Performance Pandas

Jeff Reback

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StrataNYC 2015

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https://github.com/jreback/StrataNYC2015/tree/master/performance

Jeff Reback

@jreback

- former quant
- currently working on projects at Continuum
- core commiter to pandas for last 3 years
- manage pandas since 2013

What do we care about when writing code?

Objectives

- feature set
- readability counts
- maintenance is a virtue
- tests & docs

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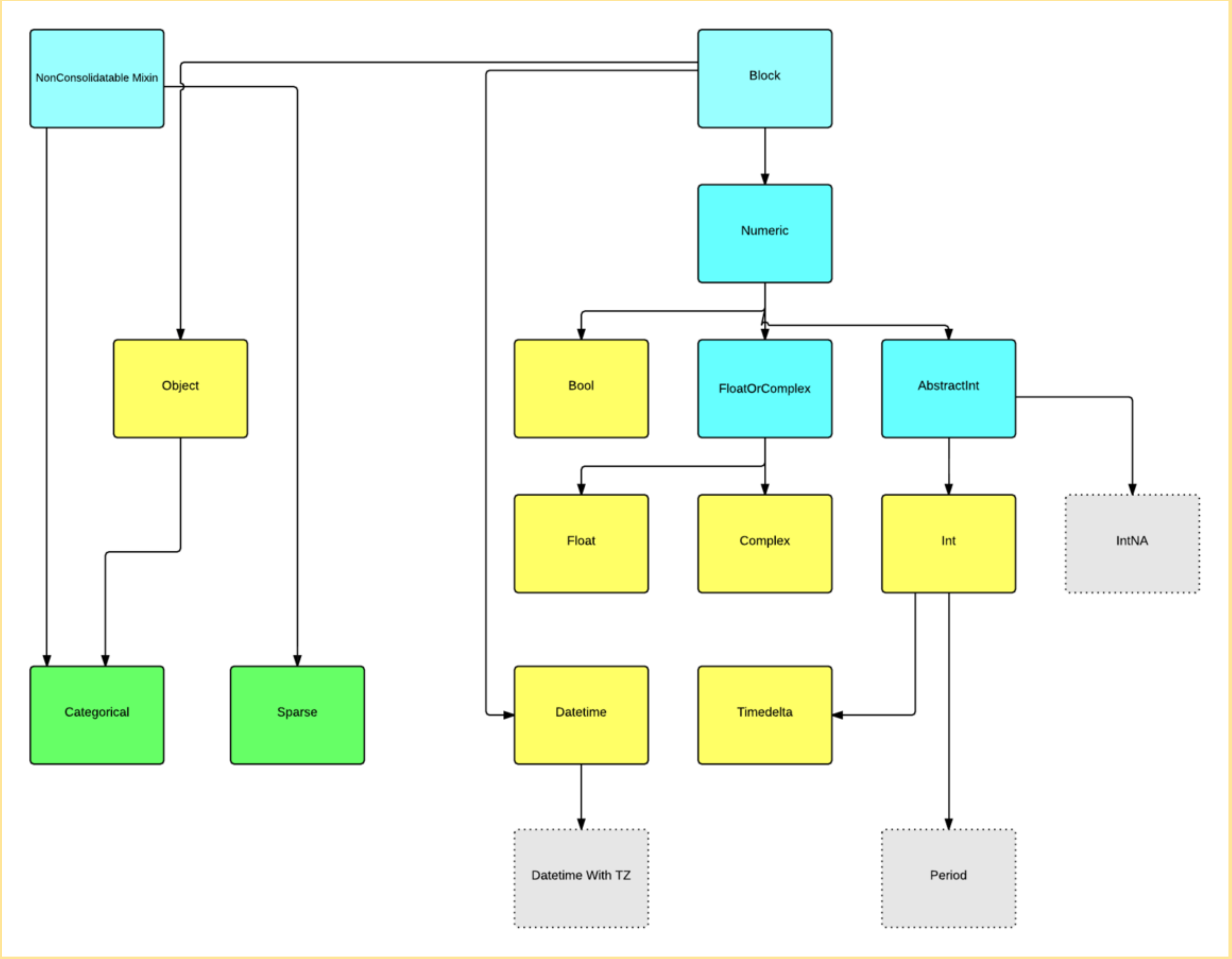
Constraints

- implementation time
- runtime
- resource utilization

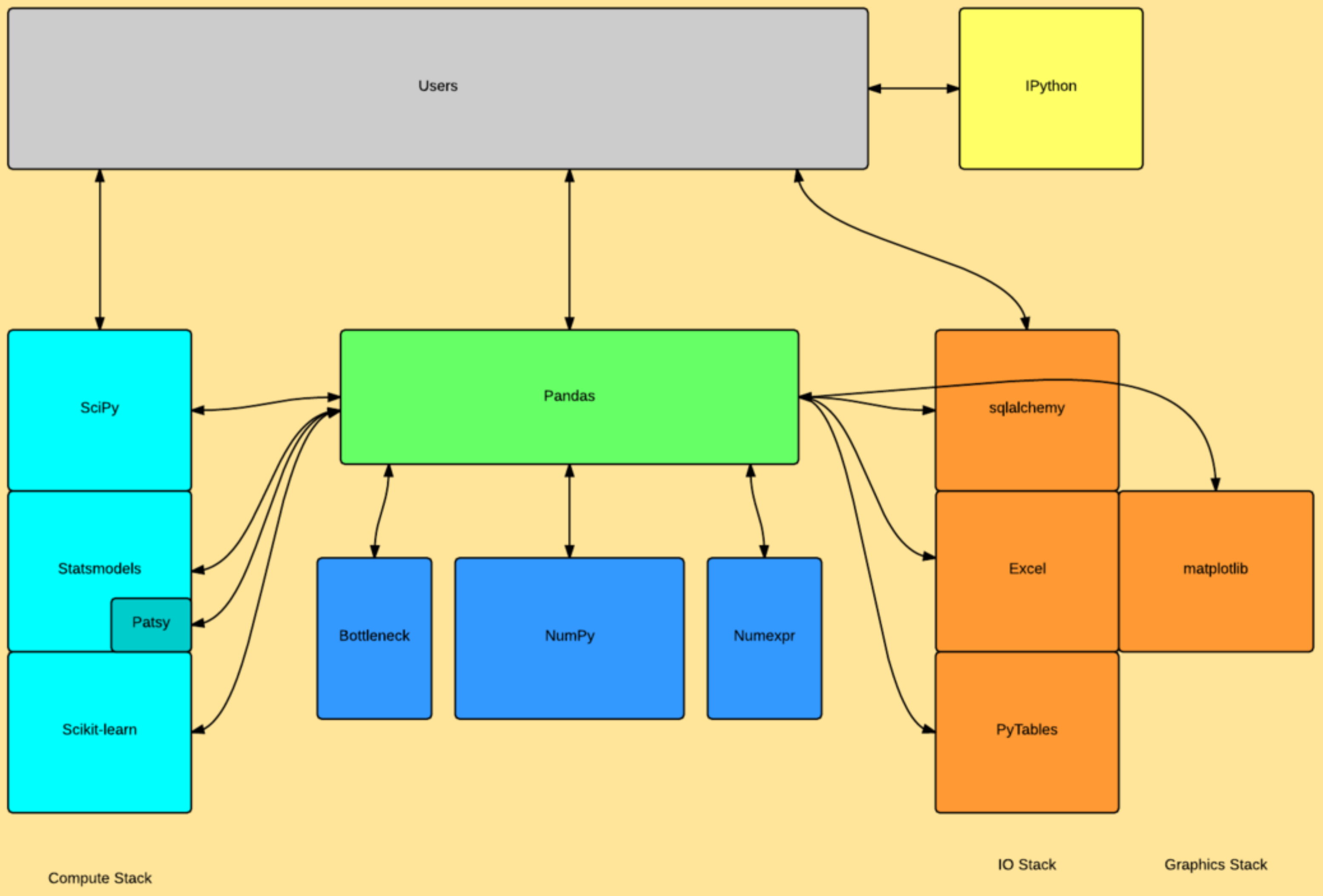
What drives pandas?

- dtype segregation
- block memory layout


NonConsolidatable Mixin
Block
Numeric
Object
Bool
FloatOrComplex
AbstractInt
Float
Complex
Int
IntNA
Categorical
Sparse
Datetime
Timedelta
Datetime With TZ
Period

What drives pandas?

- dtype segregation
- block memory layout
- **computation backends**


Users
IPython
SciPy
Pandas
sqlalchemy
Statsmodels
Patsy
Bottleneck
NumPy
Numexpr
Excel
matplotlib
Scikit-learn
PyTables
Compute Stack
IO Stack
Graphics Stack

Computation Backends

- numpy
- bottleneck
- numexpr
- DyND ?

http://slides.com/jeffreback/ds4ds-pandas#/

What drives pandas?

- dtype segregation
- block memory layout
- computation backends
- **cython for critical parts**
- **hashtable for indexing**

how to make pandas perform

1. Have Correct Code
2. Profile / Compare

how to make pandas perform

1. Have Correct Code
2. Profile / Compare
3. **Refer to Rules #1 and #2**

I DON'T ALWAYS COMPARE THINGS
BUT WHEN I DO, IT'S APPLES TO ORANGES
quickmeme.com

" Programmers waste enormous amounts of time thinking about, or worrying about, the speed of noncritical parts of their programs, and these attempts at efficiency actually have a strong negative impact when debugging and maintenance are considered.

" premature optimization is the root of all evil (or at least most of it) in programming.

The Art of Computer Programming, Donald Knuth (1974)

How to make pandas *fast*

- **algo**
- idioms
- built-in / vectorization
  - pandas/numpy
  - bottleneck/numexpr
  - cython
- ad-hoc cython/numba

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How to make pandas ~~fast~~ slow

- **apply across the rows**

dealing with apply if you're not a pandas expert

> *look for a way to vectorize it*

> *even if you are, look for another way*

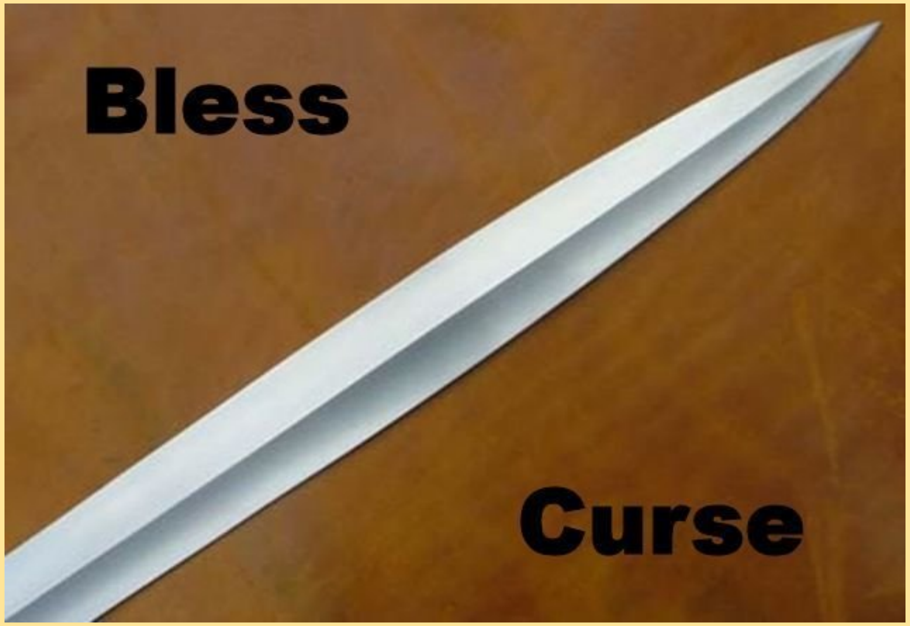
How to make pandas ~~fast~~ slow

- apply across the rows
- **itertuples/iterrows**

How to make pandas ~~fast~~ slow

- apply across the rows
- itertuples/iterrows
- **iterative updating**

.values, a double edged sword



Do's

- have the correct dtypes
- ***pd.concat***
- ***Categoricals***
- Use idioms & builtin
- ***.apply*** across columns

Don'ts

- repeated insertions
- micro optimize
- use loops / re-invent the wheel
- ***.apply*** across rows
- ***.applymap***
- nest ***groupby.apply()***
- ***inplace=True***

Memory Considerations

- conversions

Memory Considerations

- conversions
- **categoricals**

Memory Considerations

- conversions
- categoricals
- **iterators**

I/O & Serialization

- HDF5
- bcolz
- CSV
- SQL
- JSON
- pickle
- msgpack

http://matthewrocklin.com/blog/work/2015/03/16/Fast-Serialization/

http://odo.readthedocs.org/en/latest/

I need even more!

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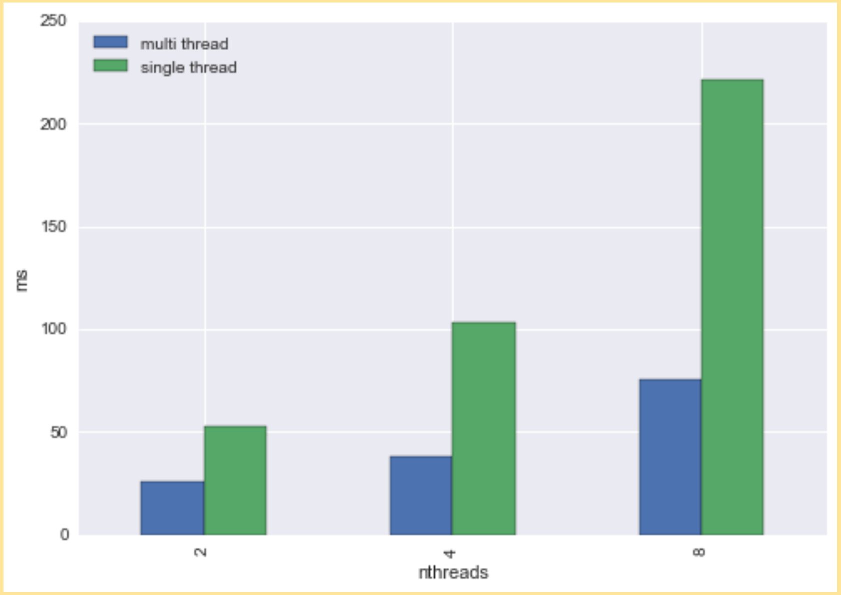

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- **out-of-core**

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- Global-Interpreter-Lock (GIL)
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- out-of-core
- **dask**
    - threading
    - multi-process
    - distributed

https://dask.readthedocs.org/en/latest/

How to contribute

https://github.com/pydata/pandas/issues

This Talk

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