Python 3: 10 years later

Looking back at Python evolutions of the last 10 years

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Victor Stinner

- CPython core developer since 2010
- Work on CPython and OpenStack for Red Hat
- Very happy Fedora and vim user!

Autumn

Birth of Python 3000

2006: PEP 3000 “Python 3000”

Fix "Python warts":

- long vs int; new class vs old class
- int vs float division
- Unicode mess
- Comparisons
- Relative imports

Risk management

- Don't break everything, only acknowledged warts
- Have a community process for deciding what to change
- Don't reimplement the interpreter from scratch
- Plan end of life for Python 2

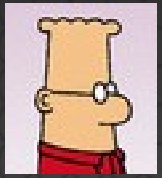
2008: Python 3.0 released

First migration plan

- Run 2to3 to port your whole code base at once: you're done! ...
- Drop Python 2 is a **no-go**, modules authors care of Python 2 users!
- All **dependencies** must be Python 3 compatible
- Python 2.7 was heavily used in **production**

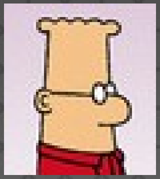
Technical debt

– Why should I let you work on adding Python 3 support?



– For all these new cool Python 3 features!

– Can we use these features?



– Well.... since we still have to support Python 2... no

Two branches in Git?

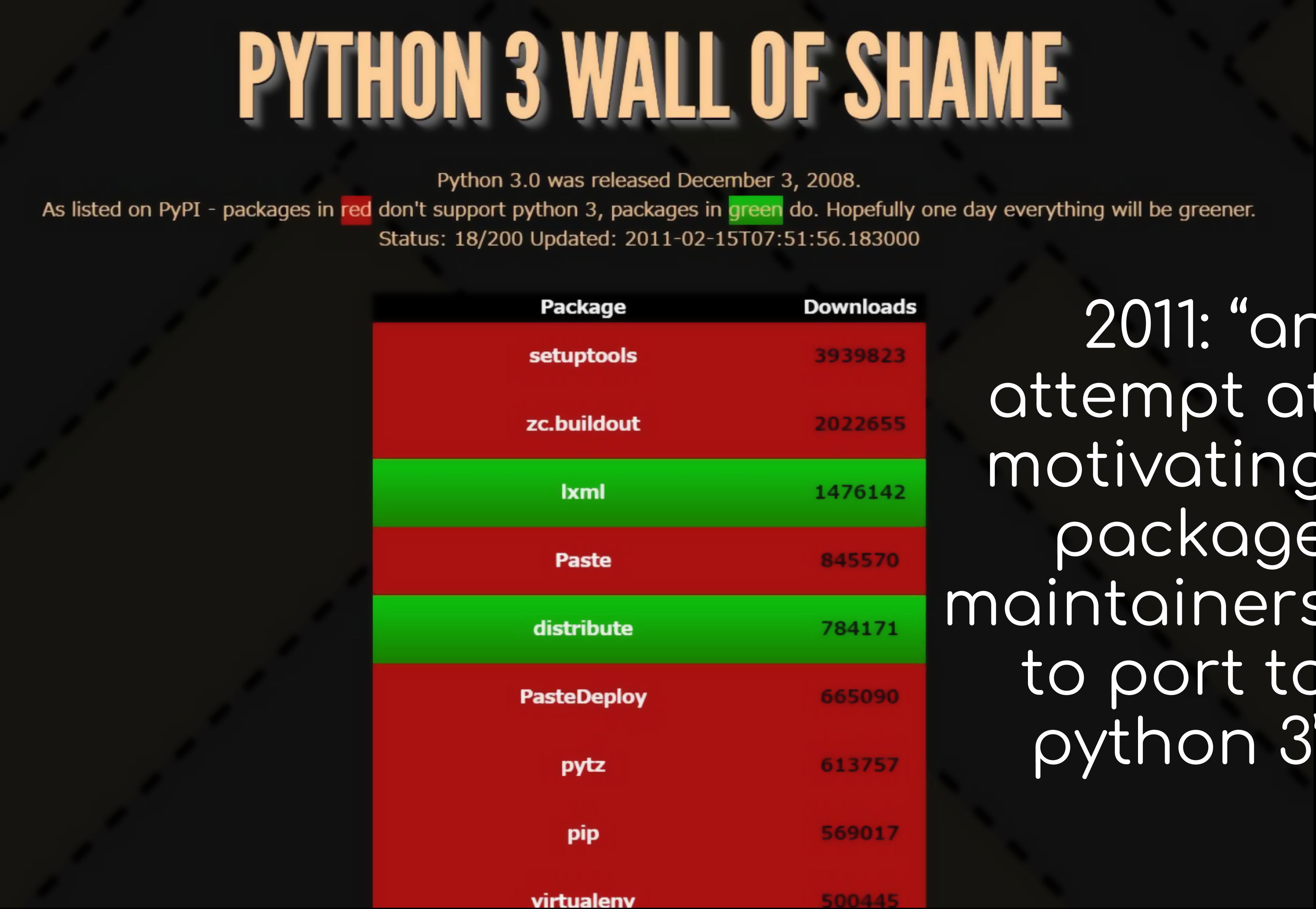
Some projects were forked to add Python 3 support:

- PIL → Pillow
- dnspython → dnspython3
- MySQL-python → mysqlclient
- mock → mock3
- python-ldap → ldap3 and pyldap

Python 2.6 and 3.2

- Python 2.6 was the stable version when 3.0 was released
- It requires unittest2 and more backports
- It requires heavy usage of the six module
- Python 3.2 requires **six.u("unicode")**; u"unicode" is a syntax error

Winter



PYTHON 3 WALL OF SHAME

Python 3.0 was released December 3, 2008.
As listed on PyPI - packages in red don't support python 3, packages in green do. Hopefully one day everything will be greener.
Status: 18/200 Updated: 2011-02-15T07:51:56.183000

Package	Downloads
🟥 setuptools	3939823
🟥 zc.buildout	2022655
🟩 lxml	1476142
🟥 Paste	845570
🟩 distribute	784171
🟥 PasteDeploy	665090
🟥 pytz	613757
🟥 pip	569017
🟥 virtualenv	500445

2011: “an attempt at motivating package maintainers to port to python 3”

Big Python 2 projects

Twisted

Heavy usage of bytes

mercurial

django

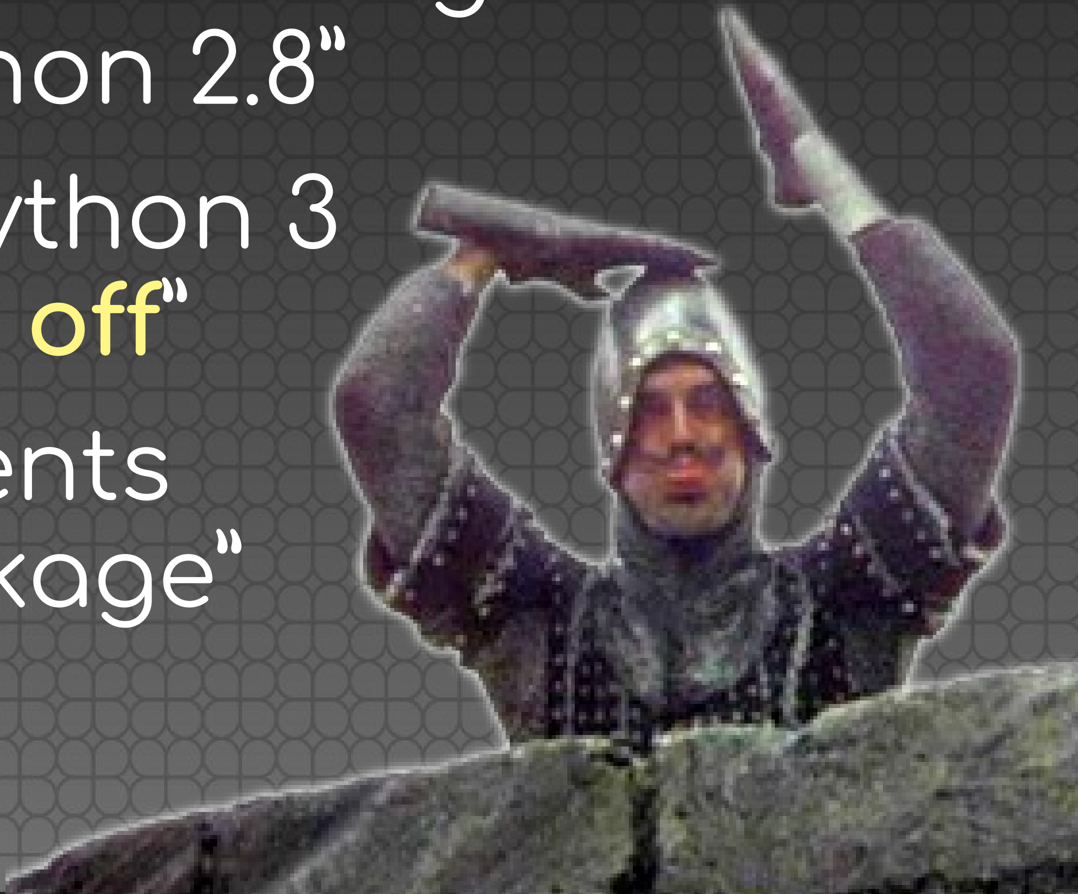
Incomplete Unicode support

Python 3 trolls

- Python 3 doesn't bring anything
- Python 3 introduces new Unicode issues
- Locales are hard to use and understand
- Bytes are simpler

Python 2.8

- 2011: PEP 404 “Python 2.8 Un-release Schedule”
- 2014: LWN article “Debating a "transitional" Python 2.8”
- “concerns that Python 3 would never take off”
- “Python 3 represents under 2% of package”



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No Python 2.8!

- 2013: Python 3 Wall of Superpowers: 39 of the top 50 projects supported Python 3 (78%)
- 2014: Python 2.7 end of life extended by 5 years to 2020

Spring

Problem #1 solved!

“How can I install a dependency?”
“How do I install setuptools?”

- 2011: **pip 1.0** released
- 2014: Python 2.7.9 and 3.4 now come with **ensurepip**
- pip: **defacto installer**
- Linux distros with pip

New approach

- Stop promoting 2to3: don’t remove Python 2 support
- Add Python 3 support
- New tools like modernize and sixer
- Incremental changes tested by a CI

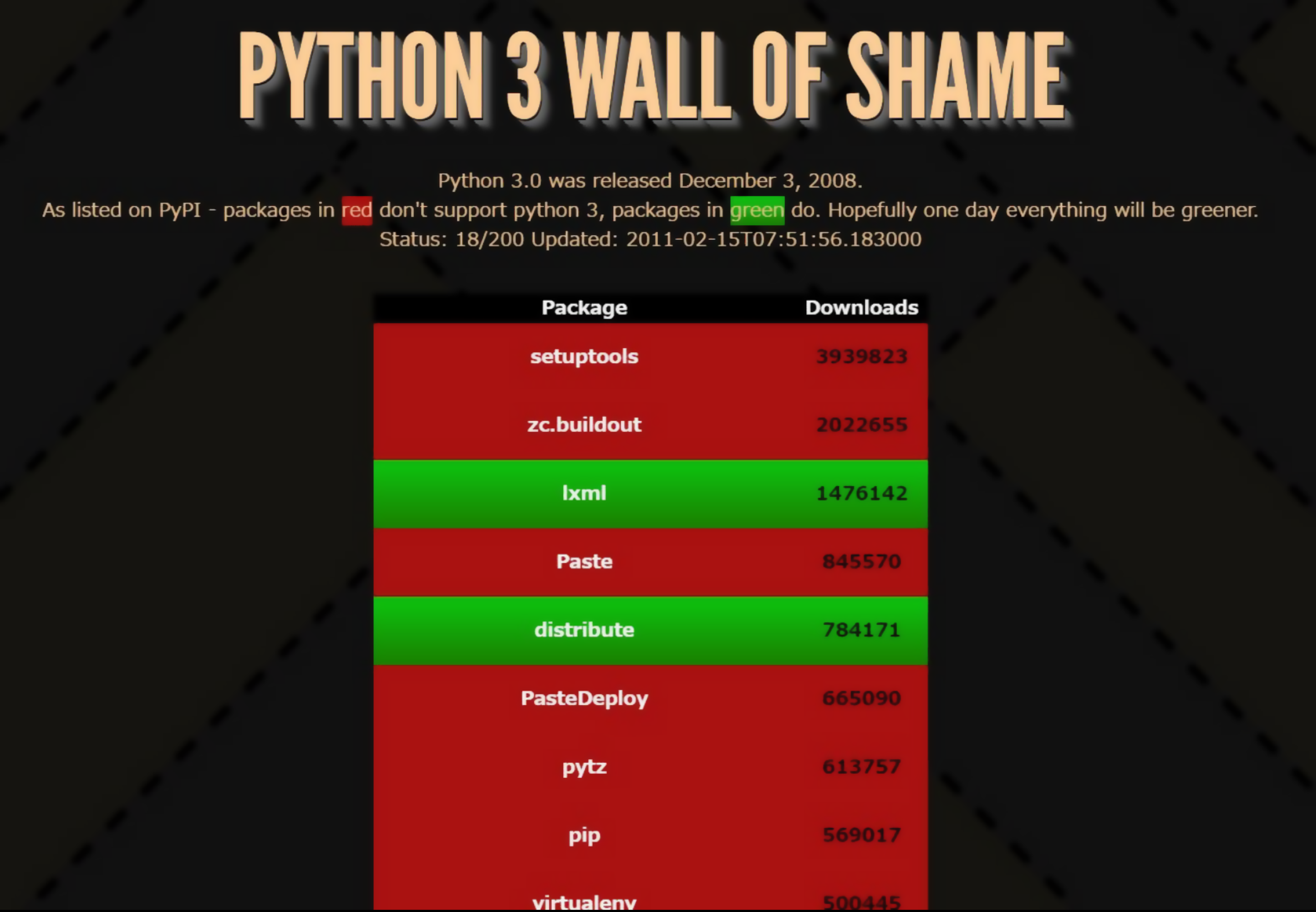
Large code base

- For legacy code bases: first add new tests to reduce the risk of regression
- Dropbox is working on mypy and typing to annotate types in their large code base

Building bridges

- 2012: Python 3.3 reintroduces **u"unicode"**
- 2015: Python 3.5 adds **bytes % args** (PEP 461)
- More py3k warnings added to Python 2.7
- More 2.7 backports: unittest2, enum34, ...

Summer



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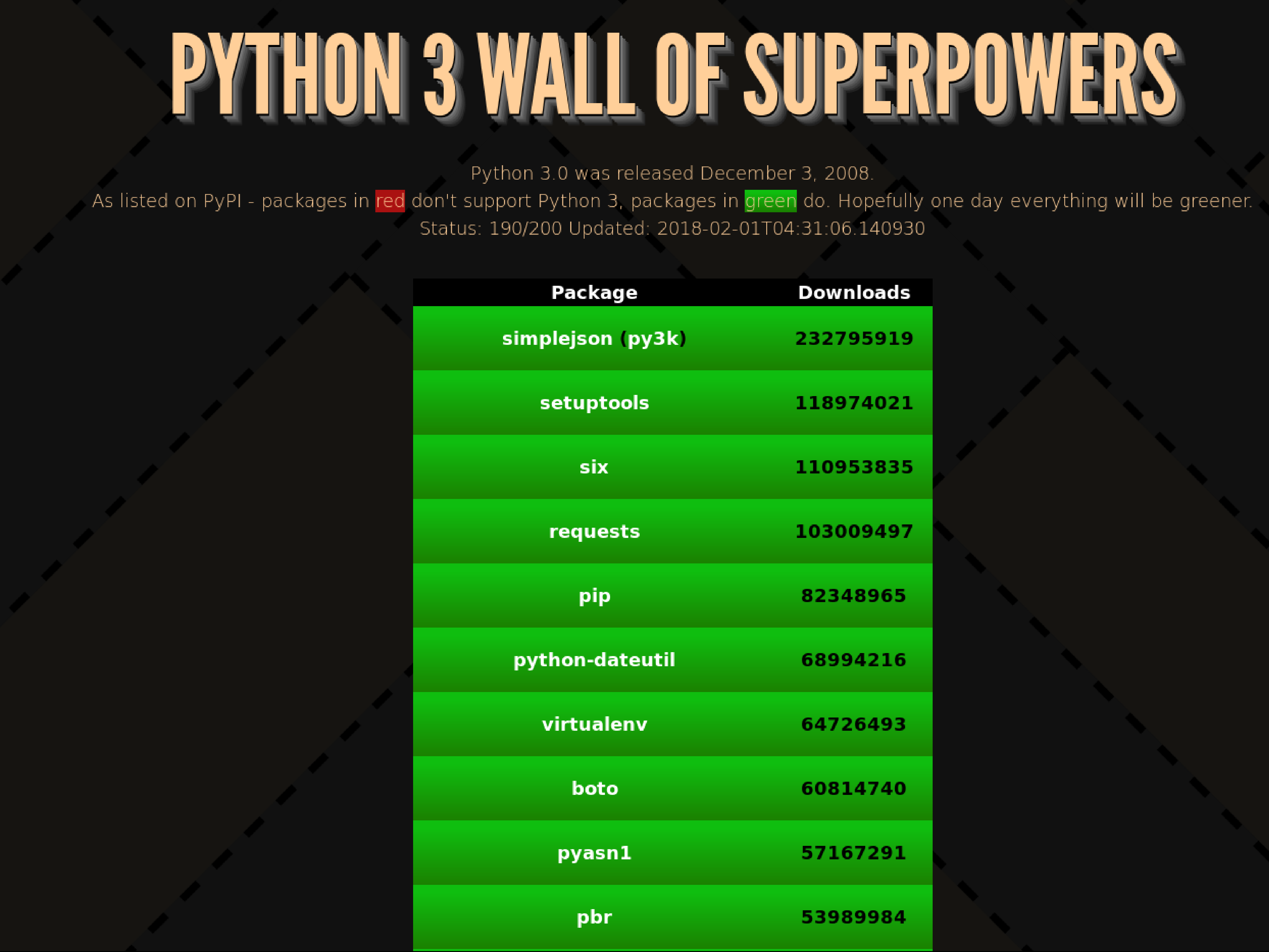


PYTHON 3 WALL OF SUPERPOWERS

Python 3.0 was released December 3, 2008.

As listed on PyPI - packages in red don't support Python 3, packages in green do. Hopefully one day everything will be greener.

Status: 190/200 Updated: 2018-02-01T04:31:06.140930

Package	Downloads
simplejson (py3k)	232795919
setuptools	118974021
six	110953835
requests	103009497
pip	82348965
python-dateutil	68994216
virtualenv	64726493
boto	60814740
pyasn1	57167291
pbr	53989984

Python 2.7 WONTFIX

Backward compatibility prevents to fix Python 2.7 bugs:

- Unicode support
- Hash not randomized by default
- subprocess is not thread safe
- threading.RLock is not signal safe
- Internal clocks are not monotonic

Fixed in Python 3

- 3.3: time.monotonic() (PEP 418)
- 3.4: file descriptors non-inheritable, fork+exec safety (PEP 446)
- 3.5: retry syscalls on EINTR (PEP 475)
- "We are aware of the code breakage this is likely to cause, and doing it anyway for the good of mankind." – Guido van Rossum PEP 446 approval

2.7 → 3.4 new modules

- 3.1: importlib, tkinter.ttk
- 3.2: concurrent.futures
- 3.3: faulthandler, ipaddress, lzma, unittest.mock, venv
- 3.4: asyncio, enum, ensurepip, pathlib, selectors, statistics, tracemalloc

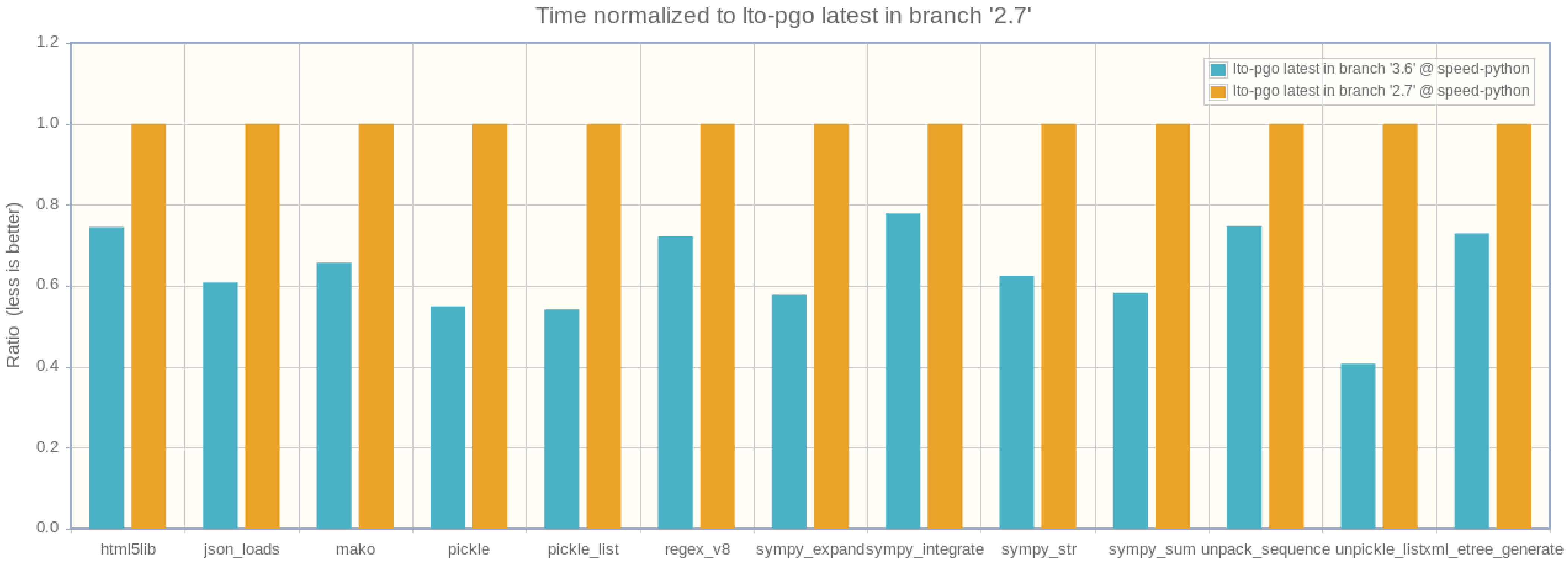
3.4 → 3.7 new modules

- 3.5: typing, zipapp
- 3.6: secrets
- 3.7: importlib.resources, contextvars, dataclasses

2.7 → 3.7

😍 21 new modules 😍

3.6 faster than 2.7



Results normalized to Python 2.7

lower = faster

Bury Python 2?

- “Python 3 only”
- Fedora 23, Ubuntu 17.10: no python2 in the base system
- 2017: IPython 6.0 and Django 2
- https://pythonclock.org/
- http://www.python3statement.org/

Python 4?

- We learnt from our mistakes
- No major backward incompatibility
- Regular deprecation process, as any other release: warning in version N, remove in version N+1

Questions?

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