Python3的新特性和改进

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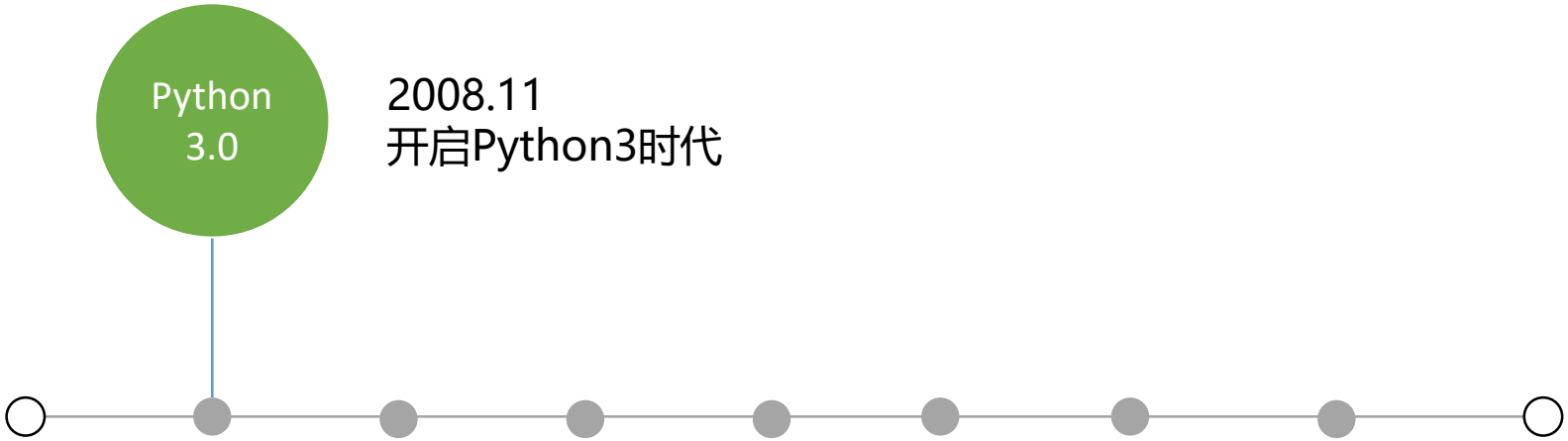
主流Python包陆续终止对Python2的支持

Python的现状

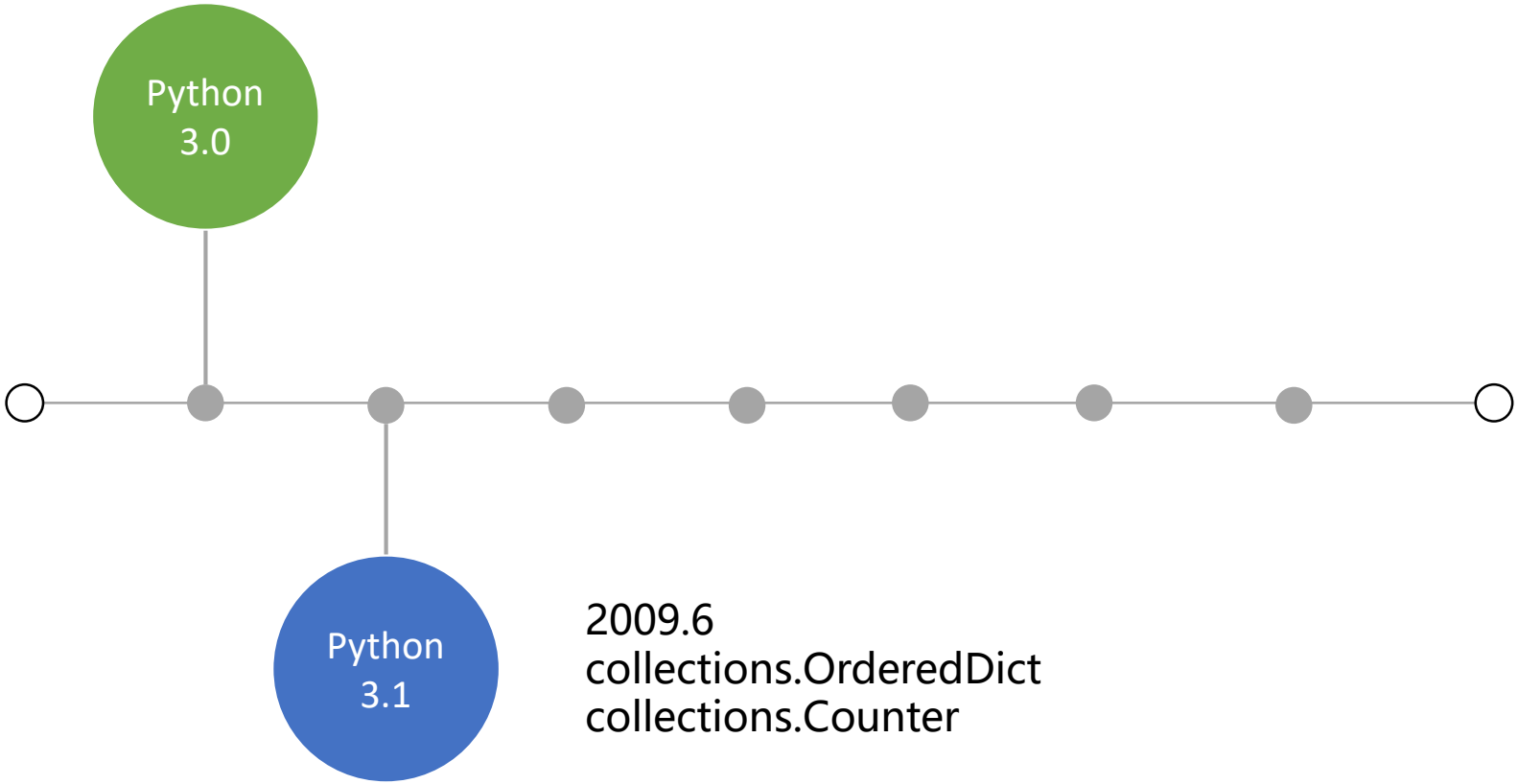
Python2.7将于2020年1月1日停止维护

主流Python包陆续终止对Python2的支持

Python的现状



Python的现状


Python 3.0
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collections.OrderedDict
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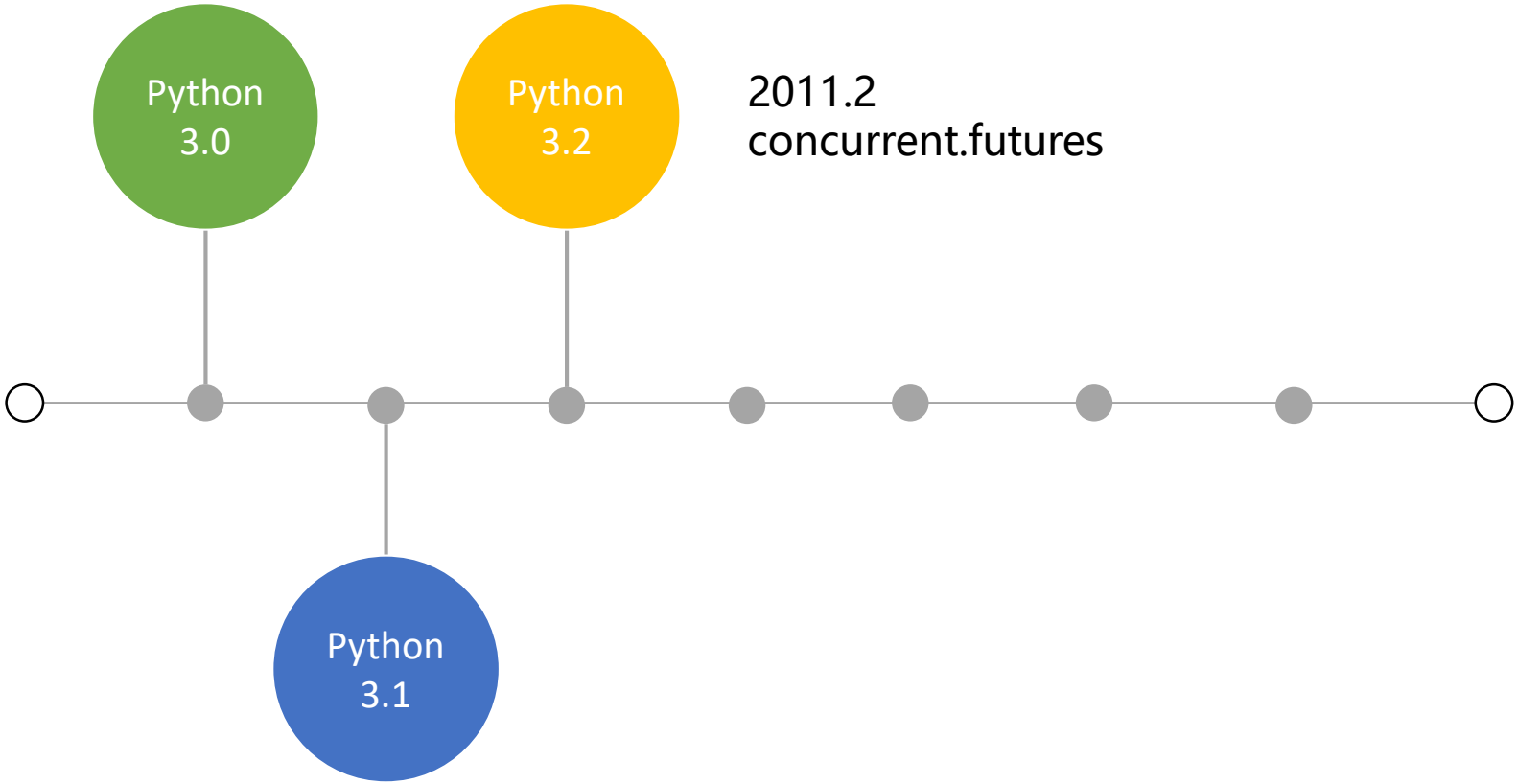
Python的现状


Python 3.0
Python 3.2
2011.2
concurrent.futures
Python 3.1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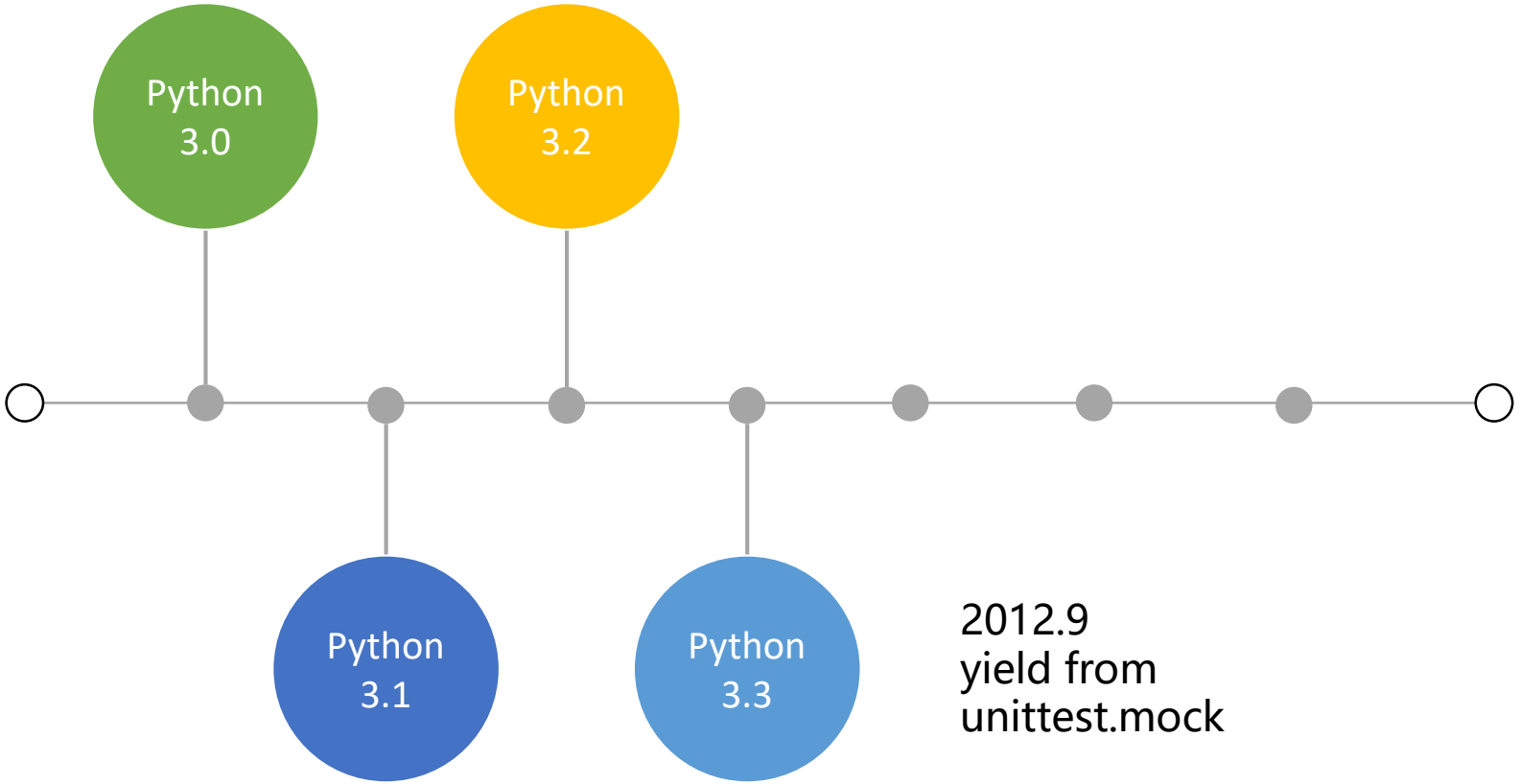
Python的现状


Python 3.0
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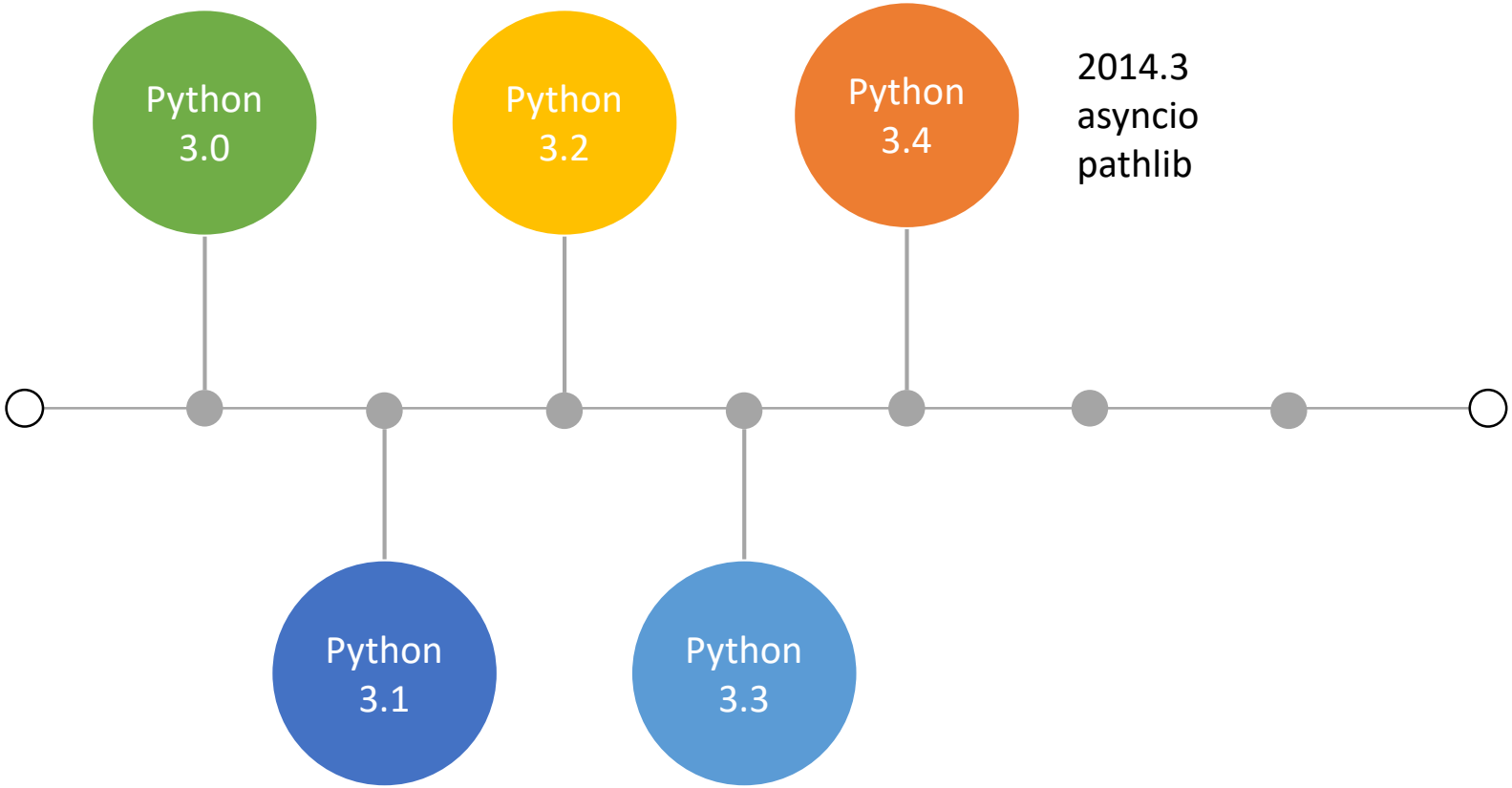
Python的现状


Python 3.0
Python 3.2
Python 3.4
2014.3
asyncio
pathlib
Python 3.1
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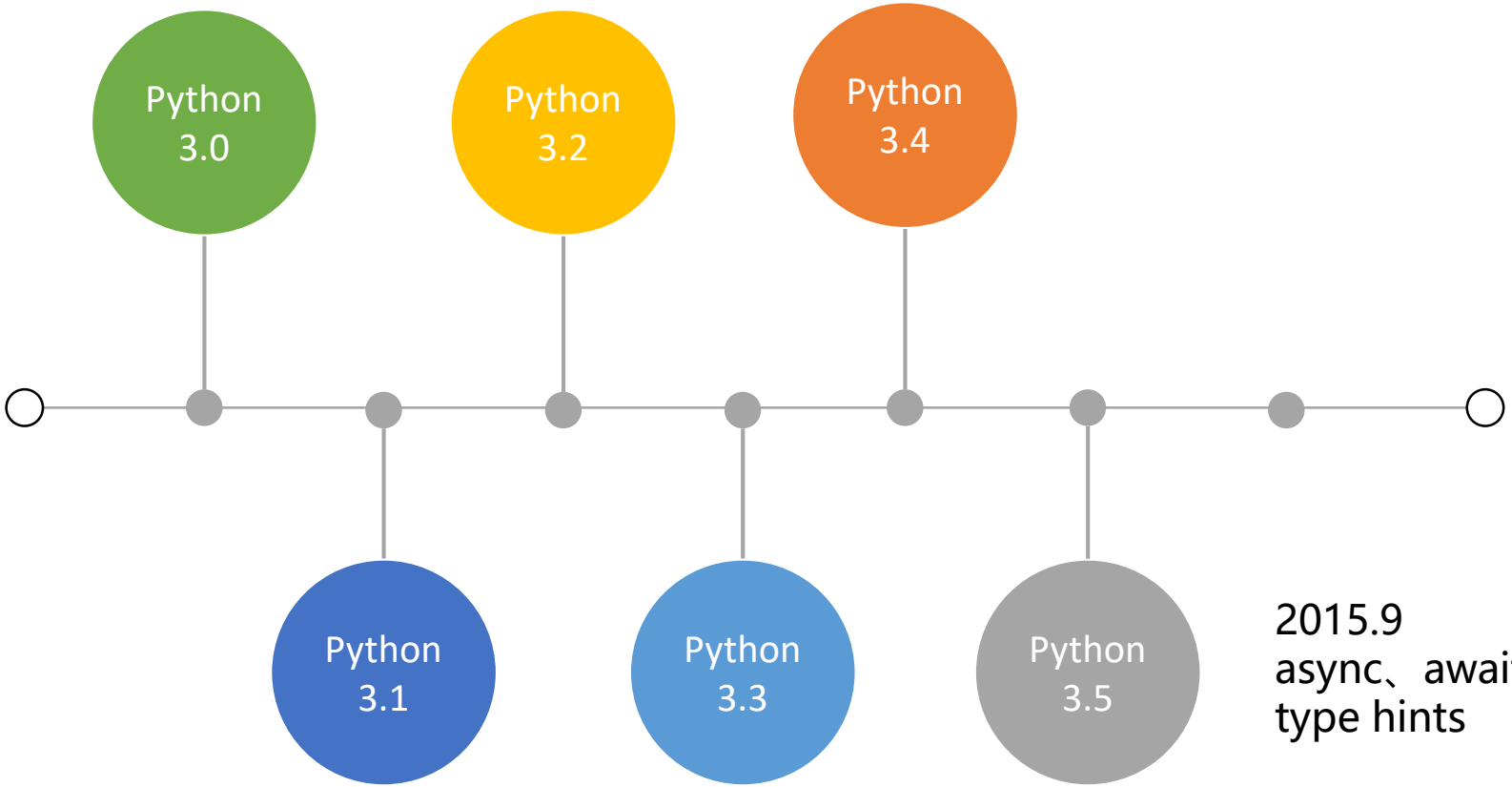
Python的现状


Python 3.0
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async、await
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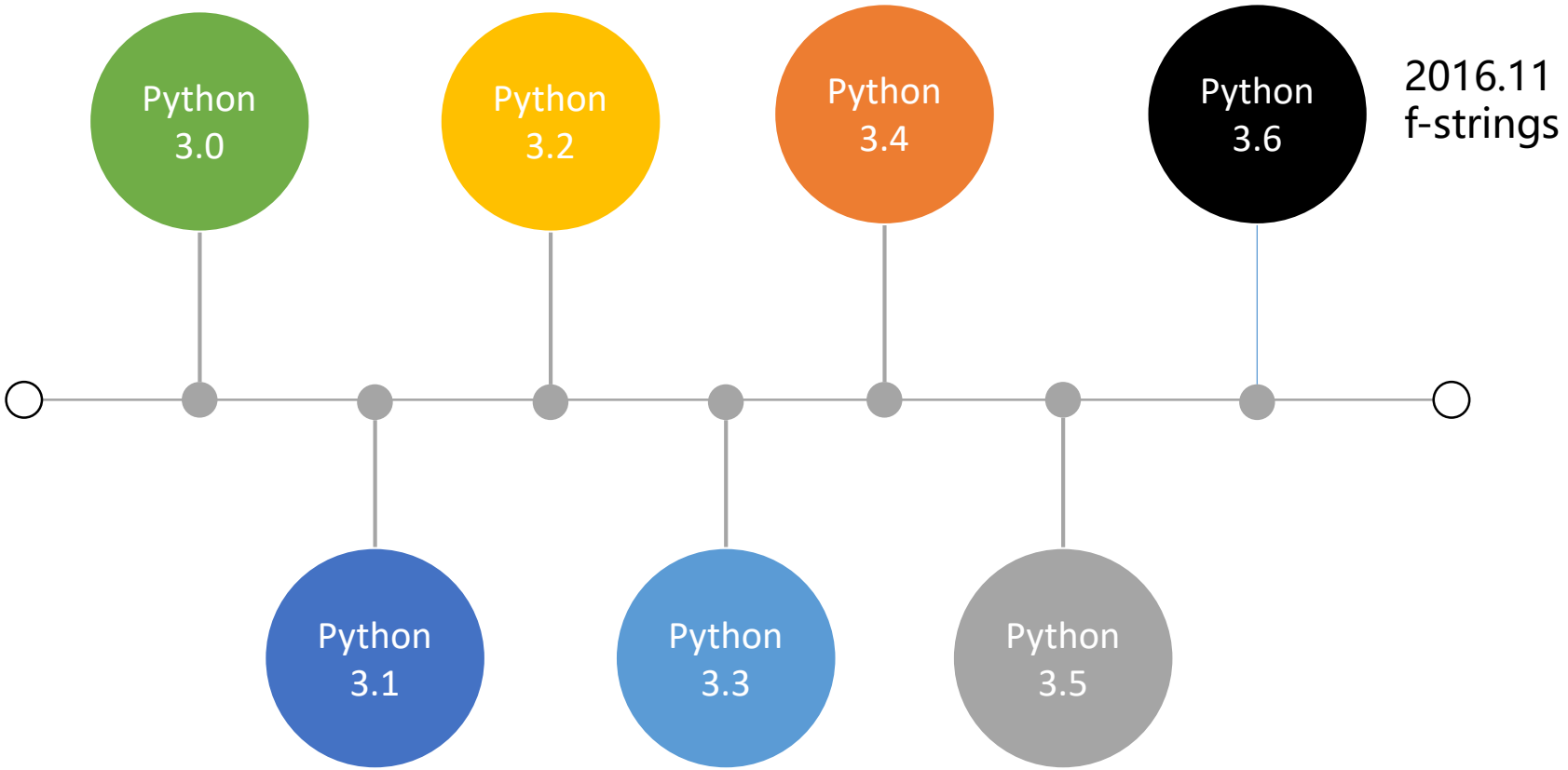
Python的现状


Python 3.0
Python 3.2
Python 3.4
Python 3.6
2016.11
f-strings
Python 3.1
Python 3.3
Python 3.5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Python的现状

当前版本

Python3.7(published at 2018.6)

dataclasses、breakpoint()

Python3.8(published at 2019-10-14本周一)

assignment expressions、positional-only parameters

2 Python3的新特性和改进
——重要变化

Python3的新特性和改进——重要变化

Text Vs. Data Instead Of Unicode Vs. 8-bit

	内容	类型	混合使用
Python3	Text Vs. Data	str Vs. bytes	✗
Python2	Unicode Vs. 8-bit	unicode Vs. str	✓

Python3的新特性和改进——重要变化

Python2

```
In [1]: a = u'你好'

In [2]: b = 'hello'

In [3]: type(a), type(b)
Out[3]: (unicode, str)

In [4]: unicode.mro(), str.mro()
Out[4]: ([unicode, basestring, object], [str, basestring, object])

In [5]: c = a + b
        print(c)
        你好hello

In [6]: type(c)
Out[6]: unicode
```

Python3的新特性和改进——重要变化

Python3

```
In [1]: a = '你好'

In [2]: b = b'hello'

In [3]: type(a), type(b)
Out[3]: (str, bytes)

In [4]: str.mro(), bytes.mro()
Out[4]: ([str, object], [bytes, object])

In [8]: a + b
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-8-bd58363a63fc> in <module>
----> 1 a + b

TypeError: must be str, not bytes

In [9]: c = a + b.decode()
        c, type(c)
Out[9]: ('你好hello', str)

In [12]: d = a.encode() + b
         d, type(d), d.decode()
Out[12]: (b'\xe4\xbd\xa0\xe5\xa5\xbdhello', bytes, '你好hello')
```

Python3的新特性和改进——重要变化

Python3的str和bytes不能混用！

Python3的新特性和改进——重要变化

求一段文本的MD5:Python2

```
In [1]: text = 'Welcome to Pycon China 2019, Hanzhou station.'

In [2]: from hashlib import md5

In [3]: md5_hash = md5(text)
        md5_hash.hexdigest()

Out[3]: '0a970d432f7a69fd2bdf0c3fc2559bbd'
```

Python3的新特性和改进——重要变化

求一段文本的MD5:Python3

```
In [1]: text = 'Welcome to Pycon China 2019, Hanzhou station.'

In [2]: from hashlib import md5

In [3]: md5_hash = md5(text)
        md5_hash.hexdigest()

---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-3-bee2ef4a3e9f> in <module>
----> 1 md5_hash = md5(text)
      2 md5_hash.hexdigest()

TypeError: Unicode-objects must be encoded before hashing

In [4]: md5_hash = md5(text.encode())
        md5_hash.hexdigest()

Out[4]: '0a970d432f7a69fd2bdf0c3fc2559bbd'
```

Python3的新特性和改进——重要变化

Views And Iterators Instead Of Lists

	Python2	Python3
dict.keys(),dict.items(), dict.values()	list	view
map,filter	list	generator(iterator)
range	list	range(iterator)*
xrange	xrange(iterator)	/
zip	list	zip(iterator)

Python3的新特性和改进——重要变化

Python2:dict

```
In [1]: a = {'a': 1, 'b': 2, 'c': 3}

In [2]: keys = a.keys()
        keys
Out[2]: ['a', 'c', 'b']

In [3]: a['d'] = 4

In [4]: keys
Out[4]: ['a', 'c', 'b']

In [5]: a.keys()
Out[5]: ['a', 'c', 'b', 'd']
```

Python3的新特性和改进——重要变化

Python3:dict

```
In [1]: a = {'a': 1, 'b': 2, 'c': 3}

In [2]: keys = a.keys()
        keys
Out[2]: dict_keys(['a', 'b', 'c'])

In [3]: a['d'] = 4

In [4]: keys
Out[4]: dict_keys(['a', 'b', 'c', 'd'])
```

Python3的新特性和改进——重要变化

Python2:range, map, zip

```
In  [1]: range(5)
Out[1]: [0, 1, 2, 3, 4]

In  [2]: map(str.upper, 'abcde')
Out[2]: ['A', 'B', 'C', 'D', 'E']

In  [3]: zip(range(5), 'abcde')
Out[3]: [(0, 'a'), (1, 'b'), (2, 'c'), (3, 'd'), (4, 'e')]
```

Python3的新特性和改进——重要变化

Python3:range, map, zip

```
In  [1]: range(5)
Out[1]: range(0, 5)

In  [2]: map(str.upper, 'abcde')
Out[2]: <map at 0x7f2c76a401d0>

In  [3]: zip(range(5), 'abcde')
Out[3]: <zip at 0x7f2c76a94308>

In  [4]: list(range(5))
Out[4]: [0, 1, 2, 3, 4]

In  [5]: list(map(str.upper, 'abcde'))
Out[5]: ['A', 'B', 'C', 'D', 'E']

In  [6]: list(zip(range(5), 'abcde'))
Out[6]: [(0, 'a'), (1, 'b'), (2, 'c'), (3, 'd'), (4, 'e')]
```

Python3的新特性和改进——重要变化

Python3:range, map, zip

```
In [1]: m = map(str.upper, 'abcde')

In [2]: list(m)
Out[2]: ['A', 'B', 'C', 'D', 'E']

In [3]: list(m)
Out[3]: []

In [4]: l = range(5)

In [5]: list(l)
Out[5]: [0, 1, 2, 3, 4]

In [6]: list(l)
Out[6]: [0, 1, 2, 3, 4]
```

Python3的新特性和改进——重要变化

使用迭代器的优势：惰性计算、节约内存、无限长度

```
In [1]: from itertools import combinations

In [2]: c = combinations('ABCDEF', 3)

In [3]: next(c)
Out[3]: ('A', 'B', 'C')

In [4]: next(c)
Out[4]: ('A', 'B', 'D')

In [5]: next(c)
Out[5]: ('A', 'B', 'E')
```

Python3的新特性和改进——重要变化

使用迭代器的优势：惰性计算、节约内存、无限长度

```
In  [1]: from sys import getsizeof

In  [2]: getsizeof(range(100000))
Out[2]: 800072
```

Python2

```
In  [1]: from sys import getsizeof

In  [2]: getsizeof(range(100000))
Out[2]: 48
```

Python3

Python3的新特性和改进——重要变化

使用迭代器的优势：惰性计算、节约内存、无限长度

```
In [1]: from itertools import count

In [2]: c = count()

In [3]: next(c)
Out[3]: 0

In [4]: for _ in range(10000):
            next(c)

In [5]: next(c)
Out[5]: 10001
```

Python3的新特性和改进——重要变化

Exception in Python2

In [2]:
```
try:
    raise Exception, 'Error'
except Exception, error:
    print error
```

```
Error
```

Python3的新特性和改进——重要变化

Exception in Python3

1. 所有自定义异常类要继承于BaseException
2. rasie 1个异常对象
3. except … as …

In [1]:
```
class MyException(BaseException):
    def __init__(self, code, msg):
        self.code = code
        self.msg = msg
    def __str__(self):
        return f'MyException(code={self.code}, msg={self.msg})'
```

In [2]:
```
try:
    raise MyException(2, 'Error Message.')
except MyException as error:
    print(error)
```

```
MyException(code=2, msg=Error Message.)
```

Python3的新特性和改进——重要变化

Python2: int and long

```
In  [1]: type(0xFFFFFFFF)
Out[1]: int

In  [2]: type(0xFFFFFFFFFFFFFFFF)
Out[2]: long

In  [3]: type(123L)
Out[3]: long
```

Python3的新特性和改进——重要变化

Python3: int

```
In  [1]: type(0xFFFFFFFFFFFFFFFF)
Out[1]: int

In  [2]: 123L
  File "<ipython-input-2-540d80edec42>", line 1
    123L
       ^
SyntaxError: invalid syntax
```

Python3的新特性和改进——重要变化

/ in Python2

```
In  [1]: 1 / 2
Out[1]: 0

In  [2]: 1 / 2.0
Out[2]: 0.5
```

Python3的新特性和改进——重要变化

Python3 区分 truediv(/)与floordiv(//)

```
In  [1]: 1 /  2
Out[1]: 0.5

In  [2]: 1 // 2
Out[2]: 0

In  [3]: 1 // 2.0
Out[3]: 0.0
```

Python3的新特性和改进——重要变化

Python2的比较操作不够严谨

```
In  [1]: None > None
Out[1]: False

In  [2]: None < None
Out[2]: False

In  [3]: 1 > 'a'
Out[3]: False
```

Python3的新特性和改进——重要变化

Python3无法比较未定义对应操作的类型

```
In [1]: None < None
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-1-0ac550fa0b68> in <module>
----> 1 None < None

TypeError: '<' not supported between instances of 'NoneType' and 'NoneType'

In [2]: 1 < 'a'
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-2-4751c80d99ec> in <module>
----> 1 1 < 'a'

TypeError: '<' not supported between instances of 'int' and 'str'
```

Python3的新特性和改进——重要变化

Python2 round()四舍五入

```
In  [1]: round(1.5)
Out[1]: 2.0

In  [2]: round(2.2)
Out[2]: 2.0

In  [3]: round(2.5)
Out[3]: 3.0
```

Python3的新特性和改进——重要变化

Python3 round()四舍六入五成双

```
In  [1]: round(1.5)
Out[1]: 2

In  [2]: round(2.2)
Out[2]: 2

In  [3]: round(2.5)
Out[3]: 2
```

Python3的新特性和改进——重要变化

Python2 元类的使用

In [2]:
```
from abc import ABCMeta, abstractmethod
```

In [3]:
```
class ICommand(object):
    __metaclass__ = ABCMeta

    @abstractmethod
    def run(self):
        pass
```

Python3的新特性和改进——重要变化

Python3 元类的使用

In [1]:
```
from abc import ABCMeta, abstractmethod
```

In [2]:
```
class ICommand(metaclass=ABCMeta):

    @abstractmethod
    def run(self):
        pass
```

2 Python3的新特性和改进
——易用性的提升

Python3的新特性和改进——易用性的提升

print is a statement in Python2

```
In [1]: a, b, c, d = range(4)

In [2]: print a, '->', b, '->', c, '->', d, '#'
0 -> 1 -> 2 -> 3 #
```

Python3的新特性和改进——易用性的提升

print is a function in Python3

```
Docstring:
print(value, ..., sep=' ', end='\n', file=sys.stdout, flush=False)

Prints the values to a stream, or to sys.stdout by default.
Optional keyword arguments:
file:  a file-like object (stream); defaults to the current sys.stdout.
sep:   string inserted between values, default a space.
end:   string appended after the last value, default a newline.
flush: whether to forcibly flush the stream.
Type:      builtin_function_or_method
```

Python3的新特性和改进——易用性的提升

print is a function in Python3

```
In [1]: a, b, c, d = range(4)

In [2]: print(a, b, c, d, sep='->', end='#')
0->1->2->3#
```

Python3的新特性和改进——易用性的提升

print can be replaced and mocked in Python3

In [1]:
```
import builtins

oldprint = print

def myprint(*args):
    oldprint(*args, sep='\n', end='\n******\n')

builtins.print = myprint
```

In [2]:
```
print(1,2,3,4)
```

```
1
2
3
4
******
```

Python3的新特性和改进——易用性的提升

print can be replaced and mocked in Python3

```
In [1]: from unittest import mock

In [2]: with mock.patch('builtins.print') as mock_print:
            print('Test')
        mock_print.assert_called_with('Test')
```

Python3的新特性和改进——易用性的提升

super() in Python2

```
In [1]:
class A(object):
    def __init__(self, a):
        self.a = a

In [2]:
class B(A):
    def __init__(self, a, b):
        super(B, self).__init__(a)
        self.b = b

In [3]:
b = B(1,2)
b.a, b.b

Out[3]:
(1, 2)
```

Python3的新特性和改进——易用性的提升

super() in Python3

```
In [3]:
class A:
    def __init__(self, a):
        self.a = a

In [4]:
class B(A):
    def __init__(self, a, b):
        super().__init__(a)
        self.b = b

In [5]:
b = B(1,2)
b.a, b.b

Out[5]:
(1, 2)
```

Python3的新特性和改进——易用性的提升

f-strings

```
In  [1]: a = 1
         b = 'hello'
         f'{a} {b} {2*3}'
Out[1]: '1 hello 6'

In  [2]: f'{90:x}'
Out[2]: '5a'

In  [4]: f'{1/3:10.4}'
Out[4]: '    0.3333'

In  [5]: f'{1/3:010.4}'
Out[5]: '00000.3333'
```

Python3的新特性和改进——易用性的提升

Iterable unpacking

```
In [1]: a, b, *rest = range(10)
        a, b, rest
Out[1]: (0, 1, [2, 3, 4, 5, 6, 7, 8, 9])

In [2]: a, *_, b = 'hello'
        a, b
Out[2]: ('h', 'o')

In [3]: *_, last = 'abcdefg'
        last
Out[3]: 'g'

In [4]: a = [1,2,3]
        [4, 5, *a]
Out[4]: [4, 5, 1, 2, 3]

In [5]: a = 1
        b = 'hello'
        f'{a} {b} {2*3}'
Out[5]: '1 hello 6'

In [6]: a = {'a':1, 'b':2, 'c':3}
        {'d':4, **a}
Out[6]: {'d': 4, 'a': 1, 'b': 2, 'c': 3}
```

Python3的新特性和改进——易用性的提升

Assignment expressions（Python 3.8）

```
if (n := len(a)) > 10:
    print(f"List is too long ({n} elements, expected <= 10)")
```

```
# Loop over fixed length blocks
while (block := f.read(256)) != '':
    process(block)
```

```
[clean_name.title() for name in names
 if (clean_name := normalize('NFC', name)) in allowed_names]
```

Python3的新特性和改进——易用性的提升

标准库：concurrent.futures

concurrent.futures

In [1]:
```
import requests
```

In [2]:
```
urls = [f'https://news.cnblogs.com/n/page/{n}' for n in range(1,100)]
```

In [3]:
```
def get_url(url):
    return requests.Session().get(url).status_code
```

In [4]:
```
get_url(urls[0])
```

Out[4]: 200

In [5]:
```
%timeit [get_url(url) for url in urls]
```

8.71 s ± 2.67 s per loop (mean ± std. dev. of 7 runs, 1 loop each)

In [6]:
```
from concurrent.futures import ThreadPoolExecutor
```

In [7]:
```
executor = ThreadPoolExecutor()
```

In [8]:
```
%timeit list(executor.map(get_url, urls))
```

1.4 s ± 198 ms per loop (mean ± std. dev. of 7 runs, 1 loop each)

Python3的新特性和改进——易用性的提升

标准库：pathlib

```
In [1]: from pathlib import Path

In [2]: path = Path('./')

In [3]: path
Out[3]: PosixPath('.')

In [4]: path.absolute()
Out[4]: PosixPath('/home/nbuser/library')

In [5]: path.is_dir()
Out[5]: True

In [6]: file = path / 'a.py'

In [7]: file.exists()
Out[7]: True

In [8]: with open(file) as f:
            print(f.readlines())
['print(\'Hello, world\')']
```

Python3的新特性和改进——易用性的提升

标准库：dataclasses

```
In [1]: from dataclasses import dataclass

In [2]: @dataclass
        class Person:
            name: str
            age: int
            female: str
            address: str

In [3]: mike = Person('Mike', 20, 'M', 'Hangzhou')

In [4]: mike
Out[4]: Person(name='Mike', age=20, female='M', address='Hangzhou')

In [5]: print(mike)
        Person(name='Mike', age=20, female='M', address='Hangzhou')
```

2 Python3的新特性和改进
——新的理念和编程方法

Python3的新特性和改进——新的理念和编程方法

async、await与asyncio

Asyncio

In [1]:
```
import asyncio
```

In [2]:
```
async def a():
    print('Coroutine A waitting for 2 seconds.')
    await asyncio.sleep(2)
    print('Coroutine A is executed.')
    return 'a'
```

In [3]:
```
async def b():
    print('Coroutine B waitting for 1 seconds.')
    await asyncio.sleep(1)
    print('Coroutine B is executed.')
    return 'b'
```

In [4]:
```
async def c():
    print('Coroutine C is executed immediately.')
    await asyncio.sleep(0)
    return 'c'
```

In [5]:
```
import time
start = time.time()
results = await asyncio.gather(a(),b(),c())
print(results)
end = time.time()
print(end - start)
```

```
Coroutine A waitting for 2 seconds.
Coroutine B waitting for 1 seconds.
Coroutine C is executed immediately.
Coroutine B is executed.
Coroutine A is executed.
['a', 'b', 'c']
2.0029242038726807
```

Python3的新特性和改进——新的理念和编程方法

async、await与asyncio

In [1]:
```
import asyncio
import aiohttp
import time
```

In [2]:
```
async def download_site(session, url):
    async with session.get(url) as response:
        return response.status
```

In [3]:
```
async def download_all_sites(sites):
    tasks = []
    async with aiohttp.ClientSession() as session:
        for url in sites:
            task = asyncio.ensure_future(download_site(session, url))
            tasks.append(task)
        await asyncio.gather(*tasks, return_exceptions=True)
    return tasks
```

In [10]:
```
urls = [f'https://www.baidu.com/s?wd=python&pn={n}0' for n in range(0,100)]
```

In [15]:
```
start = time.time()
tasks  = await download_all_sites(urls)
end = time.time()
end - start
```

Out[15]:
```
2.7349588871002197
```

In [17]:
```
tasks[0]
```

Out[17]:
```
<Task finished coro=<download_site() done, defined at <ipython-input-2-db2a903890
69>:1> result=200>
```

Python3的新特性和改进——新的理念和编程方法

async、await与asyncio

In [10]:
```
urls = [f'https://www.baidu.com/s?wd=python&pn={n}0' for n in range(0,100)]
```

In [15]:
```
start = time.time()
tasks  = await download_all_sites(urls)
end = time.time()
end - start
```

Out[15]: 2.7349588871002197

In [17]:
```
tasks[0]
```

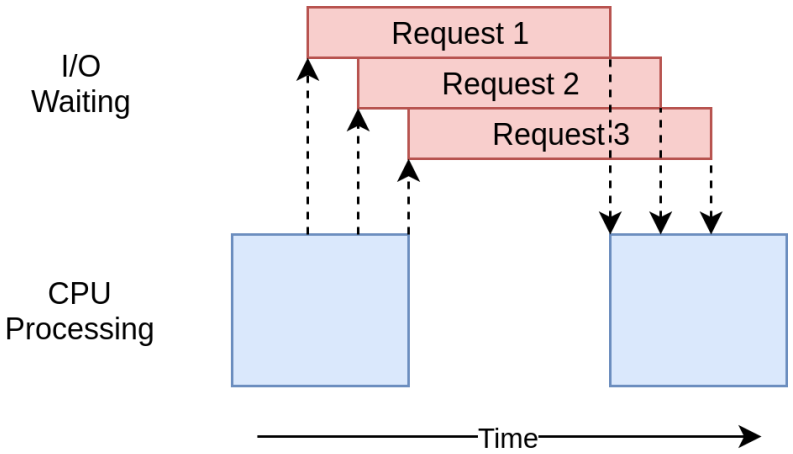
Out[17]: <Task finished coro=<download_site() done, defined at <ipython-input-2-db2a903890
69>:1> result=200>

In [14]:
```
import requests

def get_url(url):
    return requests.get(url).status_code

from concurrent.futures import ThreadPoolExecutor

executor = ThreadPoolExecutor()

start = time.time()
results = list(executor.map(get_url, urls))
end = time.time()
end - start
```

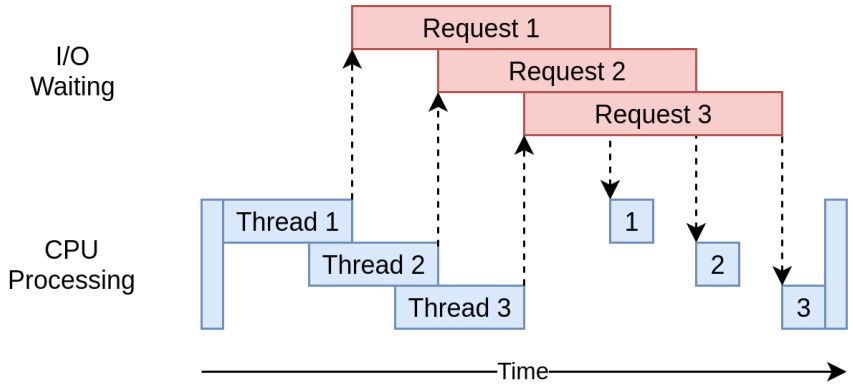
Out[14]: 15.053833246231079

Python3的新特性和改进——新的理念和编程方法

async、await与asyncio



asyncio version



threading version

Python3的新特性和改进——新的理念和编程方法

type hints

type hints

```
In [1]:
def add(a:int, b:int)->int:
    return a + b

In [2]:
add.__annotations__

Out[2]:
{'a': int, 'b': int, 'return': int}

In [3]:
from inspect import signature

In [4]:
signature(add)

Out[4]:
<Signature (a: int, b: int) -> int>

In [5]:
from typing import get_type_hints

In [6]:
get_type_hints(add)

Out[6]:
{'a': int, 'b': int, 'return': int}
```

Python3的新特性和改进——新的理念和编程方法

type hints:代码即文档

type_hints.py

type_hints.py > Python > max_length

```
1  from typing import List
2
3  def max_length(words: List[str]) → int:
4      return max(len(word) for word in words)
```

Python3的新特性和改进——新的理念和编程方法

type hints:使用mypy进行静态类型检查

static_type_check.py

```python
a: int
a = 10
print(a.upper())

def add(a:int, b:str) -> int:
    return a + b

```

```
(share) ➜ share mypy static_type_check.py
static_type_check.py:3: error: "int" has no attribute "upper"
static_type_check.py:6: error: Unsupported operand types for + ("int" and "str")
Found 2 errors in 1 file (checked 1 source file)
```

Python3的新特性和改进——新的理念和编程方法

type hints:更好地利用IDE

app.py

app.py > Python > filter_words

```
1  from typing import List
2
3  def filter_words(words: List[str]) → str:
4      ret = []
5      for word in words:
6          if word.
```

capitalize
casefold
center
count
encode
endswith
expandtabs
find
format
format_map
index
isalnum

str.capitalize() → str

Return a capitalized version of the string.

More specifically, make the first character have upper case and the rest lower case.

2 Python3的新特性和改进
——其他变化

Python3的新特性和改进——其他变化

Python3使用绝对引入(absolute import)*

Python3使用input()代替raw_input()

Python3使用next()函数代替.next方法

Python3增加了很多关键字：True、False、None、with、as、async、await

Python3使用!=代替<>

Python3修改了一些标准库的组织方式和命名：

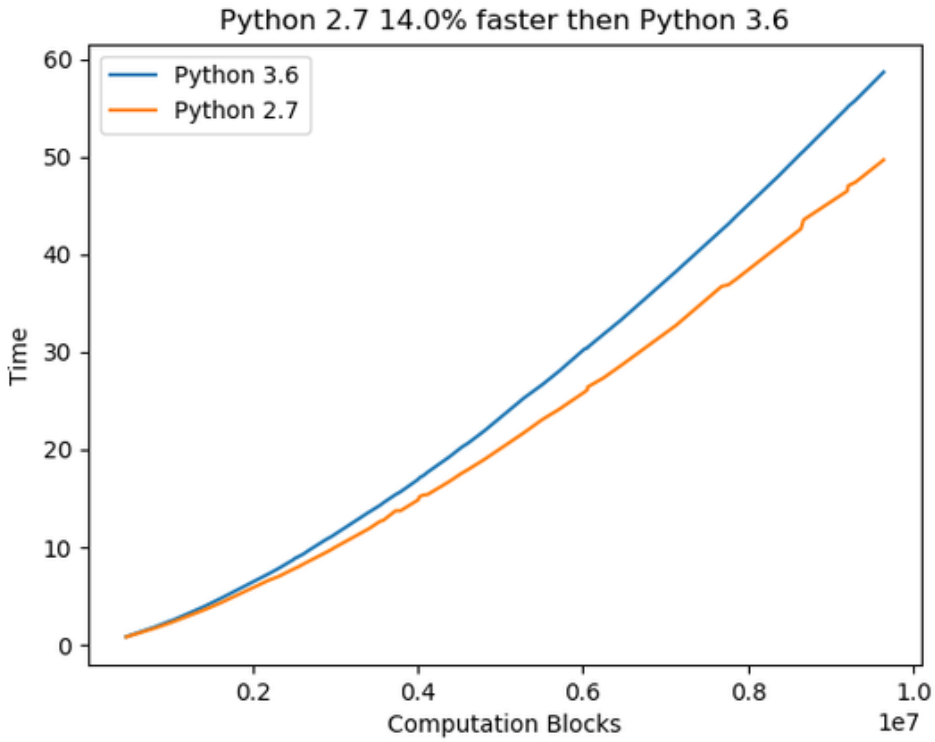
- Queue->queue
- ConfigParser->configparser
- urllib, urllib2, urlparse->urllib

2 Python3的新特性和改进

——性能提升

Python3的新特性和改进——性能提升

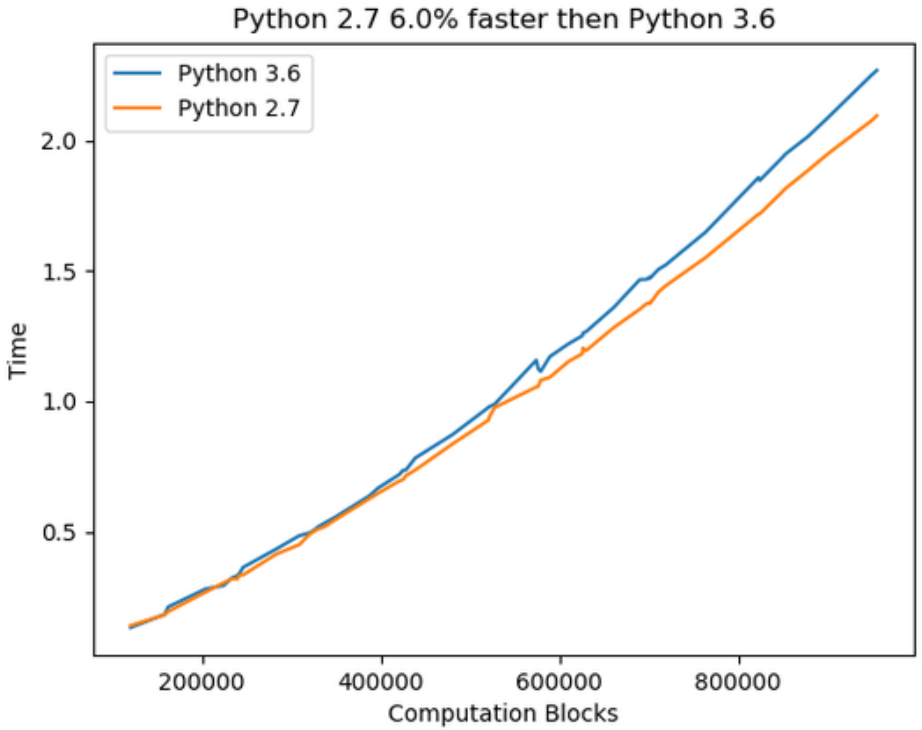
鉴于一些原因（例如Python3不区分int和long）,python3的性能比python2持平（或略差）



计算任务（机器学习等）

Python3的新特性和改进——性能提升

鉴于一些原因（例如Python3不区分int和long）,python3的性能比python2持平（或略差）



日常任务（Web应用、桌面应用）

Python3的新特性和改进——性能提升

Python3在持续的改进

Python3.6使用了新的dict实现方式，节约了大量的内存。

```
➜ ~ python2 -c "from sys import getsizeof;print getsizeof({x: x**2 for x in range(100000)})"
6291736
➜ ~ python3 -c "from sys import getsizeof;print(getsizeof({x: x**2 for x in range(100000)}))"
5242976
```

Python3的新特性和改进——性能提升

Python3在持续的改进

预计在Python3.9(dev阶段)中实现的子解释器（PEP 554），将解放GIL对CPU密集型Python多线程程序的限制。

Python3的新特性和改进——性能提升

鉴于大量的流行包使用C拓展进行加速，Python项目的开发速度和代码质量是更值得关注的指标。

3 迁移到Python3

迁移到Python3

Porting Python 2 Code to Python 3

只需关注Python2.7

保证好的测试覆盖(利用 coverage.py工具)

使用Modernize等工具更新代码

使用Pylint保证代码质量

检查和替换不支持Python3的依赖

使用持续集成保证代码在不同版本下的正常表现

考虑使用静态类型检查

迁移到Python3

Instagram的Python3迁移案例（10亿月活 Python + Django）

节约了 12% 的整体 CPU 使用率（Django/uwsgi）

节约了 30% 的内存使用（celery）

在单个接口中利用 asynio 平行的去做多件事情，降低了 20-30% 的请求延迟

4 问答环节

THANK YOU