实验报告

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1 Perf List

Perf List查看当前软硬件平台支持的性能事件列表，性能事件的属性。

```
a@ubuntu:~$ perf list

List of pre-defined events (to be used in -e):

  duration_time                                      [Tool event]

  msr/tsc/                                           [Kernel PMU event]
  ref-cycles OR cpu/ref-cycles/                      [Kernel PMU event]

  rNNN                                               [Raw hardware event descri
  cpu/t1=v1[,t2=v2,t3 ...]/modifier                  [Raw hardware event descri
   (see 'man perf-list' on how to encode it)

  mem:<addr>[/len][:access]                          [Hardware breakpoint]

(END)
```

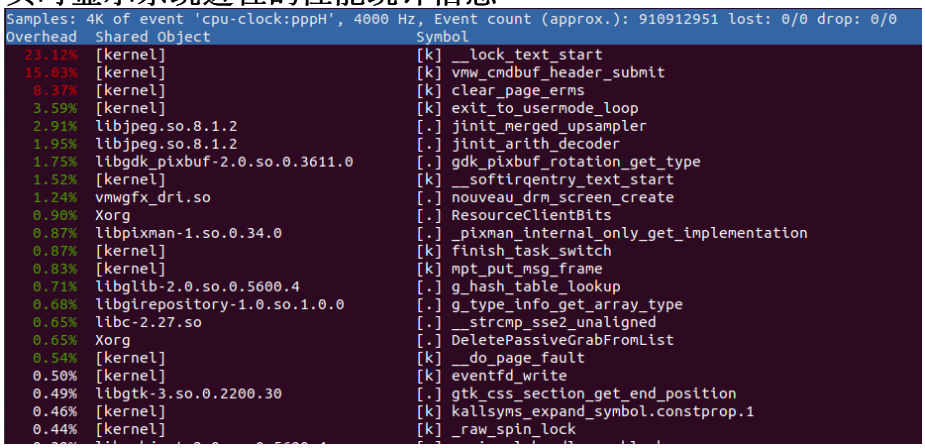
2 Perf Stat

Perf Stat分析性能,perf stat -a -d sleep 5会检测5秒钟内系统的性能事件。

```
root@ubuntu:/home/a#
root@ubuntu:/home/a# perf stat -a -d sleep 5

 Performance counter stats for 'system wide':

         10,003.53 msec cpu-clock                 #    2.000 CPUs utilized
             1,181      context-switches          #    0.118 K/sec
                 4      cpu-migrations            #    0.000 K/sec
               111      page-faults               #    0.011 K/sec
   <not supported>      cycles
   <not supported>      instructions
   <not supported>      branches
   <not supported>      branch-misses
   <not supported>      L1-dcache-loads
   <not supported>      L1-dcache-load-misses
   <not supported>      LLC-loads
   <not supported>      LLC-load-misses

       5.001897621 seconds time elapsed

root@ubuntu:/home/a#
```

3 Perf Top

实时显示系统进程的性能统计信息。



```
Samples: 4K of event 'cpu-clock:pppH', 4000 Hz, Event count (approx.): 910912951 lost: 0/0 drop: 0/0
Overhead  Shared Object                       Symbol
  23.12%  [kernel]                            [k] __lock_text_start
  15.03%  [kernel]                            [k] vmw_cmdbuf_header_submit
   8.37%  [kernel]                            [k] clear_page_erms
   3.59%  [kernel]                            [k] exit_to_usermode_loop
   2.91%  libjpeg.so.8.1.2                    [.] jinit_merged_upsampler
   1.95%  libjpeg.so.8.1.2                    [.] jinit_arith_decoder
   1.75%  libgdk_pixbuf-2.0.so.0.3611.0       [.] gdk_pixbuf_rotation_get_type
   1.52%  [kernel]                            [k] __softirqentry_text_start
   1.24%  vmwgfx_dri.so                       [.] nouveau_drm_screen_create
   0.90%  Xorg                                [.] ResourceClientBits
   0.87%  libpixman-1.so.0.34.0               [.] _pixman_internal_only_get_implementation
   0.87%  [kernel]                            [k] finish_task_switch
   0.83%  [kernel]                            [k] mpt_put_msg_frame
   0.71%  libglib-2.0.so.0.5600.4             [.] g_hash_table_lookup
   0.68%  libgirepository-1.0.so.1.0.0        [.] g_type_info_get_array_type
   0.65%  libc-2.27.so                        [.] __strcmp_sse2_unaligned
   0.65%  Xorg                                [.] DeletePassiveGrabFromList
   0.54%  [kernel]                            [k] __do_page_fault
   0.50%  [kernel]                            [k] eventfd_write
   0.49%  libgtk-3.so.0.2200.30               [.] gtk_css_section_get_end_position
   0.46%  [kernel]                            [k] kallsyms_expand_symbol.constprop.1
   0.44%  [kernel]                            [k] _raw_spin_lock
```

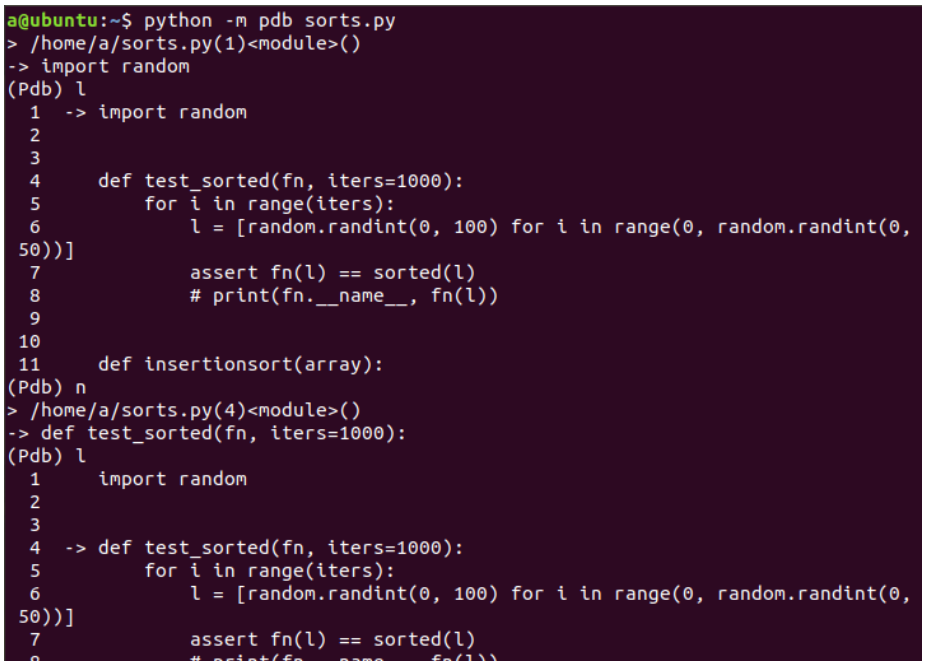
4 Python调试器pdb

在Python代码中，可以插入pdb.set_trace()来启动调试器。

```
        j = i-1
        v = array[i]
        while j >= 0 and v < array[j]:
            array[j+1] = array[j]
            j -= 1
        array[j+1] = v
    return array


def quicksort(array):
    pdb.set_trace()
    if len(array) <= 1:
        return array
    pivot = array[0]
    left = [i for i in array[1:] if i < pivot]
    right = [i for i in array[1:] if i >= pivot]
    return quicksort(left) + [pivot] + quicksort(right)


def quicksort_inplace(array, low=0, high=None):
    if len(array) <= 1:
        return array
    if high is None:
        high = len(array)-1
    if low >= high:
        return array

    pivot = array[high]
```

```
a@ubuntu:~$ python sorts.py
> /home/a/sorts.py(26)quicksort()
-> if len(array) <= 1:
(Pdb) l
 21         return array
 22
 23
 24     def quicksort(array):
 25         pdb.set_trace()
 26  ->     if len(array) <= 1:
 27             return array
 28         pivot = array[0]
 29         left = [i for i in array[1:] if i < pivot]
 30         right = [i for i in array[1:] if i >= pivot]
 31         return quicksort(left) + [pivot] + quicksort(right)
(Pdb)
```

在命令行中使用-m pdb 来启动调试器。



5 追踪程序执行时系统调用

sudo strace -e lstat ls -l ¿ /dev/null
当这个命令执行时，strace 会跟踪ls -l 命令执行过程中所有的lstat 系统调用，并将跟踪的详细信息输出到终端。

```
a@ubuntu:~$ sudo strace -e lstat ls -l > /dev/null
lstat("Templates", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("compare.sh", {st_mode=S_IFREG|0664, st_size=189, ...}) = 0
lstat("gcd.sh", {st_mode=S_IFREG|0664, st_size=186, ...}) = 0
lstat("perf.data", {st_mode=S_IFREG|0600, st_size=2105924, ...}) = 0
lstat("rho.sh", {st_mode=S_IFREG|0664, st_size=329, ...}) = 0
lstat("FlameGraph-master", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("test.py", {st_mode=S_IFREG|0664, st_size=298, ...}) = 0
lstat("sorts.py.lprof", {st_mode=S_IFREG|0664, st_size=147, ...}) = 0
lstat("test.sh", {st_mode=S_IFREG|0775, st_size=195, ...}) = 0
lstat("2.sh", {st_mode=S_IFREG|0664, st_size=40, ...}) = 0
lstat("Desktop", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("Videos", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("sorts.py", {st_mode=S_IFREG|0600, st_size=1314, ...}) = 0
lstat("Music", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("Public", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("1.sh", {st_mode=S_IFREG|0664, st_size=52, ...}) = 0
lstat("Documents", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("Downloads", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("prime.sh", {st_mode=S_IFREG|0664, st_size=400, ...}) = 0
lstat("Pictures", {st_mode=S_IFDIR|0775, st_size=4096, ...}) = 0
lstat("nar.sh", {st_mode=S_IFREG|0664, st_size=191, ...}) = 0
+++ exited with 0 +++
```

6 cProfile

cProfile列出了每个函数的调用次数、总时间、累计时间等统计信息。

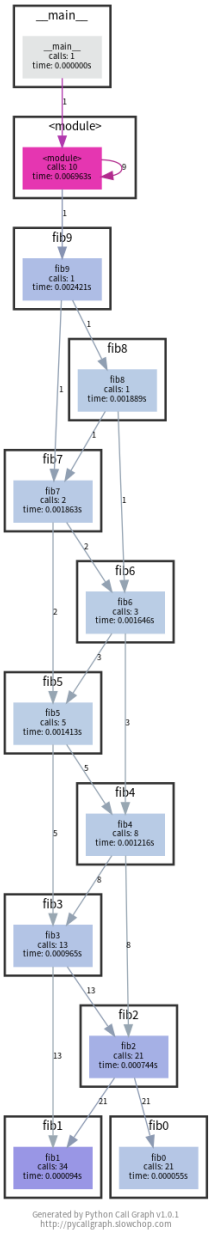
```
a@ubuntu:~$ python -m cProfile  sorts.py
         395968 function calls (330188 primitive calls) in 0.157 seconds

   Ordered by: standard name

   ncalls  tottime  percall  cumtime  percall filename:lineno(function)
        1    0.000    0.000    0.000    0.000 __future__.py:48(<module>)
        1    0.000    0.000    0.000    0.000 __future__.py:74(_Feature)
        7    0.000    0.000    0.000    0.000 __future__.py:75(__init__)
        6    0.000    0.000    0.000    0.000 hashlib.py:100(__get_openssl_con
tructor)
        1    0.001    0.001    0.001    0.001 hashlib.py:56(<module>)
        1    0.000    0.000    0.000    0.000 random.py:100(seed)
    77817    0.045    0.000    0.049    0.000 random.py:177(randrange)
    77817    0.017    0.000    0.066    0.000 random.py:240(randint)
        1    0.000    0.000    0.002    0.002 random.py:40(<module>)
        1    0.000    0.000    0.000    0.000 random.py:657(WichmannHill)
        1    0.000    0.000    0.000    0.000 random.py:72(Random)
        1    0.000    0.000    0.000    0.000 random.py:807(SystemRandom)
        1    0.000    0.000    0.000    0.000 random.py:91(__init__)
        1    0.000    0.000    0.157    0.157 sorts.py:1(<module>)
     1000    0.014    0.000    0.014    0.000 sorts.py:11(insertionsort)
32916/1000    0.025    0.000    0.027    0.000 sorts.py:23(quicksort)
34864/1000    0.023    0.000    0.026    0.000 sorts.py:32(quicksort_inplace)
        3    0.017    0.006    0.155    0.052 sorts.py:4(test_sorted)
        1    0.000    0.000    0.000    0.000 {_hashlib.openssl_md5}
```

7 memory_profiler

memory_profiler检查内存消耗

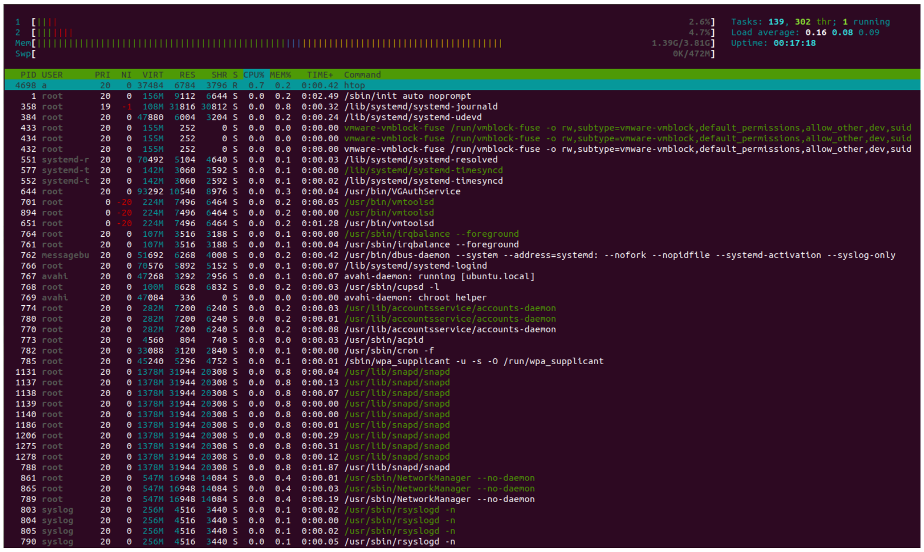
```
a@ubuntu:~$ python -m memory_profiler sorts.py

Filename: sorts.py

Line #    Mem usage    Increment   Line Contents
================================================
     9   13.867 MiB   13.867 MiB   @profile
    10                             def insertionsort(array):
    11
    12   13.867 MiB    0.000 MiB       for i in range(len(array)):
    13   13.867 MiB    0.000 MiB           j = i-1
    14   13.867 MiB    0.000 MiB           v = array[i]
    15   13.867 MiB    0.000 MiB           while j >= 0 and v < array[j]:
    16   13.867 MiB    0.000 MiB               array[j+1] = array[j]
    17   13.867 MiB    0.000 MiB               j -= 1
    18   13.867 MiB    0.000 MiB           array[j+1] = v
    19   13.867 MiB    0.000 MiB       return array
```

8 绘制python调用关系图



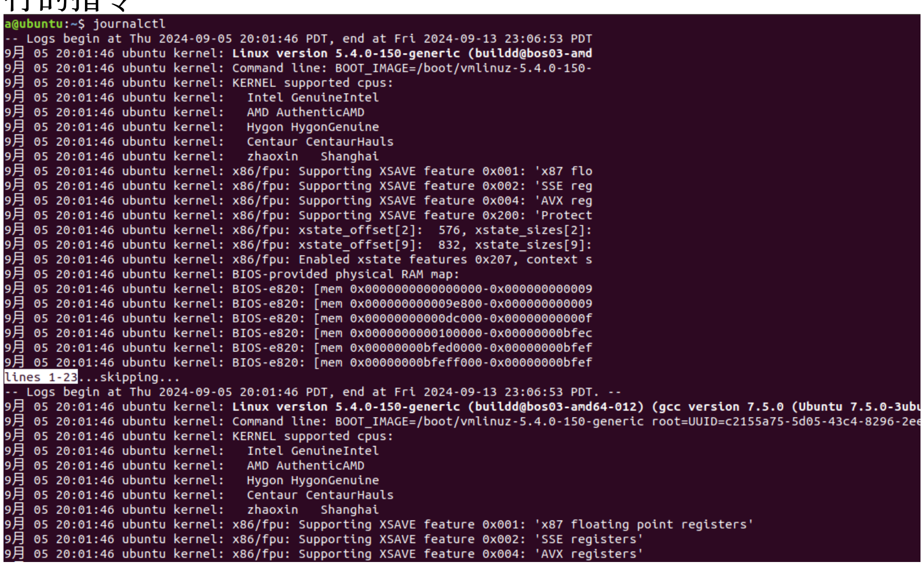

```
a@ubuntu:~$ pycallgraph graphviz -- ./fib.py
34
a@ubuntu:~$
```

9 htop进程查看器



10 journalctl

journalctl命令来获取最近一天中超级用户的登录信息及其所执行的指令



11 valgrind内存泄漏检查

-leak-check=full 执行全面的内存泄漏检查
–show-leak-kinds=all 显示所有类型的内存泄漏。
–track-origins=yes 跟踪未初始化值的来源。

```
a@ubuntu:~$ valgrind --leak-check=full --show-leak-kinds=all --track-origins=yes ./t
==3708== Memcheck, a memory error detector
==3708== Copyright (C) 2002-2017, and GNU GPL'd, by Julian Seward et al.
==3708== Using Valgrind-3.13.0 and LibVEX; rerun with -h for copyright info
==3708== Command: ./test
==3708==
ptr [0x(nil)]
==3708== Invalid write of size 4
==3708==    at 0x10867D: main (in /home/a/test)
==3708==  Address 0x0 is not stack'd, malloc'd or (recently) free'd
==3708==
==3708==
==3708== Process terminating with default action of signal 11 (SIGSEGV)
==3708==  Access not within mapped region at address 0x0
==3708==    at 0x10867D: main (in /home/a/test)
==3708==  If you believe this happened as a result of a stack
==3708==  overflow in your program's main thread (unlikely but
==3708==  possible), you can try to increase the size of the
==3708==  main thread stack using the --main-stacksize= flag.
==3708==  The main thread stack size used in this run was 8388608.
==3708==
==3708== HEAP SUMMARY:
==3708==     in use at exit: 0 bytes in 0 blocks
==3708==   total heap usage: 1 allocs, 1 frees, 1,024 bytes allocated
==3708==
==3708== All heap blocks were freed -- no leaks are possible
==3708==
==3708== For counts of detected and suppressed errors, rerun with: -v
==3708== ERROR SUMMARY: 1 errors from 1 contexts (suppressed: 0 from 0)
段错误 (核心已转储)
```

12 iostat

显示自系统启动以来的CPU 和磁盘统计报告

```
a@ubuntu:~$ iostat
Linux 5.4.0-150-generic (ubuntu)        2024年09月13日  _x86_64_        (2 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           1.01    0.14    1.66    0.08    0.00   97.11

Device             tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
loop0             0.01         0.02         0.00         47          0
loop1             0.02         0.16         0.00        334          0
loop2             0.02         0.50         0.00       1064          0
loop3             0.02         0.05         0.00        115          0
loop4             0.01         0.02         0.00         44          0
loop5             0.01         0.02         0.00         45          0
loop6             0.00         0.00         0.00          4          0
loop7             0.02         0.05         0.00        109          0
sda              12.89       439.12       282.41     926225     595684
loop8             0.02         0.05         0.00        110          0
loop9             0.03         0.50         0.00       1058          0
loop10            0.03         0.50         0.00       1048          0
loop11            0.03         0.50         0.00       1054          0
loop12            0.02         0.16         0.00        340          0
loop13            0.03         0.51         0.00       1070          0
loop14            0.02         0.05         0.00        110          0
loop15            0.02         0.16         0.00        328          0
loop16            0.02         0.16         0.00        332          0
loop17            6.90         7.38         0.00      15569          0
loop18            0.00         0.00         0.00          8          0

a@ubuntu:~$
```

显示CPU 使用情况和磁盘I/O 统计信息

```
a@ubuntu:~$ iostat -c
Linux 5.4.0-150-generic (ubuntu)        2024年09月13日  _x86_64_        (2 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.95    0.13    1.57    0.08    0.00   97.27
```

显示自系统启动以来的统计信息

```
a@ubuntu:~$ iostat -d -t
Linux 5.4.0-150-generic (ubuntu)        2024年09月13日  _x86_64_        (2 CPU)

2024年09月13日 23时43分17秒
Device             tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
loop0             0.01         0.02         0.00         47          0
loop1             0.02         0.15         0.00        334          0
loop2             0.02         0.46         0.00       1064          0
loop3             0.02         0.05         0.00        115          0
loop4             0.01         0.02         0.00         44          0
loop5             0.01         0.02         0.00         45          0
loop6             0.00         0.00         0.00          4          0
loop7             0.01         0.05         0.00        109          0
sda              11.97       403.92       260.44     926225     597200
loop8             0.02         0.05         0.00        110          0
loop9             0.03         0.46         0.00       1058          0
loop10            0.02         0.46         0.00       1048          0
loop11            0.02         0.46         0.00       1054          0
loop12            0.02         0.15         0.00        340          0
loop13            0.02         0.47         0.00       1070          0
loop14            0.02         0.05         0.00        110          0
loop15            0.02         0.14         0.00        328          0
loop16            0.02         0.14         0.00        332          0
loop17            6.35         6.79         0.00      15569          0
loop18            0.00         0.00         0.00          8          0
```

13 dstat

dstat显示了cpu使用情况，磁盘io情况，网络发包情况和换页情况，输出是彩色的，可读性较强，相对于vmstat和iostat的输入更加详细且较为直观。

```
a@ubuntu:~$ dstat
You did not select any stats, using -cdngy by default.
--total-cpu-usage-- -dsk/total- -net/total- ---paging-- ---system--
usr sys idl wai stl| read  writ| recv  send|  in   out | int   csw
  3  21  75   1   0|9131k  284k|   0     0 |   0     0 |1230  3125
  1   4  95   0   0|   0     0 |   0     0 |   0     0 | 792  1589
  0   0 100   0   0|   0     0 |   0     0 |   0     0 | 204   338
  0   1  99   0   0|   0     0 |   0     0 |   0     0 | 132   228
  2   0  98   1   0|   0    60k|   0     0 |   0     0 | 134   234
  3   1  97   0   0| 156k    0 |   0     0 |   0     0 | 181   295
  7   1  92   0   0|2280k    0 |   0     0 |   0     0 | 193   377
  0   1 100   0   0|   0     0 |   0     0 |   0     0 | 117   196
  0   2  99   0   0|   0     0 |   0     0 |   0     0 | 143   227
  0   1  99   0   0|   0     0 |   0     0 |   0     0 | 139   217
  1   0  99   0   0|   0     0 |   0     0 |   0     0 | 113   179
  1   2  98   0   0|   0  4112k|   0     0 |   0     0 | 160   232
  1   0  99   0   0|   0     0 |   0     0 |   0     0 | 107   184
  1   1  99   0   0|   0     0 |   0     0 |   0     0 |  85   195
  2   1  98   0   0|   0     0 |   0     0 |   0     0 |  87   206
  0   1  99   0   0|   0     0 |   0     0 |   0     0 | 100   180
  1   1  98   0   0|   0     0 |   0     0 |   0     0 | 221   363
  0   1  99   0   0|   0   328k|   0     0 |   0     0 | 273   451
  0   1  99   0   0|   0     0 |   0     0 |   0     0 | 112   188
  0   1  99   0   0|   0     0 |   0     0 |   0     0 | 141   238
  1   0  99   0   0|   0     0 |   0     0 |   0     0 |  93   194
  1   1  99   0   0|   0     0 |   0     0 |   0     0 | 106   229
  0   1  99   0   0|  28k  456k|   0     0 |   0     0 | 141   238
  0   1  99   0   0|   0    84k|   0     0 |   0     0 |  84   177
  1   0  99   0   0|   0     0 |   0     0 |   0     0 | 132   229
  1   1  99   0   0|   0     0 |   0     0 |   0     0 |  80   163
  0   0 100   0   0|   0     0 |   0     0 |   0     0 |  80   176
--total-cpu-usage-- -dsk/total- -net/total- ---paging-- ---system--
```

14 mpstat

mpstat用于监控CPU 利用率和性能统计的命令行工具。

```
a@ubuntu:~$ mpstat
Linux 5.4.0-150-generic (ubuntu)        2024年09月14日  _x86_64_        (2 CPU)

04时35分03秒  CPU    %usr   %nice    %sys %iowait    %irq   %soft  %steal  %guest  %gnice
  %idle
04时35分03秒  all    1.15    0.08    3.38    0.21    0.00    0.20    0.00    0.00    0.00
  94.98
a@ubuntu:~$
```

15 ps

ps 是Linux 系统中用于监控活动进程的命令行工具。它显示系统中正在运行的进程及其相关信息

```
a@ubuntu:~$ ps
    PID TTY          TIME CMD
   1810 pts/0    00:00:00 bash
   3450 pts/0    00:00:00 ps
```

ps后可以跟不同参数。
列出所有系统上的进程

```
a@ubuntu:~$ ps -A
    PID TTY          TIME CMD
      1 ?        00:00:02 systemd
      2 ?        00:00:00 kthreadd
      3 ?        00:00:00 rcu_gp
      4 ?        00:00:00 rcu_par_gp
      6 ?        00:00:00 kworker/0:0H-kb
      8 ?        00:00:00 mm_percpu_wq
      9 ?        00:00:00 ksoftirqd/0
     10 ?        00:00:00 rcu_sched
     11 ?        00:00:00 migration/0
     12 ?        00:00:00 idle_inject/0
     14 ?        00:00:00 cpuhp/0
     15 ?        00:00:00 cpuhp/1
     16 ?        00:00:00 idle_inject/1
     17 ?        00:00:00 migration/1
     18 ?        00:00:00 ksoftirqd/1
     20 ?        00:00:00 kworker/1:0H-kb
     21 ?        00:00:00 kdevtmpfs
     22 ?        00:00:00 netns
     23 ?        00:00:00 rcu_tasks_kthre
     24 ?        00:00:00 kauditd
     26 ?        00:00:00 khungtaskd
     27 ?        00:00:00 oom_reaper
     28 ?        00:00:00 writeback
```

列出当前用户的进程

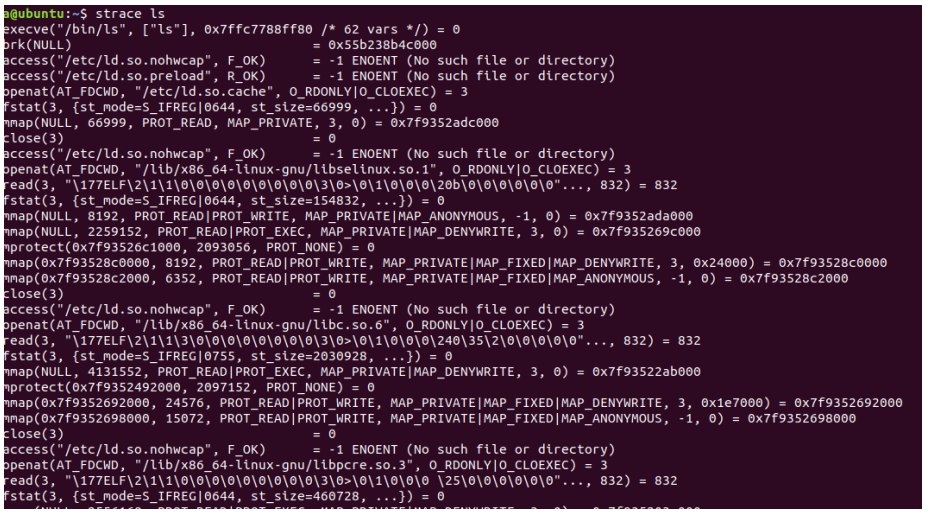
```
a@ubuntu:~$ ps -x
   PID TTY      STAT   TIME COMMAND
  1366 ?        Ss     0:00 /lib/systemd/systemd --user
  1367 ?        S      0:00 (sd-pam)
  1380 ?        Sl     0:00 /usr/bin/gnome-keyring-daemon --daemonize --login
  1384 tty2     Ssl+   0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_S
  1386 tty2     Rl+    0:06 /usr/lib/xorg/Xorg vt2 -displayfd 3 -auth /run/user/
  1390 ?        Ss     0:00 /usr/bin/dbus-daemon --session --address=systemd: --
  1393 tty2     Sl+    0:00 /usr/lib/gnome-session/gnome-session-binary --sessio
  1470 ?        Ss     0:00 /usr/bin/ssh-agent /usr/bin/im-launch env GNOME_SHEL
  1472 ?        Ssl    0:00 /usr/lib/at-spi2-core/at-spi-bus-launcher
  1477 ?        S      0:00 /usr/bin/dbus-daemon --config-file=/usr/share/defaul
  1479 ?        Sl     0:00 /usr/lib/at-spi2-core/at-spi2-registryd --use-gnome-
  1496 tty2     Rl+    0:14 /usr/bin/gnome-shell
  1502 ?        Ssl    0:00 /usr/lib/gvfs/gvfsd
  1507 ?        Sl     0:00 /usr/lib/gvfs/gvfsd-fuse /run/user/1000/gvfs -f -o b
  1518 ?        S<l    0:00 /usr/bin/pulseaudio --start --log-target=syslog
  1530 tty2     Sl     0:00 ibus-daemon --xim --panel disable
  1534 tty2     Sl     0:00 /usr/lib/ibus/ibus-dconf
  1535 ?        Ssl    0:00 /usr/libexec/xdg-permission-store
  1540 tty2     Sl     0:00 /usr/lib/ibus/ibus-x11 --kill-daemon
```

以用户为中心的格式显示进程信息

```
a@ubuntu:~$ ps -u
USER        PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
a          1384  0.0  0.1 206912  6080 tty2     Ssl+ 04:31   0:00 /usr/lib/gdm3/gdm-x-sess
a          1386  0.4  1.5 403364 63796 tty2     Sl+  04:31   0:06 /usr/lib/xorg/Xorg vt2 -
a          1393  0.0  0.3 701968 14892 tty2     Sl+  04:31   0:00 /usr/lib/gnome-session/g
a          1496  1.0  5.1 3458104 205960 tty2   Rl+  04:31   0:15 /usr/bin/gnome-shell
a          1530  0.0  0.2 356396  8128 tty2     Sl   04:31   0:00 ibus-daemon --xim --pane
a          1534  0.0  0.1 275652  6888 tty2     Sl   04:31   0:00 /usr/lib/ibus/ibus-dconf
a          1540  0.0  0.5 340064 22168 tty2     Sl   04:31   0:00 /usr/lib/ibus/ibus-x11 -
a          1586  0.0  0.5 513076 23512 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1588  0.0  0.2 344276 10172 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1590  0.0  0.1 418156  6024 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1599  0.0  0.1 270544  5860 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1600  0.0  0.2 447640  9336 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1604  0.0  0.2 373000  8320 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1605  0.0  0.2 329896  8296 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1613  0.0  0.5 489900 23284 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1618  0.0  0.5 498160 22340 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1624  0.0  0.1 273084  5884 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1625  0.0  0.5 339596 21480 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1628  0.0  0.6 654720 24108 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1632  0.0  0.3 464660 13744 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1633  0.0  0.1 359376  7336 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1634  0.0  0.5 502620 23116 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1640  0.0  0.6 1077812 24884 tty2    Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1642  0.0  0.1 273088  5844 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
a          1662  0.0  0.3 503584 12860 tty2     Sl+  04:31   0:00 /usr/lib/gnome-settings-
```

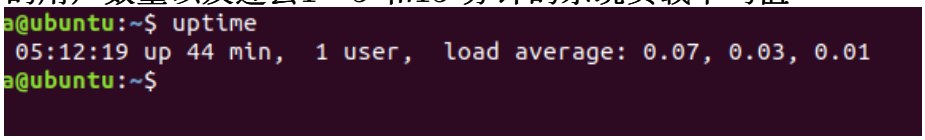
16 strace

strace 是一个在Linux 中用于追踪系统调用、信号和其他相关信息的强大工具。

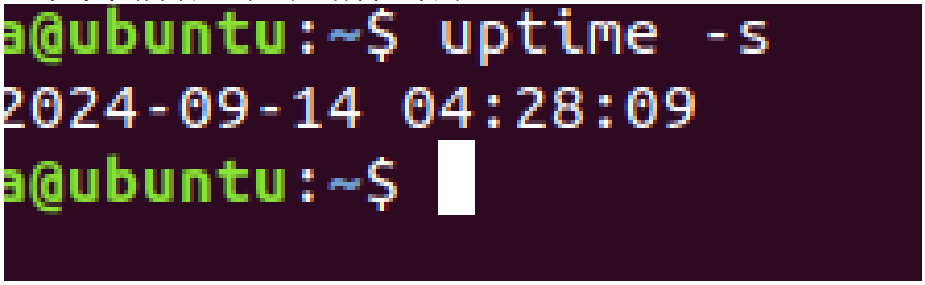


17 uptime

uptime 是Linux 系统中一个简单的命令，用于显示系统运行了多长时间，包括系统上一次启动以来的时间、当前时间、登录的用户数量以及过去1、5 和15 分钟的系统负载平均值。



显示系统启动以来的日期和时间



18 lsof

lsof用于列出由进程、用户或特定文件系统打开的文件。
lsof 显示系统中所有进程打开的文件列表

```
    138365 /lib/x86_64-linux-gnu/libkeyutils.so.1.5
pool      1746 1762                a  mem       REG                8,1  1237640       1029 /usr/lib/x86_64-linux-gnu/lib
p11-kit.so.0.3.0
pool      1746 1762                a  mem       REG                8,1   206904       4869 /usr/lib/x86_64-linux-gnu/lib
gck-1.so.0.0.0
pool      1746 1762                a  mem       REG                8,1   526792       7432 /usr/lib/x86_64-linux-gnu/lib
curl-gnutls.so.4.5.0
pool      1746 1762                a  mem       REG                8,1    84032     138352 /lib/x86_64-linux-gnu/libgpg-
error.so.0.22.0
pool      1746 1762                a  mem       REG                8,1    14488       5321 /usr/lib/x86_64-linux-gnu/lib
plds4.so
pool      1746 1762                a  mem       REG                8,1    18680       5320 /usr/lib/x86_64-linux-gnu/lib
plc4.so
pool      1746 1762                a  mem       REG                8,1   191360       7676 /usr/lib/x86_64-linux-gnu/lib
nssutil3.so
pool      1746 1762                a  mem       REG                8,1    27112     138454 /lib/x86_64-linux-gnu/libuuid
.so.1.3.0
pool      1746 1762                a  mem       REG                8,1    43616       2720 /usr/lib/x86_64-linux-gnu/lib
krb5support.so.0.1
pool      1746 1762                a  mem       REG                8,1    14248     134953 /lib/x86_64-linux-gnu/libcom_
err.so.2.1
pool      1746 1762                a  mem       REG                8,1   199104       7618 /usr/lib/x86_64-linux-gnu/lib
k5crypto.so.3.1
pool      1746 1762                a  mem       REG                8,1   877056       4539 /usr/lib/x86_64-linux-gnu/lib
krb5.so.3.3
pool      1746 1762                a  mem       REG                8,1   300968       4933 /usr/lib/x86_64-linux-gnu/lib
goa-1.0.so.0.0.0
pool      1746 1762                a  mem       REG                8,1   610824       4871 /usr/lib/x86_64-linux-gnu/lib
gcr-base-3.so.1.0.0
pool      1746 1762                a  mem       REG                8,1    34656       5260 /usr/lib/x86_64-linux-gnu/lib
oauth.so.0.8.7
pool      1746 1762                a  mem       REG                8,1 26904112       7593 /usr/lib/x86_64-linux-gnu/lib
```

lsof -u username 列出特定用户打开的文件

```
rmission denied)
kworker/0 3483                root  txt   unknown                                /proc/3483/exe (readlink: Per
mission denied)
kworker/0 3483                root NOFD                                    /proc/3483/fd (opendir: Permi
ssion denied)
kworker/0 3503                root  cwd   unknown                                /proc/3503/cwd (readlink: Per
mission denied)
kworker/0 3503                root  rtd   unknown                                /proc/3503/root (readlink: Pe
rmission denied)
kworker/0 3503                root  txt   unknown                                /proc/3503/exe (readlink: Per
mission denied)
kworker/0 3503                root NOFD                                    /proc/3503/fd (opendir: Permi
ssion denied)
kworker/u 3549                root  cwd   unknown                                /proc/3549/cwd (readlink: Per
mission denied)
kworker/u 3549                root  rtd   unknown                                /proc/3549/root (readlink: Pe
rmission denied)
kworker/u 3549                root  txt   unknown                                /proc/3549/exe (readlink: Per
mission denied)
kworker/u 3549                root NOFD                                    /proc/3549/fd (opendir: Permi
ssion denied)
kworker/u 3592                root  cwd   unknown                                /proc/3592/cwd (readlink: Per
mission denied)
kworker/u 3592                root  rtd   unknown                                /proc/3592/root (readlink: Pe
rmission denied)
kworker/u 3592                root  txt   unknown                                /proc/3592/exe (readlink: Per
mission denied)
```

19 vmstat显示虚拟内存统计信息

vmstat用于报告各种系统资源信息的命令行工具

```
a@ubuntu:~$ vmstat
procs -----------memory---------- ---swap-- -----io---- -system-- ------cpu-----
 r  b 交换 空闲 缓冲 缓存   si   so    bi    bo   in   cs us sy id wa st
 1  0      0 1547400 119284 1136524    0    0   137    51   72  161  0  1 99  0
 0
a@ubuntu:~$
```

显示自系统启动以来的平均值

```
a@ubuntu:~$ vmstat -s
      3994720 K total memory
      1190984 K used memory
      1198016 K active memory
       679344 K inactive memory
      1547912 K free memory
       119300 K buffer memory
      1136524 K swap cache
       483800 K total swap
            0 K used swap
       483800 K free swap
         3173 non-nice user cpu ticks
          260 nice user cpu ticks
         5995 system cpu ticks
       711029 idle cpu ticks
          244 IO-wait cpu ticks
            0 IRQ cpu ticks
          261 softirq cpu ticks
            0 stolen cpu ticks
       971083 pages paged in
       360980 pages paged out
            0 pages swapped in
```

20 tcpdump

tcpdump允许用户捕获和交互式或记录下来通过网络接口的数据包。

```
a@ubuntu:~$ sudo tcpdump
[sudo] a 的密码:
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
05:44:51.397443 IP localhost.60682 > localhost.domain: 53531+ [1au] A? ntp.ubuntu.com. (43)
05:44:51.397468 IP localhost.60682 > localhost.domain: 34604+ [1au] AAAA? ntp.ubuntu.com. (43)
05:44:51.397605 IP localhost.domain > localhost.60682: 53531 ServFail 0/0/1 (43)
05:44:51.397651 IP localhost.domain > localhost.60682: 34604 ServFail 0/0/1 (43)
05:44:51.399419 IP localhost.51362 > localhost.domain: 6769+ [1au] A? ntp.ubuntu.com. (43)
05:44:51.399451 IP localhost.51362 > localhost.domain: 33917+ [1au] AAAA? ntp.ubuntu.com. (43)
05:44:51.399678 IP localhost.domain > localhost.51362: 6769 ServFail 0/0/1 (43)
05:44:51.399723 IP localhost.domain > localhost.51362: 33917 ServFail 0/0/1 (43)
05:44:51.400142 IP localhost.51026 > localhost.domain: 33260+ [1au] A? ntp.ubuntu.com. (43)
05:44:51.400498 IP localhost.domain > localhost.51026: 33260 ServFail 0/0/1 (43)
05:44:51.400548 IP localhost.domain > localhost.51026: 56313 ServFail 0/0/1 (43)
05:44:51.400660 IP localhost.51026 > localhost.domain: 33260+ [1au] A? ntp.ubuntu.com. (43)
05:44:51.400694 IP localhost.51026 > localhost.domain: 56313+ [1au] AAAA? ntp.ubuntu.com. (43)
05:44:51.400969 IP localhost.domain > localhost.51026: 33260 ServFail 0/0/1 (43)
05:44:51.401028 IP localhost.domain > localhost.51026: 56313 ServFail 0/0/1 (43)
05:44:51.401306 IP localhost.33249 > localhost.domain: 18869+ [1au] A? ntp.ubuntu.com. (43)
05:44:51.401722 IP localhost.domain > localhost.33249: 18869 ServFail 0/0/1 (43)
05:44:51.401813 IP localhost.domain > localhost.33249: 18370 ServFail 0/0/1 (43)
05:44:51.402241 IP localhost.domain > localhost.38697: 32083 ServFail 0/0/1 (43)
05:44:51.402330 IP localhost.domain > localhost.38697: 37208 ServFail 0/0/1 (43)
05:44:51.402403 IP localhost.38697 > localhost.domain: 32083+ [1au] A? ntp.ubuntu.com. (43)
05:44:51.402433 IP localhost.38697 > localhost.domain: 37208+ [1au] AAAA? ntp.ubuntu.com. (43)
05:44:51.402487 IP localhost.domain > localhost.38697: 32083 ServFail 0/0/1 (43)
```

感悟

学习Linux调试及性能分析的过程让我深刻感悟到理论与实践相结合的重要性，工具的熟练运用是关键，日志和动态追踪的价值，性能监控与分析的必要性，持续学习的态度，实践案例的宝贵经验以及资源的重要性。只有掌握了操作系统原理等基础知识，才能在实际的调试和分析中游刃有余，而这些理论知识又需要通过不断的实践来巩固。

https://github.com/asd279/myrepo