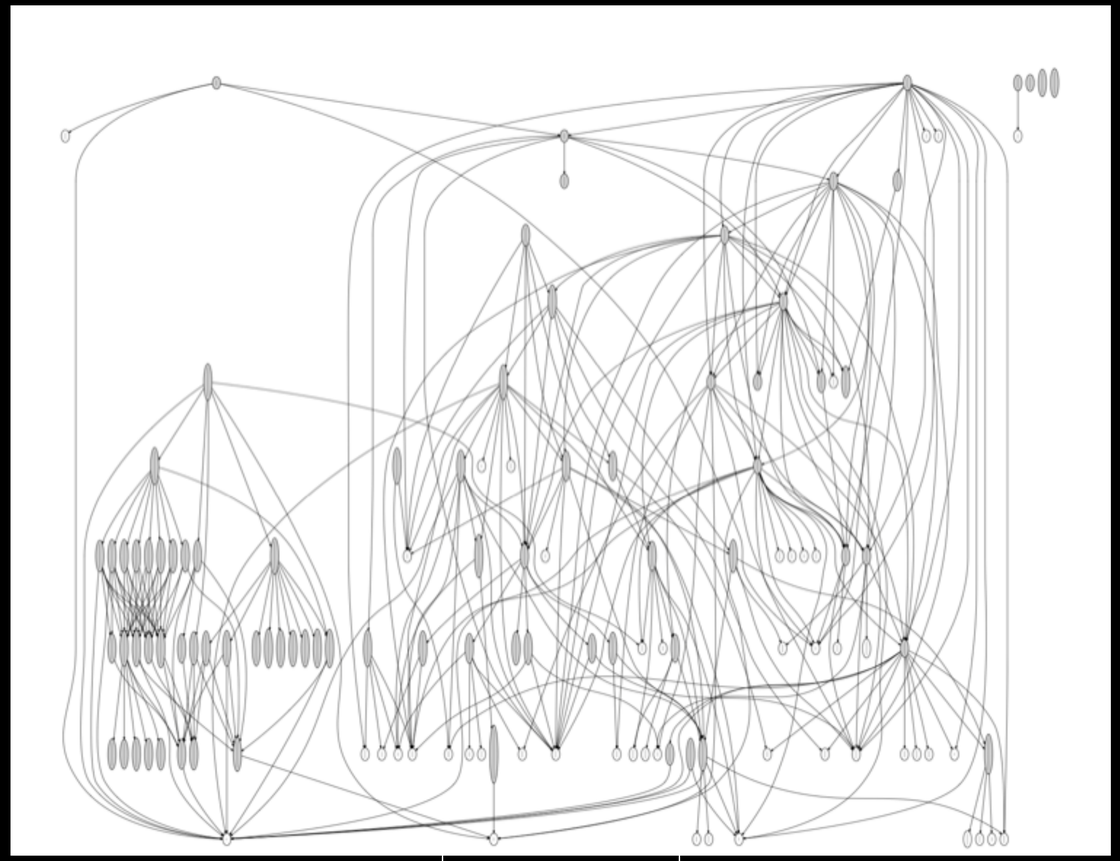

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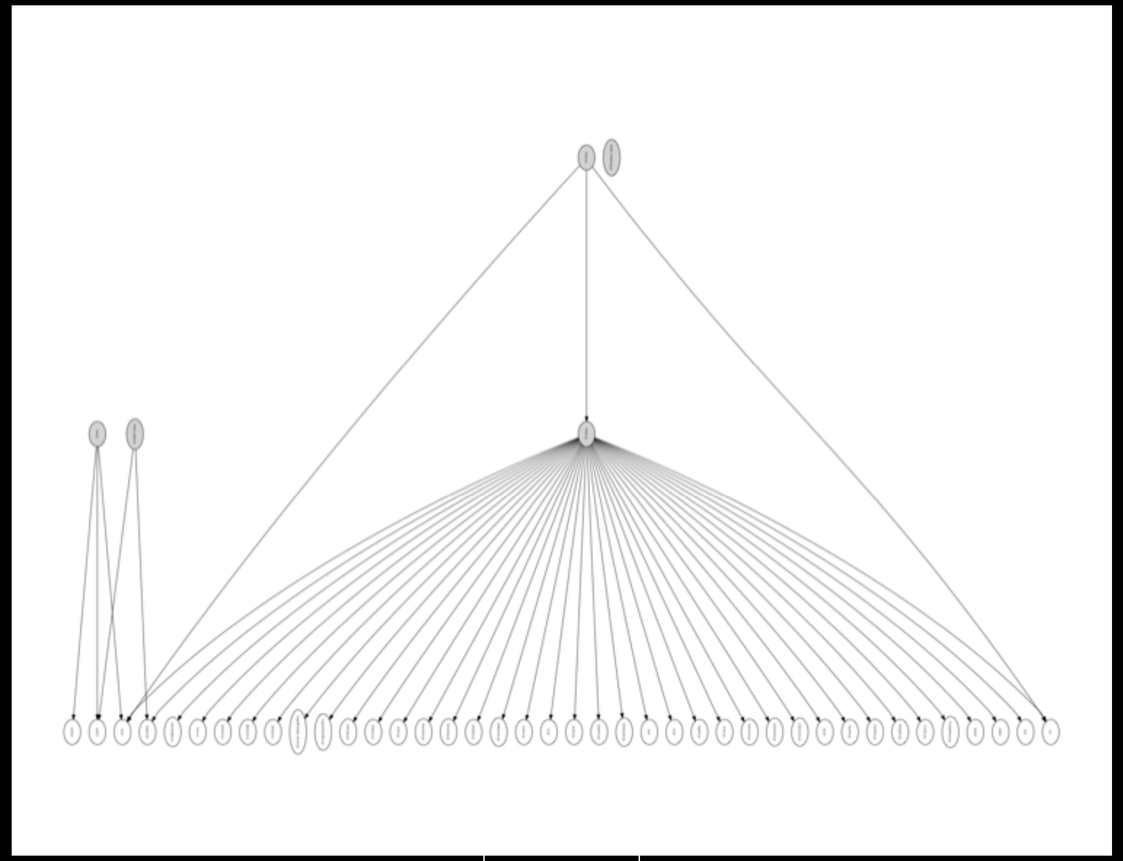

Bottle

Simple

Other Neat Packages

Extras

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Selenium – Automated web client

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Dateutil – Better date/time handling

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boto – Python interface to Amazon Web Services

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pygame – Basic game-playing tools.

Coming Soon?

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GOvals and GRects?

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(Extremely) alpha release

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Speak with us after class

What Now?

Build Build Build

Python has a strong open-source community - contribute!

What's available? Read the Standard Library

Exact Python specification? Read the Language Reference

Still have questions? Read the FAQ

Build something you love!

Next Time

Lab

Lab

Build a wallpaper scraper!

or… explore cool packages!

or… start a final project!

Next Week

Next Week

The Python Ecosystem

Python 2 vs. Python 3

Python Style

Joining a Python Codebase

Credit

Documentation for all these awesome libraries!

GrokCode for codebase complexity graphs```

FOSS community for making tools available.

PSF, of course.