

Python 3 10 years later

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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



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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

A photograph of a calico cat with white, orange, and black fur walking across a snowy landscape. The cat is positioned in the center-right of the frame, moving towards the viewer. The background consists of a bright, snow-covered ground under a clear blue sky with some wispy clouds. In the bottom-left corner, there is a solid blue rectangular overlay containing the word "Winter" in a large, white, sans-serif font.

Winter

PYTHON 3 WALL OF SHAME

Python 3.0 was released December 3, 2008.

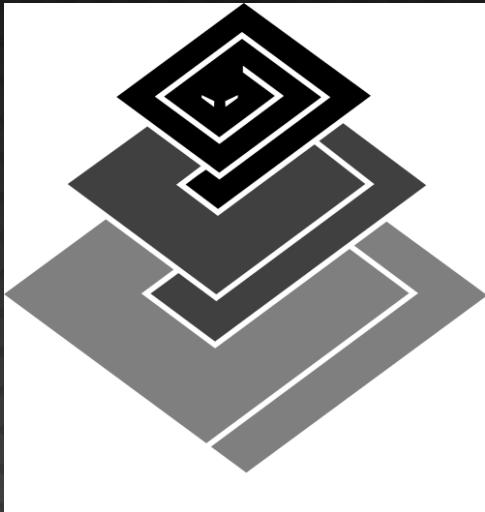
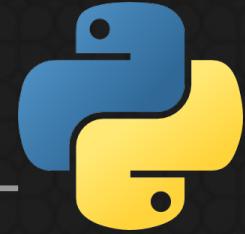
As listed on PyPI - packages in red don't support python 3, packages in green do. Hopefully one day everything will be greener.

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



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python™

Python 3 trolls



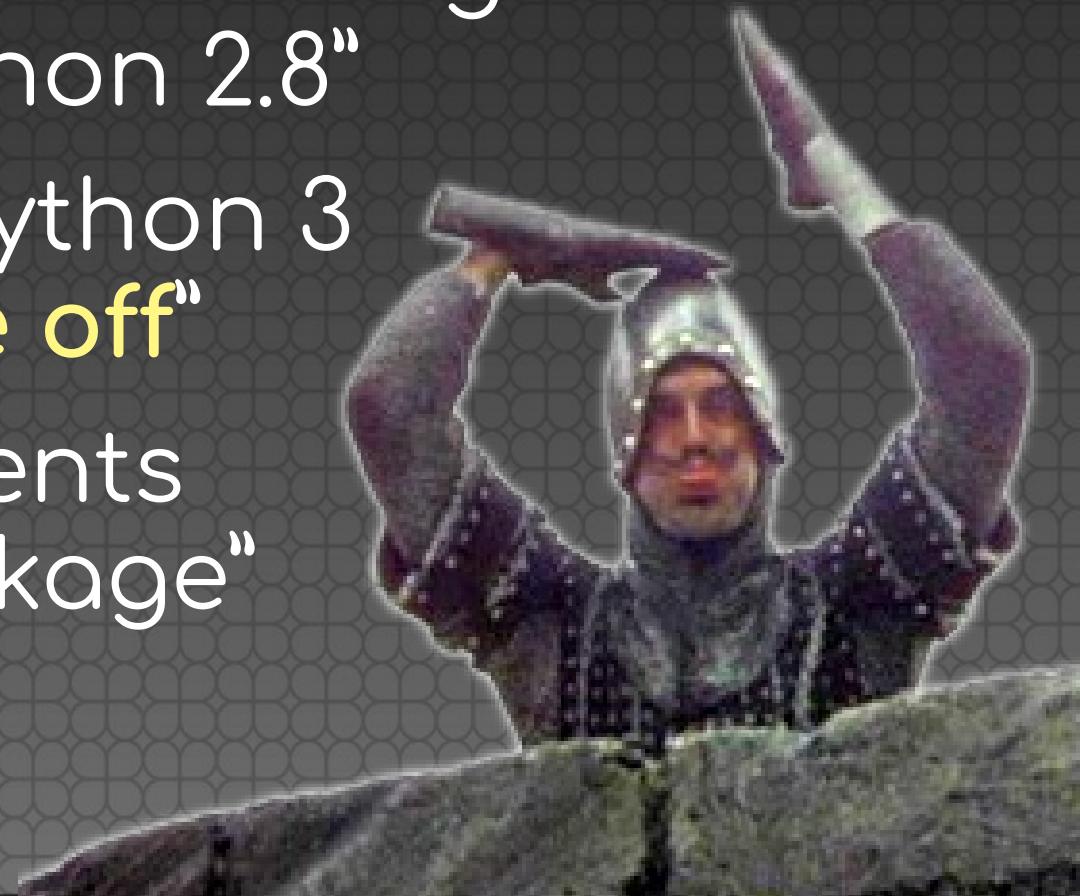
- Python 3 **doesn't bring anything**
- Python 3 introduces new **Unicode** issues
- Locales are hard to use and understand
- **Bytes** are simpler



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”



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**



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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, ...



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Summer

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

Status: 18/200 Updated: 2011-02-15T07:51:56.18300

everything will be greener.

2011: 9% :-(
(18/200)

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

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

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

g will be greener.

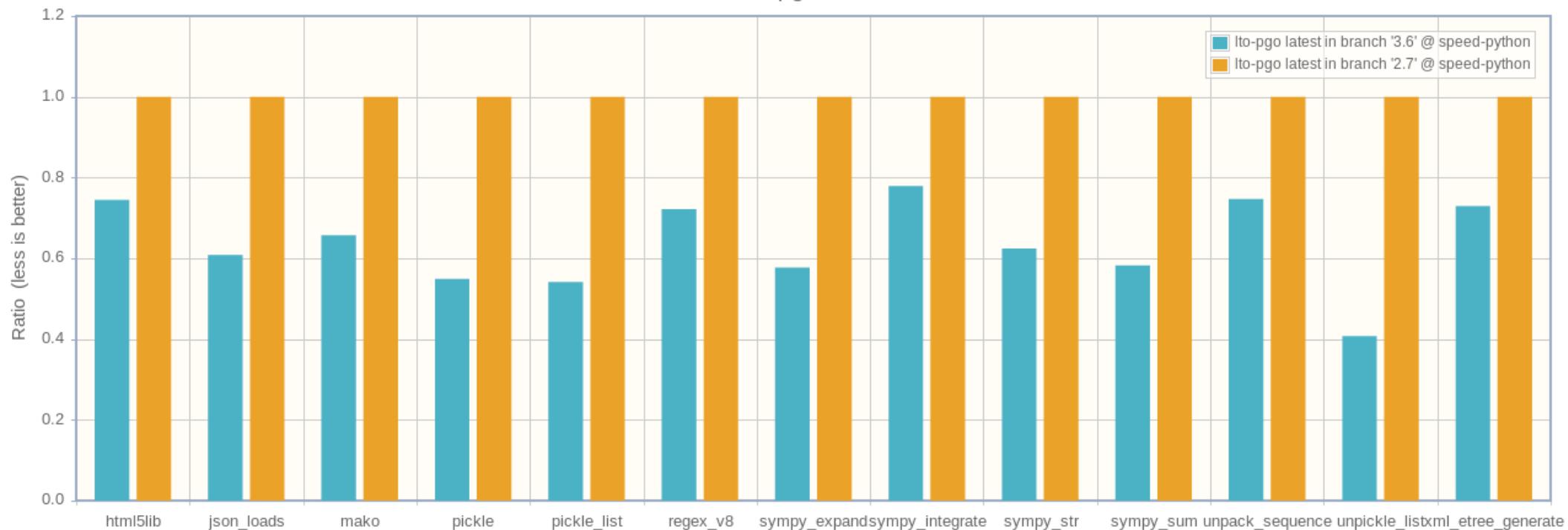
2018: 95% :-)
(190/200)

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

3.6 faster than 2.7



Time normalized to Ito-pgo latest in branch '2.7'



Results normalized to Python 2.7
lower = faster

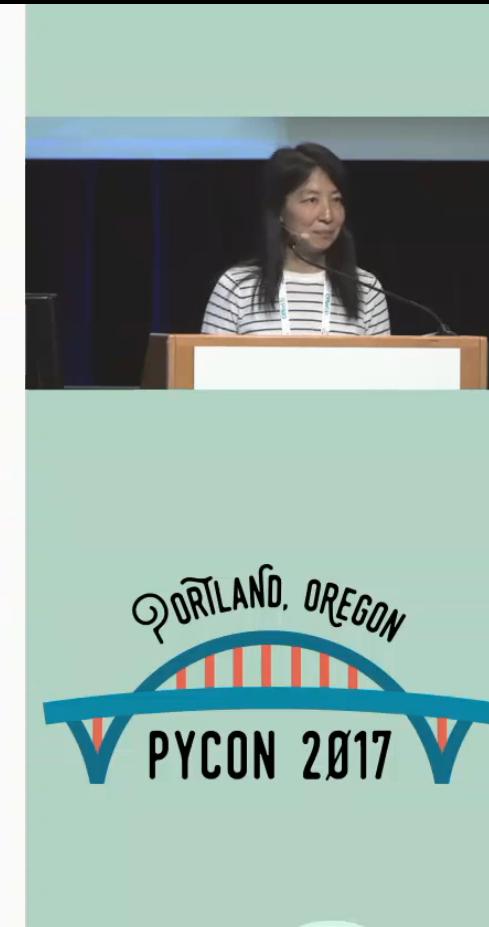
INSTAGRAM ON PYTHON3



Saving of 12%
(on uwsgi/django)



Saving of 30%
(on celery)



Instagram

PORTLAND, OREGON
MAY 17 - 25 2017

Lisa Guo and Hui Ding Keynote

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 😊



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New 3.0 syntax



- Keyword only parameters

```
def func(arg, *, kw_only=None): ...
```

- **print(msg, file=sys.stderr, end="")**
function, no longer a statement

- Octal prefix: eight = **0o10**

- one, ***tail** = range(5)

- ...

New 3.1 syntax



- Multiple context managers in a single statement:

with open(...) as infp, open(...) as outfp:

...

New 3.3 syntax



- PEP 380: delegation subgenerators

```
def generator():
    yield "start"
    yield from range(5)
```

- PEP 414: Explicit Unicode literals

```
text = u'unicode'
bytes = b'bytes'
```

New 3.5 syntax



- PEP 492: **async** and **await** "keywords"
(real keywords since 3.7)
- PEP 461: bytes **% args**
- PEP 465, matrix operator: $a @ b$
- PEP 448, generalized unpacking:
`cmd = ['python3', *args, 'script.py']`
`mydict = {"key": "value", **other_dict}`

New 3.6 syntax (1)



- PEP 515: underscores in numeric literals.

```
sec_in_us = 1_000_000
```

```
word = 0xAA_BB_CC_DD
```

- PEP 498, f-string:

```
name = "World"; print(f"Hello {name}!")
```

```
# Hello World!
```

```
x = 1; y = 2; print(f"{x} + {y} = {x + y}")
```

```
# 1 + 2 = 3
```

New 3.6 syntax (2)



- PEP 525, asynchronous generators

```
async def async_gen():
    value = await async_compute()
    yield value
```

- PEP 530: asynchronous comprehensions.

```
[expr async for it in async_gen()]
[await func() for func in funcs()]
```

New 3.6 syntax (3)



- PEP 526, variable annotations

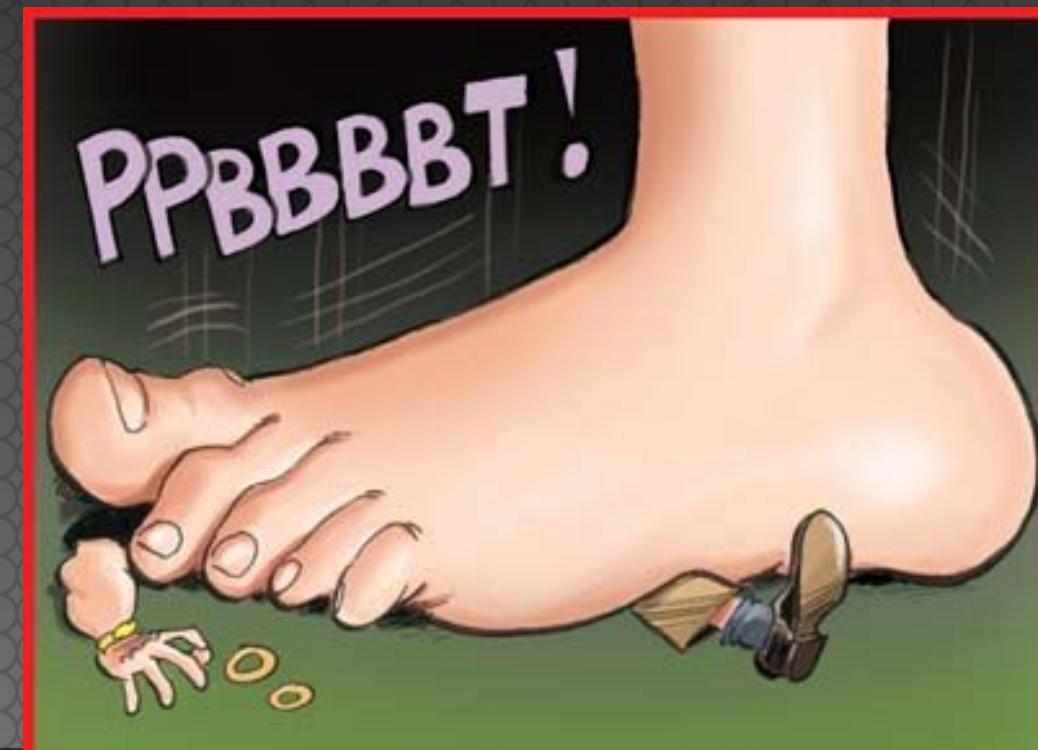
`x: int = 5`

`name: str # no initial value!`

Bury Python 2?



- Fedora 23 (2015), Ubuntu 17.10 (2017): no python2 in the base system
- python3statement.org
- pythonclock.org
- 2017: IPython 6.0 and Django 2 are Python 3 only



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Python 4?



- We learnt from our mistakes
- Regular deprecation process



Questions?



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