Python Tutorial Series 2019
Basics 3: Packages, Environments and Python Versions

Ph.D. Bruno C. Quint
bquint@gemini.edu
Data Process Developer
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

Basics II

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

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

```python
#!/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 {}'.format(roll_dice()))
```

```
In [1]: import my_module
The dice gave me 6

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

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
```

__name__

Stores the name of the scope being run.

__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

packages

```
my_project/
```

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

(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/
├── 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 install .
```

(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

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 elinminated.

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

https://pypi.org/

Default package manager

```
$ pip --help
```

Search

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

Install

```
$ pip install scipy
```

List

```
$ pip list
```

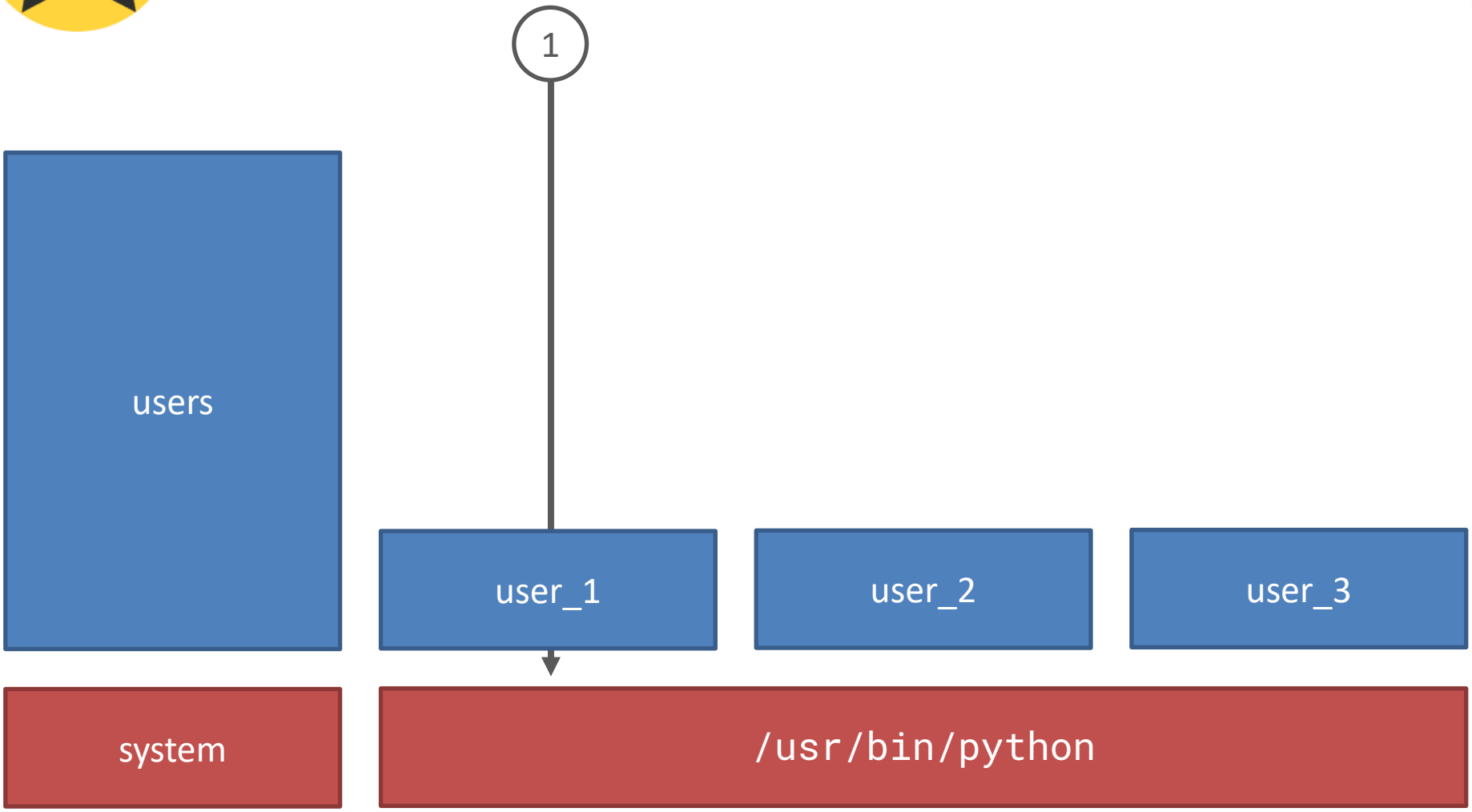
Upgrade

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

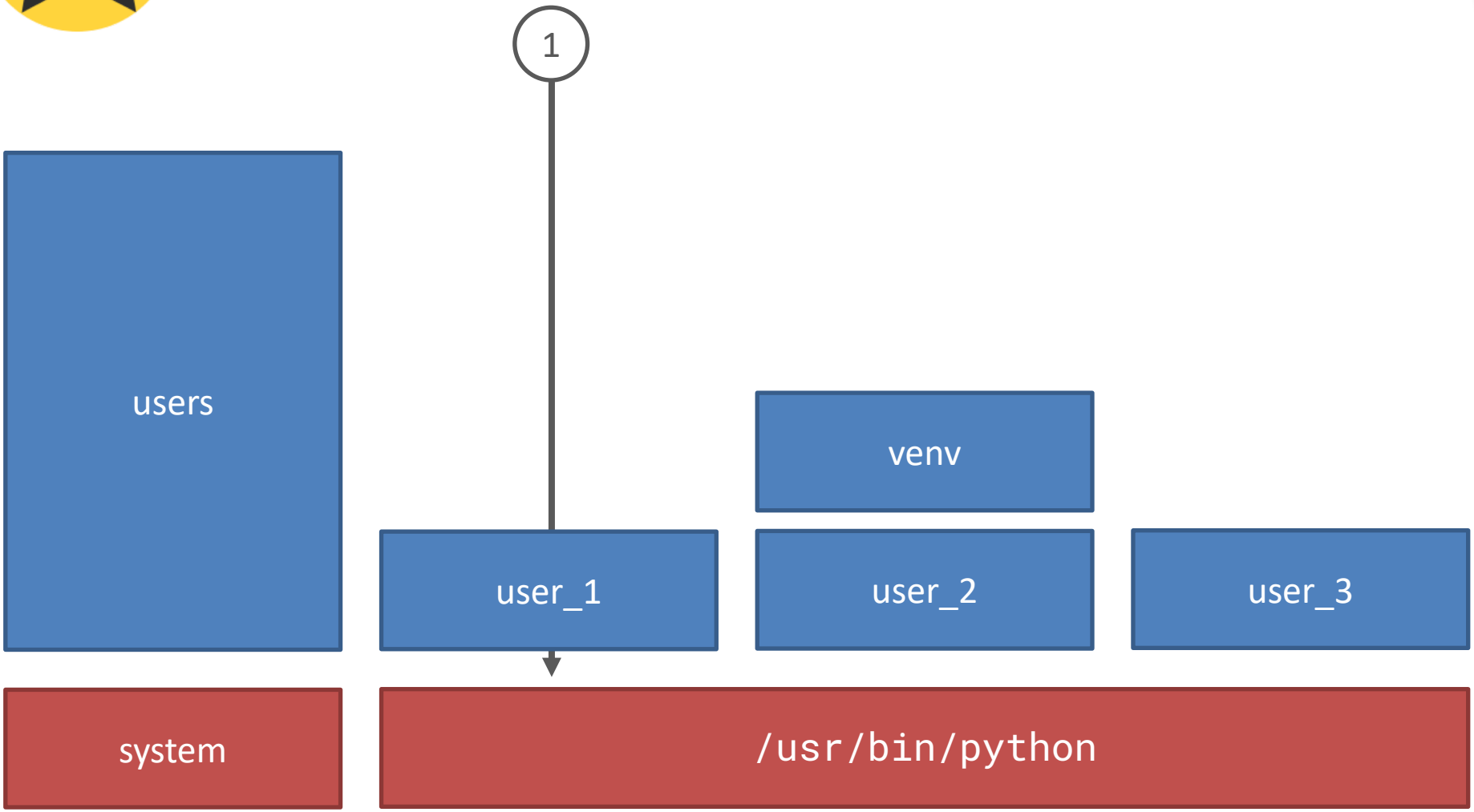
Uninstall

```
$ pip uninstall pyfits
```

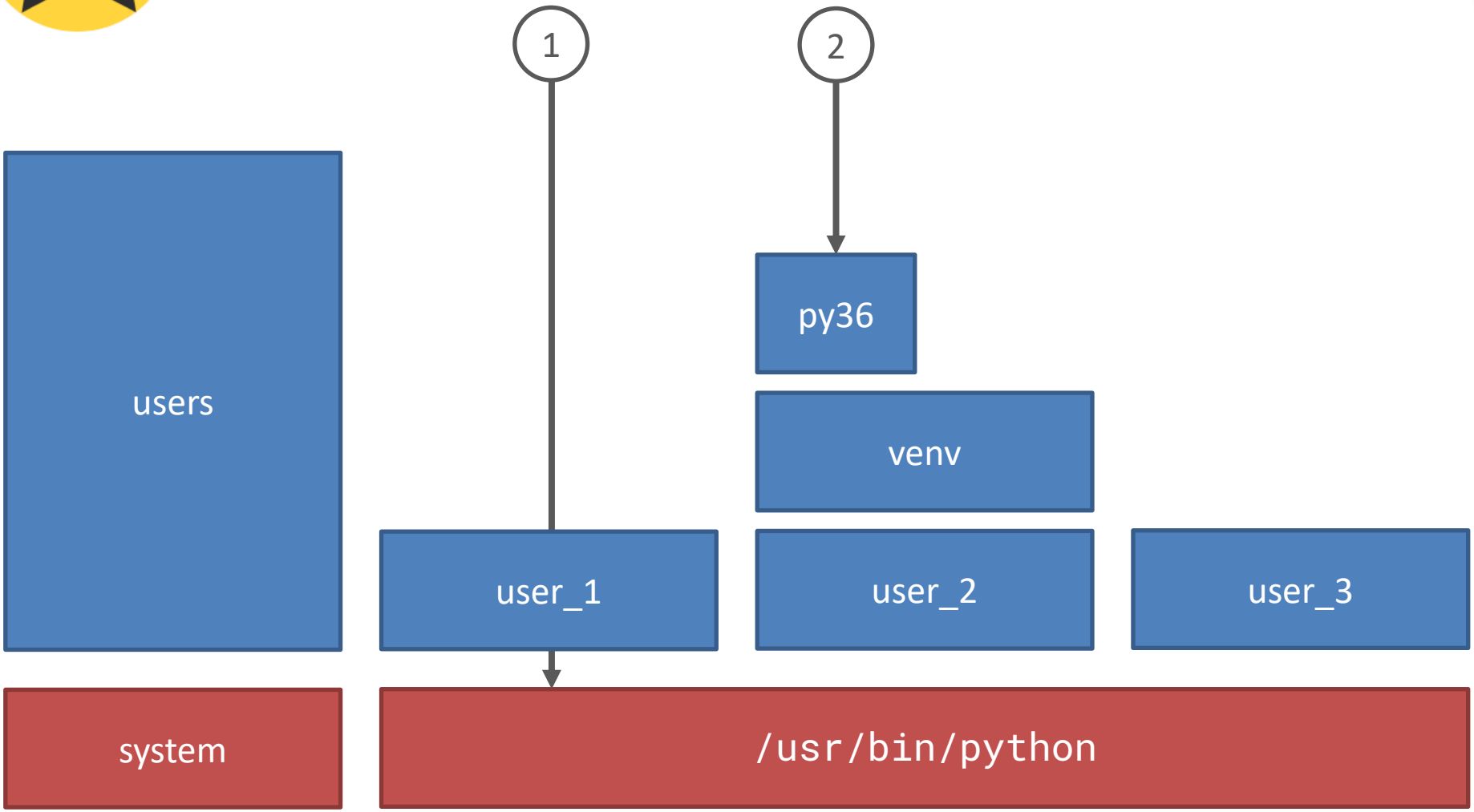
Virtual Environments



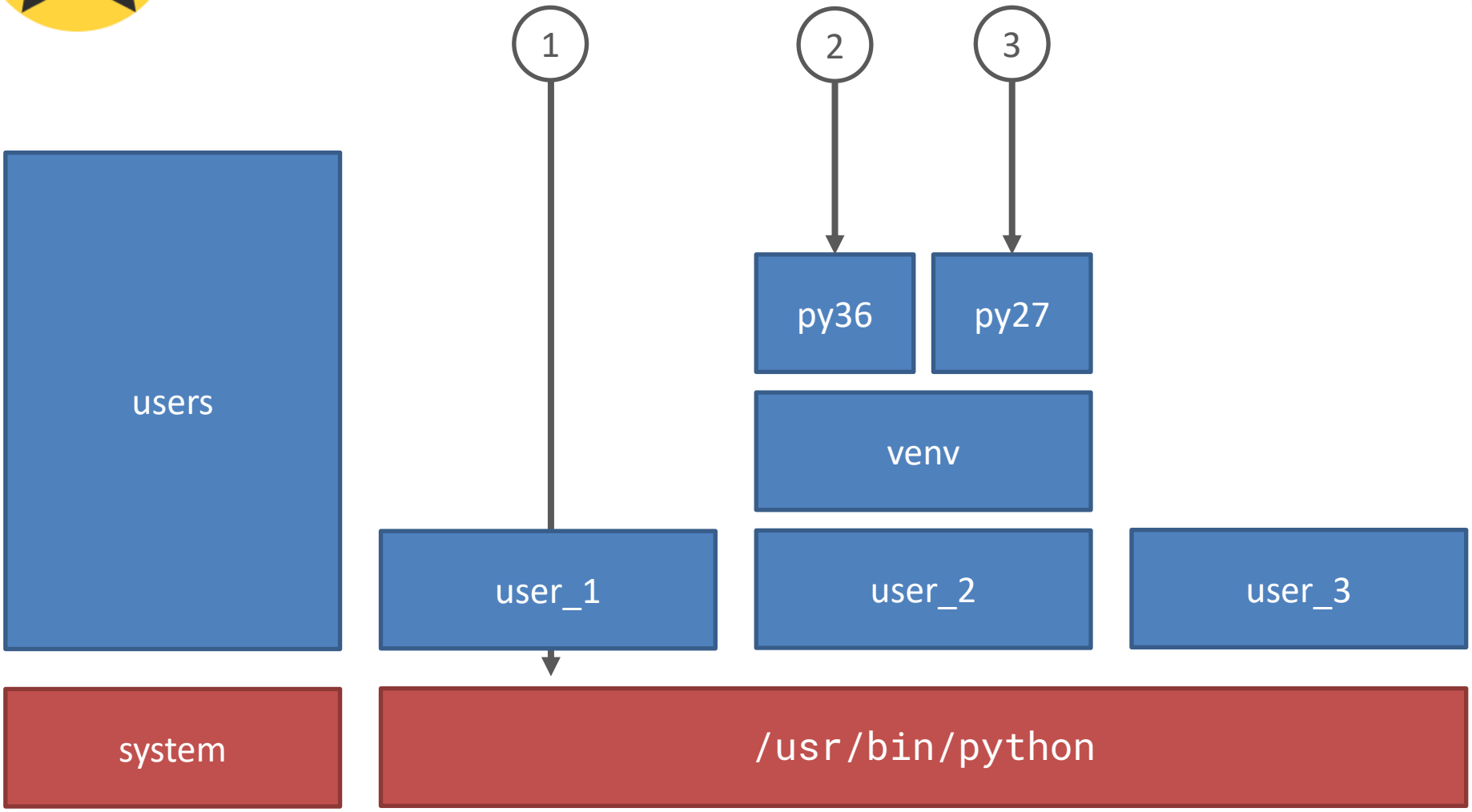
Virtual Environments



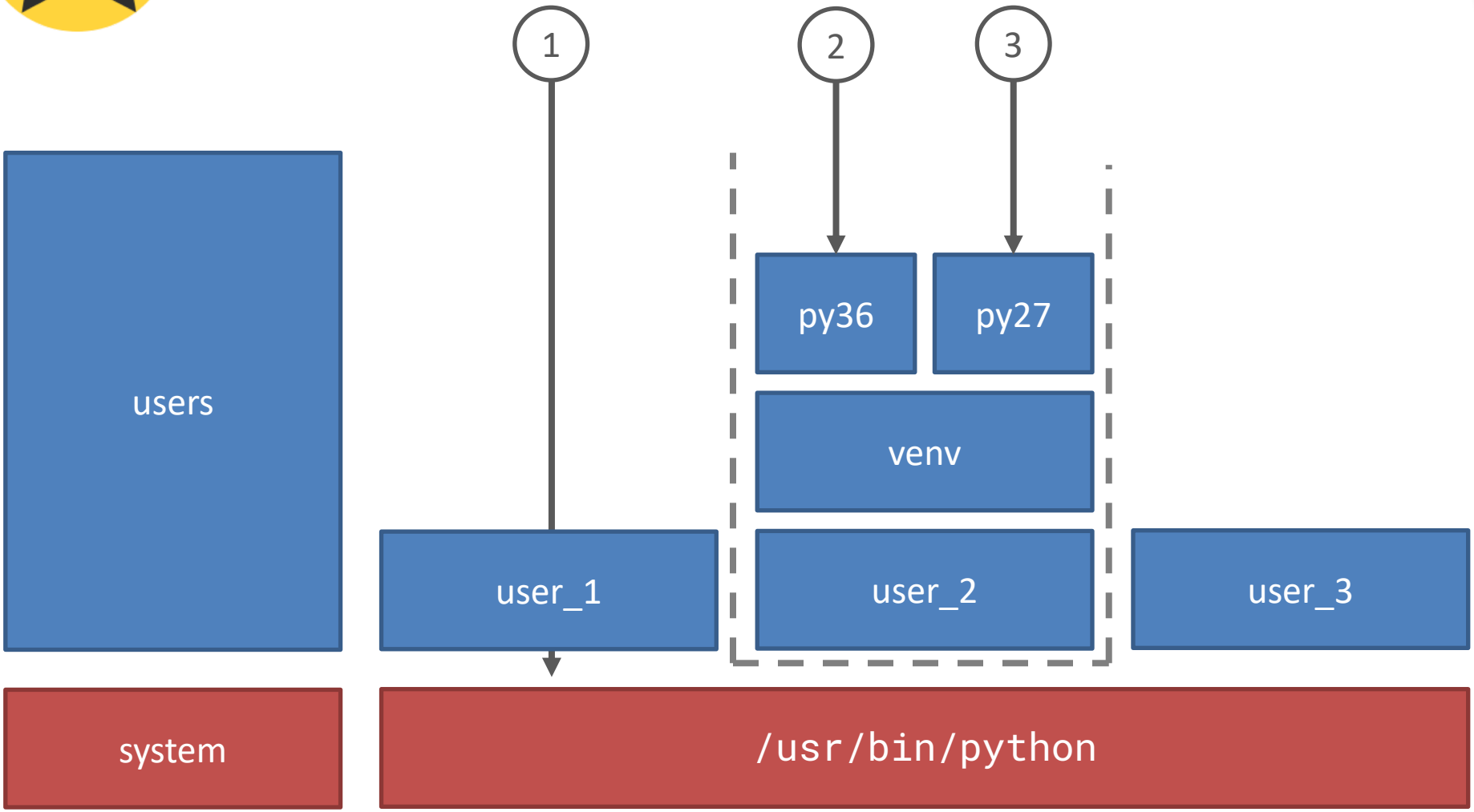
Virtual Environments



Virtual Environments



Virtual Environments



Conda and Anaconda

Conda and Anaconda

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Conda and Anaconda

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Conda and Anaconda

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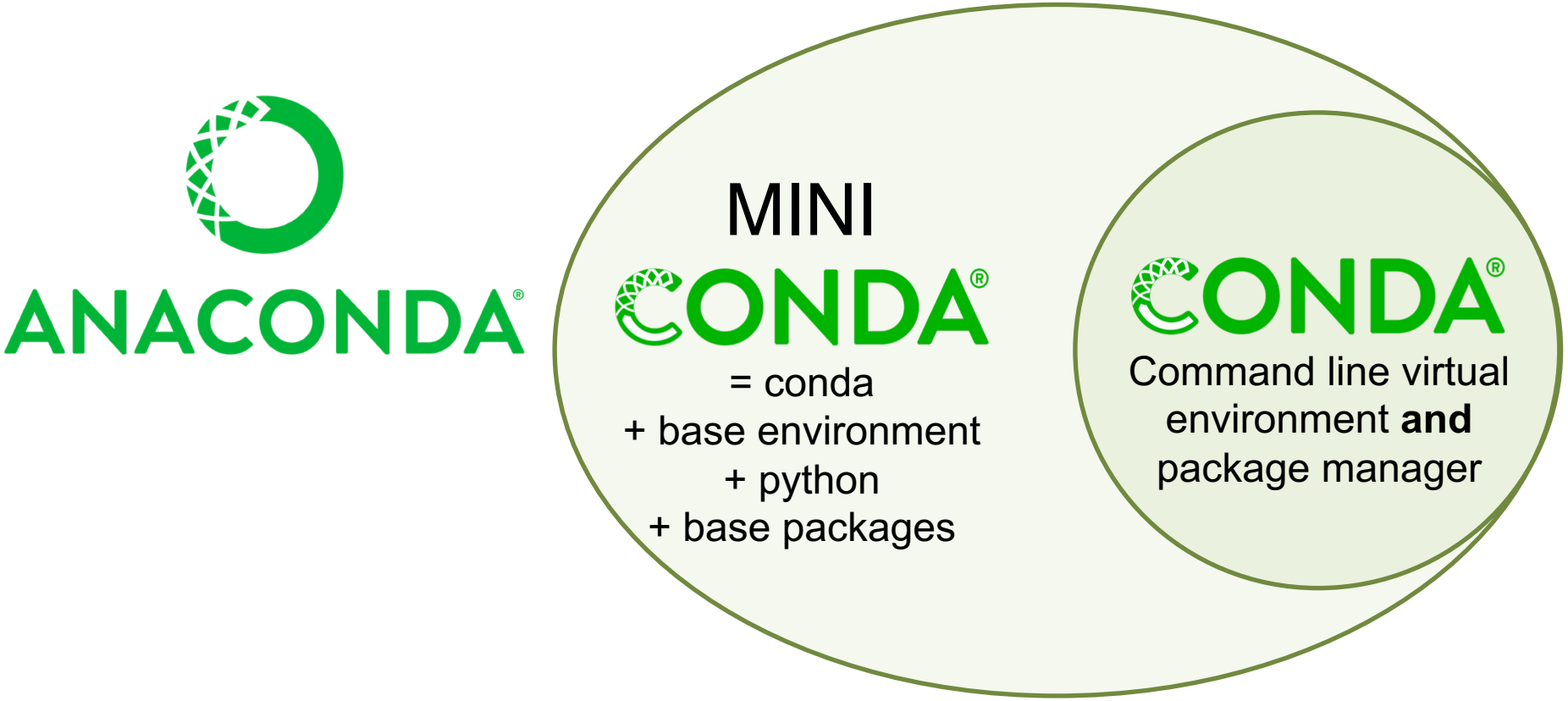
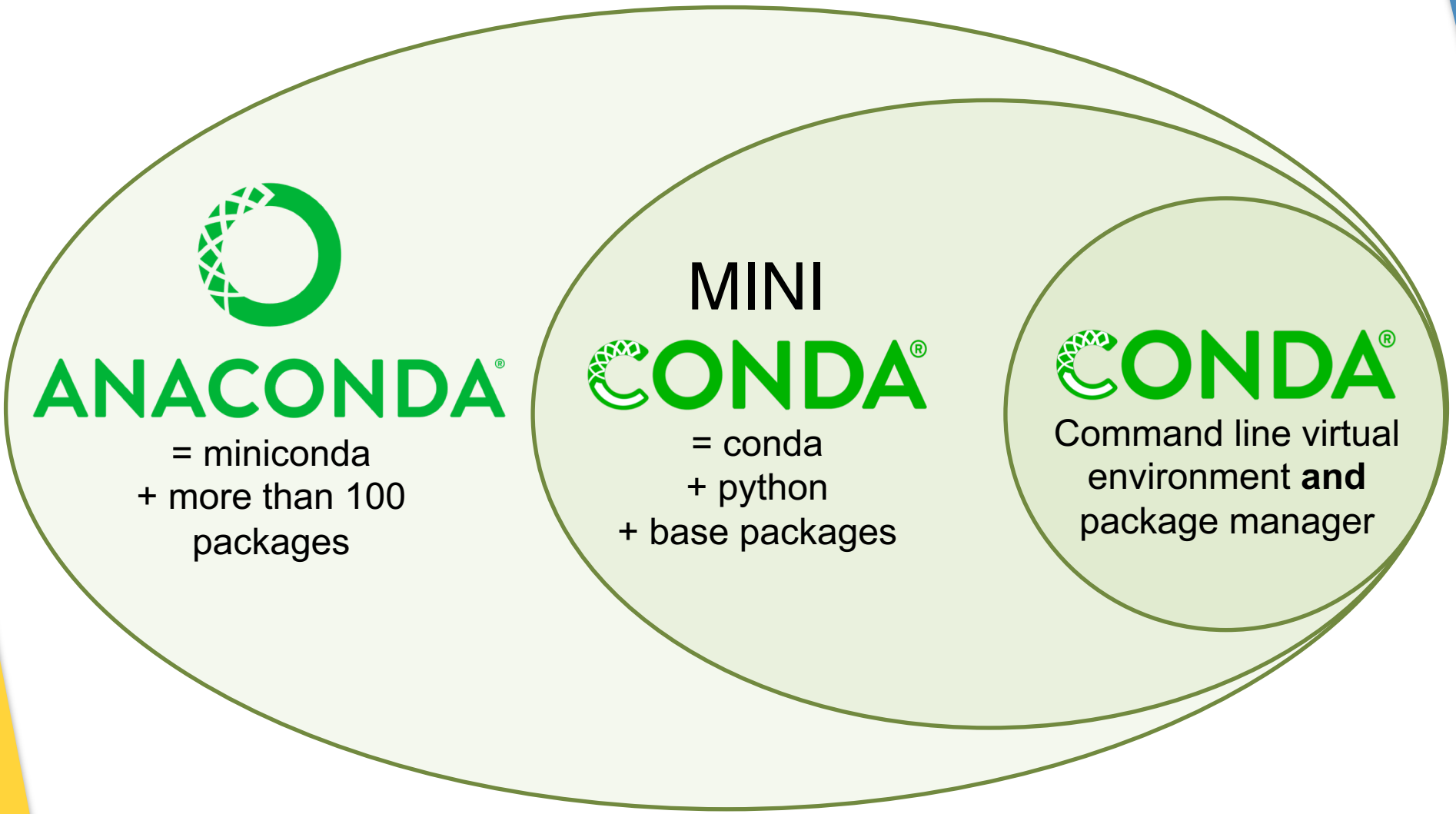
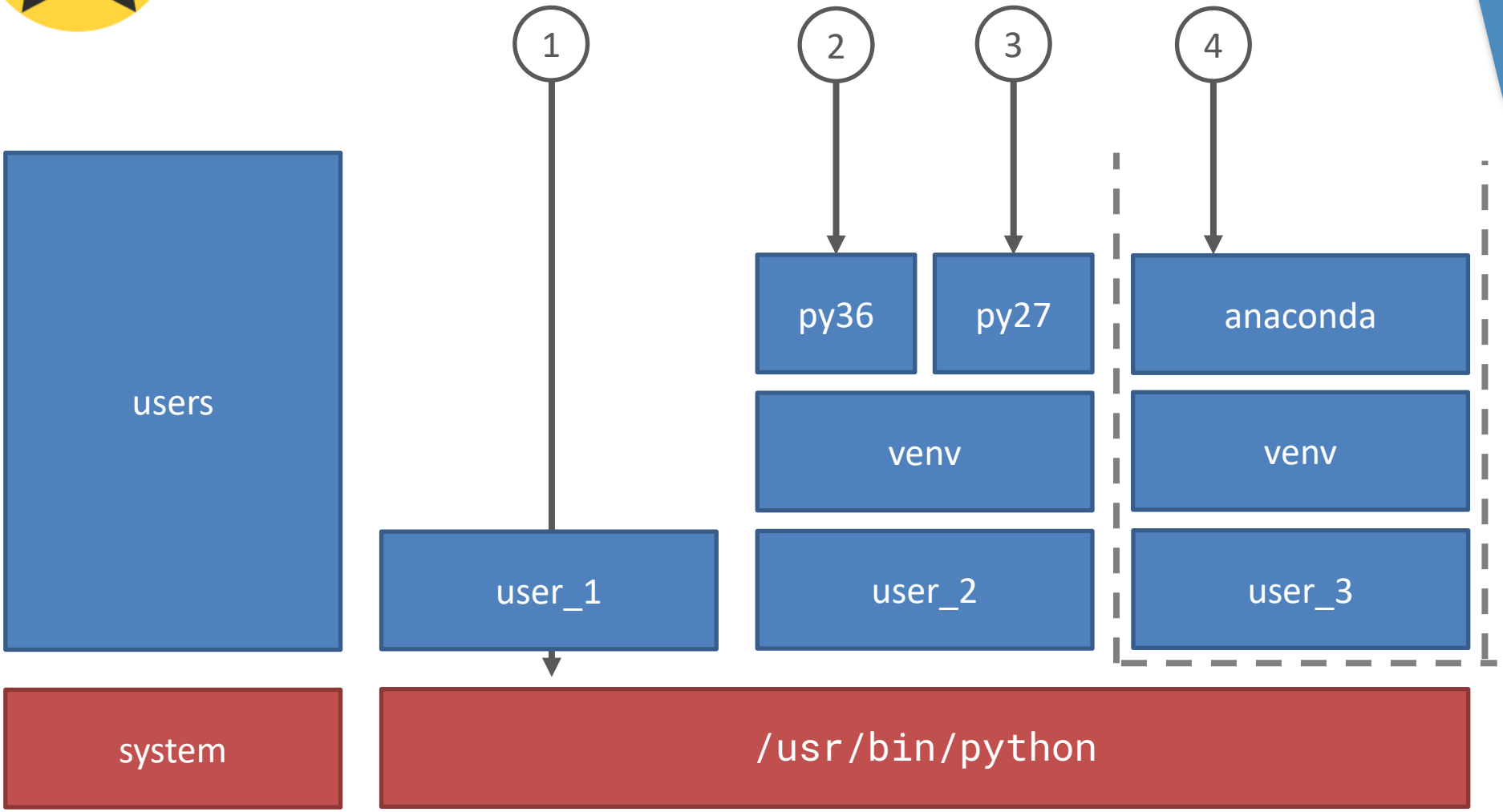
Conda and Anaconda



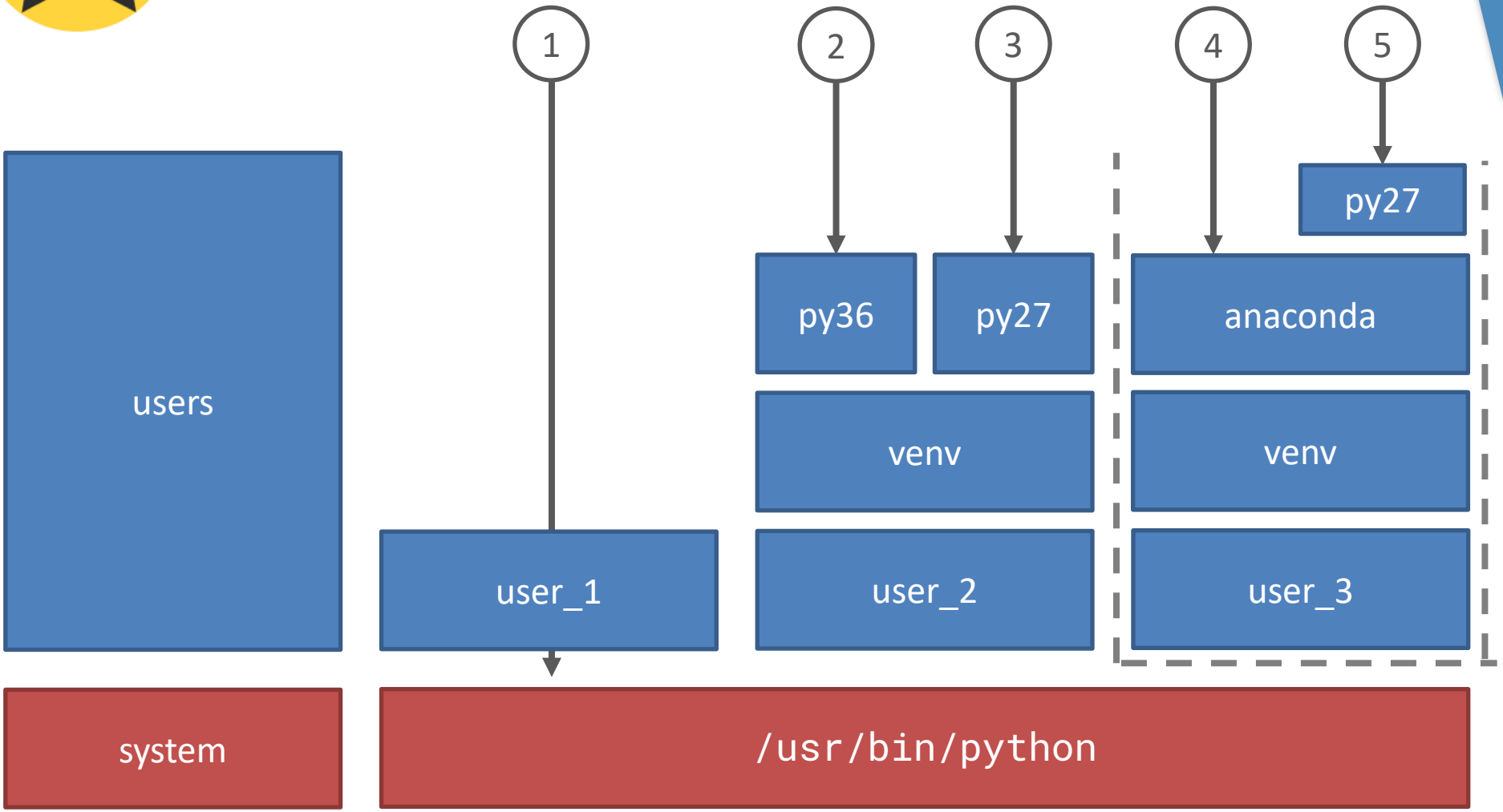
Conda and Anaconda



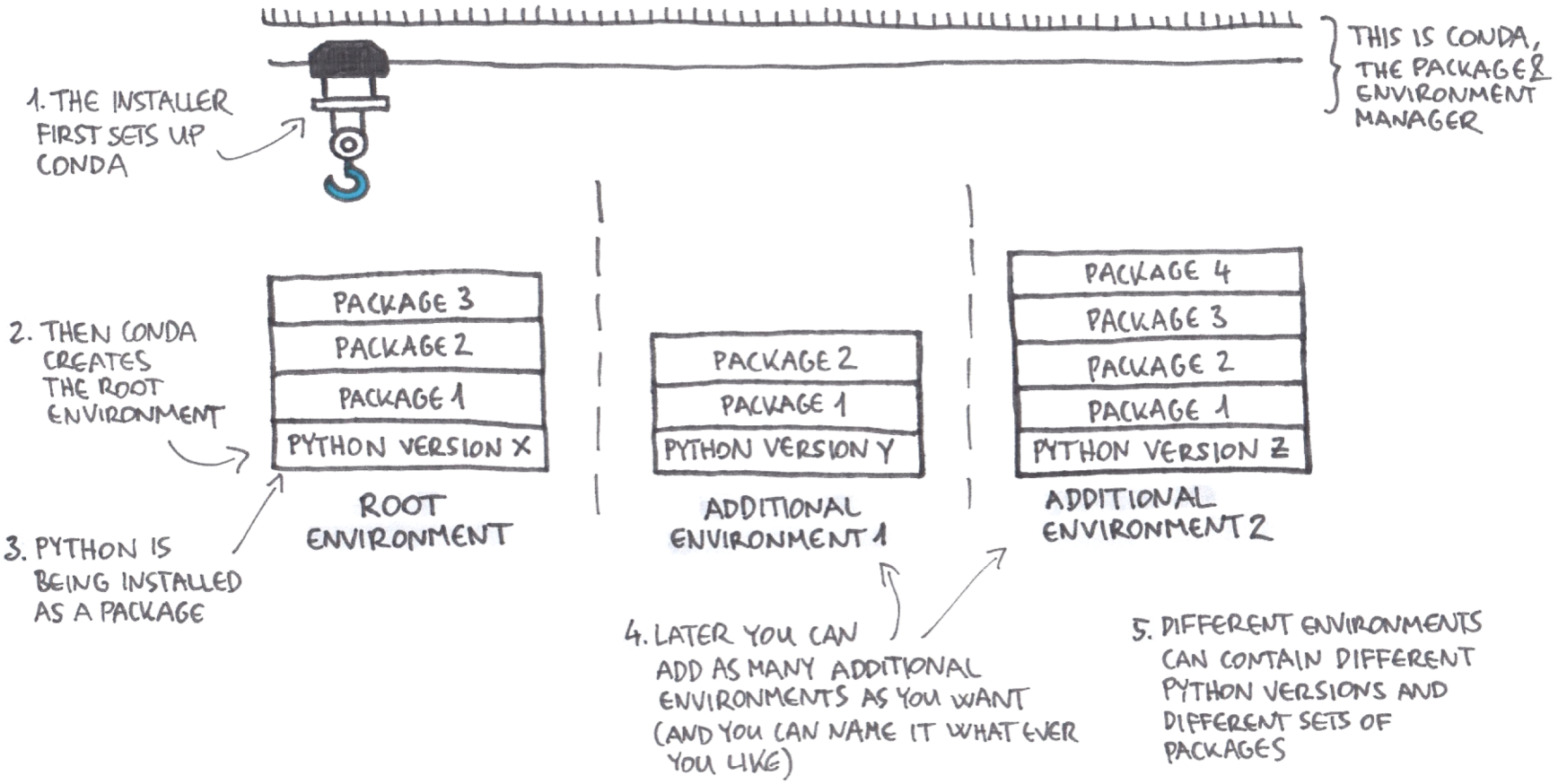
Virtual Environments



Virtual Environments



Conda and Anaconda



Conda and Anaconda

ANACONDA®

Download and Install

MINI

CONDA®

Download and Install

Conda and Anaconda

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

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

System

```
$ which python
/Users/bquint/miniconda3/bin/python
```

Miniconda

```
$ which python
/Users/bquint/anaconda3/bin/python
```

Anaconda

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 enviroments

```
$ 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
```

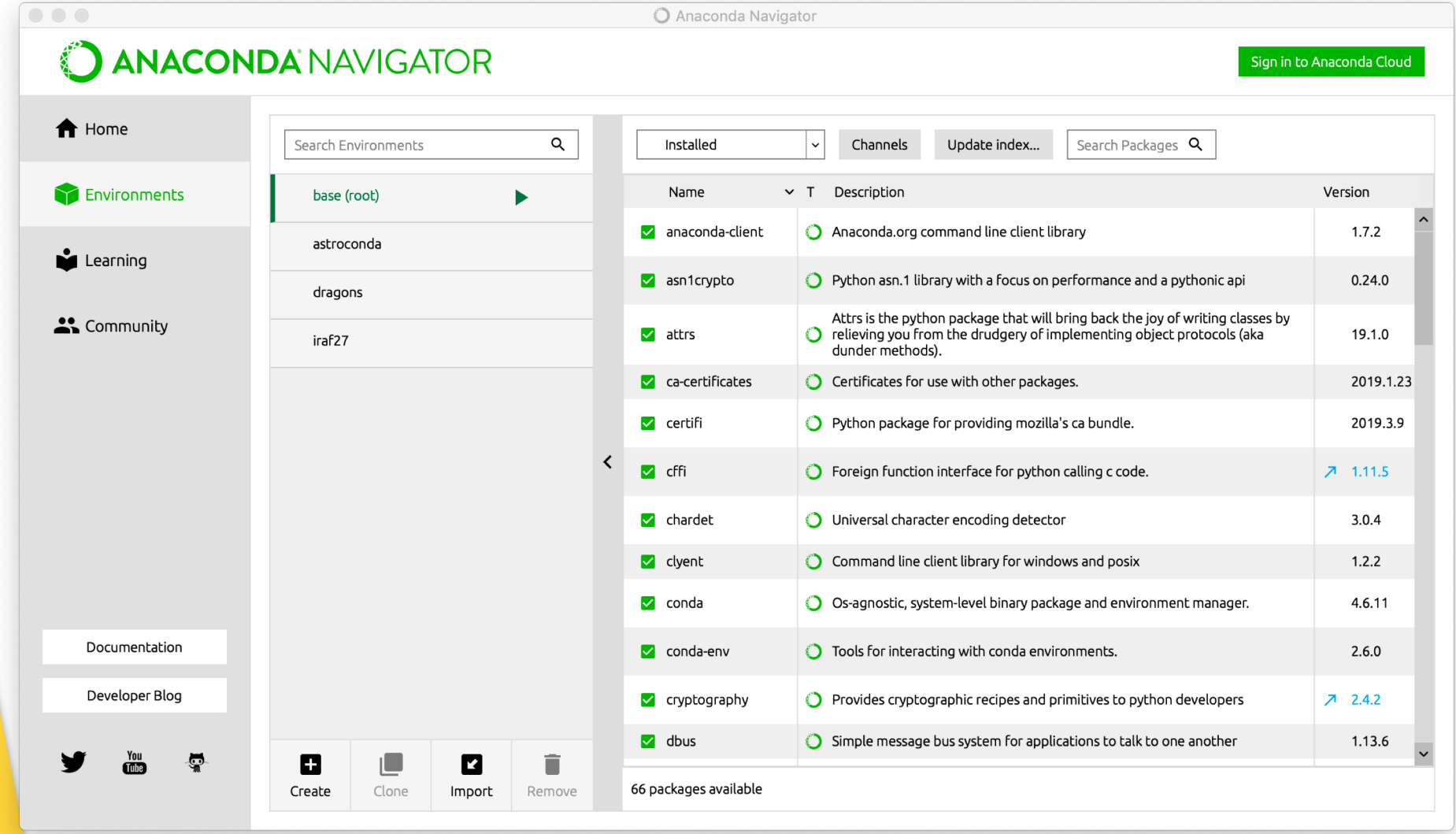
!=

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

conda vs conda env has too much confusion #5253

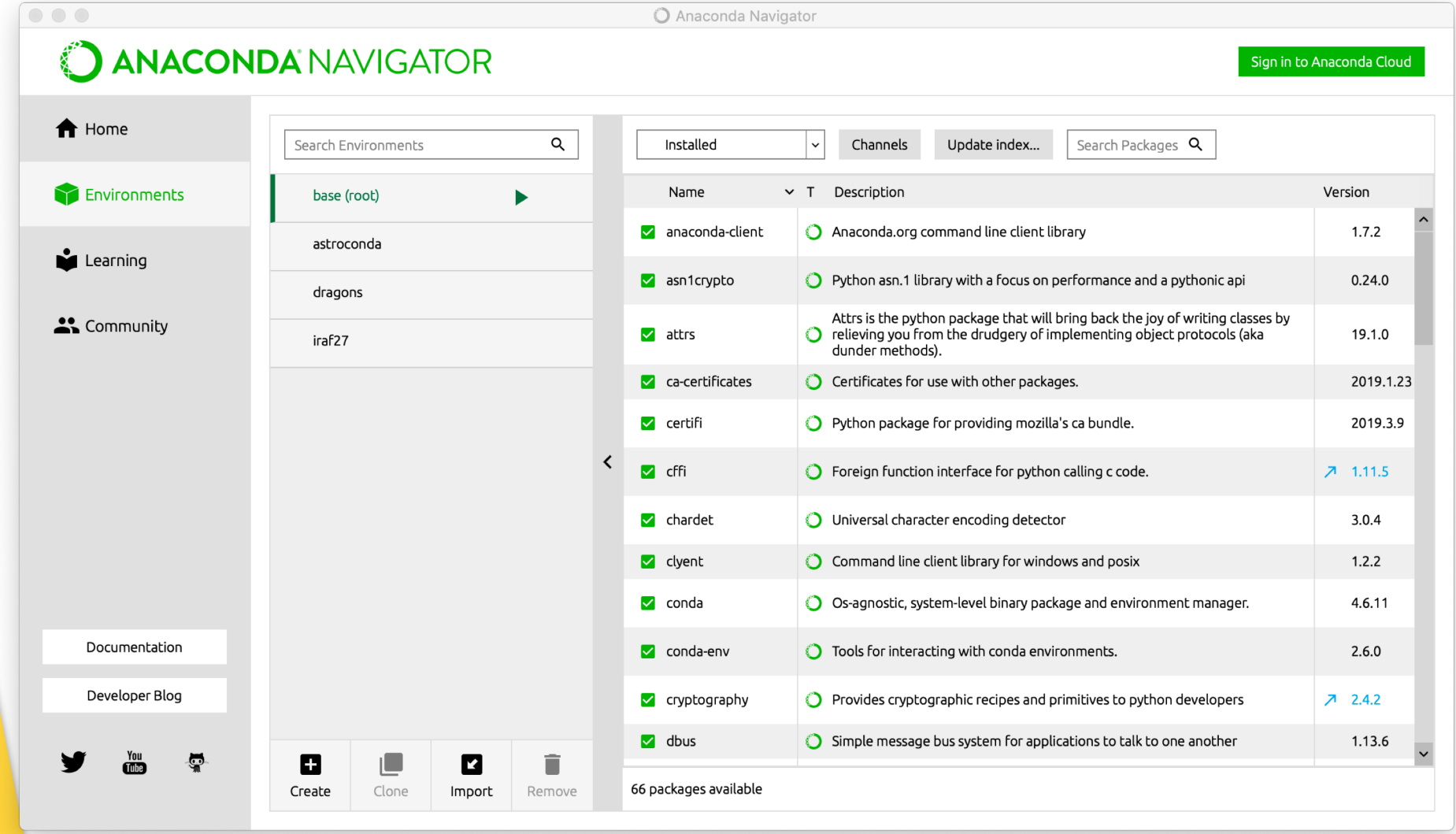
Conda and Anaconda

[Manage Environments]



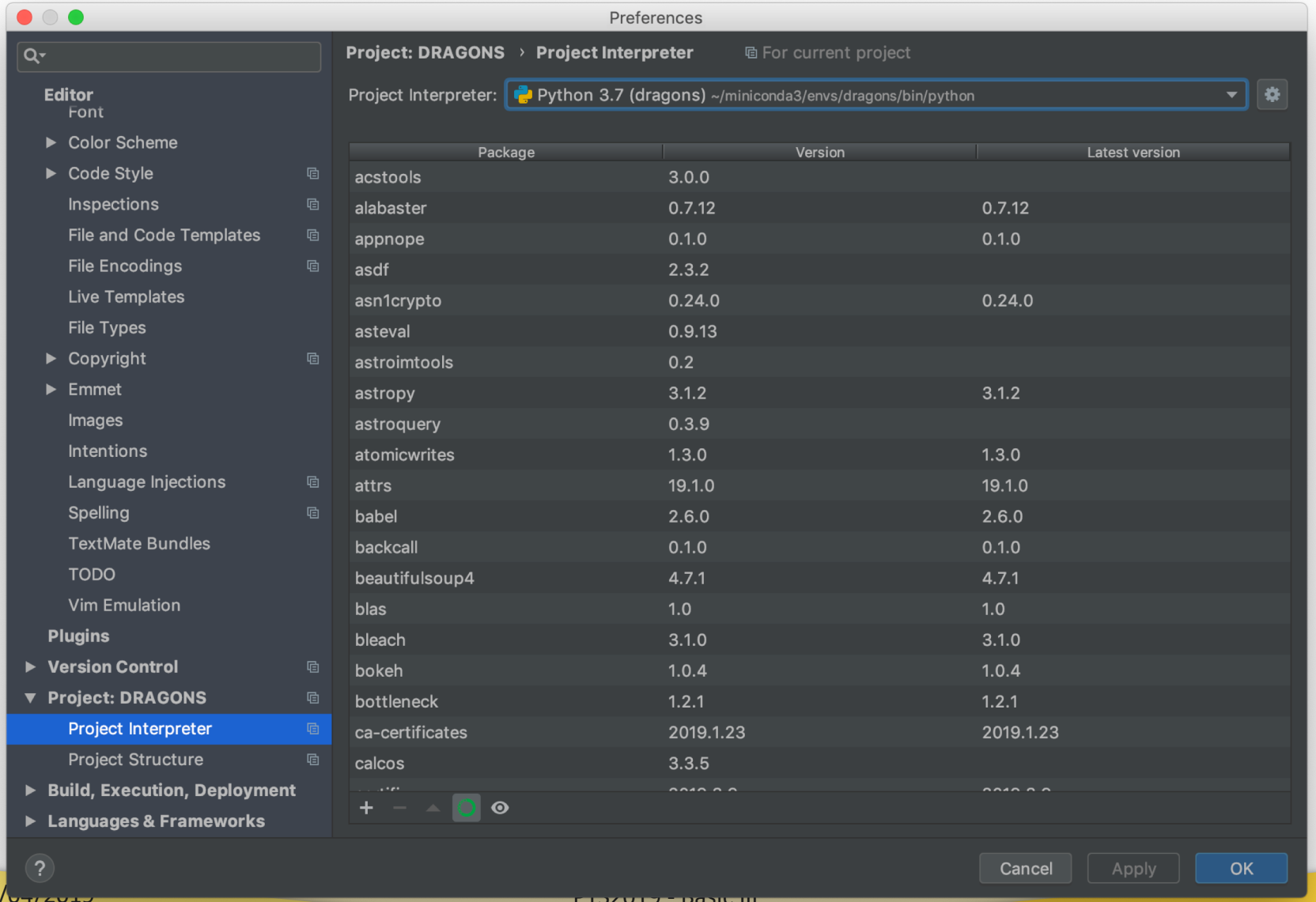
Conda and Anaconda

[Manage Environments]



Conda and Anaconda

[Manage Environments]



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?