Guider: a system-wide performance analyzer

2018.08.16

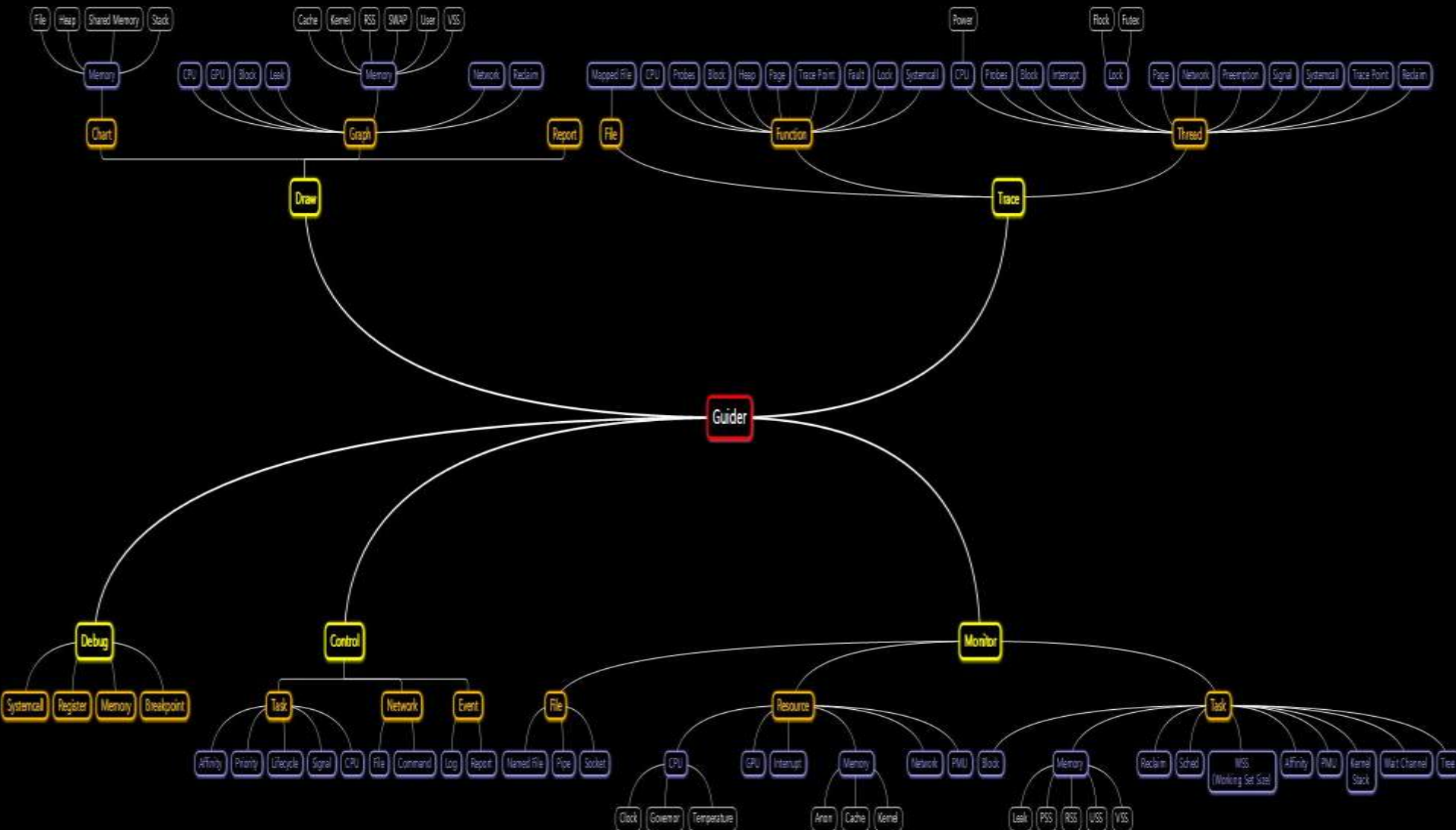이 평 화

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Guider Project

- Guider?
  - 통합 system-wide 성능 분석 도구
  - https://github.com/iipeace/guider

- 요구사항
  - Python 2.7 이상
    - 부가옵션: matplotlib package (for visualization)
  - Linux Kernel 2.6 이상
    - 부가옵션: FTRACE, KPROBE, UPROBE, …

Guider Project

설치방법

- PIP
  $ sudo -H pip install guider
  $ guider

- Source
  $ git clone https://github.com/iipeace/guider
  $ guider/guider.py

주요기능

- 실시간 모니터링

- 트레이싱

- 시각화

주요옵션

- -h : 도움말
- -a : 모든 정보 출력
- -g : 필터링 (tid, pid, file, name, ...)
- -e : 추가 기능 활성화
- -d : 특정 기능 비활성화
- -s : 추적 데이터 저장 경로
- -o : 리포트 데이터 저장 경로
- -u : 백그라운드 실행
- -R : 동작 시간(Sec) 지정

실시간 프로세스 모니터링

```
# ./guider.py top -a

[Top Info] [Time: 71406.120] [Interval: 1.0] [Ctxt: 52687] [Life: +0/-0] [IRQ: 12517] [Core: 24] [Task: 326/433] [Load: 0.2/0.4/0.5] [RAM: 63876] [Swap: 6549
          [Cycle: 2G / Inst: 6G / IPC: 2.45 / CacheMiss: 77K(6%) / BranchMiss: 857K(0%) / Clock: 22G / MinFlt: 4 / MajFlt: 0]
============================================================================================================================================================
ID    | CPU (Usr/Ker/Blk/IRQ)| Mem (Diff/ User/Cache/Kern)| Swap (Diff/  I/O )|NrPgRclm | BlkRW  | NrFlt | NrBlk | NrSIRQ | NrMlk | NrDrt  |  Network |
------------------------------------------------------------------------------------------------------------------------------------------------------------
Total | 6 %( 4 / 0 / 0 / 0 )|11074(   0/ 905/50751/1146)| 0   ( 0 / 0/0  )| 0/0  | 0/0  | 0  | 0  | 1658 | 0  | 7  | 1K/11K |

Core/0 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 0-0  | ? C | 1288 Mhz [1171-2441]|
Core/1 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 0-1  | ? C | 1530 Mhz [1171-2441]|
Core/2 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 0-2  | ? C | 1171 Mhz [1171-2441]|
Core/3 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 0-3  | ? C | 1173 Mhz [1171-2441]|
Core/4 | 8 %( 1 / 2 / 0 / 0 )|#####                                         | powersave  | 0-4  | ? C | 1171 Mhz [1171-2441]|
Core/5 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 0-5  | ? C | 1175 Mhz [1171-2441]|
Core/6 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 1-0  | ? C | 2330 Mhz [1171-2441]|
Core/7 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 1-1  | ? C | 2342 Mhz [1171-2441]|
Core/8 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 1-2  | ? C | 2367 Mhz [1171-2441]|
Core/9 | 1 %( 0 / 0 / 0 / 0 )|                                              | powersave  | 1-3  | ? C | 2246 Mhz [1171-2441]|
Core/10|100 %(99 / 0 / 0 / 0 )|#################################################################| powersave  | 1-4  | ? C | 2246 Mhz [1171-2441]|
============================================================================================================================================================
    Process    ( PID/ PPID/  Nr/ Pri)| CPU(Usr/Ker/Dly)| Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|   WaitChannel |
------------------------------------------------------------------------------------------------------------------------------------------------------------
         yes ( 2075/ 9085/  1/C  0)| 99( 99/  0/  0)|   8(  0/ 0/ 0/ 0)| 0( -/ -/ 0)| 0| 0| 256|  0: 3:43|        RUNNING     |
       a.out ( 2082/ 9085/  3/C  0)| 16(  6/ 10/  -)|  30(  1/ 0/ 1/ 0)| 0( -/ -/ 0)| 0| 0| 256|  0: 3:36| futex_wait_queue_me |
      guider ( 2182/ 9085/  1/C  0)|  3(  3/  0/  0)| 101( 62/ 2/ 5/ 0)| 0( -/ -/ 0)| 1| 1|1024|  0: 0: 2|        RUNNING     |
        bash ( 6960/ 6959/  1/C  0)|  0(  0/  0/  -)|  24(  6/ 0/ 3/ 0)| 0( -/ -/ 0)| 0| 0| 256| 20:26:27|        do_wait     |
          vi ( 7200/ 7197/  1/C  0)|  0(  0/  0/  -)|  58(  8/ 1/ 5/ 0)| 0( -/ -/ 0)| 0| 0|  64| 20:24:23|poll_schedule_timeout|
        bash ( 7916/ 6959/  1/C  0)|  0(  0/  0/  -)|  24(  6/ 0/ 3/ 0)| 0( -/ -/ 0)| 0| 0| 256| 19:57:58|        do_wait     |
        nmbd ( 2960/    1/  1/C  0)|  0(  0/  0/  -)|  91(  4/ 3/ 4/ 0)| 0( -/ -/ 0)| 0| 0|  64| 1K:20:52|poll_schedule_timeout|
       udevd ( 2222/    1/  1/C  0)|  0(  0/  0/  -)|  21(  2/ 0/ 1/ 0)| 0( -/ -/ 0)| 0| 0|  64| 1K:20:53|        ep_poll    |
 kworker/14:1H ( 3288/    2/  1/C-20)|  0(  0/  0/  -)|   0(  0/ 0/ 0/ -)| 0( -/ -/ 0)| 0| 0|  64| 1K:20:51|    worker_thread   |
      bioset ( 1265/    2/  1/C-20)|  0(  0/  0/  -)|   0(  0/ 0/ 0/ -)| 0( -/ -/ 0)| 0| 0|  64| 1K:20:54|    rescuer_thread  |
 kworker/22:1H ( 1787/    2/  1/C-20)|  0(  0/  0/  -)|   0(  0/ 0/ 0/ -)| 0( -/ -/ 0)| 0| 0|  64| 1K:20:53|    worker_thread   |
/usr/sbin/apach ( 7221/ 3817/  1/C  0)|  0(  0/  0/  -)| 250( 51/ 0/12/ 0)| 0( -/ -/ 0)| 0| 0|  64| 20:23:39|   inet_csk_accept  |
        sshd ( 1992/ 1977/  1/C  0)|  0(  0/  0/  0)| 131(  4/ 0/ 2/ 0)| 0( -/ -/ 0)| 3| 1|  64|  0: 4:39|poll_schedule_timeout|
       netns (  130/    2/  1/C-20)|  0(  0/  0/  -)|   0(  0/ 0/ 0/ -)| 0( -/ -/ 0)| 0| 0|  64| 1K:20:54|    rescuer_thread  |
```

실시간 쓰레드 모니터링

```
# ./guider.py threadtop

[Top Info] [Time: 7175936.960] [Interval: 1.0] [Ctxt: 11934] [Life: +176/-177] [IRQ: 25109] [Core: 24] [Task: 389/493] [RAM: 63876] [Swap: 65491] (Unit: %,
           [Cycle: 46G / Inst: 34G / IPC: 0.75 / CacheMiss: 23M(7%) / BranchMiss: 290M(4%) / Clock: 23G / MinFlt: 154,525 / MajFlt: 0]
==============================================================================================================================================
 ID    | CPU (Usr/Ker/Blk/IRQ)| Mem (Diff/ User/Cache/Kern)| Swap (Diff/  I/O  )|NrPgRclm | BlkRW | NrFlt | NrBlk | NrSIRQ | NrMlk | NrDrt  |   Network    |
----------------------------------------------------------------------------------------------------------------------------------------------
Total  | 87 %(80 / 3 / 0 / 0)| 5416( -32/ 1198/56102/1160)| 0   ( 0  / 0/0  )| 0/0  | 0/11  |  0   |  0   | 31709 |  0   | 17635  |   2K/15K  |
==============================================================================================================================================
    Thread       (  TID/  PID/ Nr/ Pri)| CPU(Usr/Ker/Dly)| Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    WaitChannel    |
----------------------------------------------------------------------------------------------------------------------------------------------
          cc1 (32544/32544/ 1/C  0)| 100(100/  0/  0)|  47( 40/ 12/ 13/  0)|  0( -/  -/   0)|   0|    1|  64| 0: 0: 2|      RUNNING      |
          cc1 (32646/32646/ 1/C  0)| 100(100/  0/  0)|  45( 38/ 12/ 12/  0)|  0( -/  -/   0)|   0|    3|  64| 0: 0: 1|      RUNNING      |
          cc1 (32738/32738/ 1/C  0)| 100(100/  0/  0)|  44( 37/ 12/ 12/  0)|  0( -/  -/   0)|   0|    3|  64| 0: 0: 1|      RUNNING      |
          cc1 (  319/  319/ 1/C  0)| 100( 99/  1/  0)|  39( 34/ 12/ 12/  0)|  0( -/  -/   0)|   0|    2|  64| 0: 0: 1|      RUNNING      |
          cc1 (  352/  352/ 1/C  0)| 100( 99/  2/  0)|  39( 32/ 12/ 12/  0)|  0( -/  -/   0)|   0|    1|  64| 0: 0: 1|      RUNNING      |
          cc1 (32637/32637/ 1/C  0)| 100(100/  0/  0)|  48( 41/ 12/ 12/  0)|  0( -/  -/   0)|   0|   29|  64| 0: 0: 2|      RUNNING      |
          cc1 (32746/32746/ 1/C  0)| 100(100/  0/  0)|  42( 36/ 12/ 12/  0)|  0( -/  -/   0)|   0|    1|  64| 0: 0: 1|      RUNNING      |
         *cc1 (  413/  413/ 1/C  0)|  68( 67/  1/  -)|  39( 32/ 12/ 12/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
         *cc1 (  436/  436/ 1/C  0)|  55( 54/  1/  -)|  36( 30/ 12/ 12/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
  rs:main Q:Reg ( 2773/ 2702/ 4/C  0)|  43( 33/ 10/  1)| 244(  5/  0/  2/  0)|  0( -/  -/   0)| 2291|   26|  64| 1K:18:54| futex_wait_queue_me |
         *cc1 (  469/  469/ 1/C  0)|  35( 33/  2/  -)|  32( 24/ 12/ 12/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
         *cc1 (  490/  490/ 1/C  0)|  29( 28/  1/  -)|   0(  0/  0/  -/  -)|  0( -/  -/   0)|   -|    -|   -| 0: 0: 0|                   |
         *cc1 (  479/  479/ 1/C  0)|  29( 29/  0/  -)|  34( 24/ 12/ 12/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
         *cc1 (  495/  495/ 1/C  0)|  28( 28/  0/  -)|  30( 21/ 12/  9/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
         *cc1 (  500/  500/ 1/C  0)|  27( 26/  1/  -)|  30( 21/ 12/  9/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
         *cc1 (  508/  508/ 1/C  0)|  18( 18/  0/  -)|  28( 18/ 12/  9/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
          *as (  510/  510/ 1/C  0)|  12( 12/  0/  -)|  13( 10/  1/  -/  -)|  0( -/  -/   0)|   -|    -|   -| 0: 0: 0|                   |
      rsyslogd ( 2780/ 2702/ 4/C  0)|  12(  7/  5/  0)| 244(  5/  0/  2/  0)|  0( -/  -/   0)| 2699|  232|  64| 1K:18:54|     do_syslog     |
        guider (31674/31674/ 1/C  0)|   7(  7/  0/  0)| 116( 77/  2/  5/  0)|  0( -/  -/   0)|   1|    2|1024| 0: 0: 6|      RUNNING      |
         *cc1 (  528/  528/ 1/C  0)|   7(  7/  0/  0)|  23( 14/ 12/  9/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
         *cc1 (  536/  536/ 1/C  0)|   2(  2/  0/  -)|  23( 12/ 12/  9/  0)|  0( -/  -/   0)|   -|    -|  64| 0: 0: 0|      RUNNING      |
          *as (  537/  537/ 1/C  0)|   1(  1/  0/  -)|   9(  7/  1/  -/  -)|  0( -/  -/   0)|   -|    -|   -| 0: 0: 0|                   |
----------------------------------------------------------------------------------------------------------------------------------------------
       [+]sh (  525/  525/ 1/C  0)|   0(  0/  0/  -)|  13(  2/  0/  -/  -)|  0( -/  -/   0)|   -|    -|   -| 0: 0: 1|         -         |
[+]arm-linux-gnu (  527/  527/ 1/C  0)|   0(  0/  0/  0)|   5(  1/  0/  -/  -)|  0( -/  -/   0)|   -|    -|   -| 0: 0: 1|         -         |
      [+]cc1 (  436/  436/ 1/C  0)|  55( 54/  1/  0)|  36( 30/ 12/ 12/  0)|  0( -/  -/   0)|   -|    -|   -| 0: 0: 1|         -         |
[+]arm-linux-gnu (  434/  434/ 1/C  0)|   0(  0/  0/  0)|   5(  1/  0/  -/  -)|  0( -/  -/   0)|   -|    -|   -| 0: 0: 1|         -         |
```

실시간 스택 & 성능 모니터링

```
# ./guider.py stacktop -g syslog

[Top Info] [Time: 7176163.830] [Interval: 1.0] [Ctxt: 2914] [Life: +13/-12] [IRQ: 5103] [Core: 24] [Task: 328/435] [RAM: 63876] [Swap: 65491] (Unit: %/MB/N
           [Cycle: 2G / Inst: 3G / IPC: 1.34 / CacheMiss: 6M(34%) / BranchMiss: 4M(0%) / Clock: 23G / MinFlt: 53,257 / MajFlt: 0]
==================================================================================================================================================================
 ID   | CPU (Usr/Ker/Blk/IRQ)| Mem (Diff/ User/Cache/Kern)| Swap (Diff/  I/O  )|NrPgRclm | BlkRW  | NrFlt | NrBlk | NrSIRQ | NrMlk | NrDrt  |  Network
------------------------------------------------------------------------------------------------------------------------------------------------------------------
Total | 6 %( 3 / 1 / 0 / 0 )| 4913(-204/ 974/56824/1165)| 0   ( 0  / 0/0  )| 0/0    | 0/42  | 0   | 0   | 3713  | 0   | 90901  | 2K/13K
==================================================================================================================================================================
     Thread      ( TID/ PID/  Nr/ Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    WaitChannel
------------------------------------------------------------------------------------------------------------------------------------------------------------------
     rsyslogd ( 2702/ 2702/   4/C  0)|  0( 0/ 0/ -)|  244( 5/ 0/ 2/ 0)| 0( -/ -/  0)|  0|  0| 64| 1K:22:40|poll_schedule_timeout|
                              100% | poll_schedule_timeout+0x43/0x70 <- do_select+0x711/0x7f0 <- core_sys_select+0x196/0x280 <-
                              SyS_select+0xa6/0xe0 <- entry_SYSCALL_64_fastpath+0x1a/0xa5
------------------------------------------------------------------------------------------------------------------------------------------------------------------
     rsyslogd ( 2779/ 2702/   4/C  0)|  0( 0/ 0/ -)|  244( 5/ 0/ 2/ 0)| 0( -/ -/  0)|  0|  0| 64| 1K:22:40|poll_schedule_timeout|
                              100% | poll_schedule_timeout+0x43/0x70 <- do_select+0x711/0x7f0 <- core_sys_select+0x196/0x280 <-
                              SyS_select+0xa6/0xe0 <- entry_SYSCALL_64_fastpath+0x1a/0xa5
------------------------------------------------------------------------------------------------------------------------------------------------------------------
     rsyslogd ( 2780/ 2702/   4/C  0)|  0( 0/ 0/ 0)|  244( 5/ 0/ 2/ 0)| 0( -/ -/  0)| 116|  0| 64| 1K:22:40|     do_syslog     |
                               99% | do_syslog+0x446/0x4c0 <- kmsg_read+0x3f/0x50 <- proc_reg_read+0x3d/0x60 <- __vfs_read+0x23/0x110 <-
                              vfs_read+0x91/0x130 <- SyS_read+0x41/0xa0 <- entry_SYSCALL_64_fastpath+0x1a/0xa5
------------------------------------------------------------------------------------------------------------------------------------------------------------------


# ./guider.py perftop -g yes

[Top Info] [Time: 7181955.420] [Interval: 1.0] [Ctxt: 121] [Life: +0/-0] [IRQ: 1947] [Core: 24] [Task: 317/424] [RAM: 63876] [Swap: 65491] (Unit: %/MB/NR)
==================================================================================================================================================================
 ID   | CPU (Usr/Ker/Blk/IRQ)| Mem (Diff/ User/Cache/Kern)| Swap (Diff/  I/O  )|NrPgRclm | BlkRW  | NrFlt | NrBlk | NrSIRQ | NrMlk | NrDrt  |  Network
------------------------------------------------------------------------------------------------------------------------------------------------------------------
Total | 5 %( 4 / 0 / 0 / 0 )| 3783(   0/ 875/58078/1140)| 0   ( 0  / 0/0  )| 0/0    | 0/0  | 0   | 0   | 2023  | 0   | 0    | 1K/3K
==================================================================================================================================================================
     Process     ( PID/ PPID/  Nr/ Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    WaitChannel
------------------------------------------------------------------------------------------------------------------------------------------------------------------
     yes (22371/ 9085/   1/R 90)| 99( 99/ 0/ 0)|   8( 0/ 0/ 0/ 0)| 0( -/ -/  0)|  0|  0| 256| 1:34:11|     RUNNING
         | [Cycle: 2G / Inst: 6G / IPC: 2.82 / CacheMiss: 11K(98%) / BranchMiss: 26K(0%) / Clock: 972M / MinFlt: 0 / MajFlt
------------------------------------------------------------------------------------------------------------------------------------------------------------------
```

실시간 파일 & 메모리 모니터링

```
# ./guider.py filetop -g init

[Top File Info] [Time: 7176036.720] [Proc: 322] [FD: 1323] [File: 400] (Unit: %/MB/NR)
==============================================================================================
      PROC        ( ID  / Pid / Nr / Pri)| FD |                              PATH               |
----------------------------------------------------------------------------------------------
       init (     1/    0/   1/C  0)|  12|  SOCKET: 4   DEVICE: 3   PIPE: 2   EVENT: 2   NORMAL: 1   PROC: 0 |
                                    |  11|  /var/log/upstart/mysql.log.1 (deleted)             |
                                    |  10|  socket:[13414] (@/com/ubuntu/upstart)              |
                                    |   9|  socket:[23593] (@/com/ubuntu/upstart)              |
                                    |   8|  socket:[6241]                                      |
                                    |   7|  socket:[3098] (@/com/ubuntu/upstart)               |
                                    |   6|  anon_inode:inotify                                 |
                                    |   5|  anon_inode:inotify                                 |
                                    |   4|  pipe:[3097]                                        |
                                    |   3|  pipe:[3097]                                        |
                                    |   2|  /dev/null                                          |
                                    |   1|  /dev/null                                          |
                                    |   0|  /dev/null                                          |
----------------------------------------------------------------------------------------------


# ./guider.py memtop

[Top Info] [Time: 7176233.650] [Interval: 1.0] [Ctxt: 289] [Life: +2/-2] [IRQ: 1397] [Core: 24] [Task: 323/430] [RAM: 63876] [Swap: 65491] (Unit: %/MB/NR)
           [Cycle: 127M / Inst: 121M / IPC: 0.95 / CacheMiss: 280K(23%) / BranchMiss: 437K(1%) / Clock: 22G / MinFlt: 714 / MajFlt: 0]
==========================================================================================================================================================
ID  | CPU (Usr/Ker/Blk/IRQ)| Mem (Diff/ User/Cache/Kern)| Swap (Diff/  I/O )|NrPgRclm | BlkRW | NrFlt | NrBlk | NrSIRQ | NrMlk | NrDrt  | Network  |
----------------------------------------------------------------------------------------------------------------------------------------------------------
Total | 1 %( 0 / 0 / 0 / 0)| 4706(  1/  865/57151/1154)|  0   ( 0 /  0/0  )|  0/0    | 0/0   |  0    |  0    |  484   |  0    |  35    | 1K/4K    |
==========================================================================================================================================================
      Process        ( PID/ PPID/  Nr/ Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    WaitChannel      |
----------------------------------------------------------------------------------------------------------------------------------------------------------
       guider (22307/ 9085/  1/C  0)|  2( 2/  0/  0)| 101( 62/  2/  5/  0)| 0( -/  -/   0)|  1|  0|1024| 0: 0: 5|      RUNNING        |
                           (1)[STACK] | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCK:   0K / SDRT:   0K / PDRT: 140K / NOPM:   0K|
                           (1)[SHM]   | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCK:   0K / SDRT:   0K / PDRT:   0K / NOPM:   0K|
                          (19)[FILE]  | SIZE:  44M / RSS:   6M / PSS:   2M / SWAP:   0M / HUGE:   0M / LOCK:   0K / SDRT:   0K / PDRT: 632K / NOPM:  31M|
                           (3)[ETC]   | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCK:   0K / SDRT:   0K / PDRT:   0K / NOPM:   0K|
                          (12)[ANON]  | SIZE:  56M / RSS:  56M / PSS:  56M / SWAP:   0M / HUGE:   0M / LOCK:   0K / SDRT:   0K / PDRT:  56M / NOPM:   0K|
```

쓰레드 트레이싱

```
# ./guider.py record -a -e m,b

[Thread Info] [ Elapsed: 2.050 ] [ Start: 2849868.198 ] [ Running: 112 ] [ CtxSwc: 3357 ] [ LogSize: 4054 KB ] [ Unit: Sec/MB/NR ]
====================================================================================================================================
_____Thread Info_____|_____CPU Info_____|_____SCHED Info_____|_____BLOCK Info_____|_____MEM Info_____|
                            |                                 |                     |                        |                             |
       Name(  Tid/  Pid)|LF|Usage(      %)|Delay(  Max)|Pri| IRQ | Yld| Lose|Steal| Mig| Read( MB/  Cnt)|WCnt( MB)| Sum(Usr/Buf/Ker)|Rcl|Wst|DRcl(Nr)|
====================================================================================================================================
# CPU: 12

       CORE/0(-----/-----)|--| 0.00(  0.1)| 0.00( 0.00)|  0| 0.00|   7|   -|   -|   -| 0.00(  0/    1)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/1(-----/-----)|--| 0.00(  0.1)| 0.10( 0.00)|  0| 0.00| 147|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/2(-----/-----)|--| 0.00(  0.1)| 0.16( 0.00)|  0| 0.00| 211|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/3(-----/-----)|--| 0.00(  0.1)| 0.11( 0.00)|  0| 0.00| 181|   -|   -|   -| 0.00(  0/    0)|  32(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/4(-----/-----)|--| 0.00(  0.1)| 0.11( 0.00)|  0| 0.00| 232|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/5(-----/-----)|--| 0.30( 14.8)| 0.18( 0.00)|  0| 0.00| 179|   -|   -|   -| 1.26(  6/  495)|  19(  0)|  61( 57/  0/  3)|  0|  0|0.00( 0)|
       CORE/6(-----/-----)|--| 0.00(  0.0)| 0.35( 0.00)|  0| 0.00|  57|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/7(-----/-----)|--| 0.00(  0.0)| 0.60( 0.00)|  0| 0.00| 100|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/8(-----/-----)|--| 0.00(  0.0)| 0.44( 0.00)|  0| 0.00|  59|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
       CORE/9(-----/-----)|--| 0.00(  0.0)| 1.94( 0.00)|  0| 0.00|  37|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
      CORE/10(-----/-----)|--| 0.07(  3.4)| 0.00( 0.00)|  0| 0.00|   2|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
      CORE/11(-----/-----)|--| 0.00(  0.0)| 2.05( 0.00)|  0| 0.00|  39|   -|   -|   -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|

------------------------------------------------------------------------------------------------------------------------------------
# Hot: 4

     synergyc( 3604/ 3602)|  | 0.17(  8.5)| 0.00( 0.00)|  0| 0.00|   3|  14|   3|  0| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
arm-starfish-li(16087/16087)|  | 0.13(  6.3)| 0.00( 0.00)|  0| 0.00|   0|  20| 157|  4| 1.26(  6/  496)|   0(  0)|  61( 57/  0/  3)|  0|  0|0.00( 0)|
     guider(16088/16088)|  | 0.07(  3.4)| 0.00( 0.00)|R90| 0.00|   2|   0|   2|  0| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
```

블럭 트레이싱

```
# ./guider.py record -e b

[Thread Block Info] (Unit: KB/NR)
=====================================================================================================
    ID              OPT      NrDev           TOTAL      SEQUENTIAL(       %)    FS              PATH
                                           [ACCESS]                       COUNT
=====================================================================================================
    TOTAL           READ     8:33           170,624     158,356( 92.8)    ext4            /dev/sdc1
                                     [     4K -     7K]                    2,024
                                     [     8K -    15K]                       21
                                     [    16K -    31K]                       43
                                     [    32K -    63K]                       44
                                     [    64K -   127K]                      155
                                     [   128K -   255K]                      112
                                     [   256K -   511K]                      510
                                     [   512K - 1023K]                         2

                    WRITE    8:33                 8           4( 50.0)    ext4            /dev/sdc1
                                     [     4K -     7K]                        2
-----------------------------------------------------------------------------------------------------
    cron(3115)      READ     8:33               644         576( 89.4)    ext4            /dev/sdc1
                                     [     4K -     7K]                      161
-----------------------------------------------------------------------------------------------------
    cat(10392)      READ     8:33               604         404( 66.9)    ext4            /dev/sdc1
                                     [     4K -     7K]                      110
                                     [    16K -    31K]                        1
                                     [    32K -    63K]                        1
                                     [    64K -   127K]                        1
-----------------------------------------------------------------------------------------------------
    bash(9085)      READ     8:33                28           4( 14.3)    ext4            /dev/sdc1
                                     [     4K -     7K]                        7
-----------------------------------------------------------------------------------------------------
    cat(10395)      READ     8:33           169,348     157,384( 92.9)    ext4            /dev/sdc1
                                     [     4K -     7K]                    1,746
                                     [     8K -    15K]                       21
                                     [    16K -    31K]                       42
```

시스템콜 트레이싱

```
# ./guider.py record -t

[Thread Syscall Info] (Unit: Sec/NR)
```

Name(Tid)	Syscall(ID)	Elapsed	Count	Error	Min	Max	Avg
arm-linux-gnuea(3000)							
	close(3)	0.039396	69	0	0.000001	0.005353	0.000571
	stat(4)	0.011521	74	0	0.000001	0.009423	0.000156
	fchmod(91)	0.000046	3	0	0.000002	0.000039	0.000015
	getpriority(140)	0.000017	33	0	0.000000	0.000001	0.000001
	lgetxattr(192)	0.000014	3	0	0.000003	0.000008	0.000005
	recvfrom(45)	0.000004	1	0	0.000004	0.000004	0.000004
guider(3001)							
	pause(34)	0.283474	1	1	0.283474	0.283474	0.283474
	select(23)	0.100122	1	0	0.100122	0.100122	0.100122
	write(1)	0.000234	6	0	0.000031	0.000059	0.000039
	open(2)	0.000084	7	0	0.000007	0.000038	0.000012
	ioctl(16)	0.000009	14	14	0.000001	0.000001	0.000001
	fstat(5)	0.000006	14	0	0.000001	0.000001	0.000000
	lseek(8)	0.000006	21	0	0.000000	0.000001	0.000000
	close(3)	0.000005	7	0	0.000000	0.000001	0.000001
	rt_sigaction(13)	0.000001	1	0	0.000001	0.000001	0.000001
mysqld(3237)							
	futex(202)	0.000000	1	0	0.000000	0.000000	0.000000
mysqld(3238)							
	futex(202)	0.000002	1	0	0.000002	0.000002	0.000002

락 트레이싱

```
# ./guider.py record -e L

[Thread Futex Lock Info] [ Elapsed : 1.225 ] (Unit: Sec/NR)
=========================================================================================================================================
      Name(   Tid/  Pid)    Elapsed    Process     Block  NrBlock    CallMax      Lock    LockMax   NrLock    NrWait    LBlock NrLBlock   LastStat
=========================================================================================================================================
    mysqld( 3236/ 3208)      0.469      0.000     0.469        1      0.469     0.000      0.000        0         1     0.000        0      Wait
-----------------------------------------------------------------------------------------------------------------------------------------
    mysqld( 3237/ 3208)      0.890      0.000     0.890        1      0.890     0.000      0.000        0         1     0.000        0      Wait
-----------------------------------------------------------------------------------------------------------------------------------------
    mysqld( 3238/ 3208)      1.075      0.000     1.075        1      1.075     0.000      0.000        0         1     0.000        0      Wait
-----------------------------------------------------------------------------------------------------------------------------------------

[Thread File Lock Info] (Unit: Sec/NR)
=========================================================================================================================================
      Name(   Tid)       Wait         Lock    nrTryLock    nrLocked
=========================================================================================================================================
      smbd( 2631)      0.000        0.000            3            3
-----------------------------------------------------------------------------------------------------------------------------------------
```

파일 트레이싱

```
# ./guider.py record -F

[File Usage Info] [ File: 281 ] [ RAM: 78056(KB) ] [ Keys: Foward/Back/Save/Quit ]
=====================================================================================================
__RAM(KB)___|_File(KB)_|__%__|_____Library & Process_____
=====================================================================================================
    7,616 |    7,616 |  100 | /run/samba/locking.tdb [Proc: 10] [Link: 1]
                          |            smbd ( 2937) |            smbd ( 9178) |            smbd (21387) |            smbd ( 3356) |
                          |            smbd ( 2828) |            smbd ( 2417) |            smbd ( 3862) |            smbd ( 2631) |
                          |            smbd (11086) |            smbd (  729) |
-----------------------------------------------------------------------------------------------------
    6,076 |    8,452 |   71 | /usr/lib/apache2/modules/libphp5.so [Proc: 11] [Link: 1]
                          | /usr/sbin/apach (13071) | /usr/sbin/apach (13073) | /usr/sbin/apach ( 3817) | /usr/sbin/apach ( 9111) |
                          | /usr/sbin/apach (20085) | /usr/sbin/apach ( 7221) | /usr/sbin/apach (  345) | /usr/sbin/apach (  346) |
                          | /usr/sbin/apach ( 7222) | /usr/sbin/apach (14278) | /usr/sbin/apach ( 9715) |
-----------------------------------------------------------------------------------------------------
    5,784 |    9,828 |   58 | /usr/sbin/smbd [Proc: 10] [Link: 1]
                          |            smbd ( 2937) |            smbd ( 9178) |            smbd (21387) |            smbd ( 3356) |
                          |            smbd ( 2828) |            smbd ( 2417) |            smbd ( 3862) |            smbd ( 2631) |
                          |            smbd (11086) |            smbd (  729) |
-----------------------------------------------------------------------------------------------------
    4,800 |   25,880 |   18 | /var/lib/gems/1.9.1/gems/passenger-5.1.0/buildout/support-binaries/PassengerAgent [Proc: 3] [Link: 1]
                          |    PassengerAgent (23161) |    PassengerAgent (23176) |    PassengerAgent (23191) |
-----------------------------------------------------------------------------------------------------
    3,612 |   12,016 |   30 | /usr/sbin/mysqld [Proc: 1] [Link: 1]
                          |            mysqld ( 3208) |
-----------------------------------------------------------------------------------------------------
    2,988 |    2,988 |  100 | /usr/lib/libpython2.7.so.1.0 [Proc: 6] [Link: 1]
                          |              vi (18865) |              vi (28546) |              vi ( 7200) |              vi (22546) |
                          |              vi ( 8826) |              vi ( 8135) |
-----------------------------------------------------------------------------------------------------
    2,228 |    2,884 |   77 | /usr/bin/python3.2mu [Proc: 1] [Link: 1]
                          |           guider (22637) |
-----------------------------------------------------------------------------------------------------
    2,016 |    2,016 |  100 | /usr/lib/libruby-1.9.1.so.1.9.1 [Proc: 1] [Link: 1]
```

CPU 관련 함수 트레이싱

```
# ./guider.py record -f -s .
# ./guider.py guider.dat -o . -a

[Function CPU Info] [Cnt: 394] [Interval: 8ms] (USER)
==========================================================================================================
__Usage__|_____Function_____|_____Binary_____
==========================================================================================================
   99.0% |                 cpuTest                 | /media/disk/work/test/a.out
  + 100.0% | <- startTest [/media/disk/work/test/a.out] <- main [/media/disk/work/test/a.out]
            <- __libc_start_main [/lib/x86_64-linux-gnu/libc-2.19.so]
----------------------------------------------------------------------------------------------------------
    0.5% |                 memset                  | /lib/x86_64-linux-gnu/libc-2.19.so
  + 100.0% | <- startTest [/media/disk/work/test/a.out] <- main [/media/disk/work/test/a.out]
            <- __libc_start_main [/lib/x86_64-linux-gnu/libc-2.19.so]
----------------------------------------------------------------------------------------------------------
    0.3% |                _int_malloc              | /lib/x86_64-linux-gnu/libc-2.19.so
----------------------------------------------------------------------------------------------------------
    0.3% |              00007f756e3e7ee4           | ??
  + 100.0% | <- 000000000044676f [/media/disk/work/test/a.out]
----------------------------------------------------------------------------------------------------------

[Function CPU Info] [Cnt: 394] [Interval: 8ms] (KERNEL)
==========================================================================================================
__Usage__|_____Function_____
==========================================================================================================
  100.0% |                                         hrtimer_interrupt
  +  99.5% | <- local_apic_timer_interrupt <- smp_apic_timer_interrupt <- apic_timer_interrupt
  +   0.3% | <- local_apic_timer_interrupt <- smp_apic_timer_interrupt <- apic_timer_interrupt <- do_page_fault <- page_fault
  +   0.3% | <- local_apic_timer_interrupt <- smp_apic_timer_interrupt <- apic_timer_interrupt <- __do_fault <- handle_mm_fault <- __do_page_fault
            <- do_page_fault <- page_fault
----------------------------------------------------------------------------------------------------------
```

메모리 관련 함수 트레이싱

```
# ./guider.py record -f -e m -s .
# ./guider.py guider.dat -o . -a

[Function Page Info] [Total: 11416KB] [Alloc: 11444KB(817)] [Free: 188KB(47)] (USER)
==============================================================================================
Usage ( Usr  / Buf  / Ker  )|_____Function_____|_____LifeTime_____|_____Binary_____

10256K(  2048/    0/  8208)|            memset             | AVR: 1.563 / MIN: 1.560 / MAX: 1.568  | /lib/x86_64-linux-gnu/libc-2.19.so
 + 10256K(  2048/    0/  8208)| <- startTest [/media/disk/work/test/a.out] <- main [/media/disk/work/test/a.out]
                      <- __libc_start_main [/lib/x86_64-linux-gnu/libc-2.19.so]
----------------------------------------------------------------------------------------------
  960K(   956/    0/    4)|           _int_malloc          | AVR: 1.559 / MIN: 1.554 / MAX: 1.560  | /lib/x86_64-linux-gnu/libc-2.19.so
----------------------------------------------------------------------------------------------
   56K(    16/    0/   40)|         00007f756e3e81e7        | AVR: 1.569 / MIN: 1.568 / MAX: 1.569  | ??
----------------------------------------------------------------------------------------------
   44K(    36/    0/    8)|           sysmalloc            | AVR: 1.560 / MIN: 1.558 / MAX: 1.568  | /lib/x86_64-linux-gnu/libc-2.19.so
----------------------------------------------------------------------------------------------
   12K(    12/    0/    0)|     elf_machine_rela_relative   | AVR: 1.568 / MIN: 1.568 / MAX: 1.568  | /lib/x86_64-linux-gnu/ld-2.19.so
 +   12K(    12/    0/    0)| <- dl_main [/lib/x86_64-linux-gnu/ld-2.19.so] <- _dl_sysdep_start [/lib/x86_64-linux-gnu/ld-2.19.so]
----------------------------------------------------------------------------------------------
    8K(     8/    0/    0)|           realloc             | AVR: 1.568 / MIN: 1.568 / MAX: 1.568  | /lib/x86_64-linux-gnu/ld-2.19.so
 +    4K(     4/    0/    0)| <- _dl_map_object [/lib/x86_64-linux-gnu/ld-2.19.so]
----------------------------------------------------------------------------------------------
    8K(     4/    0/    4)|            dl_main             | AVR: 1.568 / MIN: 1.568 / MAX: 1.568  | /lib/x86_64-linux-gnu/ld-2.19.so
 +    8K(     4/    0/    4)| <- _dl_sysdep_start [/lib/x86_64-linux-gnu/ld-2.19.so]
----------------------------------------------------------------------------------------------


[Function Page Info] [Total: 11416KB] [Alloc: 11444KB(817)] [Free: 188KB(47)] (KERNEL)
==============================================================================================
Usage ( Usr  / Buf  / Ker  )|_____Function_____|_____LifeTime_____

 8192K(     0/    0/  8192)|      do_huge_pmd_anonymous_page    |              AVR: 1.563 / MIN: 1.562 / MAX: 1.564
 +  8192K(     0/    0/  8192)| <- handle_mm_fault <- __do_page_fault <- do_page_fault <- page_fault
----------------------------------------------------------------------------------------------
 3084K(  3084/    0/    0)|          handle_mm_fault        |              AVR: 1.563 / MIN: 1.554 / MAX: 1.569
 +  3076K(  3076/    0/    0)| <- __do_page_fault <- do_page_fault <- page_fault
 +     4K(     4/    0/    0)| <- __get_user_pages <- get_user_pages <- copy_strings.isra.17 <- copy_strings_kernel <- do_execve_common.isra.23
                      <- SyS_execve <- stub_execve
 +     4K(     4/    0/    0)| <- __do_page_fault <- do_page_fault <- page_fault <- load_elf_binary <- search_binary_handler
                      <- do_execve_common.isra.23 <- SyS_execve <- stub_execve
----------------------------------------------------------------------------------------------
```

커널함수 트레이싱

```
# ./guider.py record -s . -K openfile:getname::**string
```

[Thread KERNEL Event Info]
===
| Event | Comm(Tid) | Usage | Count | ProcMax | ProcMin | InterMax | InterMin |
===
openfile	TOTAL(-)	0.000729	1012	0.000013	0.000001	1.979834	0.000109
	ps(10728)	0.000640	968	0.000013	0.000000	0.001636	0.000006
	python2(10727)	0.000038	26	0.000004	0.000001	1.979834	0.000020
	tmux(6959)	0.000031	9	0.000006	0.000003	0.299492	0.201316
	PassengerAgent(23183)	0.000008	5	0.000002	0.000001	0.007375	0.000109
	sendmail-mta(3419)	0.000007	2	0.000006	0.000001	0.000077	0.000077
	PassengerAgent(10729)	0.000003	1	0.000003	0.000003	0.000000	0.000000
	smbd(11086)	0.000002	1	0.000002	0.000002	0.000000	0.000000
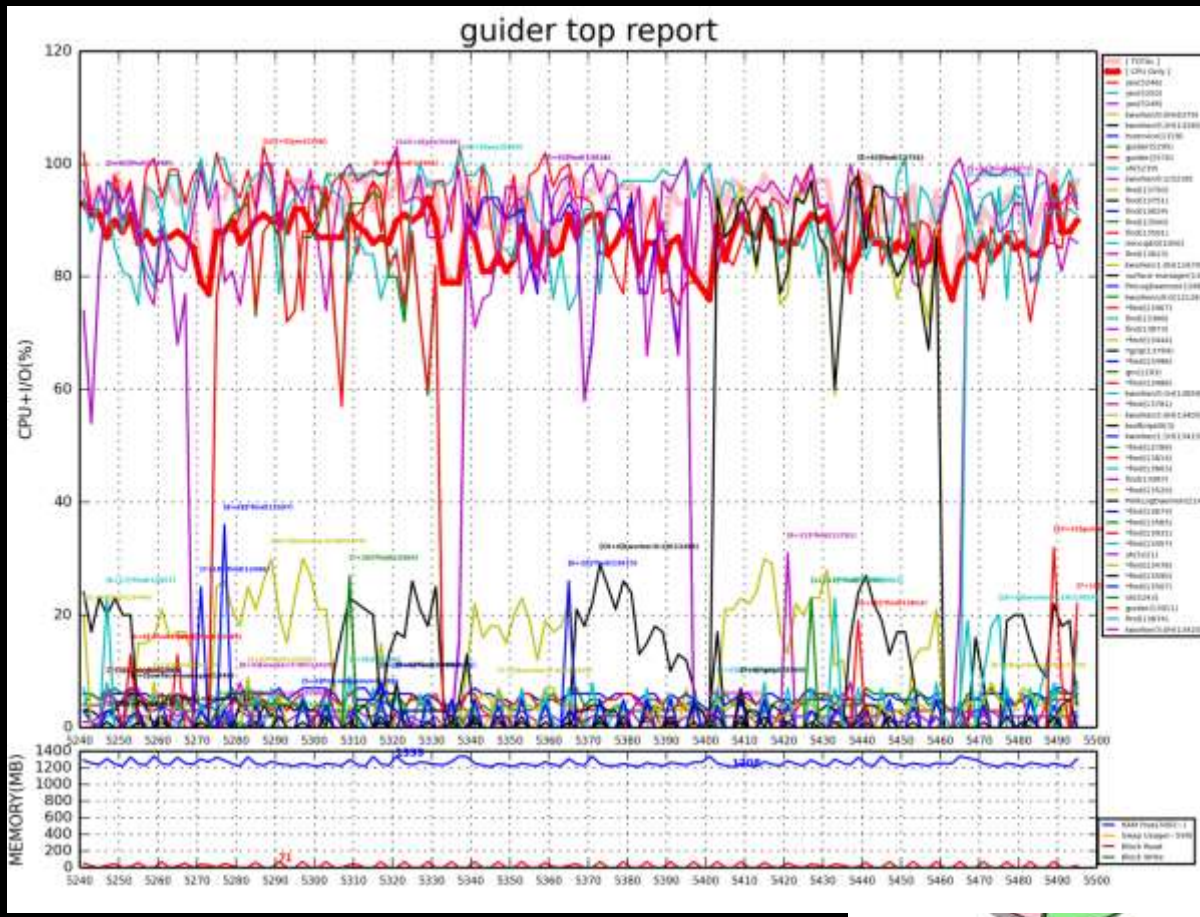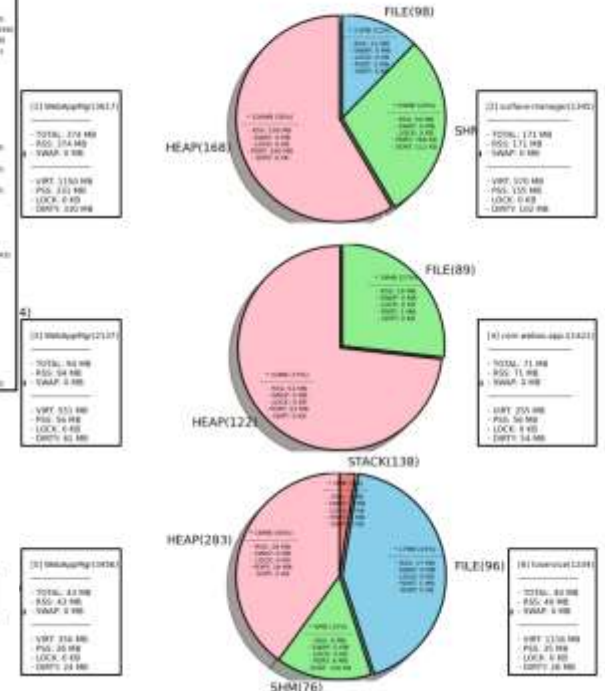
[Thread KERNEL Event History]
===
| EVENT | TYPE | TIME | COMM(TID) | CALLER | ELAPSED ARG
===
| openfile | EXIT | 0.063942 | tmux(6959) | porch_do_sys_open | 0.000003 1>"/proc/7969/cmdline"
| openfile | ENTER | 0.137626 | python2(10727) | | -
| openfile | EXIT | 0.137628 | python2(10727) | porch_do_sys_open | 0.000002 1>"/sys/kernel/debug/tracing/trace"
| openfile | ENTER | 0.363431 | tmux(6959) | | -
| openfile | EXIT | 0.363437 | tmux(6959) | porch_do_sys_open | 0.000006 1>"/proc/7197/cmdline"
| openfile | ENTER | 0.510452 | smbd(11086) | | -
| openfile | EXIT | 0.510454 | smbd(11086) | porch_do_sys_open | 0.000002 1>"/var/log/samba/log.jhkim-z97x-ud3h"
| openfile | ENTER | 0.564845 | tmux(6959) | | -
| openfile | EXIT | 0.564848 | tmux(6959) | porch_do_sys_open | 0.000003 1>"/proc/7969/cmdline"
| openfile | ENTER | 0.864255 | tmux(6959) | | -
| openfile | EXIT | 0.864258 | tmux(6959) | porch_do_sys_open | 0.000003 1>"/proc/7197/cmdline"
| openfile | ENTER | 1.065571 | tmux(6959) | | -
| openfile | EXIT | 1.065574 | tmux(6959) | porch_do_sys_open | 0.000003 1>"/proc/7969/cmdline"
| openfile | ENTER | 1.364980 | tmux(6959) | | -
| openfile | EXIT | 1.364984 | tmux(6959) | porch_do_sys_open | 0.000004 1>"/proc/7197/cmdline"
| openfile | ENTER | 1.437128 | sendmail-mta(3419) | | -
```

# 시각화

$ guider draw guider.out

# 부가기능

- cpu 제한 명령어
  # guider cpulimit -g 12345:50

- sched 명령어
  # guider setsched r:1:12345

- signal 명령어
  # guider kill -stop 12345

- list / stop / report 명령어
  $ guider list
  $ guider stop
  $ guider send

# 향후 계획

- **gui**der 도구 추가 개발
  - GUI 모드 요구사항
  - pyqt 이용 (전문가 필요!)
  - socket 기반 통신 및 원격 제어

- 실시간 태스크 자동 분석 기능 개발
  - 특정 조건에 동작 시작
  - 태스크 제어 및 정보 추출
    - ptrace feature
  - 재현이 어려운 이슈 지원