PyPy 2016

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Scipy Israel 2016

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Python means four things:

Python is

- A syntax or six *(2 * 3 = 6)*
- An interpreter to run code written in the syntax
- A set of standard libraries shipped with the interpreter
- A vibrant number of communities that share code

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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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- It ships with the standard library
- Speed is one of its main advantages
- Compatible (mostly) via pip install
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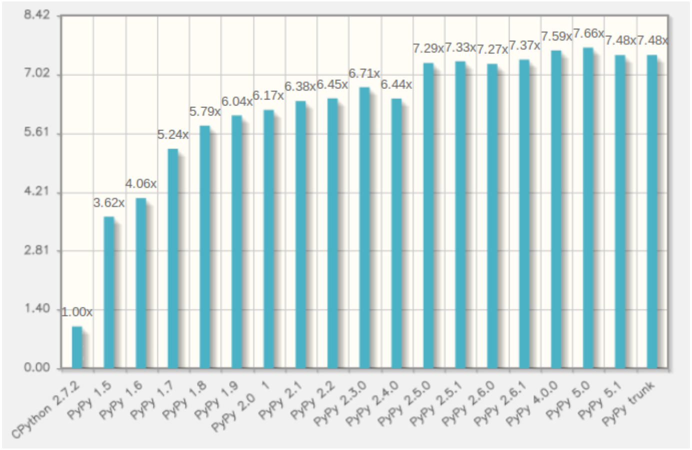
Speed (Applause)



Speed continued

- Benchmarking, statistics, politics
- Did I mention warmup time?

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How ?

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- Optimizes loops
- Traces one iteration of a loop
- Produces a linear trace of execution
- The trace is then **optimized** and compiled

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- Inlining
- Promotion
- Unrolling
- Strategies
  - Convert sequences to arrays
  - Vectorization

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Prove It

- profiling
- jitviewer

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- Python and the community
- Third-party library support
- No easy packaging (like Winpython or Anaconda)
  - Opportunity???

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- CFFI is easy, just massage the headers and that's it
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    - This means you can create your own C API in pure Python !

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- Actively worked on right now

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Python C API

- Leaks way too many implementation details (refcounting, PyObject structure fields)
- C allows you to cheat (private, read-only)
- Makes it hard to improve Python while supporting 100% of the API
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- Hint - good things are coming

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NumPyPy

- `https://bitbucket.org/pypy/numpy` + pypy
- I have been working on it since 2011, together with many others
- Replaces ndarray, umath with builtin modules
- ~85% of the numpy tests are passing, on all platforms
- Most of numpy is there: object dtypes, ufuncs
- linalg, fft, random all via cffi
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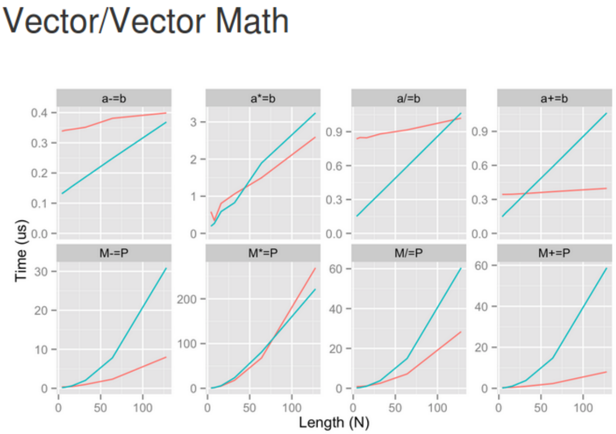

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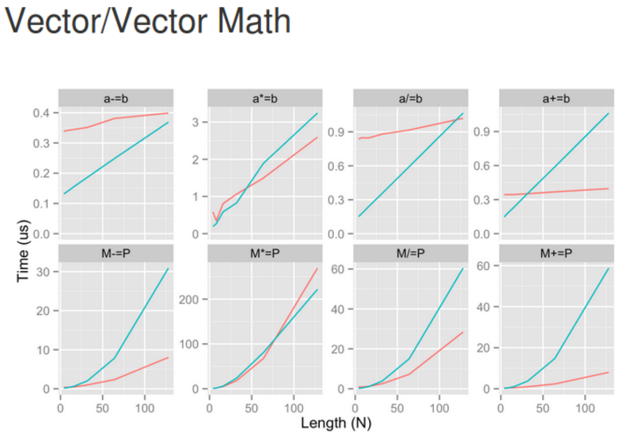

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NumPyPy future

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- But what about SciPy?

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- 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

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- 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

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- Native Numpy + Scipy + ...

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The Future is Now!

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Why this makes sense

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

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Thank You

Questions ? Examples:

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- How can I get involved?
- What about commercial involvement?
- How can I get support?
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