

# Python Tutorial Series 2019

## Basics 3: Packages, Environments and Python Versions

Bruno C. Quint - [bquint@gemini.edu](mailto:bquint@gemini.edu)

Kenneth Anderson - [kanderso@gemini.edu](mailto:kanderso@gemini.edu)

SUSD - GEMINI South, La Serena, Chile



# Previously...

## Basics I

- What is Python?
- What will you need?
- Python as a terminal
- Python as a script
- Types of variables

1.  
[x,y]  
"abc"

## Basics II

- Code Flow
- Functions
- Classes
  - Methods
  - Attributes
- Sub-Classes

class  
def  
self  
if  
else  
for  
while



# Basics 3 – Table of Contents

- (Re)using code
  - Modules
  - Packages
- Python2 to Python3
- External packages
- Virtual Environments
- Conda and Anaconda

`--main--`

`--init--`

`setup.py`

`pip`

`conda`



# (Re)using code

# modules

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result
```



# (Re)using code

# modules

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result
```

```
In [1]: import my_module
```

```
In [2]: print(my_module.roll_dice())
2
```

```
In [3]: print(my_module.roll_dice())
5
```



# (Re)using code

# script

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

print('The dice gave me {}'.format(roll_dice()))
```



# (Re)using code

# script

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

print('The dice gave me {}')
```

```
In [1]: import my_module
         .format(roll_dice())
The dice gave me 6
```

```
In [2]: print(my_module.roll_dice())
3
```



# (Re)using code

# Special Variables

`__myvariable__`

Special variables start and end with double underscore

`__name__`

Stores the name of the scope being run.

`__main__`

Name of the top level scope in Python



# (Re)using code

## Special Variables

`__myvariable__`

Special variables start and end with double underscore

```
In [1]: print(__name__)
__main__
```

```
In [2]: import my_module
The dice gave me 2
```

```
In [3]: print(my_module.__name__)
my_module
```

`__main__` Name of the top level scope  
in Python



# (Re)using code

# script

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

print('The dice gave me {}'.format(roll_dice()))
```



# (Re)using code

# script

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

print('Current scope: {}'.format(__name__))
print('The dice gave me {}'.format(roll_dice()))
```



# (Re)using code

# script

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

print('Current scope: {}'.format(__name__))
print('The dice gave me {}'.format(roll_dice()))
```

```
$ python my_module.py
Current scope: __main__
The dice gave me 1
```



# (Re)using code

# script

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

if __name__ == '__main__':
    print('The dice gave me {}'.format(roll_dice()))
```



# (Re)using code

# script

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

if __name__ == '__main__':
    print('The dice gave me {}'.format(roll_dice()))
```

```
In [1]: import my_module
In [2]: print(my_module.roll_dice())
4
```



# (Re)using code good practice

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

if __name__ == '__main__':
    print('The dice gave me {}'.format(roll_dice()))
```



# (Re)using code good practice

```
#!/usr/bin/env python
""" This module, called my_module.py, contains a function
that simulates a six side dice roll """

import random

def main():
    print('The dice gave me {}'.format(roll_dice()))

def roll_dice():
    _min = 1
    _max = 6
    result = random.randint(_min, _max)
    return result

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



# (Re)using code

my\_project/

# packages



# (Re)using code

# packages

```
my_project/  
  └ my_package/
```



# (Re)using code

# packages

```
my_project/  
  └ my_package/  
    └ __init__.py
```



# (Re)using code

# packages

my\_project/

└ my\_package/

- └ \_\_init\_\_.py
- └ first\_module.py
- └ second\_module.py



# (Re)using code

# packages

```
my_project/
└── my_package/
    ├── __init__.py
    ├── first_module.py
    └── second_module.py
```

```
In [1]: import my_package
```

```
In [2]: my_package.first_module.my_function()
```

```
In [1]: from my_package import first_module
```

```
In [2]: first_module.my_function()
```



# (Re)using code

# packages

my\_project/

  └ my\_package/

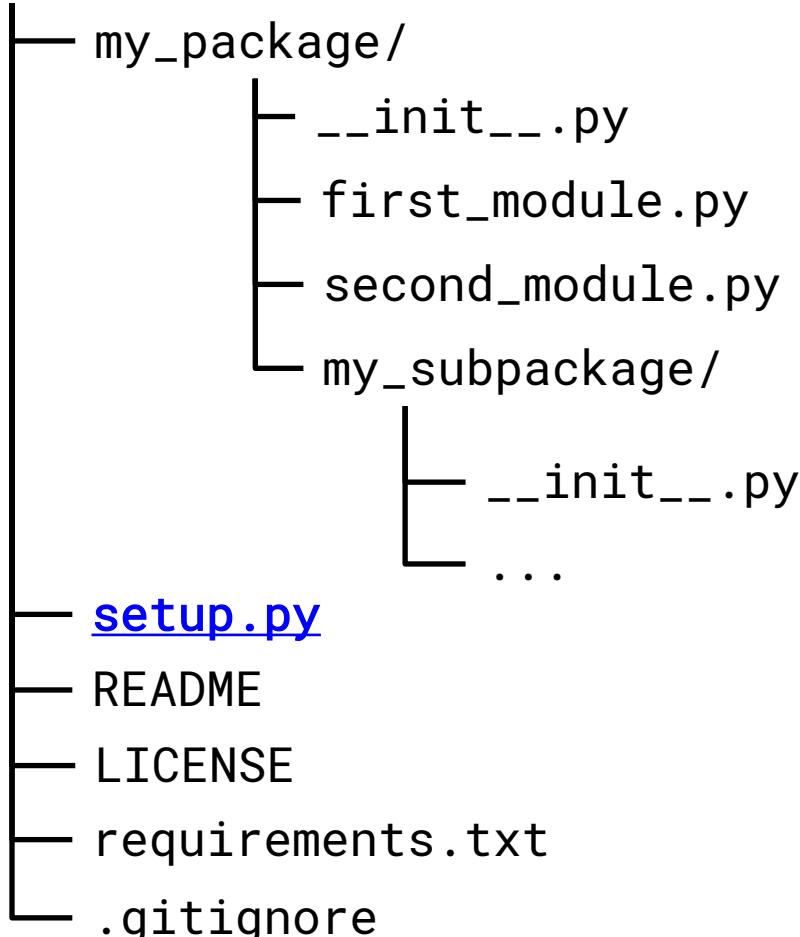
- ├ \_\_init\_\_.py
- ├ first\_module.py
- ├ second\_module.py
- └ my\_subpackage/
  - └ \_\_init\_\_.py
  - ...



# (Re)using code

# packages

my\_project/





# (Re)using code

# packages

my\_project/

```
  └── my_package/
        ├── __init__.py
        ├── first_module.py
        ├── second_module.py
        └── ...
  └── docs/
  └── tests/
  └── bin/
  └── setup.py
  └── README
  └── LICENSE
  └── requirements.txt
  └── .gitignore
```



# (Re)using code

# packages

my\_project/

```
  └── my_package/
        ├── __init__.py
        ├── first_module.py
        ├── second_module.py
        └── my_subpackage/
            ├── __init__.py
            └── ...
  └── setup.py
  └── README
  └── LICENSE
  └── requirements.txt
  └── .gitignore
```

setup.py

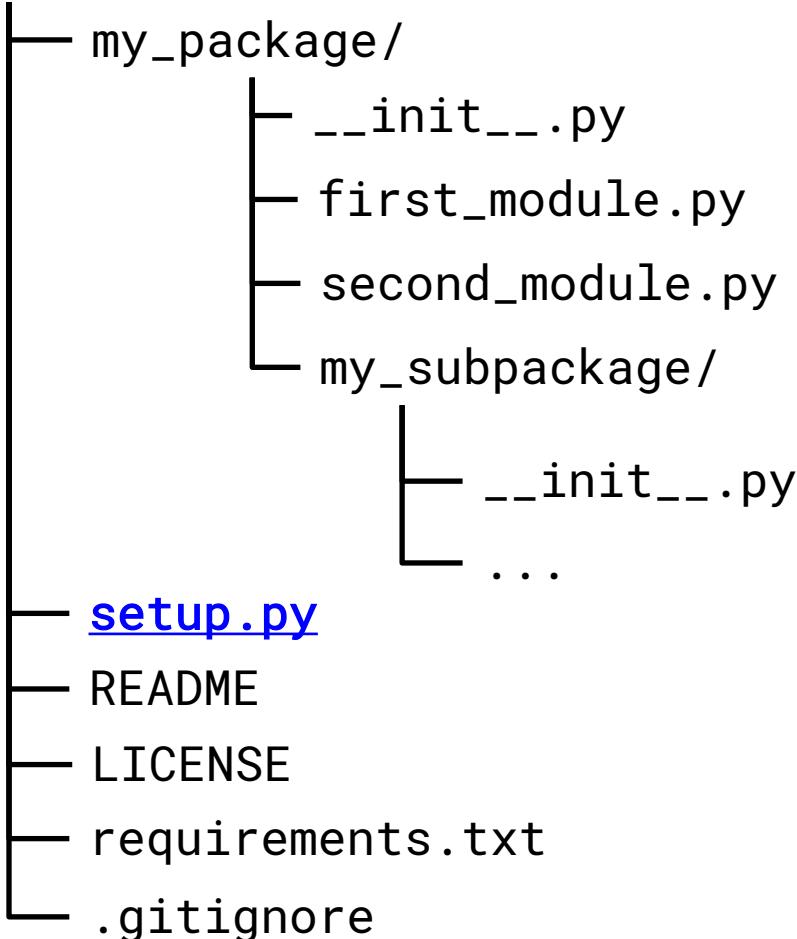
```
$ python setup.py install
```



# (Re)using code

# packages

my\_project/



setup.py

```
$ python setup.py install
```

pip

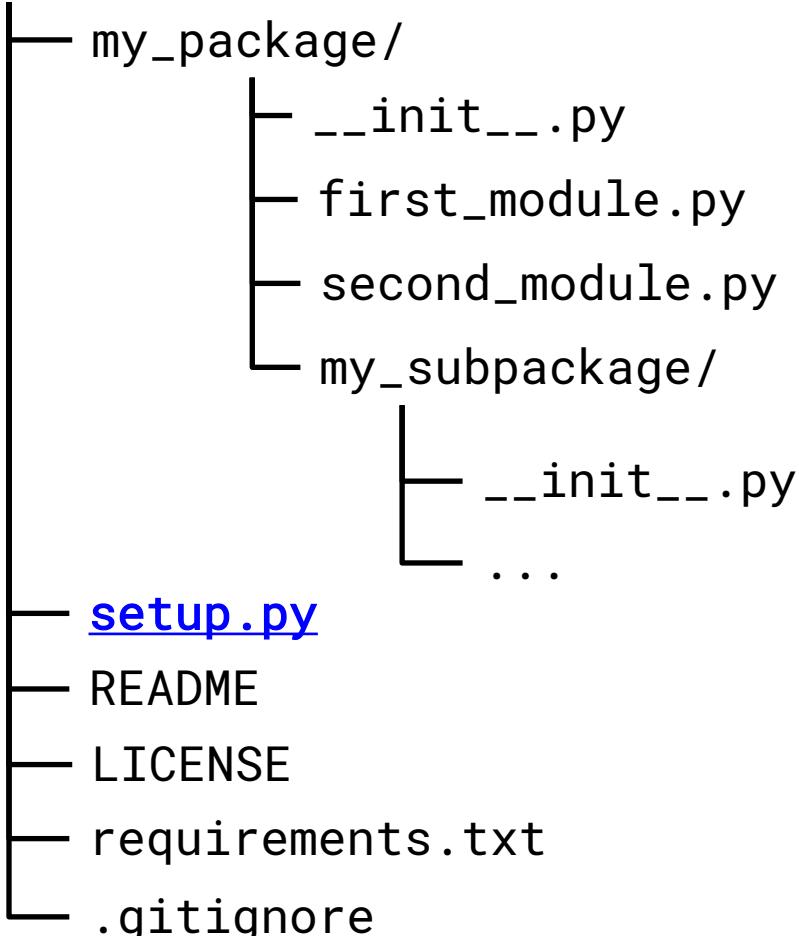
```
$ pip install .
```



# (Re)using code

# packages

my\_project/



setup.py

```
$ python setup.py install
```

pip

editable  
\$ pip install -e .  
good for development



# (Re)using code

# packages

my\_project/

```
  └── my_package/
        ├── __init__.py
        ├── first_module.py
        ├── second_module.py
        └── my_subpackage/
            ├── __init__.py
            └── ...
  └── setup.py
  └── README
  └── LICENSE
  └── requirements.txt
  └── .gitignore
```

setup.py

```
$ python setup.py install
```

pip

```
$ pip --help
```



# Py2/3 Conversion

With Python 2.x EoS slated for end of this year (2019), it is becoming increasingly important to move existing code to Python 3. There are some big differences between Python 2.x and Python 3.x., but there are resources available to help developers move to Py3.

- 2to3 – available directly with your Py3 conda environment.  

```
$ which 2to3  
~/anaconda2/envs/dragons36/bin/2to3
```
- Porting Code to Python 3 with 2to3 (Dive into Python).  
<https://www.diveinto.org/python3/porting-code-to-python-3-with-2to3.html>
- Python docs also provides help on 2to3.<https://docs.python.org/3.7/library/2to3.html>



# Py2/3 Conversion

Things to be prepared for:

print statement – not a “statement” but now a function.

e.g., `print("foo", "bar")` → `print("foo", "bar")`

strings – Py2: unicode, string, and byte

Py3: unicode, byte (all strings in Py3 are unicode).

long int – Py2 only. There is *only one* `int` type in Py3.

dict – Py3, methods on dictionaries return “views”, which are not usually what you want. To maintain the iterator behaviour of `.items()`, `.values()`, etc., methods just wrap in a list.

`a_dict.keys()` → `list(a_dict.keys())`



# Py2/3 Conversion

Python 2>3 (cont'd)

More on dict types – method `.has_key()` is gone on Py3. Use nominal Python idiom “in”. E.g.,

`a_dict.has_key('foobar')` → ‘foobar’ in `a_dict`

In Python 3, several modules have been reorganized, and/or eliminated.

Notables:

http libraries

urllib libraries

(dbm libraries)

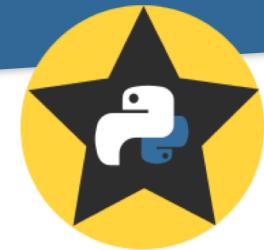
For example,

`urlparse` → `urllib.parse`

Py2 division is replaced. Use “//” for integer division. “/” is purely float div.

py2: `1/3` → 0

py3: `1/3` → 0.3333333...    `1//3` → 0



# Py2/3 Conversion

## Demo Time

Run 2to3 against some existing scripts.



# External Packages

pip

Default package manager

```
$ pip --help
```

Search

```
$ pip search <package_name>
```

Install

```
$ pip install scipy
```

Upgrade

```
$ pip install scipy --upgrade
```

List

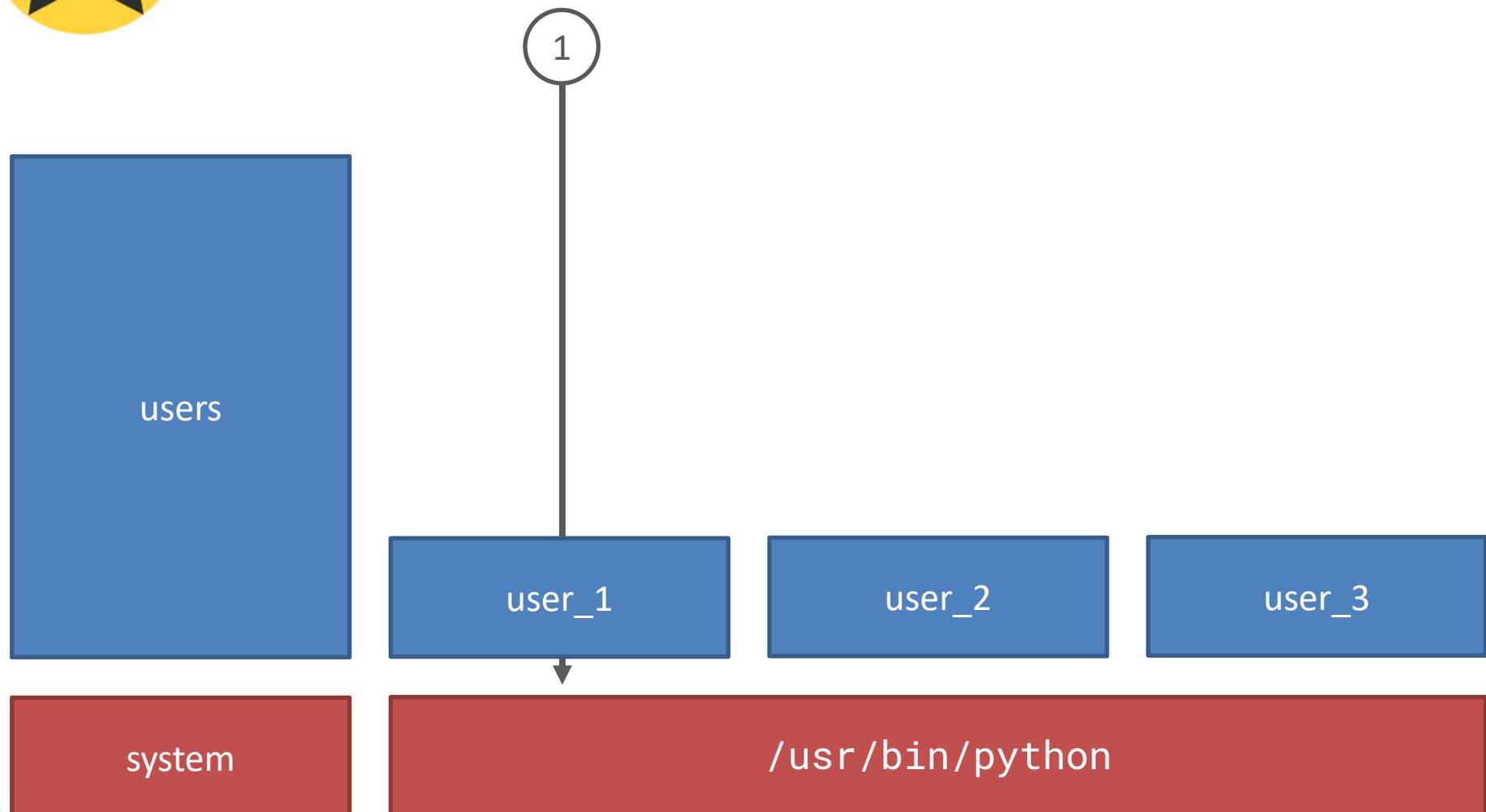
```
$ pip list
```

Uninstall

```
$ pip uninstall pyfits
```

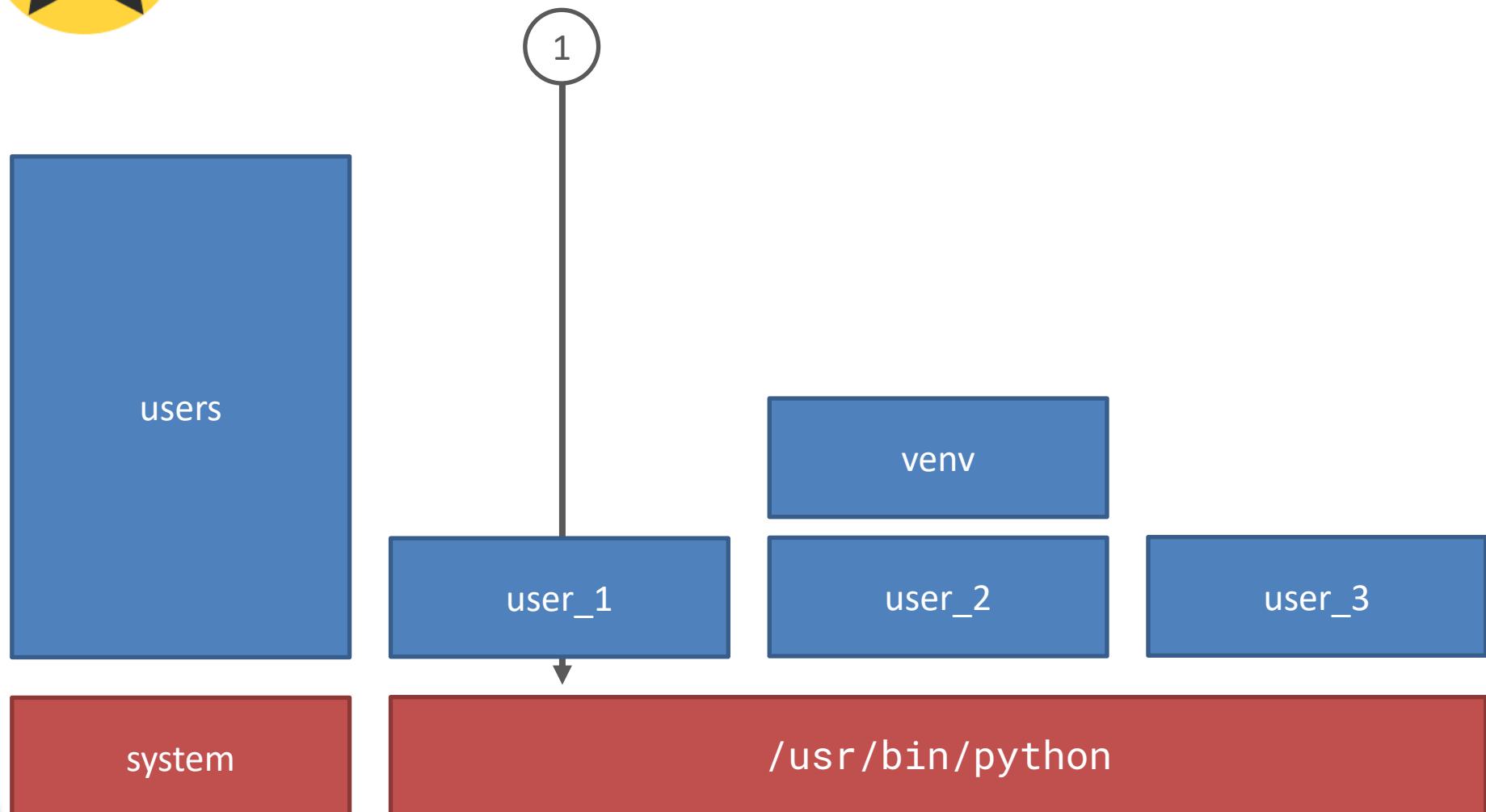


# Virtual Environments



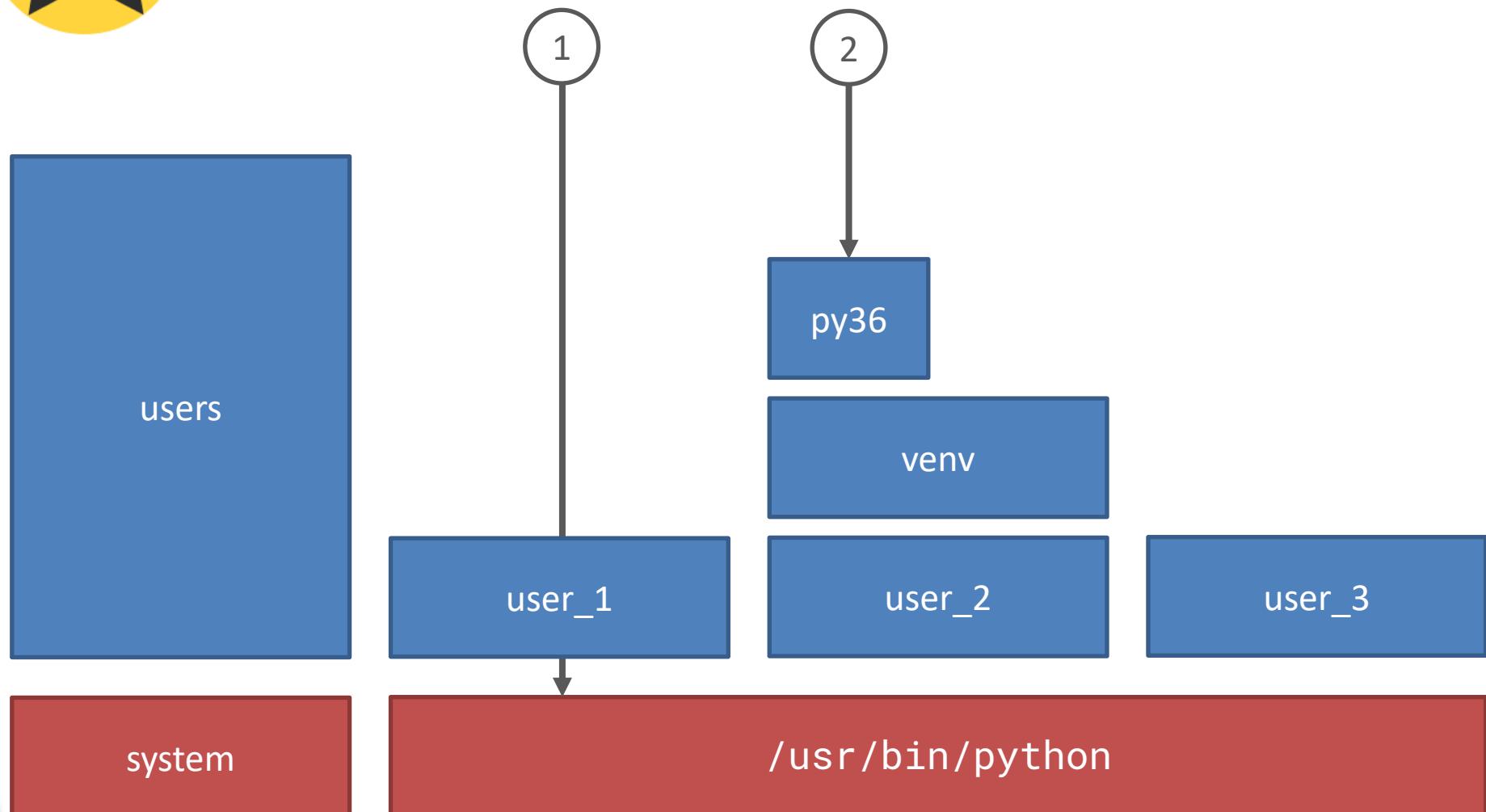


# Virtual Environments



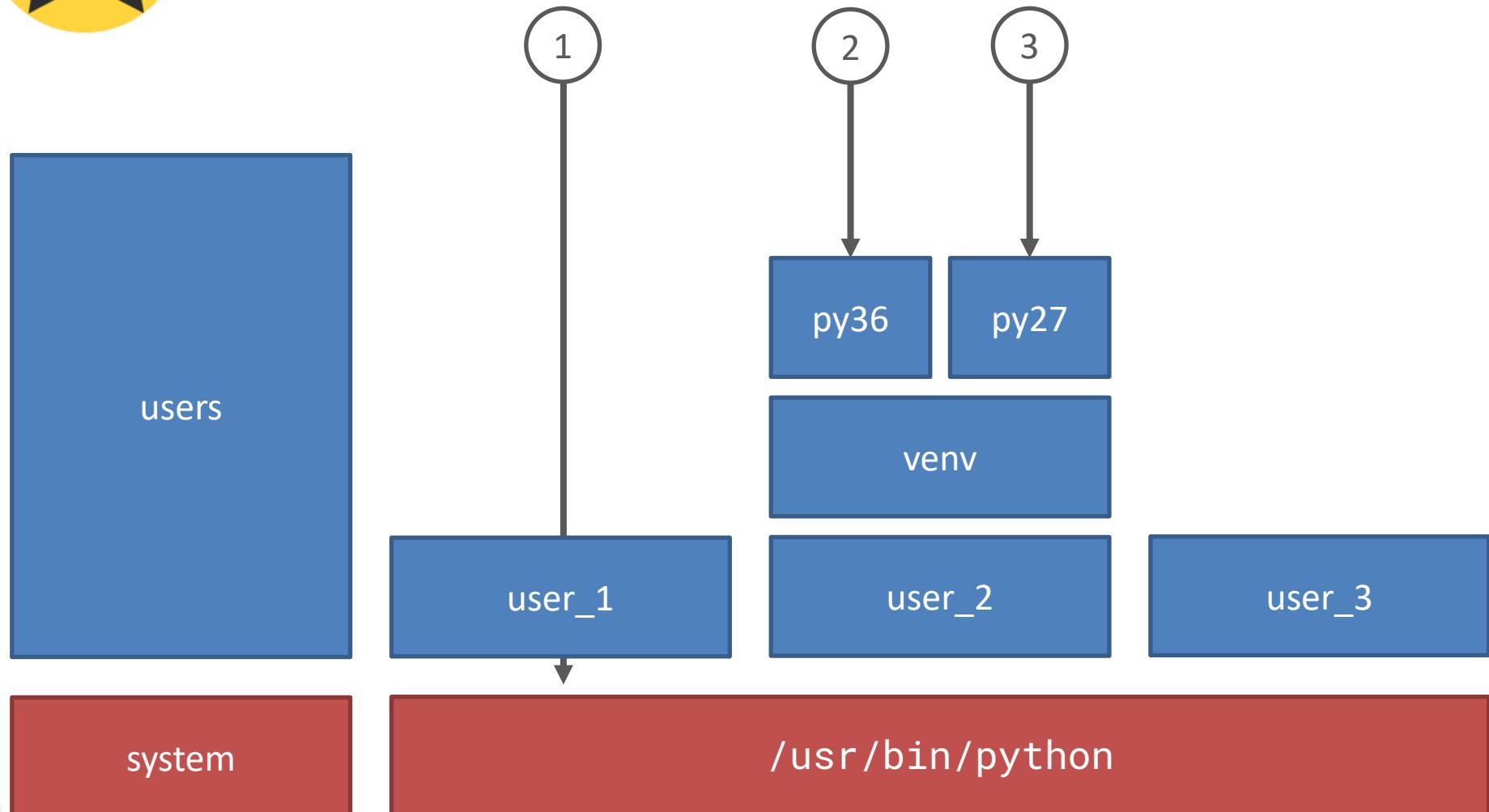


# Virtual Environments



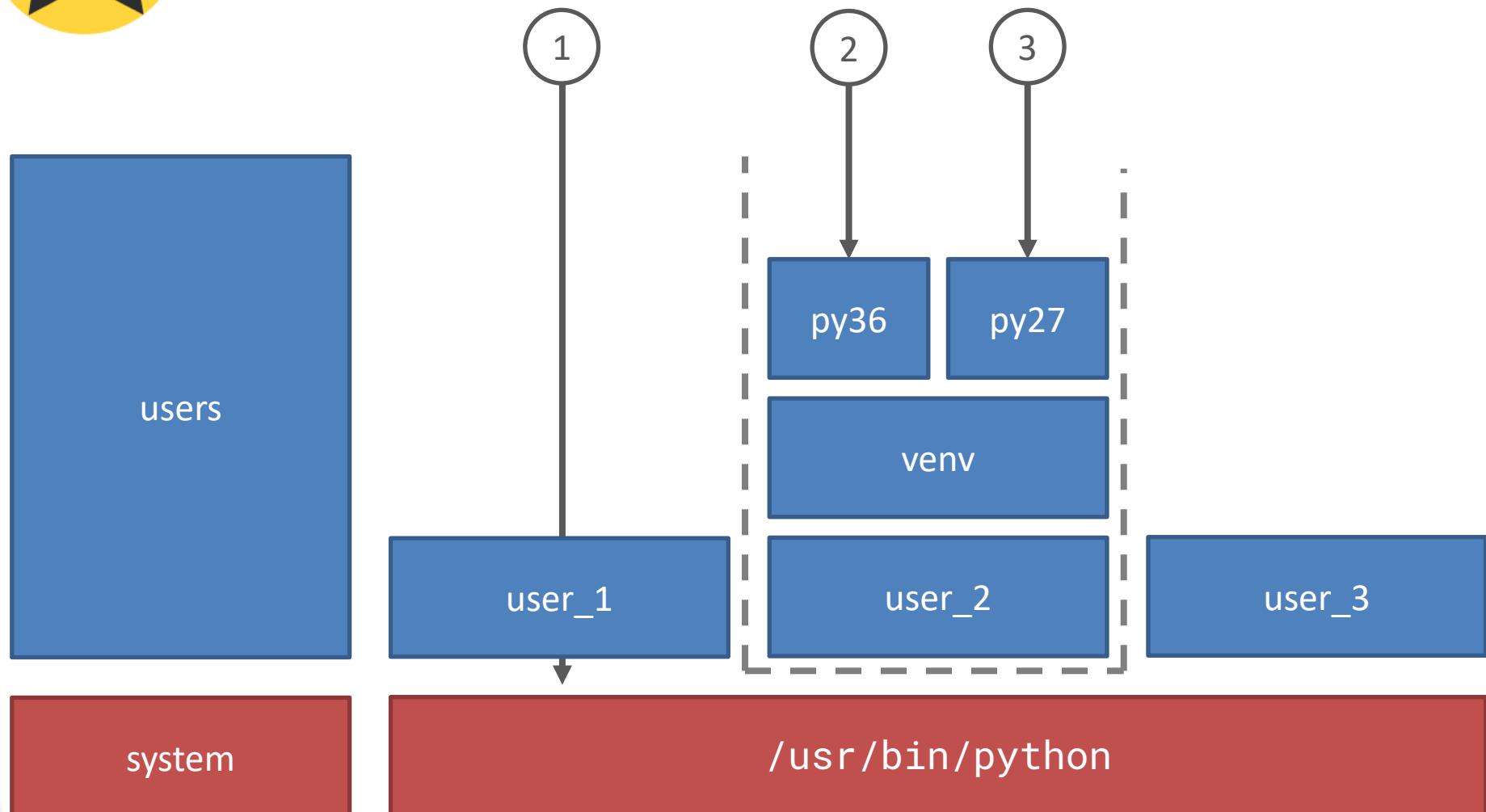


# Virtual Environments





# Virtual Environments





# Conda and Anaconda



**ANACONDA®**



# Conda and Anaconda





# Conda and Anaconda



MINI  
**CONDA**<sup>®</sup>

**CONDA**<sup>®</sup>



# Conda and Anaconda

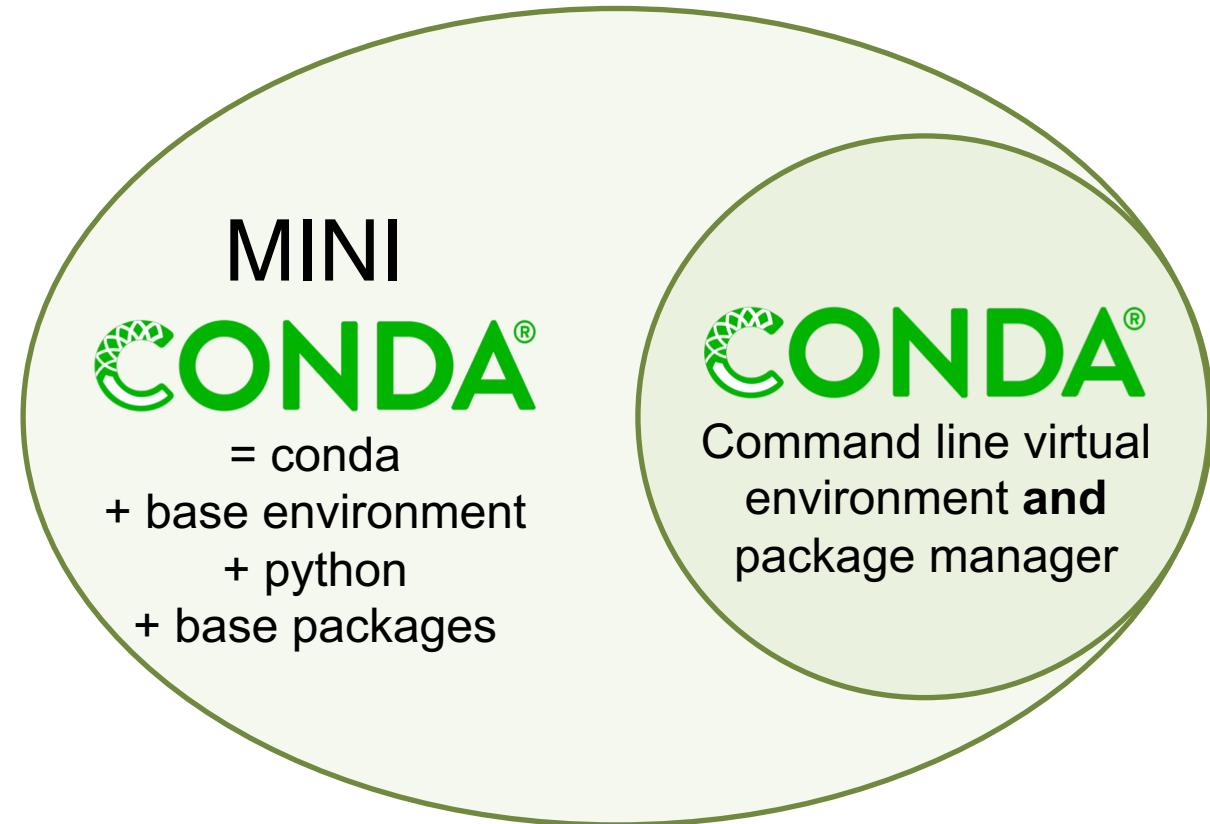


MINI  
CONDA®





# Conda and Anaconda





# Conda and Anaconda



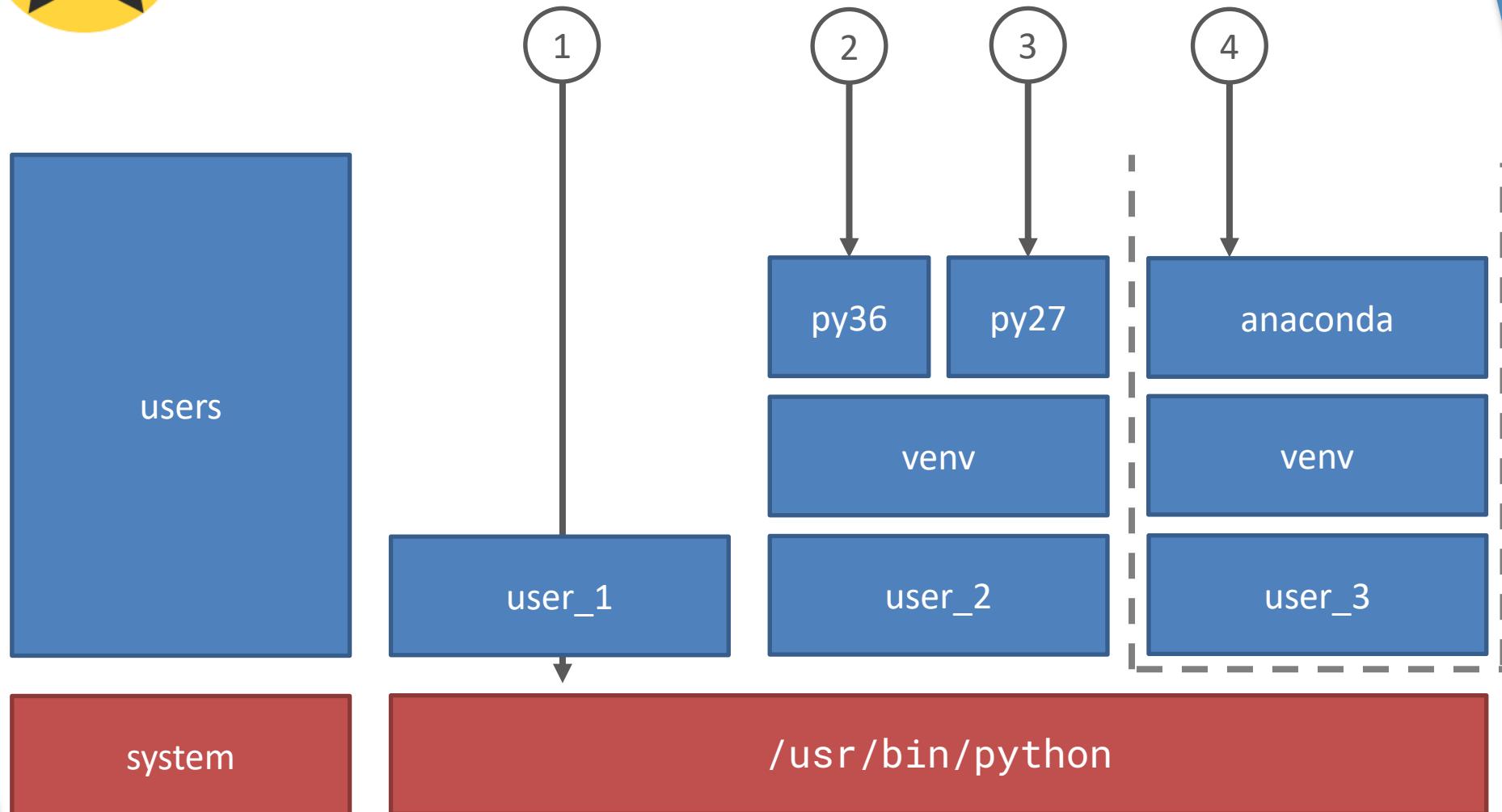
= miniconda  
+ more than 100  
packages

**MINI CONDA®**  
= conda  
+ base environment  
+ python  
+ base packages

**CONDA®**  
Command line virtual  
environment **and**  
package manager

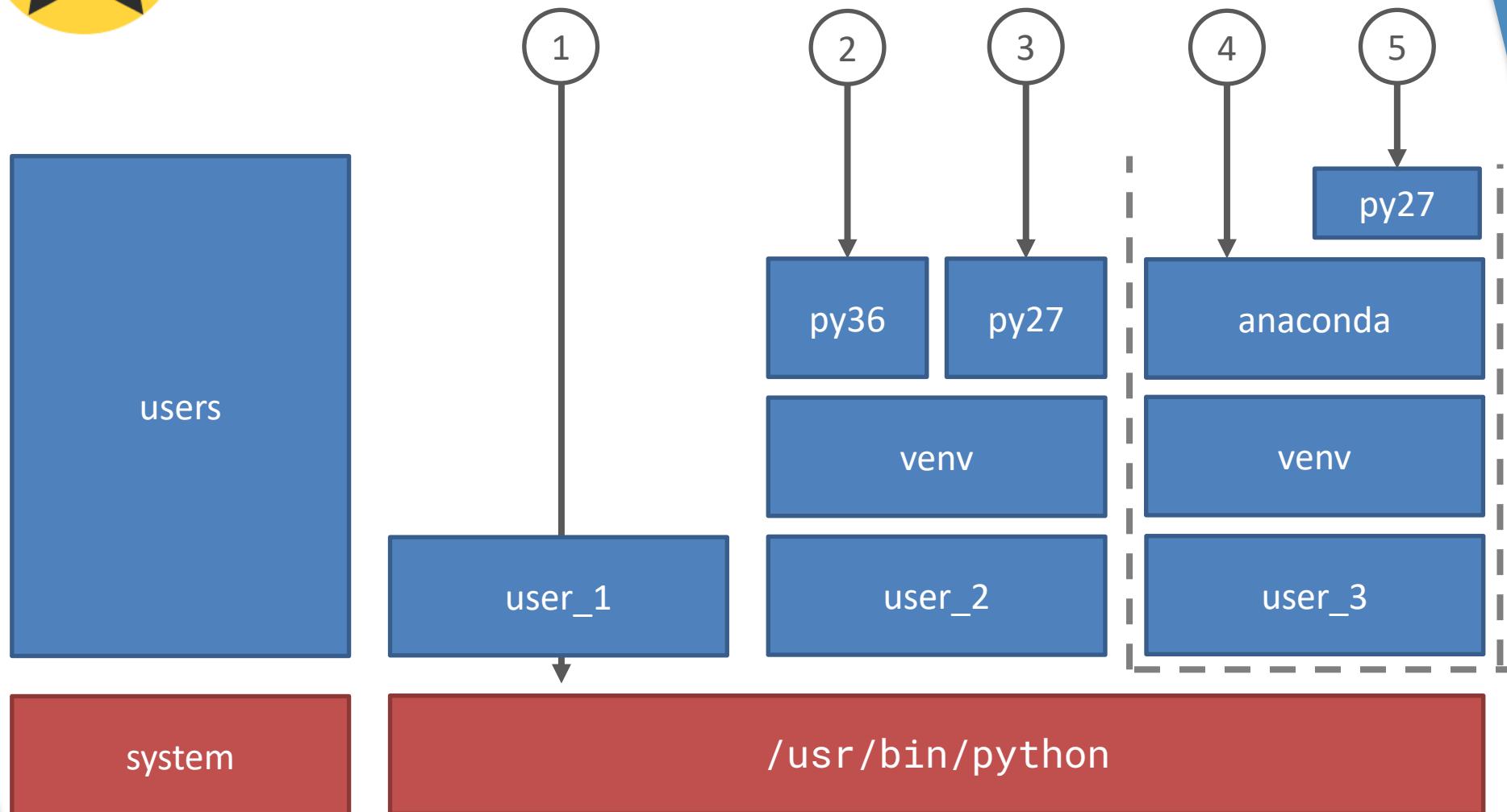


# Virtual Environments



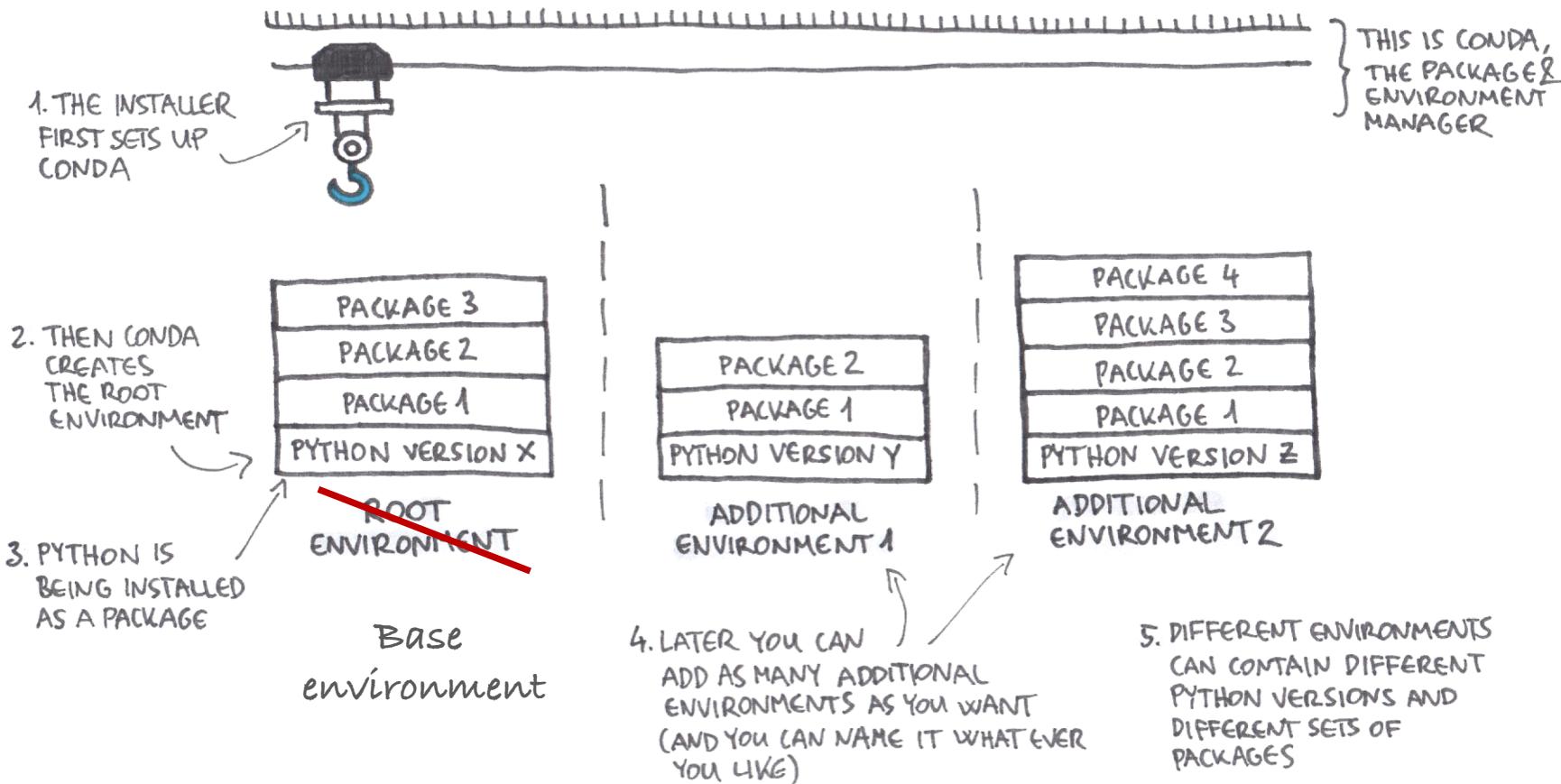


# Virtual Environments





# Conda and Anaconda





# Conda and Anaconda



**ANACONDA®**  
Download and Install



Download and Install



# Conda and Anaconda

Let's check **which** Python we are using.

```
$ which python  
/usr/bin/python
```

System

```
$ which python  
/Users/<user>/miniconda3/bin/python
```

Miniconda

```
$ which python  
/home/<user>/miniconda3/bin/python
```

```
$ which python  
/Users/<user>/anaconda3/bin/python
```

Anaconda

```
$ which python  
/home/<user>/anaconda3/bin/python
```



# Conda and Anaconda

HELP!!!

```
$ conda help
usage: conda [-h] [-V] command ...
...
...
...
```



# Conda and Anaconda

HELP!!!

```
$ conda help
usage: conda [-h] [-V] command ...
...
...
...
```

info    create                activate  
list      remove             deactivate



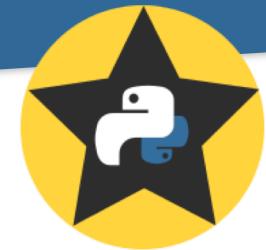
# Conda and Anaconda

HELP!!!

```
$ conda help
usage: conda [-h] [-V] command ...
...
...
...
```

info    create                activate  
list      remove             deactivate

```
$ conda create --help
```



# Conda and Anaconda

[Manage Packages](#)

## Search

```
$ conda search <package_name>
```

## Install

```
$ conda install --channel astroconda sextractor
```

```
$ conda install ds9=7.5
```

## List

```
$ conda list
```

```
$ conda list --explicit > list_of_packages.txt
```

## Remove

```
$ conda remove seaborn
```

## Update

```
$ conda update numpy
```



# Conda and Anaconda

[Manage Environments](#)

## Create

```
$ conda create --name myenv --python=3.6 pkg1 pkg2 pkg3 ...
```

```
$ conda create -n myenv --file list_of_packages.txt
```

## (De)Activate

```
$ source activate myenv
```

```
$ source deactivate
```

Conda >= 4.6

```
$ conda activate myenv
```

```
$ conda deactivate
```

## List environments

```
$ conda info --envs
```

## Remove

```
$ conda remove --name myenv --all
```



# Conda and Anaconda

## HELP!!!

```
$ conda help
usage: conda [-h] [-V] command ...
...
...
...
conda commands available from other packages:
  env
```



# Conda and Anaconda

## HELP!!!

```
$ conda help
usage: conda [-h] [-V] command ...
...
...
...
conda commands available from other packages:
    env
```





# Conda and Anaconda

HELP!!!

```
$ conda help  
usage: conda [-h] [-V] command ...  
...  
...  
...  
conda commands available from other packages:  
→ env ←
```

```
$ conda list
```

!=

```
$ conda env list
```

```
$ conda remove -n myenv --all
```

!=

```
$ conda env remove -n myenv
```



# Conda and Anaconda

HELP!!!

```
$ conda help  
usage: conda [-h] [-V] command ...  
...  
...  
...  
conda commands available from other packages:  
→ env ←
```

```
$ conda list
```

!=

```
$ conda env list
```

```
$ conda remove -n myenv --all
```

!=

```
$ conda env remove -n myenv
```

conda vs conda env has too much confusion #5253



# Conda and Anaconda

[Manage Environments](#)

Anaconda Navigator

Search Environments

Installed  Channels  Search Packages

| Name            | Description   | Version   |
|-----------------|---|-----------|
| anaconda-client | Anaconda.org command line client library  | 1.7.2     |
| asn1crypto      | Python asn.1 library with a focus on performance and a pythonic api   | 0.24.0    |
| attrs           | Attrs is the python package that will bring back the joy of writing classes by relieving you from the drudgery of implementing object protocols (aka dunder methods). | 19.1.0    |
| ca-certificates | Certificates for use with other packages.   | 2019.1.23 |
| certifi         | Python package for providing mozilla's ca bundle.   | 2019.3.9  |
| cffi            | Foreign function interface for python calling c code.   | 1.11.5    |
| chardet         | Universal character encoding detector   | 3.0.4     |
| client          | Command line client library for windows and posix   | 1.2.2     |
| conda           | Os-agnostic, system-level binary package and environment manager.   | 4.6.11    |
| conda-env       | Tools for interacting with conda environments.  | 2.6.0     |
| cryptography    | Provides cryptographic recipes and primitives to python developers  | 2.4.2     |
| dbus            | Simple message bus system for applications to talk to one another   | 1.13.6    |

66 packages available



# Conda and Anaconda

[Manage Environments](#)

Anaconda Navigator interface showing the Manage Environments page.

Left sidebar:

- Home
- Environments
- Learning
- Community
- Documentation
- Developer Blog

Bottom left icons:

- [Create](#)
- [Clone](#)
- [Import](#)
- [Remove](#)

Top right button:

[Sign in to Anaconda Cloud](#)

Search bar:

Anaconda Navigator

Search Environments



Installed

Channels

Update index...

Search Packages



base (root)



astroconda

dragons

iraf27

| Name            | Description   | Version                |
|-----------------|---|------------------------|
| anaconda-client | Anaconda.org command line client library  | 1.7.2                  |
| asn1crypto      | Python asn.1 library with a focus on performance and a pythonic api   | 0.24.0                 |
| attrs           | Attrs is the python package that will bring back the joy of writing classes by relieving you from the drudgery of implementing object protocols (aka dunder methods). | 19.1.0                 |
| ca-certificates | Certificates for use with other packages.   | 2019.1.23              |
| certifi         | Python package for providing mozilla's ca bundle.   | 2019.3.9               |
| cffi            | Foreign function interface for python calling c code.   | <a href="#">1.11.5</a> |
| chardet         | Universal character encoding detector   | 3.0.4                  |
| client          | Command line client library for windows and posix   | 1.2.2                  |
| conda           | Os-agnostic, system-level binary package and environment manager.   | 4.6.11                 |
| conda-env       | Tools for interacting with conda environments.  | 2.6.0                  |
| cryptography    | Provides cryptographic recipes and primitives to python developers  | <a href="#">2.4.2</a>  |
| dbus            | Simple message bus system for applications to talk to one another   | 1.13.6                 |

66 packages available



Preferences

Project: DRAGONS > Project Interpreter  For current project

Project Interpreter: Python 3.7 (dragons) ~/miniconda3/envs/dragons/bin/python

| Package         | Version   | Latest version |
|-----------------|-----------|----------------|
| acstools        | 3.0.0     |                |
| alabaster       | 0.7.12    | 0.7.12         |
| appnope         | 0.1.0     | 0.1.0          |
| asdf            | 2.3.2     |                |
| asn1crypto      | 0.24.0    | 0.24.0         |
| asteval         | 0.9.13    |                |
| astroimtools    | 0.2       |                |
| astropy         | 3.1.2     | 3.1.2          |
| astroquery      | 0.3.9     |                |
| atomicwrites    | 1.3.0     | 1.3.0          |
| attrs           | 19.1.0    | 19.1.0         |
| babel           | 2.6.0     | 2.6.0          |
| backcall        | 0.1.0     | 0.1.0          |
| beautifulsoup4  | 4.7.1     | 4.7.1          |
| blas            | 1.0       | 1.0            |
| bleach          | 3.1.0     | 3.1.0          |
| bokeh           | 1.0.4     | 1.0.4          |
| bottleneck      | 1.2.1     | 1.2.1          |
| ca-certificates | 2019.1.23 | 2019.1.23      |
| calcos          | 3.3.5     |                |
| certifi         | 2019.2.28 | 2019.2.28      |

Editor  
Font  
Color Scheme  
Code Style  
Inspections  
File and Code Templates  
File Encodings  
Live Templates  
File Types  
Copyright  
Emmet  
Images  
Intentions  
Language Injections  
Spelling  
TextMate Bundles  
TODO  
Vim Emulation  
Plugins  
Version Control  
Project: DRAGONS  
Project Interpreter  
Project Structure  
Build, Execution, Deployment  
Languages & Frameworks

Cancel Apply OK



# Now what?

The Exercise 3 holds a simple example of a Python Project. It includes three Python files:

- **my\_module.py** that can be invoked from a terminal and return a random value between 1 and 6,
- **dices.py** that contains classes with dices,
- **setup.py** which contains the configuration for installation of the package.

## Exercise

---

Check the GitHub Page with the exercises:

<https://github.com/b1quint/Python-Tutorial-Series/tree/master/Exercises>



# Questions?

