Traquer les fuites mémoires Python

Pycon 2013, Strasbourg

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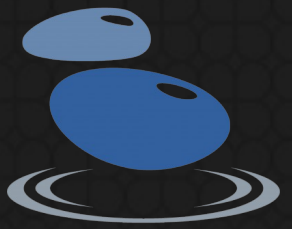

- Core developer Python depuis 2010
- `github.com/haypo/`
- `bitbucket.org/haypo/`
- Employé par eNovance

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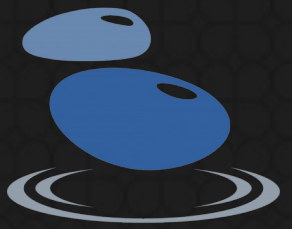
Sommaire



- Mémoire RSS
- Cycle référence
- Calcul manuel
- Heapy, Pympler, Melia
- PEP 445 : API malloc()
- PEP 454 : tracemalloc

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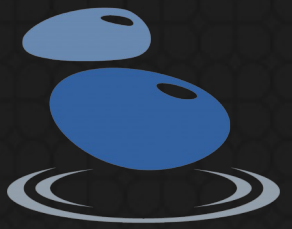
Mémoire RSS



- Représentatif pour le système
- Mesure grossière
- Difficile à exploiter
- Fragmentation du tas

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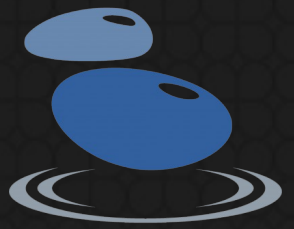
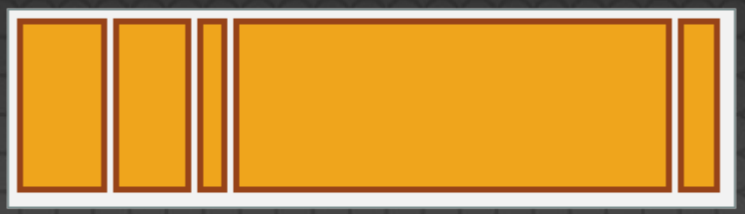
Fragmentation du tas



2 Mo / 2 Mo



10 Mo / 10 Mo

1.5 Mo / 10 Mo

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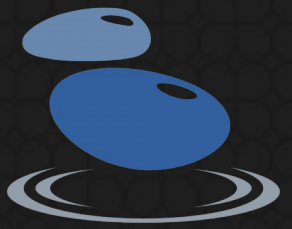
memory_profiler



```
Mem usage    Increment  Line Contents
================================================
                        @profile
  5.97 MB    0.00 MB   def my_func():
 13.61 MB    7.64 MB       a = [1] * (10 ** 6)
166.20 MB  152.59 MB       b = [2] * (10 ** 8)
 13.61 MB -152.59 MB       del b
 13.61 MB    0.00 MB       return a
```

http://pypi.python.org/pypi/memory_profiler

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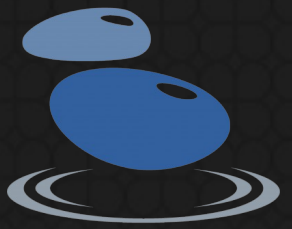
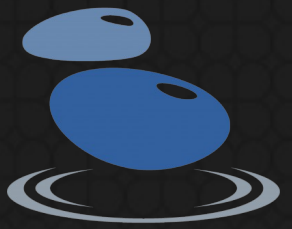
Cycle de références



```
a.b = b
b.a = a
a = None
b = None
gc.collect()
```

Cycle de références



```
a.b = b
b.a = weakref.ref(a)
# a = b.a()
a = None
```

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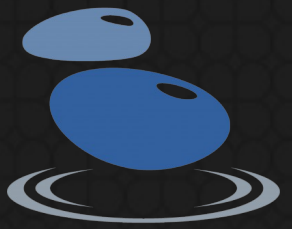
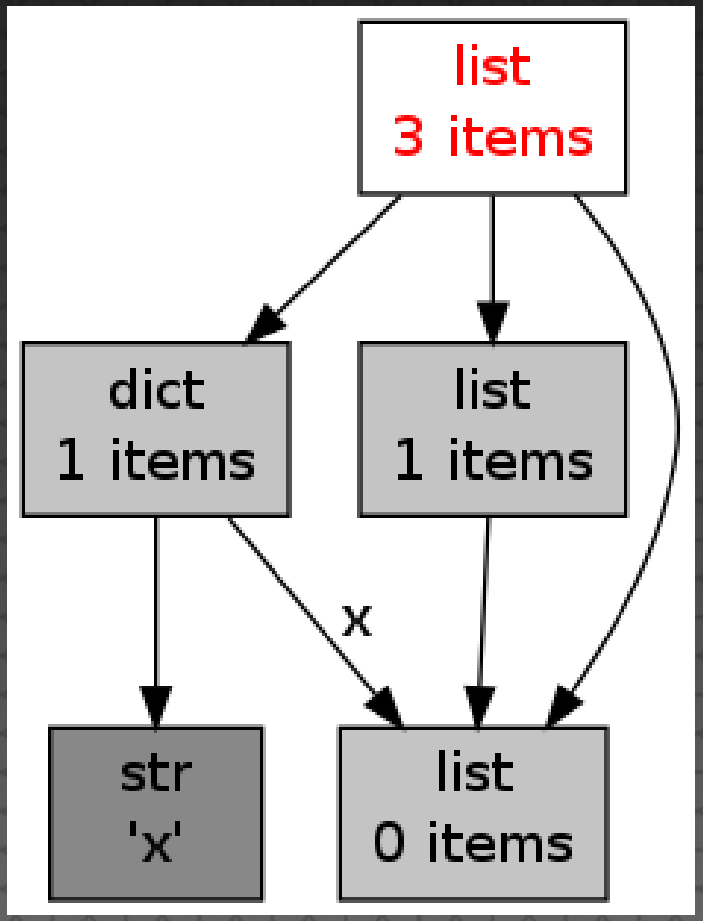
Visualiser les liens

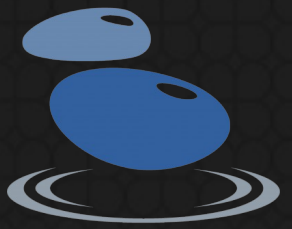


Project objgraph



`http://mg.pov.lt/objgraph/`

Introspection Python



- `gc.get_objects()`
- `gc.get_referrers()`
- `gc.get_refents()`
- `id(obj)`
- `sys.getsizeof(obj)`

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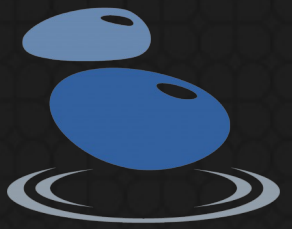
Calcul manuel



```
>>> import gc, sys
>>> dict1 = {None: b'x' * 10000}
>>> sys.getsizeof(dict1)
296
>>> sum(sys.getsizeof(ref)
...         for ref in gc.get_referents(dict1))
10049
```

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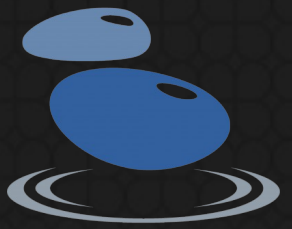
Calcul manuel



```
>>> data = b'x' * 10000
>>> dict2 = {index:data
...              for index in range(500)}
>>> sum(sys.getsizeof(ref)
...      for ref in gc.get_referents(dict2))
5030496
```

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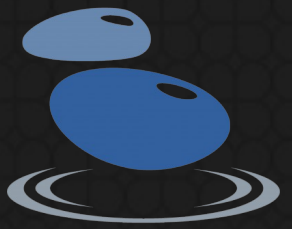
Calcul manuel



```
>>> refs = gc.get_referents(dict2)
>>> len(refs)
1000

>>> refs = set(map(id, refs))
>>> len(refs)
501
>>> sum(sys.getsizeof(ref)
...      for ref in refs)
16028
```

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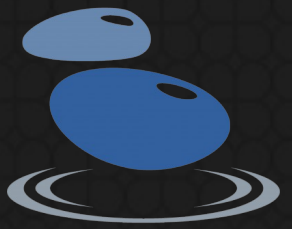
Heapy, Pympler, Melia



- Liste l'ensemble des objets Python
- Calcul la taille des objets
- Groupe les objets par taille

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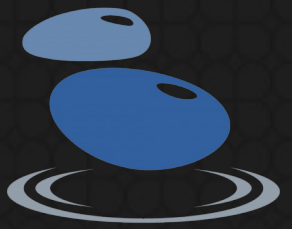

```
Total 17916 objects, 96 types,
Total size = 1.5MiB

Count       Size  Kind
  701    546,460  dict
7,138    414,639  str
  208     94,016  type
1,371     93,228  code
...
```

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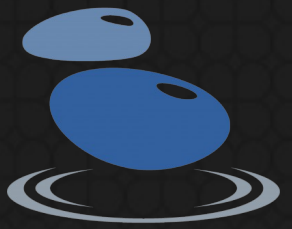

- Ne trace pas toute la mémoire (ex: zlib)
- Ne donne pas l'origine des objects
- Difficile à exploiter

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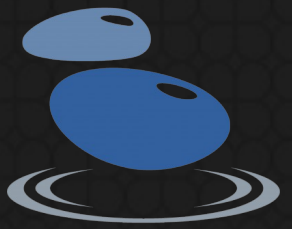
Heapy, Pympler, Melia



- http://guppy-pe.sourceforge.net/
- http://code.google.com/p/pympler/
- https://pypi.python.org/pypi/meliae

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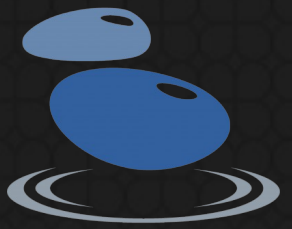
PEP 445 : API malloc()



- `PyMem_GetAllocator()`
- `PyMem_SetAllocator()`
- Implementée dans Python 3.4

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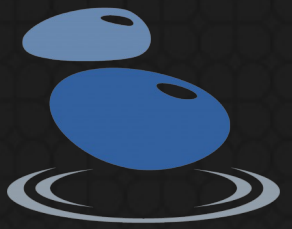
PEP 454 : tracemalloc



```
Memory block: 768 kB
  File "test/support/__init__.py", line 142
  File "test/support/__init__.py", line 206
  File "test/test_decimal.py", line 48
  File "importlib/__init__.py", line 95
  File "test/regrtest.py", line 1269
```

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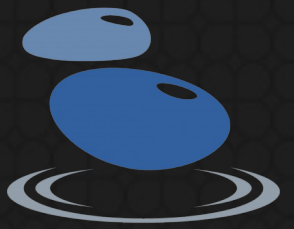
PEP 454 : tracemalloc



```
Memory block: 768 kB
  File "test/support/__init__.py", line 142
    __import__(name)
  File "test/support/__init__.py", line 206
    _save_and_remove_module(name)
  File "test/test_decimal.py", line 48
    C = import_fresh_module('decimal')
  File "importlib/__init__.py", line 95
    return _bootstrap._gcd_import(name)
  File "test/regrtest.py", line 1269
    the_module = importlib.import(abstest)
```

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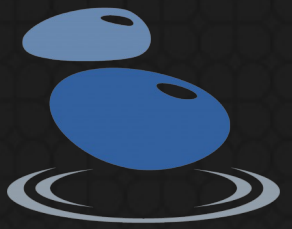
PEP 454 : tracemalloc



```
[ Top 5 ]
#1: Lib/linecache.py:127: 225.5 kB
#2: collections.py:368: 200.6 kB
#3: unittest/case.py:571: 108.6 kB
#4: Lib/abc.py:133: 87.3 kB
#5: Lib/shutil.py:401: 61.9 kB
10347 other: 3279.3 kB
Total allocated size: 4188.3 KB
```

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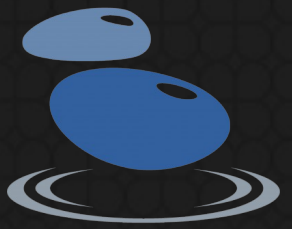
PEP 454 : tracemalloc



```
[ Top 5 differences ]
#1: test.py:4: 0.0 kB (-5.0 kB)
#2: test.py:1: 2.4 kB (0.0 kB)
#3: test.py:20: 0.6 kB (+0.6 kB)
#4: test.py:8: 0.2 kB (0.0 kB)
#5: test.py:25: 0.1 kB (0.0 kB)
```

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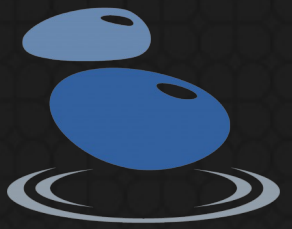
Status tracemalloc



- Disponible sur PyPI
- Nécessite de patcher et recompiler Python
- ... voir aussi recompiler les extensions Python écrites en C
- Patchs pour Python 2.5, 2.7, 3.4

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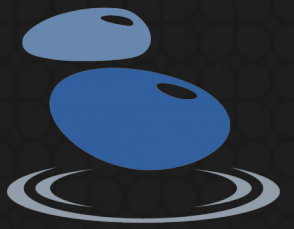
Status PEP 454



- PEP 445 (API malloc) implémentée dans Python 3.4
- PEP 454 (tracemalloc) : **brouillon**, implémentation prête
- Portable ! Windows, Linux, FreeBSD, ...
- 2x plus lent et mémoire x 2
- Pérrène : va être intégré à Python 3.4

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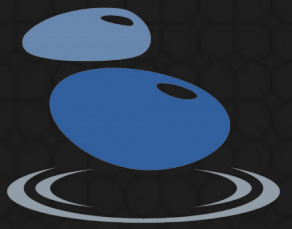
Suite de tracemlloc ?



- Faire accepter la PEP 454 !
- Mettre à jour les projets PyPI
- Outils pour générer des graphiques
- GUI pour exploiter les données
- GUI pour suivre l'évolution avec le temps

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Questions ?

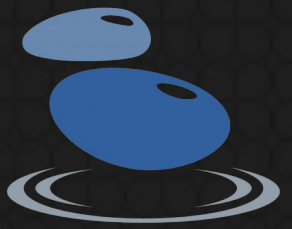
http://pypi.python.org/pypi/pytracemalloc

http://www.python.org/dev/peps/pep-0445/

http://www.python.org/dev/peps/pep-0454/

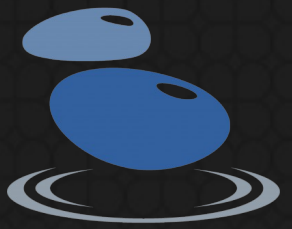
Contact :
victor.stinner@gmail.com

PEP 445 (API malloc)



- Ticket ouvert en 2008
- Patch proposé en mars 2013
- Patch commité en juin 2013
- Commit reverté -> écriture PEP 445
- Meilleure API grâce à la PEP
- PEP delegate : Antoine Pitrou

PEP 454 (tracemalloc)



- Stocke la traceback, pas juste 1 frame
- Beaucoup de code supprimé
- Code généralisé et plus haut niveau
- Échanges avec Kristján Valur Jónsson
- PEP delegate : Charles-François Natali
- Restaurant avec Charles-François

Merci David Malcom pour le modèle LibreOffice

http://dmalcolm.livejournal.com/