The speed of PyPy

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How fast is PyPy?

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- pretty fast, in places
- slower than cpython in other places
- overall, it depends
- graphs

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- **JIT is not a magical device!**
- removes bytecode overhead
- removes frame overhead
- can make runtime decisions
- more classic optimization that can follow

The main idea

- python has advanced features (frame introspection, arbitrary code execution, overloading globals)
- with JIT, you don't pay for them if you don't use them
- however, you pay if you use them, but they work

A piece of advice

- don't use advanced features if you don't have to

Tracing JIT

- compiler traces the actual execution of Python program
- then compiles linear path to assembler
- example
- mostly for speeding up loops and to certain extent recursion

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- **this enables further optimizations**

Removing object boxing

```
i = 0
while i < 100:
   i += 1
```

- for each iteration we do a comparison and addition
- xxx integers on valuestack and xxx integers in locals
- all boxing can be removed

Variable access costs

- local access costs nothing
- global access is cheap, if you don't change global `__dict__` too much XXX rephrase

Frame escapes

- **JIT** normally removes frame overhead, but
- calling `sys._getframe()`, `sys.exc_info()`
- exception escaping
- prevents a lot of optimizations

Shared dicts (aka hidden classes)

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- **only for newstyle classes**

Version tags

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- ... if you don't modify them too often
- counters on classes are bad

Call costs

- calls can be inlined
- simple arguments are by far the best
- avoid `*args` and `**kwds`
- however, `f(a=3, b=c)` is fine

Allocation patterns

- PyPy uses a moving GC (like JVM, .NET, etc.)
- pretty efficient for usecases with a lot of short-living objects
- objects are smaller than on CPython
- certain behaviors are different than on CPython

Differencies

- no refcounting semantics
- `id(obj)` can be expensive as it's a complex operation on a moving GC
- a large list of new objects is a bad case behavior

General rules

- don’t try to outsmart your compiler
- simple is better than complex
- metaprogramming is your friend
- measurment is the only meaningful way to check

Problems

- long traces - tracing is slow
- megamorphic calls
- metaclasses
- class global state

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- years of optimizations against CPython

Future

release end March

- will contain a working JIT
- will not speed up all cases
- might eat all your memory

That's all!

- Q & A
- http://morepypy.blogspot.com
- http://pypy.org
- http://merlinux.eu