1

```
log show --last 2h | egrep ".*sudo:.*COMMAND=.*"
```

3 错误的:

```
#!/bin/sh
## Example: a typical script with several problems
for f in $(ls *.m3u)
do
  grep -qi hq.*mp3 $f \
    && echo -e 'Playlist $f contains a HQ file in mp3 format'
done
```

正确的

```
6 #!/bin/sh¬
5 ## Example: a typical script with several problems¬
4 for f in ls *.m3u¬
3 do¬
2   grep -qi "hq.*mp3 $f" \¬
1     && printf "..%s.." "Playlist $f contains a HQ file in mp3 format"¬
  done¬
```

5

cProfile:

```
~ python -m cProfile -s time sorts.py | grep sorts.py
336686/10000    0.178    0.000    0.188    0.000 sorts.py:29(quicksort_inplace)
   10000    0.171    0.000    0.171    0.000 sorts.py:10(insertionsort)
338874/10000    0.151    0.000    0.232    0.000 sorts.py:20(quicksort)
   30000    0.084    0.000    0.587    0.000 sorts.py:5(<listcomp>)
  164437    0.036    0.000    0.036    0.000 sorts.py:24(<listcomp>)
  164437    0.036    0.000    0.036    0.000 sorts.py:25(<listcomp>)
       3    0.023    0.008    1.240    0.413 sorts.py:3(test_sorted)
       1    0.000    0.000    1.242    1.242 sorts.py:1(<module>)
~
```

kernprof line profiler:

quick sort

```
Total time: 0.553738 s
File: sorts.py
Function: quicksort at line 20

Line #      Hits         Time  Per Hit   % Time  Line Contents
==============================================================
    20                                           @profile
    21                                           def quicksort(array):
    22    335396      84132.0      0.3     15.2      if len(array) <= 1:
    23    172698      34884.0      0.2      6.3          return array
    24    162698      36881.0      0.2      6.7      pivot = array[0]
    25    162698     159117.0      1.0     28.7      left = [i for i in array[1:] if i < pivot]
    26    162698     157622.0      1.0     28.5      right = [i for i in array[1:] if i >= pivot]
    27    162698      81102.0      0.5     14.6      return quicksort(left) + [pivot] + quicksort(right)
```

insertion sort

```
Total time: 1.30088 s
File: sorts.py
Function: insertionsort at line 10

Line #      Hits         Time  Per Hit   % Time  Line Contents
==============================================================
    10                                           @profile
    11                                           def insertionsort(array):
    12    258705      38197.0      0.1      2.9      for i in range(len(array)):
    13    248705      39335.0      0.2      3.0          j = i-1
    14    248705      41430.0      0.2      3.2          v = array[i]
    15   2257105     433754.0      0.2     33.3          while j >= 0 and v < array[j]:
    16   2008400     373694.0      0.2     28.7              array[j+1] = array[j]
    17   2008400     326718.0      0.2     25.1              j -= 1
    18    248705      46327.0      0.2      3.6          array[j+1] = v
    19     10000       1421.0      0.1      0.1      return array
```

quick sort inplace

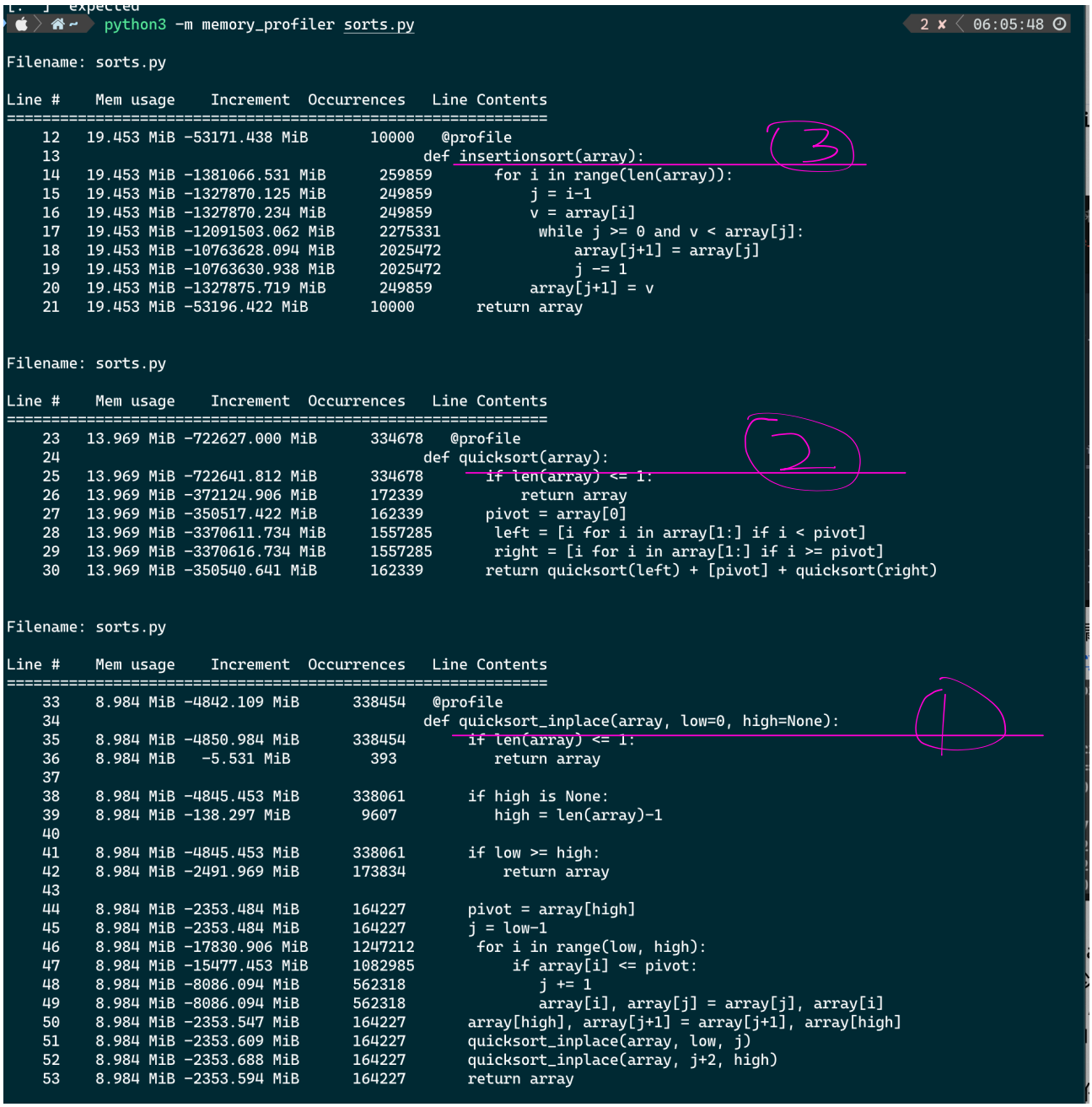
```
Total time: 1.20659 s
File: sorts.py
Function: quicksort_inplace at line 29

Line #      Hits         Time  Per Hit   % Time  Line Contents
==============================================================
    29                                           @profile
    30                                           def quicksort_inplace(array, low=0, high=None):
    31    335542      71881.0      0.2      6.0      if len(array) <= 1:
    32       402         57.0      0.1      0.0          return array
    33
    34    335140      63796.0      0.2      5.3      if high is None:
    35      9598       2067.0      0.2      0.2          high = len(array)-1
    36
    37    335140      63518.0      0.2      5.3      if low >= high:
    38    172369      27050.0      0.2      2.2          return array
    39
    40    162771      32347.0      0.2      2.7      pivot = array[high]
    41    162771      32087.0      0.2      2.7      j = low-1
    42   1238497     232624.0      0.2     19.3      for i in range(low, high):
    43   1075726     204753.0      0.2     17.0          if array[i] <= pivot:
    44    560092     105861.0      0.2      8.8              j += 1
    45    560092     140447.0      0.3     11.6              array[i], array[j] = array[j], array[i]
    46    162771      47023.0      0.3      3.9      array[high], array[j+1] = array[j+1], array[high]
    47    162771      78862.0      0.5      6.5      quicksort_inplace(array, low, j)
    48    162771      77392.0      0.5      6.4      quicksort_inplace(array, j+2, high)
    49    162771      26826.0      0.2      2.2      return array
```

Memroy analysis:

Quicksort: a lots more of calls, faster, the left and right variables to construct loops consumes most time, has more occurrences.

Insertionsort: less calls, slower, while loop consumes most time.

Quicksort inplace: least memory, no need to use memory to save temporily outcomes.



```
[:  j  expected
 python3 -m memory_profiler sorts.py                                  2 ✘  06:05:48

Filename: sorts.py

Line #    Mem usage    Increment  Occurrences   Line Contents
=============================================================
    12   19.453 MiB -53171.438 MiB       10000   @profile
    13                                           def insertionsort(array):
    14   19.453 MiB -1381066.531 MiB      259859       for i in range(len(array)):
    15   19.453 MiB -1327870.125 MiB      249859           j = i-1
    16   19.453 MiB -1327870.234 MiB      249859           v = array[i]
    17   19.453 MiB -12091503.062 MiB     2275331           while j >= 0 and v < array[j]:
    18   19.453 MiB -10763628.094 MiB     2025472               array[j+1] = array[j]
    19   19.453 MiB -10763630.938 MiB     2025472               j -= 1
    20   19.453 MiB -1327875.719 MiB      249859           array[j+1] = v
    21   19.453 MiB -53196.422 MiB       10000       return array


Filename: sorts.py

Line #    Mem usage    Increment  Occurrences   Line Contents
=============================================================
    23   13.969 MiB -722627.000 MiB      334678   @profile
    24                                         def quicksort(array):
    25   13.969 MiB -722641.812 MiB      334678       if len(array) <= 1:
    26   13.969 MiB -372124.906 MiB      172339           return array
    27   13.969 MiB -350517.422 MiB      162339       pivot = array[0]
    28   13.969 MiB -3370611.734 MiB     1557285       left = [i for i in array[1:] if i < pivot]
    29   13.969 MiB -3370616.734 MiB     1557285       right = [i for i in array[1:] if i >= pivot]
    30   13.969 MiB -350540.641 MiB      162339       return quicksort(left) + [pivot] + quicksort(right)


Filename: sorts.py

Line #    Mem usage    Increment  Occurrences   Line Contents
=============================================================
    33    8.984 MiB -4842.109 MiB      338454   @profile
    34                                         def quicksort_inplace(array, low=0, high=None):
    35    8.984 MiB -4850.984 MiB      338454       if len(array) <= 1:
    36    8.984 MiB   -5.531 MiB         393           return array
    37
    38    8.984 MiB -4845.453 MiB      338061       if high is None:
    39    8.984 MiB -138.297 MiB        9607           high = len(array)-1
    40
    41    8.984 MiB -4845.453 MiB      338061       if low >= high:
    42    8.984 MiB -2491.969 MiB      173834           return array
    43
    44    8.984 MiB -2353.484 MiB      164227       pivot = array[high]
    45    8.984 MiB -2353.484 MiB      164227       j = low-1
    46    8.984 MiB -17830.906 MiB     1247212       for i in range(low, high):
    47    8.984 MiB -15477.453 MiB     1082985           if array[i] <= pivot:
    48    8.984 MiB -8086.094 MiB       562318               j += 1
    49    8.984 MiB -8086.094 MiB       562318               array[i], array[j] = array[j], array[i]
    50    8.984 MiB -2353.547 MiB       164227       array[high], array[j+1] = array[j+1], array[high]
    51    8.984 MiB -2353.609 MiB       164227       quicksort_inplace(array, low, j)
    52    8.984 MiB -2353.688 MiB       164227       quicksort_inplace(array, j+2, high)
    53    8.984 MiB -2353.594 MiB       164227       return array
```

6

安装pycallgraph出现问题： error in pycallgraph setup command: use_2to3 is invalid.

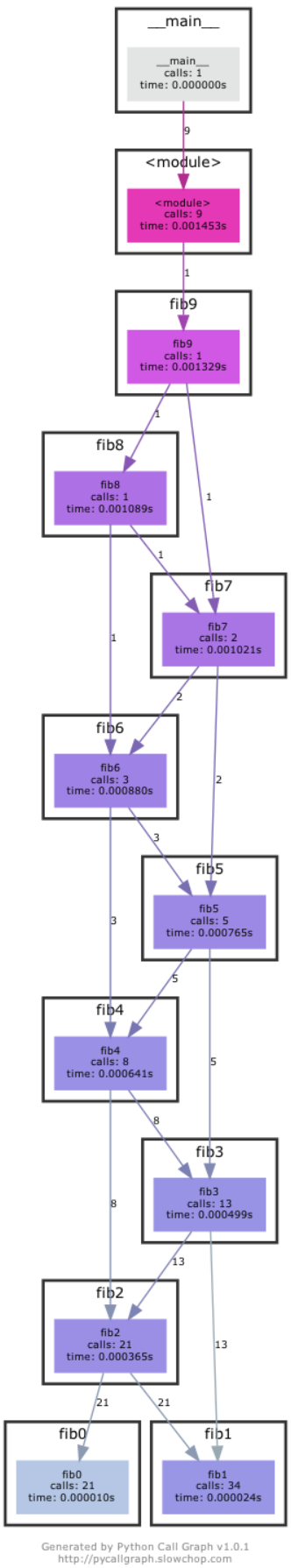
It looks like setuptools≥58 breaks support for use_2to3

方法：pip install setuptools==58，在安装。

ans: fib(0) gots call 21 times.

pycallgraph 使用方法：

```
⌥⌘1                    fib.py (~) - VIM
19 #!/usr/bin/env python¬
18 ¬
17 from pycallgraph import PyCallGraph¬
16 from pycallgraph.output import GraphvizOutput¬
15 ¬
14 def mygod():¬
13         print(5-2)¬
12 ¬
11 def f(n):¬
10     print(n)¬
 9     d(2)¬
 8 ¬
 7 def d(n):¬
 6     print(n)¬
 5     mygod()¬
 4 ¬
 3 if __name__ == '__main__':¬
 2     graphviz = GraphvizOutput()¬
 1     graphviz.output_file = 'basic2.png'¬
20 ...¬
 1     with PyCallGraph(output=graphviz):¬
 2         f(9)¬
```



7 taskset可现在任务绑定在某个cpu核心，也可以限制资源消耗。

```
Start a new process with affinity for a single CPU:
  taskset --cpu-list {{cpu id}] {{command}]

ans: taskset --cpu-list 0,2 stress -c 3
```

8

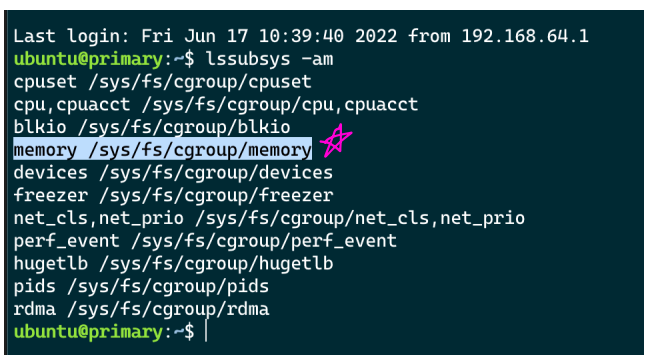
Ans:

stress -m 3 --vm-bytes 512M

创建3个进程来不停的申请 512M 内存

lssubsys -am

检查设备是否已经挂载，没有就 mount -t cgroup -o memory mem_only_group /sys/fs/cgroup/memory



- 先变为root user:

sudo -i

- 在cgroup下创建memory子系统，创建名叫mem_only_group节点

cgcreate -g memory:mem_only_group

- 设置在memory子系统下的mem_only_group的内存大小限制为100MB。

echo 100M > /sys/fs/cgroup/memory/mem_only_group/memory.limit_in_bytes

- 在mem_only_group申请111MB内存测试一下，失败。99MB可以!

cgexec -g memory:mem_only_group stress -m 1 --vm-bytes 111M

```
root@primary:/sys/fs/cgroup/devices/test# cgexec -g memory:mem_only_group stress -m 1 --vm-bytes 111M
stress: info: [1481] dispatching hogs: 0 cpu, 0 io, 1 vm, 0 hdd
stress: FAIL: [1481] (415) <-- worker 1482 got signal 9
stress: WARN: [1481] (417) now reaping child worker processes
stress: FAIL: [1481] (451) failed run completed in 0s
```

参考来源：https://tech.meituan.com/2015/03/31/cgroups.html

- Linux中，用户可以使用mount命令挂载 cgroups 文件系统，其中 subsystems 表示需要挂载的 cgroups 子系统（cpu, cpuset, memory, devices, cpuacct ...），格式为:

mount -t cgroup -o subsystems name /cgroup/name

- 比如挂载 cpuset, cpu, cpuacct, memory 4个subsystem到/cgroup/cpu_and_mem 目录下，就可以使用

mount -t cgroup -o remount,cpu,cpuset,memory cpu_and_mem /cgroup/cpu_and_mem

- 使用cgcreate命令的方法创建 cgroups 层级结构中的节点。比如通过命令 cgcreate -t sankuai:sankuai -g cpu:test 就可以在 cpu 子系统下建立一个名为 test 的节点。

- cgset 命令也可以设置 cgroups 子系统的参数，格式为 cgset -r parameter=value path_to_cgroup。

- 当需要删除某一个 cgroups 节点的时候，可以使用 cgdelete 命令，比如要删除上述的 test 节点，可以使用 cgdelete -r cpu:test 命令进行删除

- 把进程加入到 cgroups 子节点也有多种方法，可以直接把 pid 写入到子节点下面的 task 文件中。也可以通过 cgclassify 添加进程，格式为 cgclassify -g subsystems:path_to_cgroup pidlist，也可以直接使用 cgexec 在某一个 cgroups 下启动进程，格式为 cgexec -g subsystems:path_to_cgroup command arguments.

实例：
对于这样的“一小份”数据，对及时更新的要求不高，生成商品信息又是一个比较费资源的任务，所以我们把这个任务的cpu资源使用率限制在了50%。

首先在 cpu 子系统下面创建了一个 halfapi 的子节点：
cgcreate abc:abc -g cpu:halfapi

然后在配置文件中写入配置数据：
echo 50000 > /cgroup/cpu/halfapi/cpu.cfs_quota_us
cpu.cfs_quota_us 中的默认值是100000，写入50000表示只能使用50%的 cpu 运行时间。

最后在这个cgroups中启动这个任务：
cgexec -g "cpu:/halfapi" php halfapi.php half >/dev/null 2>&1