PyPy 2016

Introduction

Python is

- A syntax or two
- An interpreter
- A set of standard libraries shipped with the interpreter
- A vibrant number of communitis that shares code

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PyPy

- PyPy is an interpreter written in RPython
- Speed is one of its main advantages
- Compatible (mostly)

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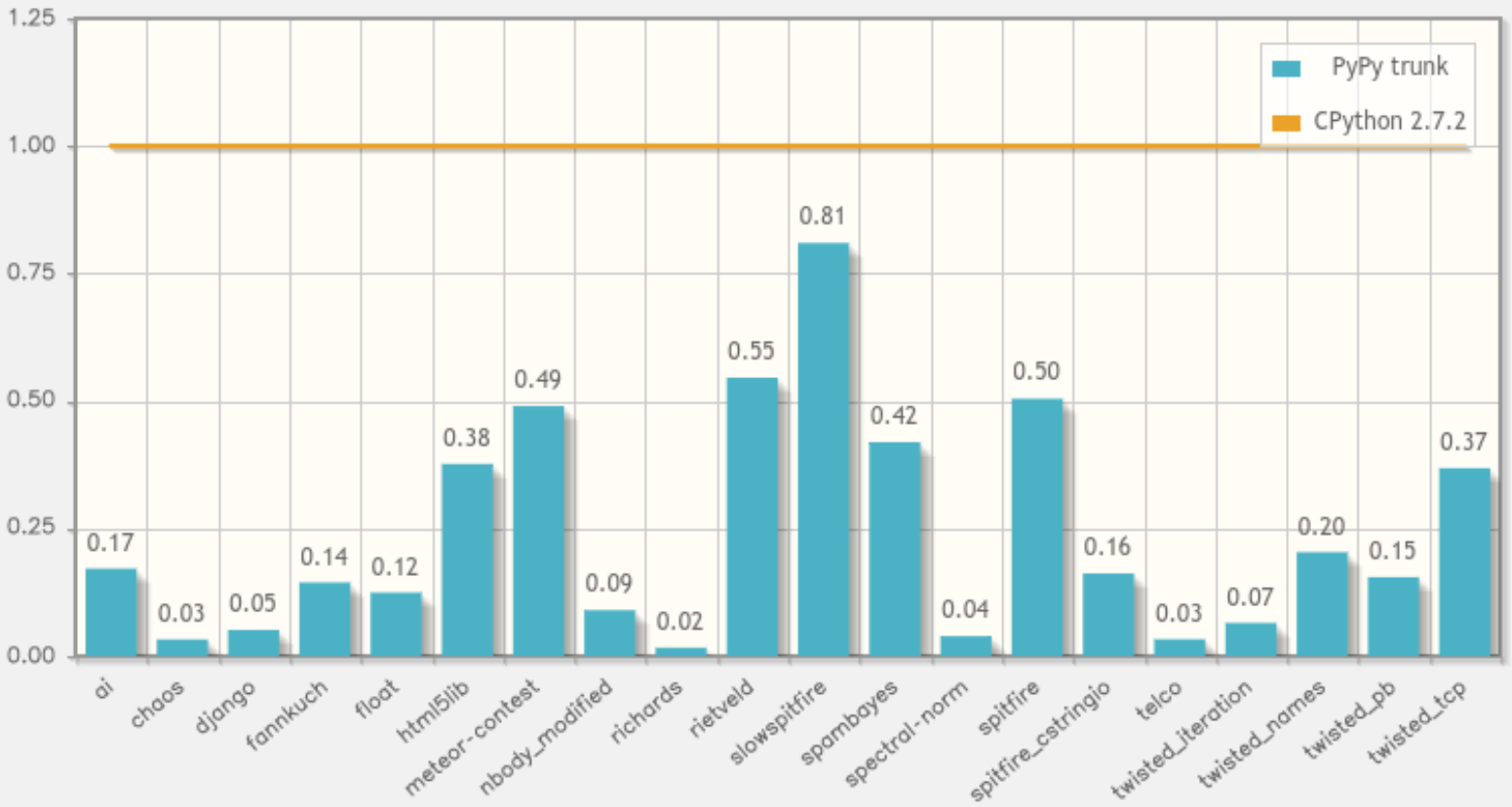
Speed



Plot 1: The above plot represents PyPy trunk (with JIT) benchmark times normalized to CPython. Smaller is better.

It depends greatly on the type of task being performed. The geometric average of all benchmarks is 0.15 or **6.8** times *faster* than CPython

How ?

- Tracing Just-In-Time compiler
- Optimizes loops
- Traces one iteration of a loop
- Produces a linear trace of execution
- Inlines almost everything
- The trace is then optimized and compiled
- Removes overhead

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Prove It

Techniques to achieve performant Python

- Write better code
  - string concatenation
  - attribute lookup
- Rewrite your code in C
- Rewrite your code in Cython
- Add accelators like Numba
- Use PyPy

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Why not PyPy?

- Python III
- Third-party library support

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PyPy and C (1/2)

- PyPy and CFFI
- CFFI is the easiest tool to I've used so far
- Very fast on PyPy, fast enough on CPython
- Used by NumPyPy
- Use CFFI to call python from C
  - This means you can create your own C API in pure Python !

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- What about C-API (glad you asked)
- Actively worked on right now

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- Makes it hard to improve Python while supporting 100% of the API
- PyPy 5.0 introduced a major rewrite
- Hint - good things are coming

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- I have been working on it since 2011
- Replaces ndarray, umath with builtin modules
- ~85% of the numpy tests are passing, on all platforms
- Most of numpy is there: object dtypes, ufuncs
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- Work in progress
- Allows you to use any CPython module on PyPy (scipy for example)
- Embeds CPython into PyPy with CFFI
- Numpy arrays can be shared between PyPy and CPython

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PyMetabiosis

```
from pymetabiosis import import_module

cpython_virtualenv_path =
    "/tmp/venv/bin/activate_this.py"

builtin = import_module("__builtin__")

# Activate a virtualenv for the cpython interpreter
builtin.execfile(cpython_virtualenv_path,
    {"__file__" : cpython_virtualenv_path}
)

pylab = import_module("matplotlib.pylab")

pylab.plot([1, 2, 3, 4])
pylab.show()
```

JitPy

- http://jitpy.readthedocs.io
- Proof of concept (Maciej Fijałkowski)
- Embeds PyPy into CPython
- Provides a decorator that allows you to run specific functions on PyPy
- Is used the same way as numba, but different performance characteristics

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```
import numpy as np
from jitpy import setup
setup('<path-to-pypy-home>')
from jitpy.wrapper import jittify

@jittify(['array', float], float)
def f(a, s):
    r = 0
    for i in xrange(a.shape[0]):
        r += a[i] * s
return s
func(np.arange(10000), 1.2)
```

Future - wouldn't it be great if

- Improved C extension compatibility
- Native Numpy + Scipy + ...

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The Future is Now!

- (Applause)
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Why this makes sense

- Advantages and disadvantages of RPython
- Advantages of a JIT (vectorization)
- Leveraging this for other dynamic languages

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Takeaway

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- Try it
- Give us feedback (good or bad)

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Thank You

Questions ?