Beyond Python

Ali Akbar Septiandri

Universitas Al-Azhar Indonesia

aliakbars@live.com

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Overview

Bahan Bacaan

1. Dokumentasi Cython: `http://docs.cython.org/en/latest/`
2. Dokumentasi Jython: `http://www.jython.org/docs/index.html`
3. Honnibal, M. (2014). Writing C in Cython. Retrieved May 22, 2017, from `https://explosion.ai/blog/writing-c-in-cython`

Python di Industri

Python untuk YouTube

"Google runs millions of lines of Python code. The front-end server that drives youtube.com and YouTubes APIs is primarily written in Python, and it serves millions of requests per second!" [Trotter, 2017]

Python untuk Quora

Quora

"Python was a language that Charlie and I both knew reasonably well (though I know it a lot better now than I did when we started). We also briefly considered C#, Java, and Scala. The biggest issues with Python are speed and the lack of typechecking." [D'Angelo, 2014]

Lebih Lanjut tentang Quora

"We decided that Python was **fast enough** *for most of what we need to do (since we push our performance-critical code to backend servers written in C++ whenever possible). As far as typechecking, we ended up* **writing very thorough unit tests** *which are worth writing anyway, and achieve most of the same goals."* [D'Angelo, 2014]

"For a lot of little reasons, Java programs end up **being longer** and **more painful** to write than the equivalent Python programs."
[D'Angelo, 2014]

Masalah pada Python

Beberapa hal yang sering disebut atau ditanyakan mengenai kelemahan Python antara lain:

1. *slow*

Masalah pada Python

Beberapa hal yang sering disebut atau ditanyakan mengenai kelemahan Python antara lain:

1. *slow*
2. *dynamically-typed*

Masalah pada Python

Beberapa hal yang sering disebut atau ditanyakan mengenai kelemahan Python antara lain:

1. *slow*
2. *dynamically-typed*
3. *can it run elsewhere?*

Spectral Norm Benchmarking

`https://benchmarksgame.alioth.debian.org/u64q/spectralnorm.html`

"...calculate the spectral norm of an infinite matrix A, with entries a11=1, a12=1/2, a21=1/3, a13=1/4, a22=1/5, a31=1/6, etc"

program	secs	mem	gz	cpu
C	1.99	1,824	1139	7.88
Java	4.29	29,884	950	16.56
Python 3	188.83	54,524	437	12 min

Statically vs Dynamically Typed

Example (Kode dalam C++)

```
string f(char x, char y) {
    string z = "";
    return z + x + y;
}
```

Statically vs Dynamically Typed

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    string z = "";
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}
```

Example (Kode dalam Python)

```
def f(x, y) {
  # Argumen x dan y bisa jadi apapun!
  return x + y
}
```

Jython

"Write once, run anywhere"

Java Virtual Machine

1. JVM yang berjalan di atas berbagai macam platform
2. Menjalankan program yang **dikompilasi** ke dalam Java bytecode
3. Berada di atas kode mesin

Java Bytecode

Beberapa *compilers* yang menghasilkan Java bytecode:

1. Groovy
2. Scala
3. Kotlin
4. JRuby
5. **Jython**

Jython

"Most Jython developers are either Python developers that are looking to make use of the vast library of tools that the JVM has to offer, or Java developers that would like to utilize the Python language semantics without migrating to a completely different platform."
[Juneau et al., 2010]

Integrasi Java

Example

```
print "Hello, World!"
```

Integrasi Java

Example

```
from java.lang import System

System.out.println("Hello, World!")
```

Integrasi Java

Dengan mengintegrasikan Python dengan Java, artinya kita bisa mengimpor modul seperti swing, AWT, servlet, dsb.

Jim Baker - Getting to Jython 2.7 and beyond (PyCon 2015)
https://www.youtube.com/watch?v=hLm3garVQFo

Cython

Pertama: Bedakan CPython dan Cython!

CPython vs Cython

CPython:

1. implementasi *interpreter* bahasa Python yang ditulis dalam bahasa C
2. kode **dikompilasi** menjadi *bytecode*
3. bawaan dari paket instalasi Python

Cython:

1. superset dari bahasa Python
2. kode **ditranslasi** menjadi kode C/C++ teroptimasi
3. "The best of both worlds"

Contoh Kode

Example

```
import random
from cymem.cymem cimport Pool

from libc.math cimport sqrt

cimport cython

cdef struct Point:
    double x
    double y
```

Contoh Kode

Example

```
cdef class World:
    cdef Pool mem
    cdef int N
    cdef double* m
    cdef Point* r
    cdef Point* v
    cdef Point* F
    cdef readonly double dt
    def __init__(self, N, threads=1, m_min=1, m_max=30.0, r_max=50.0, v_max=4.0, dt=1e-3):
        self.mem = Pool()
        self.N = N
        self.m = <double*>self.mem.alloc(N, sizeof(double))
        self.r = <Point*>self.mem.alloc(N, sizeof(Point))
        self.v = <Point*>self.mem.alloc(N, sizeof(Point))
        self.F = <Point*>self.mem.alloc(N, sizeof(Point))
        for i in range(N):
            self.m[i] = random.uniform(m_min, m_max)
            self.r[i].x = random.uniform(-r_max, r_max)
            self.r[i].y = random.uniform(-r_max, r_max)
            self.v[i].x = random.uniform(-v_max, v_max)
            self.v[i].y = random.uniform(-v_max, v_max)
            self.F[i].x = 0
            self.F[i].y = 0
        self.dt = dt
```

Contoh Kode Pencari Bilangan Prima

Example

```
def primes(int kmax):
    cdef int n, k, i
    cdef int p[1000]
    result = []
    if kmax > 1000:
        kmax = 1000
    k = 0
    n = 2
    while k < kmax:
        i = 0
        while i < k and n % p[i] != 0:
            i = i + 1
        if i == k:
            p[k] = n
            k = k + 1
            result.append(n)
        n = n + 1
    return result
```

Writing C in Cython

https://explosion.ai/blog/writing-c-in-cython

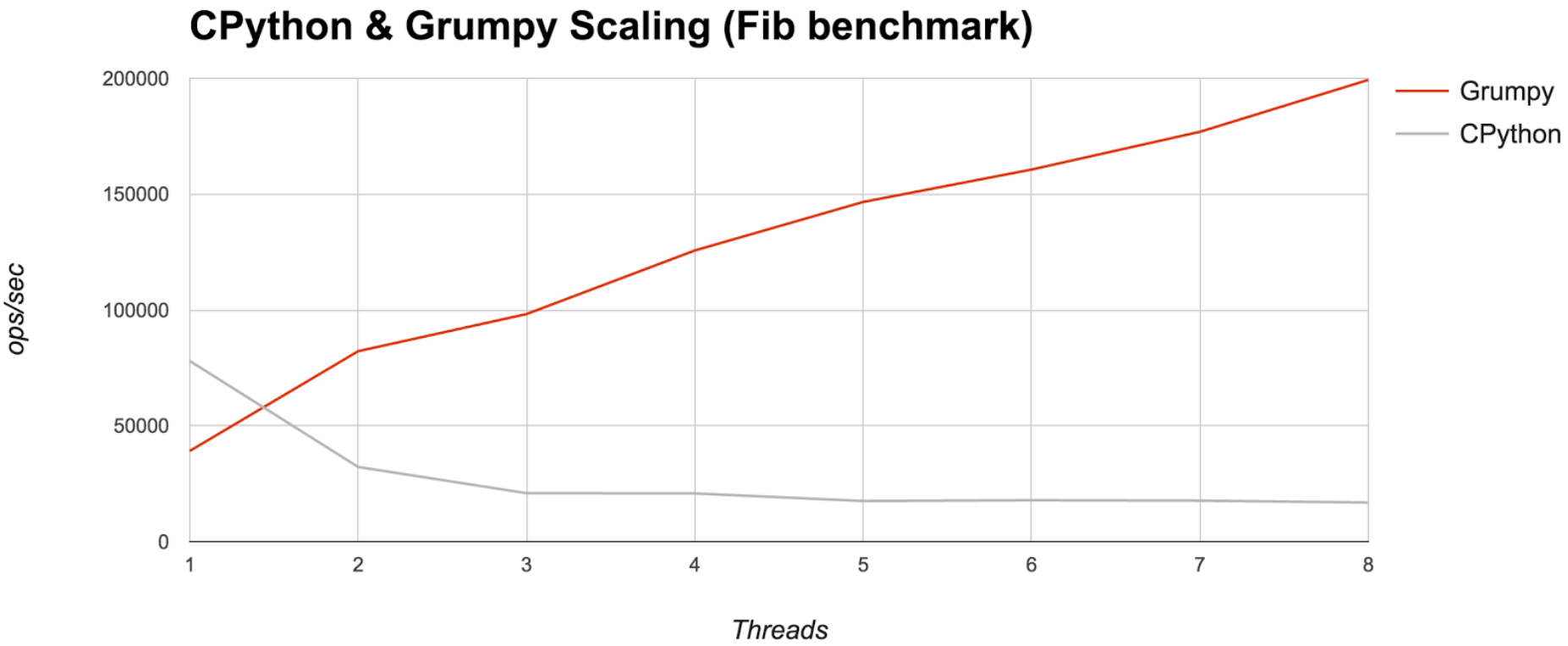
Implementasi Lain

Proyek Pengembangan Python

Beberapa implementasi bahasa pemrograman Python:

1. IronPython - .NET
2. Pyjs - JavaScript
3. Grumpy - Go

Benchmark



Gambar: Benchmarking dengan menghasilkan n bilangan Fibonacci [Trotter, 2017]

References

Dylan Trotter (4 January 2017)

Grumpy: Go running Python!

https://opensource.googleblog.com/2017/01/grumpy-go-running-python.html

Adam D'Angelo (13 September 2014)

Why did Quora choose Python for its development?

https://www.quora.com/Why-did-Quora-choose-Python-for-its-development

Josh Juneau, et al. (25 March 2010)

Chapter 10: Jython and Java Integration

http://www.jython.org/jythonbook/en/1.0/JythonAndJavaIntegration.html

Terima kasih