

TRACING PYTHON MEMORY LEAKS

By: [Marek Majkowski](#) on November 14, 2008



LabShift Technology

While I was writing a python daemon, I noticed that my application process memory usage is growing over time. The data wasn't increasing so there must have been some memory leak.

It's not so easy for a Python application to leak memory. Usually there are three scenarios:

1. some low level C library is leaking
2. your Python code have global lists or dicts that grow over time, and you forgot to remove the objects after use
3. there are some [reference cycles](#) in your app

I remembered the [post from Marius Gedminas](#), in which he traced his memory leaks, but I haven't noticed before that [he published](#) his [tools](#).

The tools are awesome. Just take a look at my session:

```
$ pdb ./myserver.py
> /server.py(12) ()
-> import sys
(Pdb) r
2008-11-13 23:15:36,619 server.py      INFO    Running with verbosity
10 (>=DEBUG)
2008-11-13 23:15:36,620 server.py      INFO    Main dir='./server',
args=[]
```

After some time, when my application collected some garbages I pressed Ctrl+C:

```
2008-11-13 18:41:40,136 server.py      INFO    Quitting
(Pdb) import gc
(Pdb) gc.collect()
58
(Pdb) gc.collect()
0
```

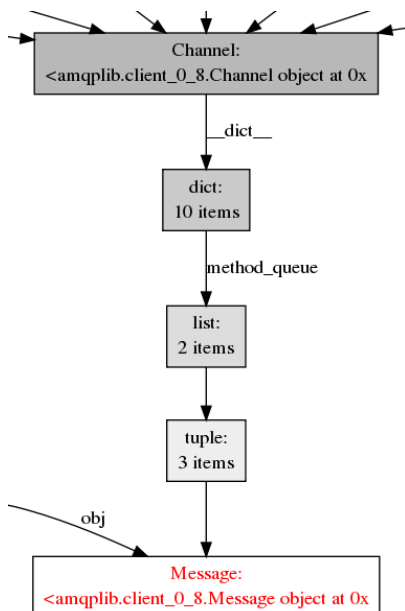
Let's see some statistics of object types in memory:

```
(Pdb) import objgraph
(Pdb) objgraph.show_most_common_types(limit=20)
dict                378631
list                184791
builtin_function_or_method 57542
tuple               55478
Message             48129
function            45575
instancemethod      31949
NonBlockingSocket   31876
NonBlockingConnection 31876
_socketobject       31876
_Condition          28320
AMQPReader          14900
cell                9678
```

Message objects definitely shouldn't be in the memory. Let's see where are they referenced:

```
(Pdb) objgraph.by_type('Message')[1]
<amqplib.client_0_8.Message object at 0x8a5b7ac>
(Pdb) import random
(Pdb) obj = objgraph.by_type('Message')[random.randint(0, 48000)]
(Pdb) objgraph.show_backrefs([obj], max_depth=10)
Graph written to objects.dot (15 nodes)
Image generated as objects.png
```

This is what I saw:



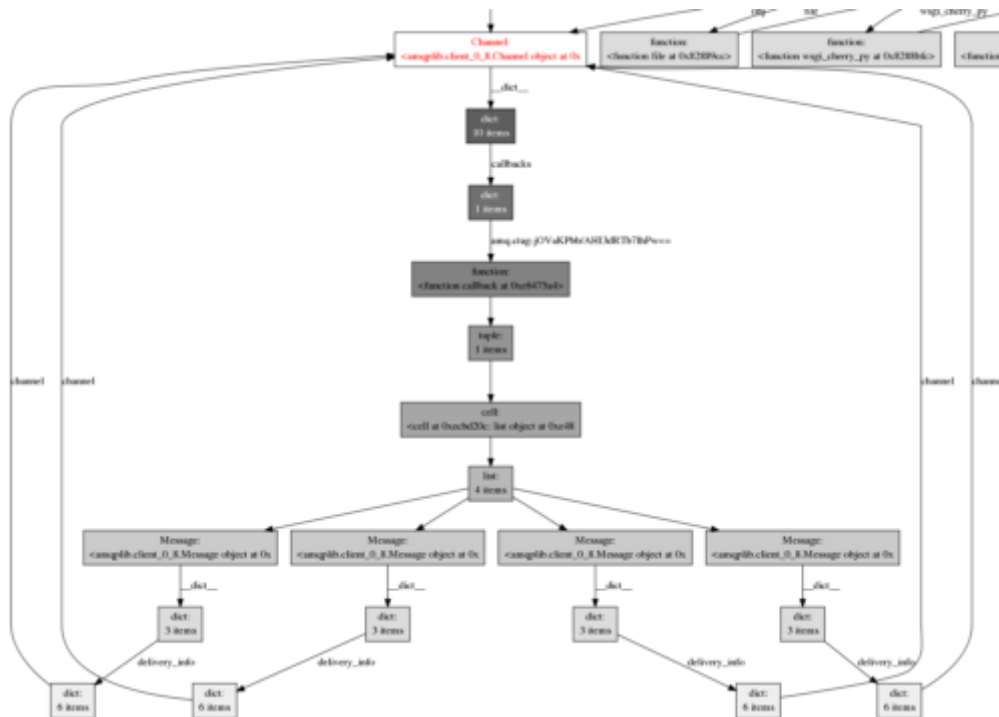
Ok. A Channel object still has references to our Message. Let's move on to see why Channel is not freed:

```
(Pdb) obj = objgraph.by_type('Channel')[random.randint(0, 31000)]
(Pdb) objgraph.show_backrefs([obj], max_depth=10)
```

Graph written to objects.dot (35 nodes)

Image generated as objects.png

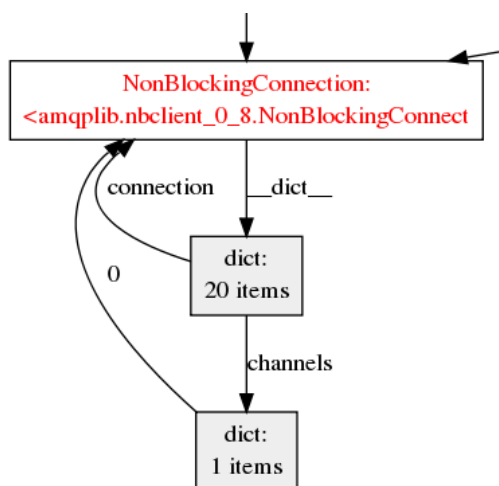
Channel object references are much more interesting – we just caught a reference cycle here!



There is also one other class that's not being freed – NonBlockingConnection:

```
(Pdb) obj = objgraph.by_type('NonBlockingConnection')
[random.randint(0, 31000)]
(Pdb) objgraph.show_backrefs([obj], max_depth=10)
Graph written to objects.dot (135 nodes)
Image generated as objects.png
```

Here's the cycle we're looking for:



To fix this issue it's enough to break the reference loops in one place. This is the code that fixes the reference loops:

```
# we don't need channel and connection any more
channel.close()
connection.close()
# remove the reference cycles:
```

```
del channel.callbacks
del connection.channels
del connonection.connection
```

26 COMMENTS

Noel Welsh

November 14, 2008 at 3:58 pm

Isn't this case a result of Python lacking a real garbage collector? Cycles should prevent garbage being collected.

Kevin

November 14, 2008 at 4:19 pm

The garbage collector will collect objects in reference cycles unless they have **del** — make sure to see <http://docs.python.org/library/gc.html#gc.garbage>

Seun Osewa

November 14, 2008 at 6:06 pm

I think the tools you've demonstrated are interesting, but why should one not just use `gc.collect()` from time to time to remove the reference cycles?

Hazka

November 14, 2008 at 8:14 pm

I might have missed a step here but how did the Channel object graph lead you to the cycle in NonBlockingConnection?

Marius Gedminas

November 14, 2008 at 11:05 pm

I'm happy you found my tools useful!

The thing with the reference cycle is strange — Python can collect those just fine, as long as the objects in the cycle don't have `del` methods. Do they? I believe my latest version of `objgraph.py` is supposed to highlight objects with `del` in some way in the output graph.

By the way I suggest using `random.choice(objgraph.by_type('Foo'))` instead of indexing with a random index from a range that you have to manually specify.

Marius Gedminas

November 14, 2008 at 11:06 pm

Just a clarification: that bold-ed 'del' should really be 'underscode underscore del underscore underscore'. I don't know how to get past this blog markup, and because there's no "Preview" button I don't want to experiment.

marek

November 15, 2008 at 3:06 pm

Marius Gedminas:

Python can collect those just fine, as long as the objects in the cycle don't have del methods. Do they?

Kevin:

The garbage collector will collect objects in reference cycles unless they have del " make sure to see

<http://docs.python.org/library/gc.html#gc.garbage>

From the [python docs](#):

Objects that have **del()** methods and are part of a reference cycle cause the entire reference cycle to be uncollectable.

From my application:

```
(Pdb) getattr(random.choice(objgraph.by_type('Channel')),
'__del__')
<bound method Channel.__del__ of <amqplib.client_0_8.Channel
object at 0xbbba7cc>>
```

In general python should do fine with collecting cycles. In my case the cycles are coming from an external library, which is not perfect and uses **del** on Channel objects. I agree that the problem with comes from the broken library rather than python garbage collector. But it's nice to be able to see the cycles anyway.

Seun Osewa:

I think the tools you've demonstrated are interesting, but why should one not just use gc.collect() from time to time to remove the reference cycles?

I did it just at the beginning.

Hazka

I might have missed a step here but how did the Channel object graph lead you to the cycle in NonBlockingConnection?

It didn't. Both *Message* and *NonBlockingConnection* are taken from the *objgraph.showmostcommon_types* output.

Chui Tey

November 28, 2008 at 10:18 am

Marius, objgraph.py rocks. I had to use it to troubleshoot leaks at work over the past two days, and it's a time saver.

Ulrik

March 1, 2009 at 4:57 pm

I'm looking at my toy application and its memory usage is constantly growing — very fast if I put the catalog rescan rate to 1/sec (normally 1/hour). However I can't see any significant change in the "most used objects" graph and specifically the overview over objects from my objects show no exaggerated numbers at all — they are constant.

It is safe to conclude that some library I use, probably in C, (like gnomedesktop) is leaky?

marek

March 2, 2009 at 10:48 pm

Ulrik: It is safe to conclude that some library I use, probably in C, (like gnomedesktop) is leaky?

Try to use Valgrind.

Wil Tan

September 14, 2009 at 10:36 am

Wow! The tools are cool but I didn't have to use them at all because thanks to this blog entry I know my problem is due to the amqpilib that we're using!

Thanks so much (and also for RabbitMQ)!

Gabriel Faure

May 24, 2010 at 1:59 am

Used this successfully in two projects. Awesome stuff!

Niklas

November 12, 2010 at 8:04 am

This helped me getting started with python memory leaks and objgraph, thank you for that!

Josh

August 19, 2011 at 3:46 am

Three years later and this still helped me. Thanks for keeping this up.

Robin Wittler

March 29, 2013 at 5:18 pm

It is 2013 and your article is actual as it was on 2008. Thx.
Helped me alot.

cheers,
Robin

Bhupesh

July 25, 2016 at 4:29 am

Hi,

1. I have a situation wherein my application is leaking some memory after significant amount of time. In such scenarios how can I debug it? How can I let the application run in pdb mode for sometime until it hits a trigger?
2. Can you also point out the dependency needed for building all the graphs. I tried to figure out but I am not able to find all the dependency for my CentOS.

Please help

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