

# Python 3 10 years later

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Victor Stinner



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# Victor Stinner

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





Autumn

# Birth of Python 3000

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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

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- Don't break everything, only acknowledged **warts**
- Have an open 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

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- 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

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- Why should I let you work on 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.

- Same upstream, two names:  
`dnspython` → `dnspython3`
- Community fork:  
`PIL` → `Pillow`
- Upstream does not reply:  
`MySQL-python` → `mysqlclient`

# 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 and 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.

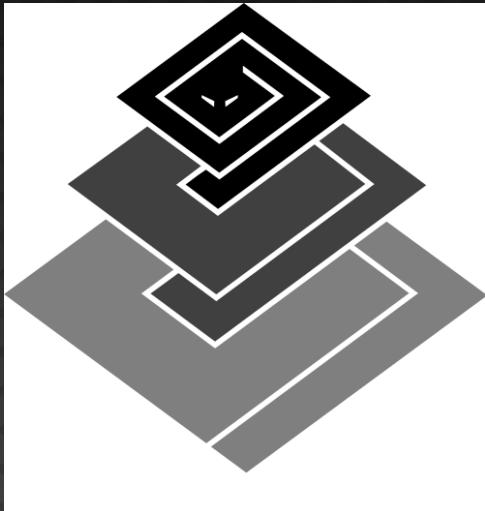
Status: 18/200 Updated: 2011-02-15T07:51:56.183000

Only **9%** :-(  
(18/200)

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

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

# Big Python 2 projects



Twisted

**django**

Heavy usage of  
**bytes**



Incomplete  
**Unicode** support



# Python 3 trolls



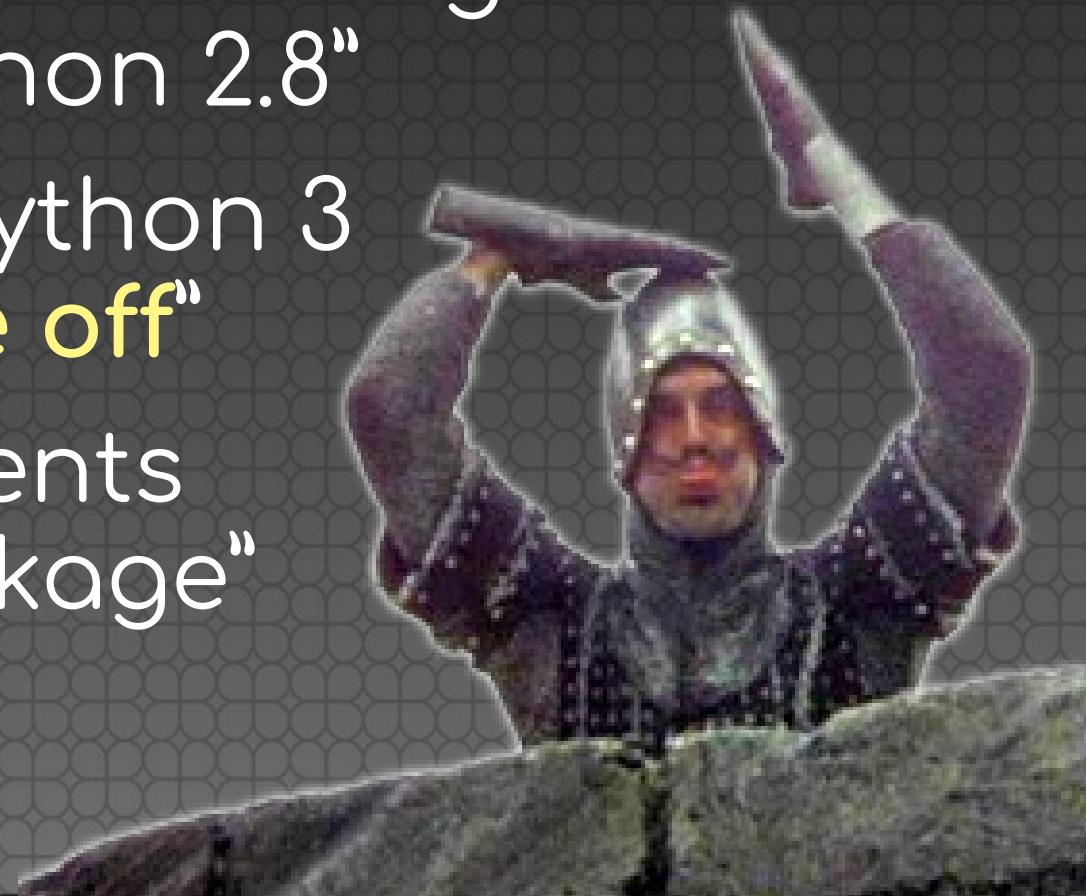
- Python 3 **doesn't bring anything**
- Python 3 introduces new **Unicode** issues
- Using **bytes** is simpler



# Python 2.8 idea



- Python 2.7 is alive: let's continue the development!
- 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!

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- 2011: PEP 404 (“PEP not found ;-))  
“Python 2.8 Un-release Schedule”
- 2013: 80% of top 50 projects  
supports Python 3
- 2014: Python 2.7  
end of life extended  
by 5 years to 2020





Spring

# Problem #1 solved!



“How to install a dependency?”

“How to 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



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# New approach

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- 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

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- 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

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- 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.

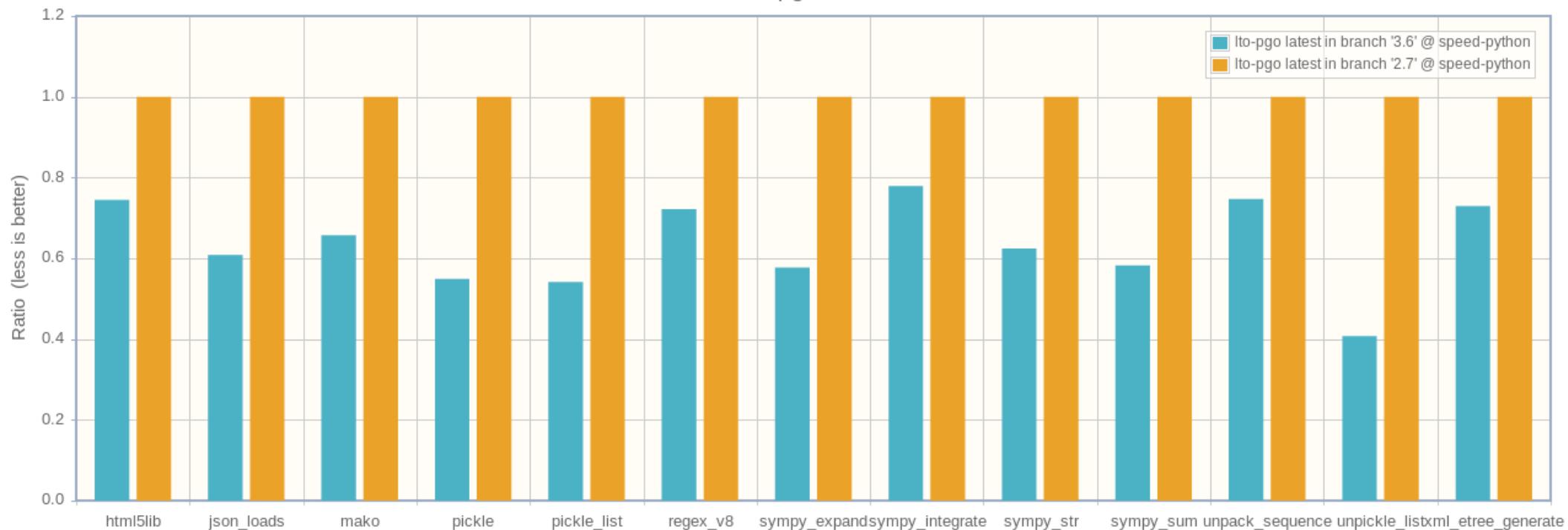
2018: 95% :-)  
(190/200)

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

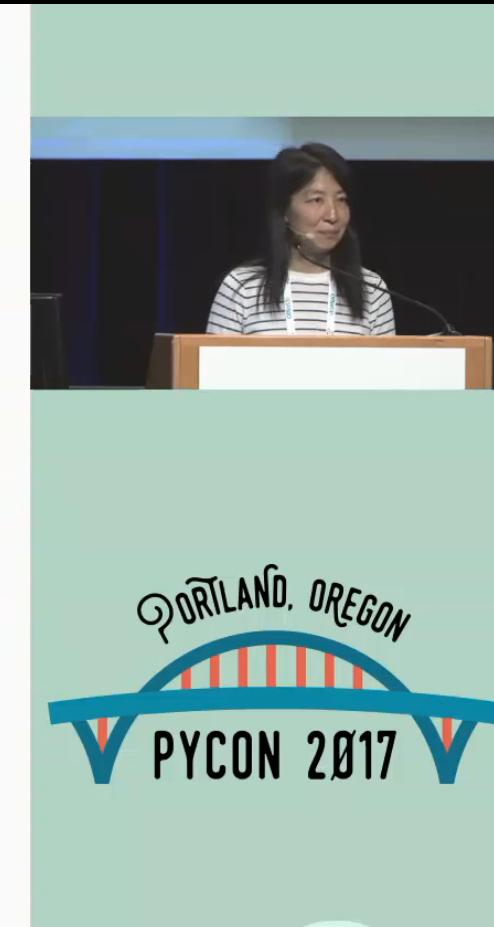
# INSTAGRAM ON PYTHON3



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

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- 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 → 3.7 new modules



`asyncio`, `concurrent.futures`,  
`contextvars`, `dataclasses`, `enum`,  
`ensurepip`, `faulthandler`, `importlib`,  
`importlib.resources`, `ipaddress`, `lzma`,  
`pathlib`, `secrets`, `selectors`, `statistics`,  
`tkinter.ttk`, `tracemalloc`,  
`typing`, `unittest.mock`,  
`venv`, `zipapp`

☺ 21 new modules ☺



# f-string (PEP 498)



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

```
>>> print(f"Hello {name.title()}")  
Hello World!
```

```
>>> x = 1; y = 2; print(f"{x} + {y} = {x + y}")  
1 + 2 = 3
```

```
>>> msg = f"{1+2}"; print(msg)  
3
```

# Python 3 coroutines



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

async def coroutine():
    return await async_read()

async def async_generator():
    yield ...
    [... async for it in async_gen()]
    [await func() for func in funcs()]
```

# New Python 3 syntax



- `def func(arg, *, kw_only=None): ...`
- `print(msg, file=sys.stderr, end="")`
- `one, *tail = range(5)`  
`cmd = ['python3', *args, 'script.py']`  
`mydict = {"key": "value", **other_dict}`

# New Python 3 syntax



- `million = 1_000_000`
- `x: int = 5`
- `with open(...) as infp, open(...) as outfp: ...`
- `bytes % args`
- `matrix_multiplication = a @ b`

# Bury Python 2?



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



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# RHEL

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RHEL 7.5: Python 2 has been deprecated and **will be replaced with Python 3** in the next Red Hat Enterprise Linux major release.

Software Collections (SCL):

- Python 3.6: RHEL/Centos 7
- Python 3.5: RHEL/Centos 6 & 7
- Supported 3 years (ex: 2.7 SCL gone)

# Javascript approach

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- Daniel Esposti's talk "Evolution or stagnation programming languages" (last Friday at Pycon IT)
- **Javascript** language evolved without breaking the backward compatibility
- Transpiling using **Babel** & **polyfill**: run newer Javascript on old JS VM

Python 4?

# Questions?

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- Twitter: @VictorStinner
- IRC (Freenode): vstinner



# Sources, copyrights

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