Python

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Why Python???

. . .

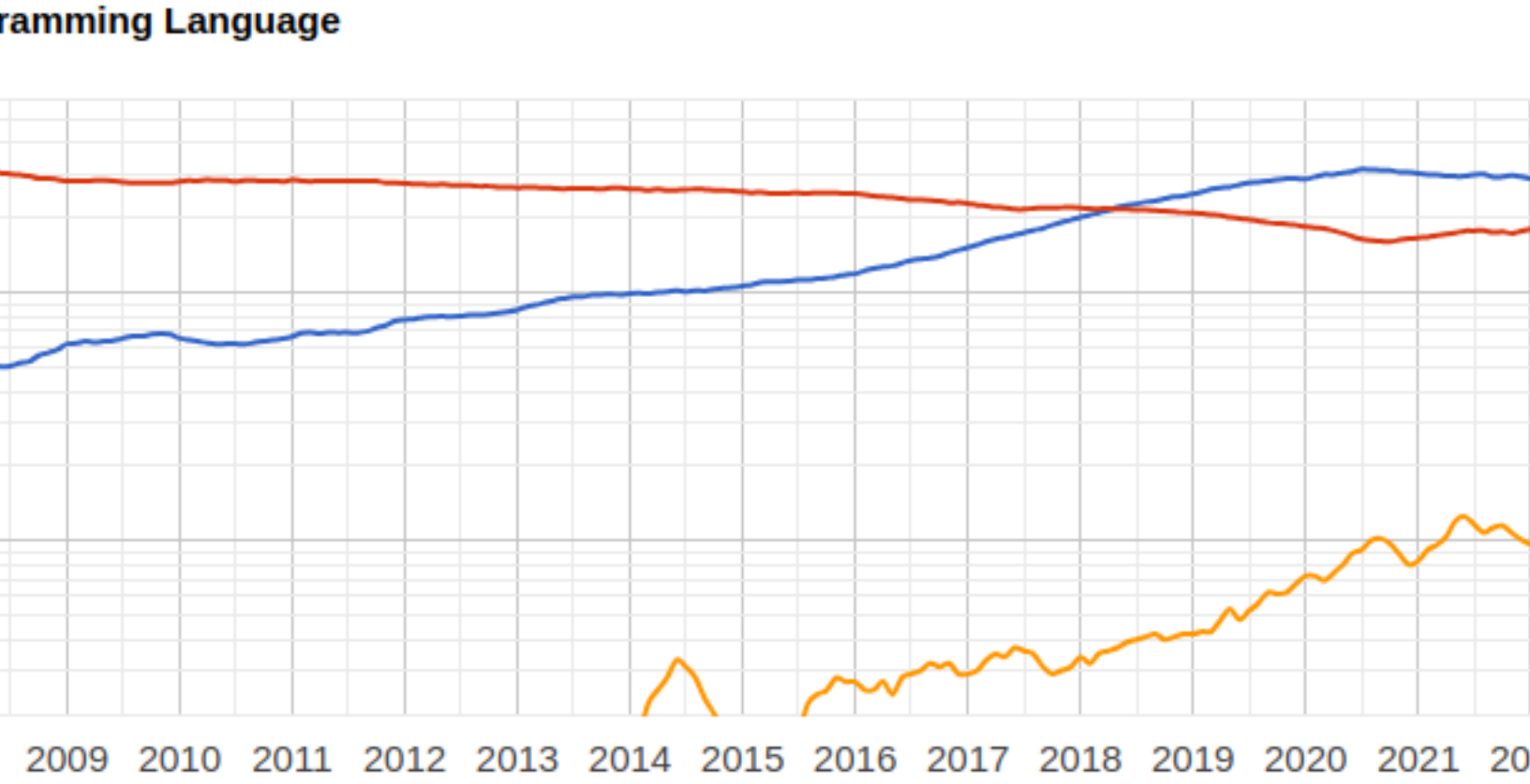


Figure 1: Center

. . .

Python:

- is popular

- is free and opensource
- has many many libraries
- vibrant community
- lots of online resources

Why Python? (3)

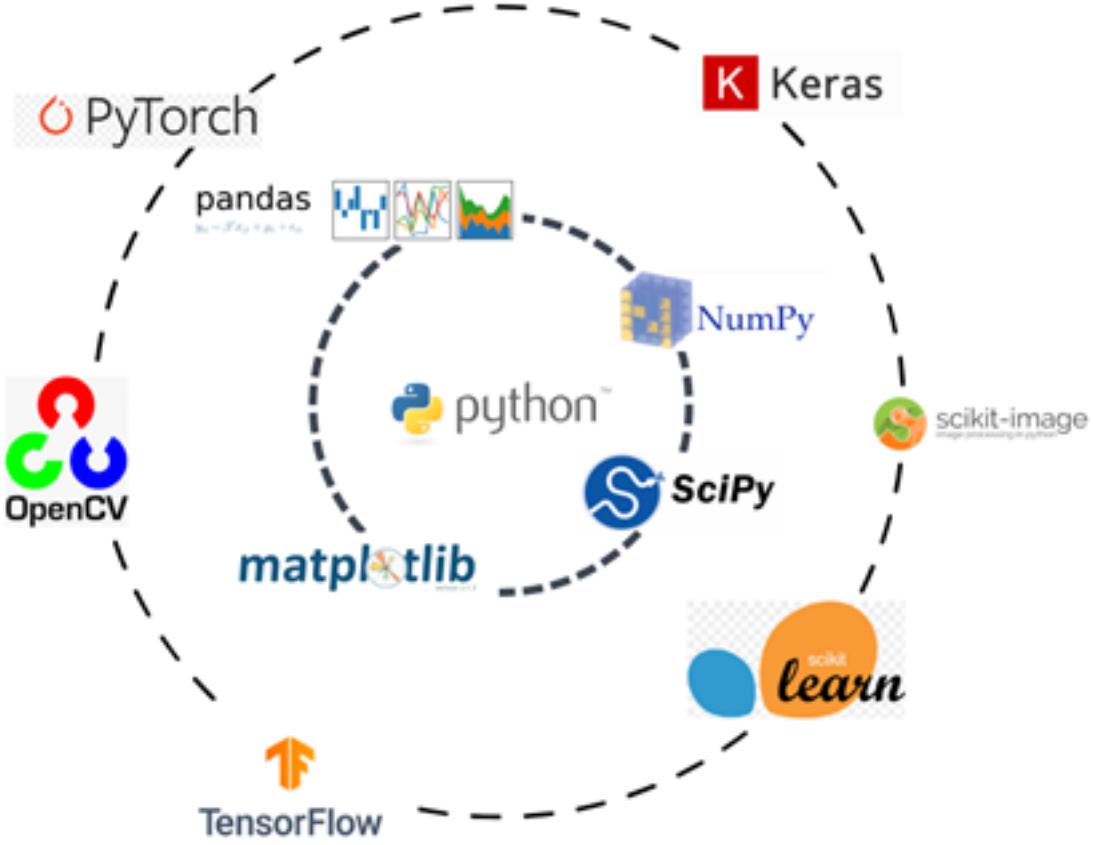
Historically, python was a glue language used to interoperate many low-level/system languages.

It has been increasingly used for web-development (cf django)

. . .

Nowadays it is the lingua franca of machine learning

Most major machine learning / deep learning libraries have python bindings



An example

```
def say_hello(name):
    """This function prints morning greetings"""
```

```
    print(f"Good morning {name}!\n")

    # we can import libraries
    import datetime
    t = datetime.datetime.now()

    # blocks are defined by indentation and colons
    if (t.hour,t.min) <= (9,15):
        print("All good?\n")
    else:
        print("Time to get started?\n")


say_hello("Pablo")
```

Python is everywhere

Figure 2: Code Warriors

- Windows
- Linux
- Web

The Python family

There are several flavours of Python:

- Full Syntax
  - CPython, PyPy, Pyston
- Subset-Syntax
  - micropython
  - numba, pythran
- Superset-Syntax
  - mypy (*)
  - cython
  - mojo
- Near-Syntax
  - boo
- subset-syntax: restrict functionalities (no classes, simpler objects) for easier compilation
- superset-syntax: add type/memory information
- near-syntax: different language that looks familiar

Examples

- mojo:

```
fn greet2(name: String) -> String:
    return "Hello, " + name + "!"
```

- cython

```
from libcpp.vector cimport vector

def primes(unsigned int nb_primes):

    cdef int n, i
    cdef vector[int] p
    p.reserve(nb_primes)  # allocate memory for 'nb_primes' elements.

    n = 2
    while p.size() < nb_primes:  # size() for vectors is similar to len()
        for i in p:
            if n % i == 0:
                break
```

Python is interpreted

> **i** Interpreted language
>
> In an interpreted language, instructions are read and translated into processor instructions, one after another.

As consequence, it is:

- flexible
  - interactive development
  - immediate feedback
- slooooww[1]

Intepreters

- Python
- ipython a.k.a. jupyter
  - send instructions to a kernel
  - receive back MIME objects (with nice html representation)
- VSCode
  - has its own python kernel implementation
- C API python.h
  - julia
  - your own...

Packages and Environment

Python modules

A file ending with .py is a *python module*

- `program.py`

```
key = "low"
def something():
    return "hey"
```

The content from a module can be *imported*

```
from program import something
```

To import all objects in a module (functions, strings, ...)

```
```

[1] actualy not so much because python modules are converted into bytecode and because common objects are well optimized

```
from program import *
```

Submodules

- A folder containing modules and an `__init.py__` is a `package`.
- import a package or a submodule:
  - `import package`
  - `from package.submodule import something`
- The content of modules and submodules is evaluated only once.[2]
- It is actually precompiled.
- This is perfect for distributing a package.
- Not so much to develop code interactively.

Package managers

Several ways to create / distribute python packages have been developped over the years.

- setup.py, pip
- setuptools, distutils, ...
- pipenv, poetry, ...
- conda

There are essentially two kinds of packages:

- pip packages
- conda packages

Pip packages

- pip files (what are eggs btw)
  - pure python
  - binary
- can be installed with `pip install package`
- no dependency solving ! no proper uninstallation !
- pip files a virtual evnironment created with `venv`
- reproducible setup can be described in
  - requirements.txt (old)
  - pyproject.toml (new)
- directory specific environments can be managed with `poetry` or `venv`:

[2] since python 3.4 you can actually reload a module with `importlib.reload()`

- `python -m venv directory`

Conda environment

- conda files
- installed in a conda environment
- with proper / reversible dependency solving
  - very quick using `mamba` or `micromamba`
- reproducible environment can be described in:
  - environment.yml (dependencies)
  - manifest (...)
- directory specific environments can be managed with `pixi`

Syntax Review

Let's setup the environment specified in requirements.txt

. . .

Move to python syntax tutorial