guider: a system-wide performance analyzer

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Introduction

- Dig deeper into your machine

Installation

- git

  $ git clone https://github.com/iipeace/guider.git

  $ cd guider

  # make && make install

- pip

  # pip install –pre guider

Contents

- A system-wide performance analyzer
  - thread analysis
  - function analysis
  - real-time analysis
  - file analysis
- Open-source contribution
  - https://github.com/iipeace/guider

Requirement

- Linux kernel (>= 3.0)
- Python (>= 2.7)
- Kernel configuration
  - CONFIG_FTRACE
  - CONFIG_TRACING, CONFIG_TRACING_SUPPORT
  - CONFIG_EVENT_TRACING
  - CONFIG_TRACEPOINTS
  - CONFIG_DYNAMIC_FTRACE
  - CONFIG_FTRACE_SYSCALLS
  - CONFIG_UPROBES, CONFIG_UPROBE_EVENT
  - CONFIG_KPROBES, CONFIG_KPROBE_EVENTS

Thread analysis

guider record -s ./

Save trace file in current directory

Input ctrl + c

guider ./guider.dat -o ./ -a

Show all information

Save report file in current directory

View guider.out

Thread analysis

- CPU usage of yes(29309) thread
  - Running for 1,370ms(92.7%)
  - Delayed for 200ms by preemption
  - Preempted 231 times by other threads

```
[Thread Info] [ Elapsed: 1.473 ] [ Start: 4581053.513 ] [ Running: 126 ] [ CtxSwc: 5124 ] [ LogSize: 873 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(  0.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/1(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/2(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/3(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/4(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/5(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/6(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/7(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/8(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
         CORE/9(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
        CORE/10(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
        CORE/11(-----/-----)|--| 1.47(100.0)| 0.00( 0.00)|  0| 0.00|    0|    -|    -|    -| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|

---------------------------------------------------------------------------------------------------------------------------------------------
# Hot: 115

           yes(29309/29309)|  | 1.37( 92.7)| 0.12( 0.01)|  0| 0.00|    0|  231|    0|    1| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
           yes(29312/29312)|  | 1.28( 87.1)| 0.20( 0.01)|  0| 0.00|    0|  109|    0|    1| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
           yes(29306/29306)|  | 1.26( 85.6)| 0.21( 0.02)|  0| 0.00|    0|  132|    0|    4| 0.00(  0/    0)|   0(  0)|   0(  0/  0/  0)|  0|  0|0.00( 0)|
```

Thread analysis

guider record -s ./ -e mbi

Trace also memory, block, irq

Save trace file in current directory

Input ctrl + c

guider ./guider.dat -o ./ -a

Show all information

Save report file in current directory

View guider.out

Thread analysis

- Memory and block usage of cat(28912) thread
  - Allocated 17MB memory into user space
  - Loaded 17MB file for 60ms

```
[Thread Info] [ Elapsed: 4.610 ] [ Start: 4580384.919 ] [ Running: 154 ] [ CtxSwc: 9333 ] [ LogSize: 3566 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(	0.0)	0.00(0.00)	0	0.00		0	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/1(-----/-----)	--	0.02(	0.4)	0.07(0.00)	0	0.00		835	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/2(-----/-----)	--	0.01(	0.3)	0.48(0.00)	0	0.00		115	-	-	-	0.09(17/	82)	379(1)	17(17/	0/	0)	0	0	0.00(0)
CORE/3(-----/-----)	--	4.61(100.0)		0.00(0.00)	0	0.00		0	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/4(-----/-----)	--	0.01(	0.2)	0.10(0.00)	0	0.00		564	-	-	-	0.00(0/	0)	1(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/5(-----/-----)	--	0.02(	0.4)	0.00(0.00)	0	0.00		36	-	-	-	0.00(0/	0)	1(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/6(-----/-----)	--	0.00(	0.1)	0.02(0.00)	0	0.00		83	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/7(-----/-----)	--	0.00(	0.0)	1.77(0.00)	0	0.00		35	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/8(-----/-----)	--	0.00(	0.1)	1.77(0.00)	0	0.00		37	-	-	-	0.00(0/	3)	0(0)	-1(0/	0/	-1)	0	0	0.00(0)
CORE/9(-----/-----)	--	0.00(	0.0)	1.96(0.00)	0	0.00		44	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/10(-----/-----)	--	0.00(	0.1)	0.08(0.00)	0	0.00		132	-	-	-	0.00(0/	1)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/11(-----/-----)	--	0.01(	0.3)	0.01(0.00)	0	0.00		177	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
# Hot: 143																				
yes(28026/28026)		4.61(100.0)		0.00(0.00)	0	0.00		0	448	0	0	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
guider(28909/28909)		0.01(	0.2)	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)
chromium-browse(4051/ 4051)		0.01(	0.1)	0.00(0.00)	0	0.00		6	0	6	0	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
chromium-browse(4084/ 4084)		0.01(	0.1)	0.00(0.00)	0	0.00		10	1	17	1	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
cat(28912/-----)	ND	0.01(	0.1)	0.00(0.00)	0	0.00		1	3	77	3	0.06(17/	76)	0(0)	17(17/	0/	0)	0	0	0.00(0)
chromium-browse(4359/ 4359)		0.00(	0.1)	0.00(0.00)	0	0.00		5	0	3	0	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
chromium-browse(16887/16887)		0.00(	0.1)	0.00(0.00)	0	0.00		3	0	3	1	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)

Thread analysis

- Family and signal of cat(31668) thread
  - Created by bash(11562) after 1.727 sec from starting tracing
  - Running for 10ms on CPU
  - Let its parent bash(11562) wait for 67ms
  - Sent SIGCHLD signal to bash(11562) at 1.794369 sec

```
[Thread Creation Info] [Alive: +] [Die: -] [CreatedTime: //] [ChildCount: ||] [CpuUsage: <>] [WaitTimeForChilds: {}] [WaitTimeOfParent: []]
================================================================================================================================================
+ bash(30061) <0.001> |3| {2.000}
     - sleep(31666) /0.757/ <0.001> [1.000]
     - sleep(31669) /1.757/ <0.001> [1.000]
     + sleep(31670) /2.757/ <0.001>
+ bash(11562) <0.002> |1| {0.067}
     - cat(31668) /1.727/ <0.010> [0.067]
+ Plex Media Serv(2954) <0.000> |1|
     + Plex(31667) /1.263/ <0.000>
------------------------------------------------------------------------------------------------------------------------------------------------

[Thread Signal Info]
================================================================================================================================================
 TYPE        TIME           SENDER(  TID)    SIGNAL           RECEIVER(  TID)
================================================================================================================================================
 SEND    0.756282           sleep(31663)   SIGCHLD              bash(30061)
 RECV    0.756376                          SIGCHLD              bash(30061)
 SEND    1.756742           sleep(31666)   SIGCHLD              bash(30061)
 RECV    1.756839                          SIGCHLD              bash(30061)
 SEND    1.794369             cat(31668)   SIGCHLD              bash(11562)
```

Thread analysis

- Interrupts
  - Check irq(88) and softirq(1, 3, 7, 9)
    - Usage: total time for handling the interrupt
    - ProcMax: maximum time for handling the interrupt
    - ProcMin: minimum time for handling the interrupt
    - InterMax: longest interval of the interrupt
    - InterMin: shortest interval of the interrupt

```
[Thread IRQ Info]
==========================================================================================================================
      IRQ       (                              Name                              ):    Count       Usage    ProcMax   ProcMin   InterMax  InterMin
==========================================================================================================================
# IRQ(5) / Total( 0.000) / Cnt(65)

        irq/88(                               ahci                               ):           6  0.000042  0.000010  0.000004  0.195325  0.000020
     softirq/1(                              TIMER                               ):          22  0.000149  0.000014  0.000001  0.331557  0.015981
     softirq/4(                              BLOCK                               ):           6  0.000111  0.000028  0.000010  0.195326  0.000019
     softirq/7(                              SCHED                               ):          12  0.000056  0.000007  0.000003  0.331560  0.000002
     softirq/9(                               RCU                                ):          19  0.000029  0.000003  0.000001  0.331559  0.000014

--------------------------------------------------------------------------------------------------------------------------
```

Thread analysis

guider record -s ./ -e mb

Trace also memory and block

Save trace file in current directory

Input ctrl + c

guider ./guider.dat -o ./ -a -i

Show also interval information

Show all information

Save report file in current directory

View guider.out

Thread analysis

- Memory and block usage of cat(28912) thread
  - Allocated 17MB memory into user space
  - Loaded 17MB file for 60ms

```
[Thread Info] [ Elapsed: 4.610 ] [ Start: 4580384.919 ] [ Running: 154 ] [ CtxSwc: 9333 ] [ LogSize: 3566 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(	0.0)	0.00(0.00)	0	0.00		0	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/1(-----/-----)	--	0.02(	0.4)	0.07(0.00)	0	0.00		835	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/2(-----/-----)	--	0.01(	0.3)	0.48(0.00)	0	0.00		115	-	-	-	0.09(17/	82)	379(1)	17(17/	0/	0)	0	0	0.00(0)
CORE/3(-----/-----)	--	4.61(100.0)		0.00(0.00)	0	0.00		0	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/4(-----/-----)	--	0.01(	0.2)	0.10(0.00)	0	0.00		564	-	-	-	0.00(0/	0)	1(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/5(-----/-----)	--	0.02(	0.4)	0.00(0.00)	0	0.00		36	-	-	-	0.00(0/	0)	1(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/6(-----/-----)	--	0.00(	0.1)	0.02(0.00)	0	0.00		83	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/7(-----/-----)	--	0.00(	0.0)	1.77(0.00)	0	0.00		35	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/8(-----/-----)	--	0.00(	0.1)	1.77(0.00)	0	0.00		37	-	-	-	0.00(0/	3)	0(0)	-1(0/	0/	-1)	0	0	0.00(0)
CORE/9(-----/-----)	--	0.00(	0.0)	1.96(0.00)	0	0.00		44	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/10(-----/-----)	--	0.00(	0.1)	0.08(0.00)	0	0.00		132	-	-	-	0.00(0/	1)	0(0)	0(0/	0/	0)	0	0	0.00(0)
CORE/11(-----/-----)	--	0.01(	0.3)	0.01(0.00)	0	0.00		177	-	-	-	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
# Hot: 143																				
yes(28026/28026)		4.61(100.0)		0.00(0.00)	0	0.00		0	448	0	0	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
guider(28909/28909)		0.01(	0.2)	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)
chromium-browse(4051/ 4051)		0.01(	0.1)	0.00(0.00)	0	0.00		6	0	6	0	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
chromium-browse(4084/ 4084)		0.01(	0.1)	0.00(0.00)	0	0.00		10	1	17	1	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
cat(28912/-----)	ND	0.01(	0.1)	0.00(0.00)	0	0.00		1	3	77	3	0.06(17/	76)	0(0)	17(17/	0/	0)	0	0	0.00(0)
chromium-browse(4359/ 4359)		0.00(	0.1)	0.00(0.00)	0	0.00		5	0	3	0	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)
chromium-browse(16887/16887)		0.00(	0.1)	0.00(0.00)	0	0.00		3	0	3	1	0.00(0/	0)	0(0)	0(0/	0/	0)	0	0	0.00(0)

Thread analysis

- Interval information
  - Divided as each interval
    - Default: 1 sec
  - Check life cycle of threads
    - N: New
    - D: Die
    - F: Fault

```
[Thread Interval Info] [ Unit: 1 Sec ]
=====================================================
            Name(  Tid/  Pid):   1   2   3   4  4.30
=====================================================
# Total(%/MB/Cnt)

          CORE/0(    0/-----):   0   0   0   0   0
          CORE/1(    0/-----):   0   0   0   0   0
          CORE/2(    0/-----):   0   0   0   0   0
          CORE/3(    0/-----):   0   0   0   0   0
          CORE/4(    0/-----):   0   0   0   0   0
          CORE/5(    0/-----):   2   0   0   0   0
          CORE/6(    0/-----):   0   0   0   0   0
          CORE/7(    0/-----):   0   0   0   0   0
          CORE/8(    0/-----):   0   0   0   0   0
          CORE/9(    0/-----):   0   0   0   0   0
         CORE/10(    0/-----):   0   0   0   0   0
         CORE/11(    0/-----):   0   0   0   0   0

             MEM(    0/-----):   0  17   0   0   0

          BLK_RD(    0/-----):   0  17   0   0   0
          BLK_WR(    0/-----):   0   0   0   0   0

-----------------------------------------------------
# CPU(%)

          guider(32191/32191):   1   0   0   0   0

-----------------------------------------------------
# Delay(%)

       rcu_sched(    7/    7):   0   0   0   0   0

-----------------------------------------------------
# MEM(MB)

             cat(32194/-----):   0 N17D -1   0   0
 chromium-browse( 4051/ 4051):   0   0   0   0   0

-----------------------------------------------------
# BLK_RD(MB)

             cat(32194/-----):   0 N17D  0   0   0
        Watchdog( 3922/ 3810):   0   0   0   0   0

-----------------------------------------------------
# BLK_WR(MB)

        Watchdog( 3922/ 3810):   0   0   0   0   0

-----------------------------------------------------
```

Thread analysis

guider record -s ./ -t -u

Run in background

Trace also systemcall

Save trace file in current directory

guider stop

guider ./guider.dat -o ./ -a

Show all information

Save report file in current directory

View guider.out

Thread analysis

- Per-thread systemcall summary

[Thread Syscall Info]

Name(Tid)	Syscall	SysId	Usage	Count	Min	Max	Avg
BrowserBlocking(3808)							
	sys_futex	202	0.000	6	0.000001	0.000151	0.000031
BrowserBlocking(3749)							
	sys_futex	202	0.000	1	0.000001	0.000001	0.000001
BrowserBlocking(3807)							
	sys_futex	202	0.000	5	0.000001	0.000010	0.000004
	sys_write	1	0.000	1	0.000011	0.000011	0.000011
Chrome_ChildIOT(4299)							
	sys_epoll_wait	232	0.999	13	0.000001	0.997952	0.076824
	sys_sendmsg	46	0.000	2	0.000013	0.000015	0.000014
	sys_recvmsg	47	0.000	4	0.000002	0.000008	0.000005
	sys_futex	202	0.000	2	0.000009	0.000009	0.000009
	sys_read	0	0.000	4	0.000003	0.000006	0.000004
Chrome_ChildIOT(4052)							
	sys_recvmsg	47	0.000	2	0.000002	0.000011	0.000006
	sys_epoll_wait	232	0.000	2	0.000001	0.000001	0.000001
	sys_gettid	186	0.000	1	0.000001	0.000001	0.000001
Chrome_ChildIOT(4085)							
	sys_epoll_wait	232	0.000	5	0.000001	0.000416	0.000084
	sys_sendmsg	46	0.000	2	0.000002	0.000015	0.000008
	sys_recvmsg	47	0.000	2	0.000002	0.000012	0.000007
	sys_read	0	0.000	1	0.000008	0.000008	0.000008
	sys_gettid	186	0.000	1	0.000001	0.000001	0.000001

Thread analysis

- Per-thread systemcall history

[Thread Syscall History]

Name(Tid)	Time	Diff	Type	Syscall	SysId	Core	Return	Parameter
guider(906)	0.006250	0.000000	exit	sys_write	1	5	1	-
guider(906)	0.006253	0.000002	both	sys_close	3	5	0	(3, 7f0f22d84000, 7f0f22d85000, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.006258	0.000005	both	sys_munmap	11	5	0	(7f0f22d84000, 1000, 0, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.006284	0.000013	both	sys_open	2	5	-2	(a3ad70, 241, 1b6, 91a870, f2e286, 240)
guider(906)	0.006349	0.000012	both	sys_open	2	5	3	(a3ad70, 241, 1b6, 91a870, f2e286, 240)
guider(906)	0.006362	0.000002	both	sys_fstat	5	5	0	(3, 7ffd99a57a20, 7ffd99a57a20, 1, 0, 240)
guider(906)	0.006367	0.000000	both	sys_fstat	5	5	0	(3, 7ffd99a57a30, 7ffd99a57a30, d, ab2c30, 7f0f22d07414)
guider(906)	0.006368	0.000003	both	sys_mmap	9	5	139702985834496	(0, 1000, 3, 22, ffffffff, 0)
guider(906)	0.006379	0.000218	both	sys_write	1	5	1	(3, 7f0f22d84000, 1, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.006599	0.000000	both	sys_close	3	5	0	(3, 7f0f22d84000, 7f0f22d85000, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.006602	0.000006	both	sys_munmap	11	5	0	(7f0f22d84000, 1000, 0, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.006625	0.000012	both	sys_open	2	5	3	(a3ad70, 241, 1b6, 91a870, f2e286, 240)
guider(906)	0.006638	0.000001	both	sys_fstat	5	5	0	(3, 7ffd99a57a20, 7ffd99a57a20, 1, 0, 240)
guider(906)	0.006642	0.000000	both	sys_fstat	5	5	0	(3, 7ffd99a57a30, 7ffd99a57a30, d, 9dcbb0, 7f0f22d07414)
guider(906)	0.006643	0.000003	both	sys_mmap	9	5	139702985834496	(0, 1000, 3, 22, ffffffff, 0)
guider(906)	0.006653	0.000200	both	sys_write	1	5	1	(3, 7f0f22d84000, 1, 4f43e0, 9dcbb0, 7f0f22d59740)
guider(906)	0.006855	0.000001	both	sys_close	3	5	0	(3, 7f0f22d84000, 7f0f22d85000, 4f43e0, 9dcbb0, 7f0f22d59740)
guider(906)	0.006858	0.000005	both	sys_munmap	11	5	0	(7f0f22d84000, 1000, 0, 4f43e0, 9dcbb0, 7f0f22d59740)
guider(906)	0.006880	0.000010	both	sys_open	2	5	3	(a3ad70, 241, 1b6, 91a870, f2e286, 240)
guider(906)	0.006891	0.000002	both	sys_fstat	5	5	0	(3, 7ffd99a57a20, 7ffd99a57a20, 1, 0, 240)
guider(906)	0.006895	0.000001	both	sys_fstat	5	5	0	(3, 7ffd99a57a30, 7ffd99a57a30, d, ab2c30, 7f0f22d07414)
guider(906)	0.006896	0.000003	both	sys_mmap	9	5	139702985834496	(0, 1000, 3, 22, ffffffff, 0)
guider(906)	0.006906	0.000704	both	sys_write	1	5	1	(3, 7f0f22d84000, 1, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.007611	0.000001	both	sys_close	3	5	0	(3, 7f0f22d84000, 7f0f22d85000, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.007614	0.000005	both	sys_munmap	11	5	0	(7f0f22d84000, 1000, 0, 4f43e0, ab2c30, 7f0f22d59740)
guider(906)	0.007636	0.000010	both	sys_open	2	5	3	(be5750, 241, 1b6, 91a870, f2e286, 240)
guider(906)	0.007648	0.000001	both	sys_fstat	5	5	0	(3, 7ffd99a57a20, 7ffd99a57a20, 1, 0, 240)
guider(906)	0.007652	0.000000	both	sys_fstat	5	5	0	(3, 7ffd99a57a30, 7ffd99a57a30, d, 9dcbb0, 7f0f22d07414)

Thread analysis

- Restrictions
  - Sufficient system memory is required to record events
    - Long time recording will cause wrong result in poor memory system
    - If you should record for long time then use -R option for recording

Contents

- A system-wide performance analyzer
  - thread analysis
  - function analysis
  - real-time analysis
  - file analysis
- Open-source contribution
  - https://github.com/iipeace/guider

Requirement

- Linux kernel (>= 3.0)
- Python (>= 2.7)
- Kernel configuration
  - CONFIG_FTRACE
  - CONFIG_TRACING, CONFIG_TRACING_SUPPORT
  - CONFIG_EVENT_TRACING
  - CONFIG_TRACEPOINTS
  - CONFIG_DYNAMIC_FTRACE
  - CONFIG_FTRACE_SYSCALLS
  - CONFIG_STACKTRACE, CONFIG_STACKTRACE_SUPPORT, CONFIG_USER_STACKTRACE_SUPPORT
  - CONFIG_UPROBES, CONFIG_UPROBE_EVENT
  - CONFIG_KPROBES, CONFIG_KPROBE_EVENTS
- Kernel patch
  - ust_arm_apcs.patch (only for ARM)

Function analysis

- memTest()
  - Alloc 10MB to memory
- diskTest()
  - Read 10MB from disk
- cpuTest()
  - Spin in a loop

```c
#include <stdio.h>
#include <fcntl.h>

char *g_buf = NULL;
long g_bufsize = 1024 * 1024 * 10; // 10MB

void memTest() {
        long cnt;
        g_buf = (char *)malloc(g_bufsize);
        memset(g_buf, (char)0, g_bufsize); // ALLOC 10MB
}

void diskTest() {
        int fd = open("testBin", O_RDONLY);
        read(fd, g_buf, g_bufsize); // READ 10MB
}

void cpuTest() {
        long idx;
        while(1); // SPIN
        for(idx= 0; idx< g_bufsize * 100; idx++)
                NULL; // SPIN
}

void faultTest() {
        char res = *((char *)0); // SEGFAULT
}

void startTest() {
        memTest();
        diskTest();
        cpuTest();
        //faultTest();
}

int main() {
        startTest();
        return 0;
}
```

Function analysis

```
$ gcc test.c -rdynamic -fno-omit-frame-pointer

# guider record -f -s ./ -e mb -u

$ ./a.out &

# guider stop

# guider ./guider.dat -o ./ -l $(which addr2line) -r /
```

View guider.out

Run in background

Trace also memory and block

Save trace file in current directory

Function mode

Set root path

Set addr2line path

Save report file in current directory

Function analysis

```
[Function Thread Info] [ Elapsed: 1565470.501 ] [ Start: 2063704.322 ] [ Threads: 36 ] [ LogSize: 8525 KB ]
```

Name	Tid	Pid	Target	CPU	MEM (USER / BUF / KERN)	UFREE	HEAP	BLK_RD	BLK_WR	CUSTOM	DIE	NEW
a.out	30807	-----	*	87.0%	20800k(12520k/ 16k/ 8264k)	72k	0k	10396k	0k	0		v
guider	30804	30804	*	5.2%	8864k(8k/ 8552k/ 304k)	0k	0k	4k	8508k	0		
synergyc	3445	3443	*	4.9%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
chromium-browse	16887	16887	*	1.2%	244k(232k/ 0k/ 12k)	160k	0k	0k	0k	0		
chromium-browse	4084	4084	*	0.2%	216k(216k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex DLNA Serve	26078	3007	*	0.2%	0k(0k/ 0k/ 0k)	32k	0k	0k	24k	0		
ksoftirqd/1	37	37	*	0.2%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
irqbalance	1300	1300	*	0.1%	16k(0k/ 0k/ 16k)	4k	0k	0k	0k	0		
ksoftirqd/4	52	52	*	0.1%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
ksoftirqd/2	42	42	*	0.1%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex Media Serv	2961	2953	*	0.1%	232k(0k/ 232k/ 0k)	0k	0k	232k	0k	0		
Plex DLNA Serve	25949	3007	*	0.1%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
chromium-browse	3709	3709	*	0.1%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex DLNA Serve	26525	3007	*	0.1%	44k(0k/ 12k/ 32k)	12k	0k	0k	36k	0		
chromium-browse	4051	4051	*	0.1%	132k(132k/ 0k/ 0k)	4k	0k	0k	0k	0		
python	2992	2963	*	0.1%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex DLNA Serve	26520	3007	*	0.1%	0k(0k/ 0k/ 0k)	0k	0k	0k	24k	0		
chromium-browse	4015	4015	*	0.1%	0k(0k/ 0k/ 0k)	4k	0k	0k	0k	0		
chromium-browse	4260	4260	*	0.0%	8k(8k/ 0k/ 0k)	0k	0k	0k	0k	0		
Chrome_CacheThr	3754	3709	*	0.0%	272k(0k/ 272k/ 0k)	0k	0k	268k	8k	0		
Xorg	1774	1774	*	0.0%	4k(0k/ 0k/ 4k)	4k	0k	0k	0k	0		
Plex DLNA Serve	26077	3007	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	24k	0		
BrowserBlocking	3749	3709	*	0.0%	168k(16k/ 152k/ 0k)	0k	0k	160k	24k	0		
chromium-browse	4005	4005	*	0.0%	8k(8k/ 0k/ 0k)	48k	0k	0k	0k	0		
chromium-browse	12210	12210	*	0.0%	68k(56k/ 0k/ 12k)	936k	0k	0k	0k	0		
unity-settings-	2017	2017	*	0.0%	4k(0k/ 0k/ 4k)	4k	0k	0k	0k	0		
jbd2/sda2-8	309	309	*	0.0%	16k(0k/ 16k/ 0k)	0k	0k	0k	20k	0		
gmain	1093	1090	*	0.0%	4k(0k/ 4k/ 0k)	0k	0k	4k	0k	0		
kworker/u24:2	30483	30483	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex DLNA Serve	3263	3007	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
chromium-browse	4359	4359	*	0.0%	60k(48k/ 0k/ 12k)	924k	0k	0k	0k	0		
bash	3541	3541	*	0.0%	80k(72k/ 0k/ 8k)	0k	0k	0k	0k	0		
screen	3460	3460	*	0.0%	4k(0k/ 0k/ 4k)	4k	0k	0k	0k	0		
Plex Media Serv	30795	2953	*	0.0%	16k(16k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex DLNA Serve	3015	3007	*	0.0%	8k(0k/ 8k/ 0k)	0k	0k	0k	8k	0		
gmain	2676	2636	*	0.0%	8k(0k/ 8k/ 0k)	0k	0k	8k	0k	0		

guider ./guider.dat -o ./ -l $(which addr2line) -r / -g 30807

View guider.out

Function analysis

```
void cpuTest() {
        long idx;
        while(1); // SPIN
        for(idx= 0; idx< g_bufsize * 100; idx++)
                NULL; // SPIN
}
```

```
[Function CPU Info] [Cnt: 820] [Interval: 21ms] (USER)
==========================================================================================================================================================
__Usage__|___________________Function____________________|_____________________Binary___________________|____________________Source______________________
==========================================================================================================================================================
   99.5% |                     cpuTest                   |/media/disk/work/test/a.out                   |/home/iipeace/work/test/guiderTest.c:20 (discri
     +  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]
----------------------------------------------------------------------------------------------------------------------------------------------------------
    0.2% |                     memset                    |/lib/x86_64-linux-gnu/libc-2.19.so            |/build/eglibc-oGUzwX/eglibc-2.19/string/../sysde
emset.S:80
     +  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]
----------------------------------------------------------------------------------------------------------------------------------------------------------
    0.2% |                     __read                    |/lib/x86_64-linux-gnu/libc-2.19.so            |/build/eglibc-oGUzwX/eglibc-2.19/io/../sysdeps/u
-template.S:81
     +  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]
----------------------------------------------------------------------------------------------------------------------------------------------------------

[Function CPU Info] [Cnt: 820] [Interval: 21ms] (KERNEL)
==========================================================================================================================================================
__Usage__|_____________________________________________________________Function_____________________________________________________________________________
==========================================================================================================================================================
  100.0% |                                                      hrtimer_interrupt
     +   99.5% | <- local_apic_timer_interrupt <- smp_apic_timer_interrupt <- apic_timer_interrupt
     +    0.2% | <- local_apic_timer_interrupt <- smp_apic_timer_interrupt <- apic_timer_interrupt <- print_context_stack <- dump_trace
                 <- save_stack_trace <- __ftrace_trace_stack
     +    0.1% | <- local_apic_timer_interrupt <- smp_apic_timer_interrupt <- apic_timer_interrupt <- __do_page_fault <- do_page_fault <- page_fault
     +    0.1% | <- local_apic_timer_interrupt <- smp_apic_timer_interrupt <- apic_timer_interrupt <- __kernel_text_address <- print_context_stack
                 <- dump_trace <- save_stack_trace
----------------------------------------------------------------------------------------------------------------------------------------------------------
```

Function analysis

```
[Function Memory Info] [Total: 20816KB] [Alloc: 20836KB(3165)] [Free: 180KB(45)] (USER)
=============================================================================================================================================
 Usage ( Usr  / Buf  / Ker  )|_____________Function_____________|_____________Binary_____________|_____Source_____
=============================================================================================================================================
 10256K(  2048/     0/  8208)|                 memset             |/lib/x86_64-linux-gnu/libc-2.19.so          |/build/eglibc-oGUzwX/eglibc-
/../sysdeps/x86_64/memset.S:80
    +  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]
---------------------------------------------------------------------------------------------------------------------------------------------
    12K(    12/     0/     0)|          elf_machine_rela_relative      |/lib/x86_64-linux-gnu/ld-2.19.so          |/build/eglibc-oGUzwX/eglibc-
/sysdeps/x86_64/dl-machine.h:493
    +     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             |/lib/x86_64-linux-gnu/ld-2.19.so          |/build/eglibc-oGUzwX/eglibc-
/../sysdeps/x86_64/multiarch/../memcpy.S:167
    +      4K(     4/     0/     0)| <- _dl_map_object [/lib/x
---------------------------------------------------------------
     8K(     4/     0/     4)|                 sysmalloc
/malloc.c:2337
---------------------------------------------------------------

[Function Memory Info] [Total: 20816KB] [Alloc: 20836KB(3165)]
=============================================================
 Usage ( Usr  / Buf  / Ker  )|_____
=============================================================================================================================================
 10396K( 10380/    16/     0)|       __page_cache_alloc
    +  10112K( 10112/     0/     0)| <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_async_readahead <- generic_file_aio_read
                                    <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +    256K(   256/     0/     0)| <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_sync_readahead <- generic_file_aio_read
                                    <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +     12K(    12/     0/     0)| <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_sync_readahead <- generic_file_aio_read
                                    <- do_sync_read <- vfs_read <- kernel_read <- prepare_binprm <- do_execve_common.isra.23 <- SyS_execve
                                    <- stub_execve
    +     12K(     0/    12/     0)| <- find_or_create_page <- __getblk <- ext4_get_branch <- ext4_ind_map_blocks <- ext4_map_blocks <- _ext4_get_block
                                    <- ext4_get_block <- do_mpage_readpage <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead
                                    <- ondemand_readahead <- page_cache_async_readahead <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read
                                    <- system_call_fastpath
    +      4K(     0/     4/     0)| <- find_or_create_page <- __getblk <- ext4_get_branch <- ext4_ind_map_blocks <- ext4_map_blocks <- _ext4_get_block
                                    <- ext4_get_block <- do_mpage_readpage <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead
                                    <- ondemand_readahead <- page_cache_sync_readahead <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read
                                    <- system_call_fastpath
---------------------------------------------------------------------------------------------------------------------------------------------
  8192K(     0/     0/  8192)|   do_huge_pmd_anonymous_page
    +   8192K(     0/     0/  8192)| <- handle_mm_fault <- __do_page_fault <- do_page_fault <- page_fault
---------------------------------------------------------------------------------------------------------------------------------------------
  2096K(  2096/     0/     0)|        handle_mm_fault
    +   2088K(  2088/     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
---------------------------------------------------------------------------------------------------------------------------------------------
```

```
void memTest() {
        long cnt;
        g_buf = (char *)malloc(g_bufsize);
        memset(g_buf, (char)0, g_bufsize); // ALLOC 10MB
}
```

Function analysis

```c
void diskTest() {
        int fd = open("testBin", O_RDONLY);
        read(fd, g_buf, g_bufsize); // READ 10MB
}
```

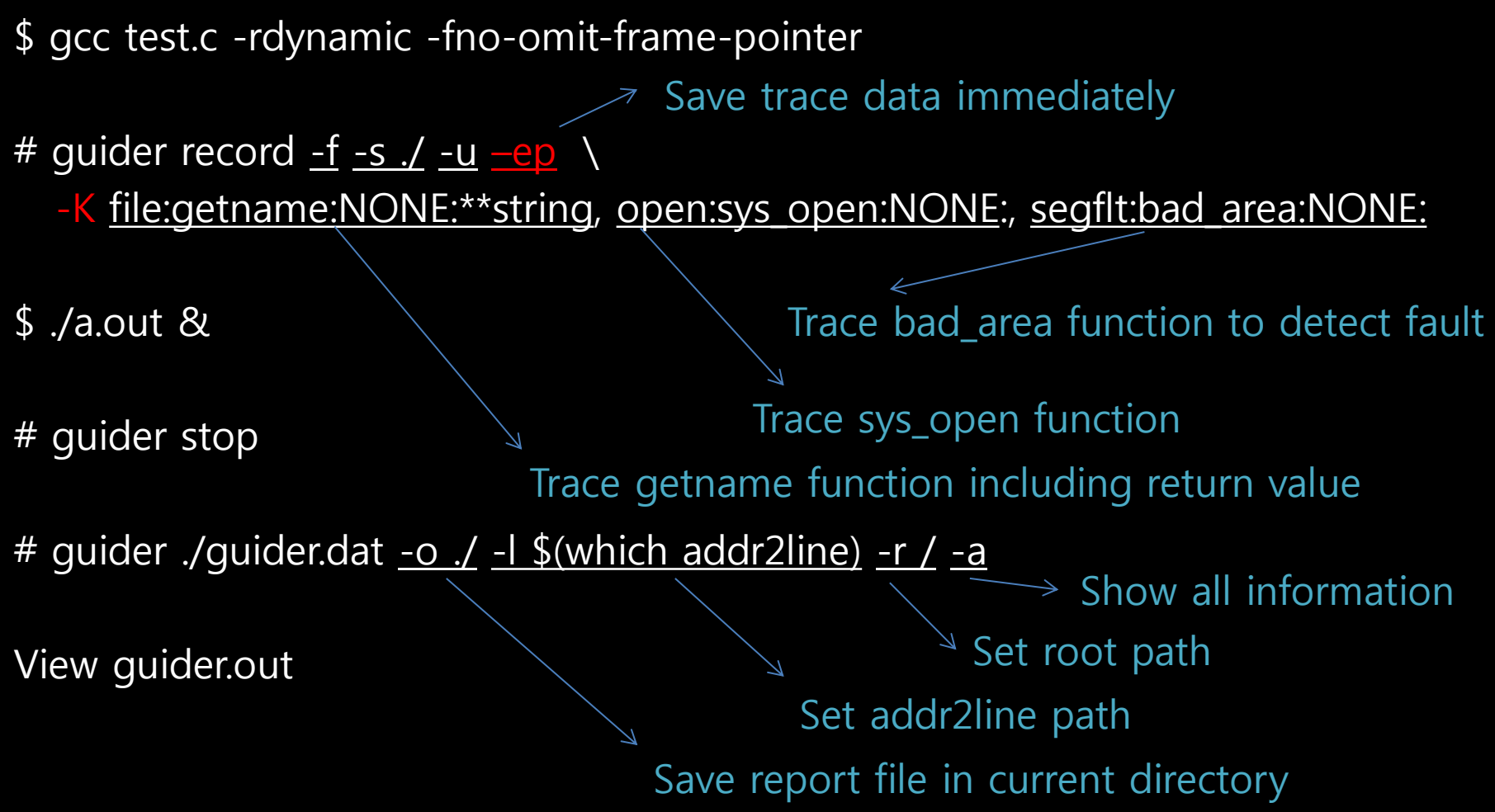
```
[Function BLK_RD Info] [Size: 10396KB] [Cnt: 90] (USER)
==============================================================================================================================================================
__Usage__|___________________Function____________________|_____________________Binary_____________________|____________________Source______________________
==============================================================================================================================================================
  10384K |                    __read                     |/lib/x86_64-linux-gnu/libc-2.19.so               |/build/eglibc-oGUzwX/eglibc-2.19/io/../sysdeps/u
-template.S:81
    +     10384K | <- 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]
--------------------------------------------------------------------------------------------------------------------------------------------------------------
     12K |               00007ff6563001e7                |??                                                 |
--------------------------------------------------------------------------------------------------------------------------------------------------------------

[Function BLK_RD Info] [Size: 10396KB] [Cnt: 90] (KERNEL)
==============================================================================================================================================================
__Usage__|___________________Function____________________|_____________________Binary_____________________|____________________Source______________________
==============================================================================================================================================================
  10396K |                  submit_bio                   |                                                  |
    +     10016K | <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_async_readahead
                 <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +       128K | <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_sync_readahead
                 <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +        96K | <- do_mpage_readpage <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead
                 <- page_cache_async_readahead <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +        80K | <- do_mpage_readpage <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_sync_readahead
                 <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +        48K | <- do_mpage_readpage <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_sync_readahead
                 <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +        12K | <- _submit_bh <- bh_submit_read <- ext4_get_branch <- ext4_ind_map_blocks <- ext4_map_blocks <- _ext4_get_block <- ext4_get_block
                 <- do_mpage_readpage <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead
                 <- page_cache_async_readahead <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
    +        12K | <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead <- page_cache_sync_readahead
                 <- generic_file_aio_read <- do_sync_read <- vfs_read <- kernel_read <- prepare_binprm <- do_execve_common.isra.23 <- SyS_execve
                 <- stub_execve
    +         4K | <- _submit_bh <- bh_submit_read <- ext4_get_branch <- ext4_ind_map_blocks <- ext4_map_blocks <- _ext4_get_block <- ext4_get_block
                 <- do_mpage_readpage <- mpage_readpages <- ext4_readpages <- __do_page_cache_readahead <- ondemand_readahead
                 <- page_cache_sync_readahead <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read <- system_call_fastpath
--------------------------------------------------------------------------------------------------------------------------------------------------------------
```

Function analysis

- diskTest()
  - Open “testBin” file
- faultTest()
  - Access violation

```c
#include <stdio.h>
#include <fcntl.h>

char *g_buf = NULL;
long g_bufsize = 1024 * 1024 * 10; // 10MB

void memTest() {
        long cnt;
        g_buf = (char *)malloc(g_bufsize);
        memset(g_buf, (char)0, g_bufsize); // ALLOC 10MB
}

void diskTest() {
        int fd = open("testBin", O_RDONLY);
        read(fd, g_buf, g_bufsize); // READ 10MB
}

void cpuTest() {
        long idx;
        while(1); // SPIN
        for(idx= 0; idx< g_bufsize * 100; idx++)
                NULL; // SPIN
}

void faultTest() {
        char res = *((char *)0); // SEGFAULT
}

void startTest() {
        //memTest();
        diskTest();
        //cpuTest();
        faultTest();
}

int main() {
        startTest();
        return 0;
}
```

Function analysis



Function analysis

```
[Function Thread Info] [ Elapsed: 1565467.778 ] [ Start: 2067574.135 ] [ Threads: 25 ] [ LogSize: 408 KB ]
```

Name	Tid	Pid	Target	CPU	MEM (USER/BUF/KERN)	UFREE	HEAP	BLK_RD	BLK_WR	CUSTOM	DIE	NEW
synergyc	3445	3443	*	30.1%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
guider	968	968	*	22.3%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	375		
apport	976	-----	*	21.4%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	413	v	v
chromium-browse	16887	16887	*	9.7%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
chromium-browse	4084	4084	*	1.9%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
chromium-browse	4051	4051	*	1.9%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
Chrome_ChildIOT	4085	4084	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
ksoftirqd/1	37	37	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
BrowserBlocking	3807	3709	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
<...>	3755	3709	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex DLNA Serve	26077	3007	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	4		
Plex DLNA Serve	26078	3007	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	4		
Plex DLNA Serve	26520	3007	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	4		
Plex DLNA Serve	26525	3007	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	4		
Chrome_ChildIOT	4052	4051	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
bash	3541	3541	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
screen	3460	3460	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
gmain	2676	2636	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
ksoftirqd/5	57	57	*	1.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
rs:main Q:Reg	975	955	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	20		
a.out	972	-----	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	12	v	v
kworker/u24:1	31749	31749	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		
Plex DLNA Serve	966	-----	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0	v	
Plex DLNA Serve	3115	3007	*	0.0%	0k(0k/ 0k/ 0k)	0k	0k	0k	0k	0		

guider ./guider.dat -o ./ -l $(which addr2line) -r / -a -g 972

View guider.out

Function analysis

File names opened

```
[Function segflt_enter, open_enter, segflt_exit, file_enter, file_exit, open_exit History] [Cnt: 12] [Total: 12]
=====================================================================================================================================================
             Event             |                                                   Info
=====================================================================================================================================================
         file_exit             | (SyS_execve+0x19/0x50 <ffffffff811c9179> <- getname <ffffffff811d1680>) arg1="./a.out" by a.out(972)[007]
                        [User] | 00007ff6563001e7[??]
                      [Kernel] | stub_execve
-----------------------------------------------------------------------------------------------------------------------------------------------------
         file_exit             | (do_sys_open+0xf9/0x2a0 <ffffffff811c0549> <- getname <ffffffff811d1680>) arg1="/etc/ld.so.cache" by a.out(972)[008]
                        [User] | realloc[/lib/x86_64-linux-gnu/ld-2.19.so]
                      [Kernel] | SyS_open <- [unknown/kretprobe'd]
-----------------------------------------------------------------------------------------------------------------------------------------------------
         open_exit             | (system_call_fastpath+0x1a/0x1f <ffffffff8173a9dd> <- SyS_open <ffffffff811c06f0>) by a.out(972)[008]
                        [User] | realloc[/lib/x86_64-linux-gnu/ld-2.19.so]
                      [Kernel] | 0
-----------------------------------------------------------------------------------------------------------------------------------------------------
         file_exit             | (do_sys_open+0xf9/0x2a0 <ffffffff811c0549> <- getname <ffffffff811d1680>) arg1="/lib/x86_64-linux-gnu/libc.so.6" by a.out(972)[008]
                        [User] | realloc[/lib/x86_64-linux-gnu/ld-2.19.so]
                      [Kernel] | SyS_open <- [unknown/kretprobe'd]
-----------------------------------------------------------------------------------------------------------------------------------------------------
         open_exit             | (system_call_fastpath+0x1a/0x1f <ffffffff8173a9dd> <- SyS_open <ffffffff811c06f0>) by a.out(972)[008]
                        [User] | realloc[/lib/x86_64-linux-gnu/ld-2.19.so]
                      [Kernel] | 0
-----------------------------------------------------------------------------------------------------------------------------------------------------
         file_exit             | (do_sys_open+0xf9/0x2a0 <ffffffff811c0549> <- getname <ffffffff811d1680>) arg1="testBin" by a.out(972)[008]
                        [User] | __open64[/lib/x86_64-linux-gnu/libc-2.19.so] <- 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]
                      [Kernel] | SyS_open <- [unknown/kretprobe'd]
-----------------------------------------------------------------------------------------------------------------------------------------------------
         open_exit             | (system_call_fastpath+0x1a/0x1f <ffffffff8173a9dd> <- SyS_open <ffffffff811c06f0>) by a.out(972)[008]
                        [User] | __open64[/lib/x86_64-linux-gnu/libc-2.19.so]
                      [Kernel] | 0
-----------------------------------------------------------------------------------------------------------------------------------------------------
        segflt_exit            | (__do_page_fault+0x462/0x560 <ffffffff817362a2> <- bad_area <ffffffff81722b0e>) by a.out(972)[008]
                        [User] | __read[/lib/x86_64-linux-gnu/libc-2.19.so] <- 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]
                      [Kernel] | do_page_fault <- page_fault <- file_read_actor <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read
                                 <- system_call_fastpath
-----------------------------------------------------------------------------------------------------------------------------------------------------
        segflt_exit            | (__do_page_fault+0x462/0x560 <ffffffff817362a2> <- bad_area <ffffffff81722b0e>) by a.out(972)[008]
                        [User] | __read[/lib/x86_64-linux-gnu/libc-2.19.so] <- 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]
                      [Kernel] | do_page_fault <- page_fault <- file_read_actor <- generic_file_aio_read <- do_sync_read <- vfs_read <- SyS_read
                                 <- system_call_fastpath
-----------------------------------------------------------------------------------------------------------------------------------------------------
        segflt_exit            | (__do_page_fault+0x462/0x560 <ffffffff817362a2> <- bad_area <ffffffff81722b0e>) by a.out(972)[008]
                        [User] | faultTest[/media/disk/work/test/a.out] <- 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]
                      [Kernel] | do_page_fault <- page_fault
-----------------------------------------------------------------------------------------------------------------------------------------------------
```

Call sequence of open

Call sequence of segmentation fault

Function analysis

- Restrictions
  - Target threads should be alive during profiling
    - If target threads should be killed then use -e p option for recording
  - Relevant binaries should be built with bellow options
    - -rdynamic -fno-omit-frame-pointer
    - -mapcs-frame (only for ARM)
  - A kernel patch is needed to trace user stack
    - ust_arm_apcs.patch (only for ARM)
  - the max length of a call chain is restricted by 8

Contents

- A system-wide performance analyzer
  - thread analysis
  - function analysis
  - real-time analysis
  - file analysis
- Open-source contribution
  - https://github.com/iipeace/guider

Real-time analysis

- Show real-time system status with processes
  $ guider top

```
 _________________________
/ g.u.i.d.e.r   ver.3.8.3 /
-------------------------

[Top Info] [Time: 2232770.320] [Interval: 1.0] [Ctxt: 2059] [Fork: 1] [IRQ: 1016] [Core: 12] [Task: 348/898] [RAM: 64374] [Swap: 65477] [Unit: %/MB]
=============================================================================================================================================
  ID   | CPU (Usr/Ker/Blk/IRQ)| Mem (Free/Anon/File/Slab)| Swap (Used/ InOut )| Reclaim  | BlkRW | NrFlt | NrBlk | NrSIRQ  | NrMlk | NrDrt  |   NetIO    |
---------------------------------------------------------------------------------------------------------------------------------------------
Total  |  0 %( 0 / 0 / 0 / 0 )|3583 ( 2  / -4 / 0  / 0  )| 1226 ( 0  /  0/0  )|   0/0    |  0/0  |   0   |   0   |   169   |  17   |   17   |   8K/10K   |
=============================================================================================================================================
    Process      ( ID  / Pid / Nr / Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    SignalHandler    |
---------------------------------------------------------------------------------------------------------------------------------------------
 Plex DLNA Serve ( 3007/ 2953/  54/C  0)|   3(  1/  2/  -)| 1522(886/  3/  4/ 14)|   0(   -/   -/    0)|    0|     0| 256|620:12:38|      1800004e8      |
 chromium-browse (16887/ 3734/  13/C  0)|   2(  2/  0/  -)| 1828(602/ 40/434/  6)|   0(   -/   -/    0)|    -|     -| 512|188:33:34|      1c0014eed      |
 chromium-browse ( 4084/ 3734/  10/C  0)|   1(  1/  0/  -)| 1308(165/ 40/ 31/  7)|   0(   -/   -/    0)|    -|     -| 512|620:11:11|      1c0014eed      |
---------------------------------------------------------------------------------------------------------------------------------------------
        [-]bash (13974/ 3460/   1/C  0)|   0(  0/  0/  -)|   25(  5/  0/  -/  -)|   0(   -/   -/    0)|    -|     -|   -|  0: 0: 4|          -          |
---------------------------------------------------------------------------------------------------------------------------------------------
```

Real-time analysis

- Show real-time system status with threads

  $ guider top -e t

```
 _________________________
/ g.u.i.d.e.r   ver.3.8.3 /
-------------------------

[Top Info] [Time: 2232132.360] [Interval: 1.0] [Ctxt: 2060] [Fork: 0] [IRQ: 1034] [Core: 12] [Task: 352/921] [RAM: 64374] [Swap: 65477] [Unit: %/MB]
=================================================================================================================================================
  ID   | CPU (Usr/Ker/Blk/IRQ)| Mem (Free/Anon/File/Slab)| Swap (Used/ InOut )| Reclaim  | BlkRW | NrFlt | NrBlk | NrSIRQ  | NrMlk | NrDrt  |   NetIO    |
-------------------------------------------------------------------------------------------------------------------------------------------------
Total  |  0 %( 0 / 0 / 0 / 0 )|3825 ( -2 / 1  / 0  / 0  )| 1226 ( 0  /  0/0  )|   0/0    |  0/0  |   0   |   0   |   138   |  17   |   57   |   2K/6K    |
=================================================================================================================================================
     Thread      ( ID  / Pid / Nr / Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    SignalHandler    |
-------------------------------------------------------------------------------------------------------------------------------------------------
       synergyc ( 3445/ 3443/   3/C  0)|  13( 13/  0/  -)|  226( 94/  0/  1/  0)|   0(   -/   -/    0)|    -|     -|  64|620: 1:40|      180000200     |
         guider (13349/13349/   1/C  0)|   2(  1/  1/  -)|   47( 18/  2/  2/  0)|   0(   -/   -/    0)|    -|     -|1024|  0: 0: 2|      180000006     |
 chromium-browse (16887/16887/  18/C  0)|   1(  1/  0/  0)| 1841(599/ 40/434/  6)|   0(   -/   -/    0)|   17|     6| 512|188:22:56|      1c0014eed     |
-------------------------------------------------------------------------------------------------------------------------------------------------
```

Real-time analysis

- Show only specific processes

  $ guider top -g chrome

```
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/ g.u.i.d.e.r   ver.3.8.3 /
-------------------------

[Top Info] [Time: 2232220.360] [Interval: 1.0] [Ctxt: 2004] [Fork: 0] [IRQ: 978] [Core: 12] [Task: 351/919] [RAM: 64374] [Swap: 65477] [Unit: %/MB]
=============================================================================================================================================
  ID    | CPU (Usr/Ker/Blk/IRQ)| Mem (Free/Anon/File/Slab)| Swap (Used/ InOut )| Reclaim  | BlkRW | NrFlt | NrBlk | NrSIRQ  | NrMlk | NrDrt |   NetIO    |
---------------------------------------------------------------------------------------------------------------------------------------------
Total   |  0 %( 0 / 0 / 0 / 0 )|3827 ( 0  / -1 / 0  / 0  )| 1226 ( 0  /  0/0  )|   0/0    |  0/0  |   0   |   0   |   110   |  17   |   3   |   3K/11K   |
=============================================================================================================================================
    Process      ( ID  / Pid / Nr / Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    SignalHandler    |
---------------------------------------------------------------------------------------------------------------------------------------------
 chromium-browse (16887/ 3734/  18/C  0)|   2(  2/  0/  0)| 1841(600/ 40/434/  6)|   0(   -/   -/   0)|  13|     5| 512|188:24:24|      1c0014eed      |
 chromium-browse ( 4015/ 3734/  13/C  0)|   1(  0/  1/  0)| 1777(239/ 40/ 39/  9)|   0(   -/   -/   0)|   2|     0| 512|620: 2: 5|      1c0014eed      |
 chromium-browse ( 4298/ 3734/  10/C  0)|   1(  1/  0/  0)| 1178( 77/ 40/ 16/ 24)|   0(   -/   -/   0)|   2|     0| 512|620: 1:53|      1c0014eed      |
 chromium-browse ( 3921/ 3810/   1/C  0)|   0(  0/  0/  -)|  694(  1/ 40/  0/ 12)|   0(   -/   -/   0)|   0|     0| 256|620: 2:14|      1c00004e8      |
 chromium-browse ( 4323/ 3734/  10/C  0)|   0(  0/  0/  -)| 1185( 85/ 40/ 26/  8)|   0(   -/   -/   0)|   0|     0| 512|620: 1:52|      1c0014eed      |
 chromium-browse ( 4359/ 3734/  17/C  0)|   0(  0/  0/  0)| 1308(148/ 40/ 30/  8)|   0(   -/   -/   0)|   1|     0| 512|620: 1:51|      1c0014eed      |
 chromium-browse ( 3709/ 1814/  39/C  0)|   0(  0/  0/  0)| 1985(160/ 40/ 47/ 18)|   0(   -/   -/   0)|   7|     0| 512|620: 2:15|      180014003      |
 chromium-browse ( 4380/ 3734/   9/C  0)|   0(  0/  0/  -)| 1029( 33/ 40/ 16/  9)|   0(   -/   -/   0)|   0|     0| 512|620: 1:51|      1c0014eed      |
 chromium-browse ( 4260/ 3734/  10/C  0)|   0(  0/  0/  0)| 1139( 78/ 40/ 15/ 17)|   0(   -/   -/   0)|   1|     0| 512|620: 1:55|      1c0014eed      |
 chromium-browse ( 4269/ 3734/  10/C  0)|   0(  0/  0/  -)| 1087( 30/ 40/ 16/ 22)|   0(   -/   -/   0)|   0|     0| 512|620: 1:55|      1c0014eed      |
 chromium-browse ( 4005/ 3734/  10/C  0)|   0(  0/  0/  0)| 1335(177/ 40/ 34/ 17)|   0(   -/   -/   0)|   1|     0| 512|620: 2: 5|      1c0014eed      |
 chromium-browse ( 4168/ 3734/  10/C  0)|   0(  0/  0/  -)| 1082( 24/ 40/ 14/ 17)|   0(   -/   -/   0)|   0|     0| 512|620: 1:59|      1c0014eed      |
 chromium-browse ( 3971/ 3734/  10/C  0)|   0(  0/  0/  -)| 1096( 30/ 40/ 15/ 22)|   0(   -/   -/   0)|   0|     0| 512|620: 2: 8|      1c0014eed      |
 chromium-browse ( 4306/ 3734/  10/C  0)|   0(  0/  0/  -)| 1085( 25/ 40/ 15/ 17)|   0(   -/   -/   0)|   0|     0| 512|620: 1:52|      1c0014eed      |
 chromium-browse ( 4238/ 3734/  18/C  0)|   0(  0/  0/  -)| 1359(179/ 40/ 85/  7)|   0(   -/   -/   0)|   0|     0| 512|620: 1:57|      1c0014eed      |
 chromium-browse ( 3942/ 3734/  10/C  0)|   0(  0/  0/  -)| 1268( 66/ 40/ 18/148)|   0(   -/   -/   0)|   0|     0| 512|620: 2:10|      1c0014eed      |
 chromium-browse ( 4126/ 3734/  10/C  0)|   0(  0/  0/  -)| 1152( 48/ 40/ 17/ 37)|   0(   -/   -/   0)|   0|     0| 512|620: 2: 0|      1c0014eed      |
 chromium-browse ( 4389/ 3734/  10/C  0)|   0(  0/  0/  -)| 1106( 33/ 40/ 16/ 23)|   0(   -/   -/   0)|   0|     0| 512|620: 1:51|      1c0014eed      |
 chromium-browse ( 3728/ 3709/   1/C  0)|   0(  0/  0/  -)|  654(  6/ 40/  4/  8)|   0(   -/   -/   0)|   0|     0| 256|620: 2:14|      1800104e8      |
 chromium-browse ( 4051/ 3734/  10/C  0)|   0(  0/  0/  0)| 1299(136/ 40/ 21/ 14)|   0(   -/   -/   0)|   1|     0| 512|620: 2: 3|      1c0014eed      |
 chromium-browse ( 4084/ 3734/  10/C  0)|   0(  0/  0/  0)| 1307(163/ 40/ 31/  7)|   0(   -/   -/   0)|   1|     0| 512|620: 2: 1|      1c0014eed      |
 chromium-browse ( 3810/ 3709/   3/C  0)|   0(  0/  0/  -)|  800( 36/ 40/ 13/ 11)|   0(   -/   -/   0)|   0|     0| 512|620: 2:14|      1c00004e8      |
 chromium-browse ( 3734/ 3728/   1/C  0)|   0(  0/  0/  -)|  654(  3/ 40/  0/  7)|   0(   -/   -/   0)|   0|     0| 256|620: 2:14|      1800104e8      |
---------------------------------------------------------------------------------------------------------------------------------------------
```

Real-time analysis

- Show memory details of processes

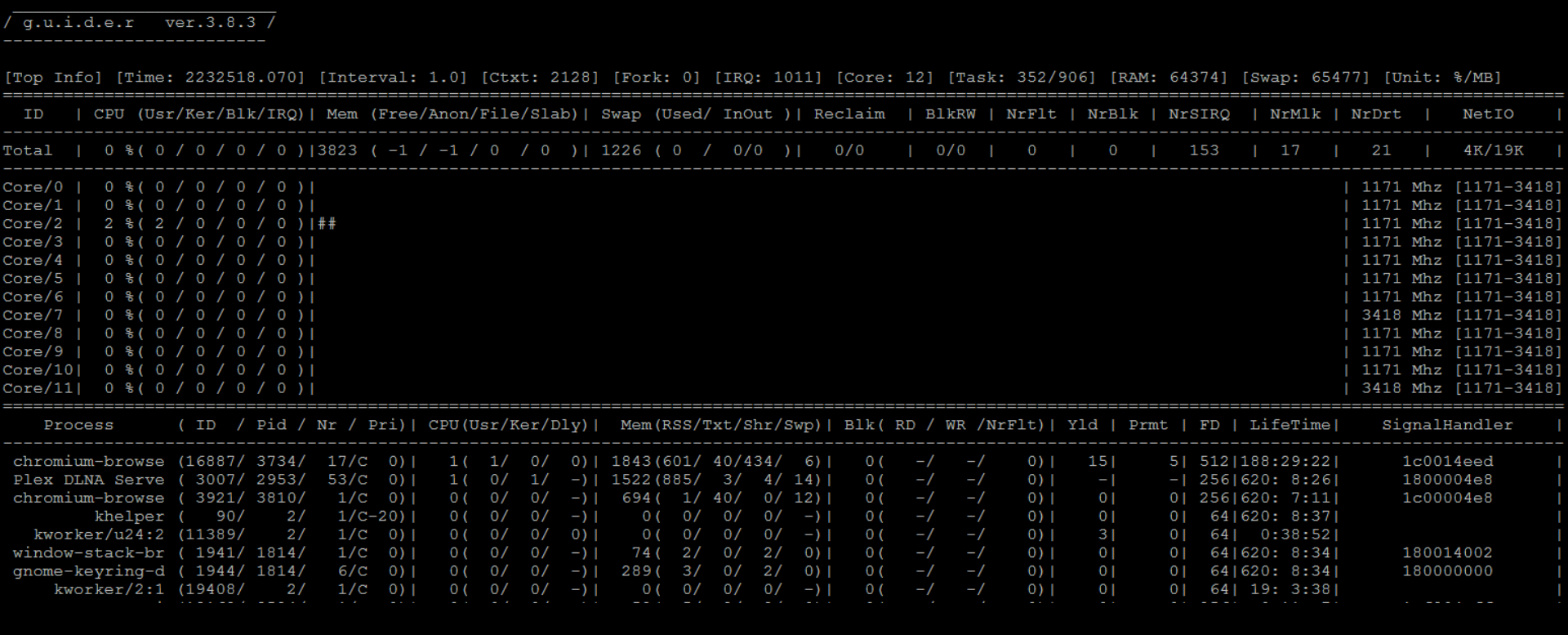
  $ guider top -e m

```
 _____________
/ g.u.i.d.e.r   ver.3.8.3 /
-------------------------

[Top Info] [Time: 2232341.560] [Interval: 1.0] [Ctxt: 2073] [Fork: 2] [IRQ: 1009] [Core: 12] [Task: 352/914] [RAM: 64374] [Swap: 65477] [Unit: %/MB]
=================================================================================================================================================
  ID   | CPU (Usr/Ker/Blk/IRQ)| Mem (Free/Anon/File/Slab)| Swap (Used/ InOut )| Reclaim  | BlkRW | NrFlt | NrBlk | NrSIRQ  | NrMlk | NrDrt  |   NetIO    |
-------------------------------------------------------------------------------------------------------------------------------------------------
Total  |  0 %( 0 / 0 / 0 / 0 )|3824 ( -1 / -1 / 0  / 0  )| 1226 ( 0  /  0/0  )|   0/0    |  0/0  |   0   |   0   |   134   |  17   |   29   |   3K/8K    |
=================================================================================================================================================
   Process      ( ID  / Pid / Nr / Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    SignalHandler    |
-------------------------------------------------------------------------------------------------------------------------------------------------
         guider (13461/11562/   1/C  0)|   2(  2/  0/  0)|   41( 15/  2/  2/  0)|   0(   -/   -/    0)|   1|    65| 512|  0: 0: 3|      180000006      |
                          (1)[STACK] | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY:  44K
                         (20)[HEAP] | SIZE:  14M / RSS:  12M / PSS:  12M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY:  12M
                         (11)[FILE] | SIZE:  27M / RSS:   2M / PSS:   2M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY: 328K
                          (2)[ETC] | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY:   0K
-------------------------------------------------------------------------------------------------------------------------------------------------
 chromium-browse (16887/ 3734/  18/C  0)|   1(  1/  0/  0)| 1842(600/ 40/434/  6)|   0(   -/   -/    0)|  13|     5| 512|188:26:25|      1c0014eed      |
                         (18)[STACK] | SIZE: 136M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY: 596K
                        (112)[SHM] | SIZE: 449M / RSS: 402M / PSS: 400M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY: 596K / PDIRTY: 398M
                        (740)[HEAP] | SIZE: 639M / RSS: 162M / PSS: 162M / SWAP:   0M / HUGE:  38M / LOCKED:   0K / SDIRTY:  72K / PDIRTY: 161M
                        (204)[FILE] | SIZE: 617M / RSS:  36M / PSS:   6M / SWAP:   5M / HUGE:   0M / LOCKED:   0K / SDIRTY:2732K / PDIRTY: 184K
                          (2)[ETC] | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY:   0K
-------------------------------------------------------------------------------------------------------------------------------------------------
 Plex DLNA Serve ( 3007/ 2953/  54/C  0)|   1(  1/  0/  -)| 1522(885/  3/  4/ 14)|   0(   -/   -/    0)|   -|     -| 256|620: 5:29|      1800004e8      |
                         (54)[STACK] | SIZE: 424M / RSS:  50M / PSS:  50M / SWAP:   0M / HUGE:  50M / LOCKED:   0K / SDIRTY:   0K / PDIRTY:  50M
                          (2)[SHM] | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   4K / PDIRTY:   0K
                        (190)[HEAP] | SIZE: 928M / RSS: 831M / PSS: 831M / SWAP:  10M / HUGE: 818M / LOCKED:   0K / SDIRTY:   0K / PDIRTY: 831M
                         (63)[FILE] | SIZE: 169M / RSS:   4M / PSS:   2M / SWAP:   4M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY: 160K
                          (2)[ETC] | SIZE:   0M / RSS:   0M / PSS:   0M / SWAP:   0M / HUGE:   0M / LOCKED:   0K / SDIRTY:   0K / PDIRTY:   0K
-------------------------------------------------------------------------------------------------------------------------------------------------
```

Real-time analysis

- Show all information every 3 second

  $ guider top -a -i 3



Real-time analysis

- Show open files of specific processes

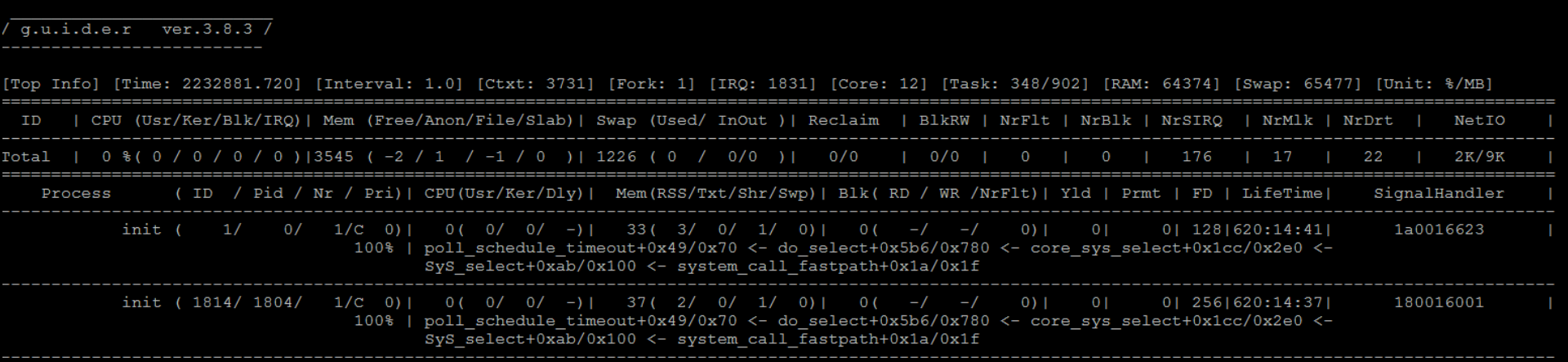
  $ guider top -e f -g sshd, upstart

```
 _____________
/ g.u.i.d.e.r   ver.3.8.3 /
-------------------------

[Top File Info] [Time: 2232642.640] [Proc: 352] [FD: 7652] [File: 1780] [Unit: %/MB]
=============================================================================================================================================
     PROC       ( ID  / Pid / Nr / Pri)| FD |                                                PATH                                              |
---------------------------------------------------------------------------------------------------------------------------------------------
          sshd (12875/12835/   1/C  0)|  13|  PIPE: 5   SOCKET: 4   DEVICE: 3   FILE: 1   PROC: 0   EVENT: 0                                 |
                                      |  14|  pipe:[50833107]                                                                                |
                                      |  12|  pipe:[50833106]                                                                                |
                                      |  11|  pipe:[50833105]                                                                                |
                                      |   9|  pipe:[50843741]                                                                                |
                                      |   8|  pipe:[50843741]                                                                                |
                                      |   7|  /run/systemd/sessions/222.ref                                                                  |
                                      |   6|  socket:[50842802]                                                                              |
                                      |   5|  socket:[50842749]                                                                              |
                                      |   4|  socket:[50842747]                                                                              |
                                      |   3|  socket:[50833095]                                                                              |
                                      |   2|  /dev/null                                                                                      |
                                      |   1|  /dev/null                                                                                      |
                                      |   0|  /dev/null                                                                                      |
---------------------------------------------------------------------------------------------------------------------------------------------
          sshd (12451/12367/   1/C  0)|  13|  DEVICE: 6   SOCKET: 4   PIPE: 2   FILE: 1   PROC: 0   EVENT: 0                                 |
                                      |  13|  /dev/ptmx                                                                                      |
                                      |  12|  /dev/ptmx                                                                                      |
                                      |  10|  /dev/ptmx                                                                                      |
                                      |   9|  pipe:[50829119]                                                                                |
                                      |   8|  pipe:[50829119]                                                                                |
                                      |   7|  /run/systemd/sessions/221.ref                                                                  |
                                      |   6|  socket:[50829930]                                                                              |
                                      |   5|  socket:[50829911]                                                                              |
                                      |   4|  socket:[50832296]                                                                              |
                                      |   3|  socket:[50832581]                                                                              |
                                      |   2|  /dev/null                                                                                      |
                                      |   1|  /dev/null                                                                                      |
                                      |   0|  /dev/null                                                                                      |
---------------------------------------------------------------------------------------------------------------------------------------------
          sshd (12367/ 1233/   1/C  0)|  11|  SOCKET: 6   DEVICE: 4   FILE: 1   PIPE: 0   PROC: 0   EVENT: 0                                 |
                                      |  10|  socket:[50829942]                                                                              |
                                      |   9|  socket:[50829935]                                                                              |
                                      |   8|  socket:[50829931]                                                                              |
                                      |   7|  /run/systemd/sessions/221.ref                                                                  |
                                      |   6|  /dev/ptmx                                                                                      |
```

Real-time analysis

- Show stacks of specific processes

  $ guider top -e s -g init



Real-time analysis

- Show system report

  $ guider top -o ./ -u

  $ guider stop

  View guider.out

  Run in background

  Set path of report file

- System summary information

[Top Summary Info]

IDX	Interval	CPU(%)	MEM(MB)	BlkRW(MB)	BlkWait(%)	SWAP(MB)	Rclm(MB)	NrFlt	NrCtxt	NrIRQ	NrTask	NetIO
1	START - 14562.390	27	274	0/0	0	0	0/0	0	10549	7122	211/863	4K/4K
2	14562.390 - 14563.420	24	274	0/0	0	0	0/0	0	10458	6932	211/864	0K/2K
3	14563.420 - 14564.450	30	274	0/0	0	0	0/0	0	10563	6927	211/864	8K/6K
4	14564.450 - 14565.490	25	274	0/0	0	0	0/0	0	10596	6762	211/864	3K/3K
5	14565.490 - 14566.520	29	274	0/0	0	0	0/0	0	10504	6889	211/864	3K/3K
6	14566.520 - 14567.550	27	274	0/0	0	0	0/0	0	10297	6553	211/863	3K/3K
7	14567.550 - 14568.580	25	274	0/0	0	0	0/0	0	10035	6645	211/863	3K/3K
8	14568.580 - 14569.610	31	274	0/0	0	0	0/0	0	10191	6996	211/863	3K/3K
9	14569.610 - 14570.640	28	274	0/0	0	0	0/0	0	9993	6763	211/863	4K/3K
10	14570.640 - 14571.680	31	274	0/0	0	0	0/0	0	10172	6703	211/863	3K/3K
11	14571.680 - 14572.710	33	274	0/0	0	0	0/0	0	10326	6628	211/863	4K/4K
12	14572.710 - 14573.740	27	274	0/0	0	0	0/0	0	10258	6802	211/863	4K/5K
13	14573.740 - 14574.770	29	274	0/0	0	0	0/0	0	10199	6501	211/863	4K/5K

Real-time analysis

- CPU usage(%) per process in report

[Top CPU Info] [Unit: %]

COMM (ID / Pid / Nr / Pri)	Avg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
		43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
		64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
		85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
		106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126
		127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147
		148	149	150	151	152	153	154	155	156												
[CPU] (- / - / - / -)	33	27	24	30	25	29	27	25	31	28	31	33	27	29	27	31	28	27	33	29	29	30
		31	39	36	39	32	32	33	34	34	32	31	35	33	35	36	37	34	32	31	32	33
		31	27	28	29	30	31	32	36	32	34	33	31	29	33	33	35	29	32	30	33	29
		34	32	25	30	29	32	29	35	30	30	27	28	31	30	30	28	25	29	32	29	28
		31	25	28	30	28	28	31	30	24	27	26	29	25	33	32	31	30	27	24	33	35
		33	32	33	33	33	35	38	38	35	34	37	36	36	36	32	35	30	32	31	34	36
		37	33	35	39	30	30	28	27	44	43	38	39	36	43	65	54	46	66	76	75	73
		62	38	38	43	38	38	48	45	16												
chrome (4053/ 3861/ 22/C 0)	66	77	74	78	77	76	80	77	82	80	77	80	77	75	75	76	73	76	76	75	75	74
		78	81	79	79	77	75	75	76	75	74	76	75	77	76	78	76	78	77	80	77	79
		75	75	74	75	76	74	79	77	77	76	76	76	76	79	79	77	77	73	75	77	75
		78	76	76	75	74	79	78	77	75	75	79	76	74	73	76	74	74	77	76	77	76
		77	77	77	77	77	77	76	75	74	75	74	74	77	79	77	77	76	77	81	79	78
		75	75	73	76	75	76	75	78	77	77	80	79	78	78	79	77	76	75	75	79	87
		81	70	72	86	76	84	75	68	81	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0												
surface-manager (1380/ 1/ 23/C 0)	19	16	18	18	19	20	20	22	21	23	25	25	16	15	16	17	17	19	19	20	21	22
		22	20	23	19	15	16	17	16	19	18	20	21	21	22	24	23	23	15	15	17	17
		18	19	19	20	20	22	24	24	24	19	15	17	17	18	18	20	20	20	21	23	23
		24	23	14	16	17	17	18	20	20	19	22	23	23	25	24	16	15	16	17	18	18
		20	20	21	21	23	23	25	20	14	15	16	17	19	20	20	19	21	22	22	23	26
		15	15	15	17	17	18	20	21	20	22	23	22	24	19	15	17	16	17	17	19	19
		22	22	23	22	23	23	15	15	17	16	18	17	19	19	19	22	23	20	21	16	13
		14	16	14	15	15	16	17	19	18												

Real-time analysis

- Memory usage(MB) per process in report

```
[Top Memory Info] [Unit: MB]
=====================================================================================================================================
     COMM        ( ID  / Pid / Nr / Pri)| Diff |   1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21
                                              |  22   23   24   25   26   27   28   29   30   31   32   33   34   35   36   37   38   39   40   41   42
                                              |  43   44   45   46   47   48   49   50   51   52   53   54   55   56   57   58   59   60   61   62   63
                                              |  64   65   66   67   68   69   70   71   72   73   74   75   76   77   78   79   80   81   82   83   84
                                              |  85   86   87   88   89   90   91   92   93   94   95   96   97   98   99  100  101  102  103  104  105
                                              | 106  107  108  109  110  111  112  113  114  115  116  117  118  119  120  121  122  123  124  125  126
                                              | 127  128  129  130  131  132  133  134  135  136  137  138  139  140  141  142  143  144  145  146  147
                                              | 148  149  150  151  152  153  154  155  156
=====================================================================================================================================
    [FREE]       (  -  /  -  / -  /   -)|  226 |   0    0    0    0    0    0   -1    0    0   -1    0    0    0    0    0   -1    0   -1    0    0   -1
                                              |   0   -1    0   -1    0   -1    0   -1    0   -1    0   -1    0   -1    0   -1    0   -1   -1    0    0
                                              |   0   -1   -1    0   -1    0    0    0    0   -1    0   -1   -1    0    0   -1    0   -1    0   -1    0
                                              |   0    0    0    0    0    0   -1    0   -1    0   -1    0   -1    0   -1   -1    0   -1    0   -1    0
                                              |   0    0    0    0   -1    0    0   -1    0    0    0    0    0   -1    0    0   -1    0    0    0   -1
                                              |   0   -1    0   -1    0   -1    0   -1   -1   -1    0   -1   -1    0    0   -1    0    0    0    0    4
                                              |   0    0   -1   -2    0   -1    0    0   -2  299    4   -6  -11   -7  -15   -3   -8  -43   23   -8   -8
                                              |  20   -1   -4   -2   -8    2   -3   -5   -1
-------------------------------------------------------------------------------------------------------------------------------------
        chrome (29381/ 3861/  25/C  0)|  104 |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0   36   -6    7   16   13   11   12    6   -3    1    3    2
                                              |   4    1    0    0    1    0    0    0    0
-------------------------------------------------------------------------------------------------------------------------------------
        chrome (29422/ 3861/  10/C  0)|   67 |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
                                              |   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0   59  -24    6    5
                                              |   3    0    3    1    4    0    5    5    0
```

Real-time analysis

- Memory details per process in report

[Top Memory Details] [Unit: MB]

COMM (ID / Pid)	Type	Cnt	VIRT	RSS	PSS	SWAP	HUGE	LOCKED(KB)	PDIRTY(KB)	SDIRTY(KB)
surface-manager (1380/ 1)	[TOTAL]	323	562	175	160	0	0	0	105032	112
	STACK	23	176	0	0	0	0	0	276	0
	SHM	43	181	55	55	0	0	0	1196	112
	HEAP	158	123	99	99	0	0	0	102020	0
	FILE	97	82	21	6	0	0	0	1540	0
	ETC	2	0	0	0	0	0	0	0	0
chrome (3861/ 1450)	[TOTAL]	331	522	104	63	0	0	0	37684	33148
	STACK	38	280	0	0	0	0	0	488	0
	SHM	33	51	33	17	0	0	0	416	33148
	HEAP	129	57	32	32	0	0	0	33000	0
	FILE	129	134	39	14	0	0	0	3780	0
	ETC	2	0	0	0	0	0	0	0	0
chrome (29381/ 3861)	[TOTAL]	452	519	121	82	0	0	0	68352	9000
	STACK	25	160	0	0	0	0	0	356	0
	SHM	27	32	8	4	0	0	0	8	9000
	HEAP	260	119	62	62	0	0	0	64052	0
	FILE	138	208	51	16	0	0	0	3936	0
	ETC	2	0	0	0	0	0	0	0	0

Real-time analysis

- System statistics in report

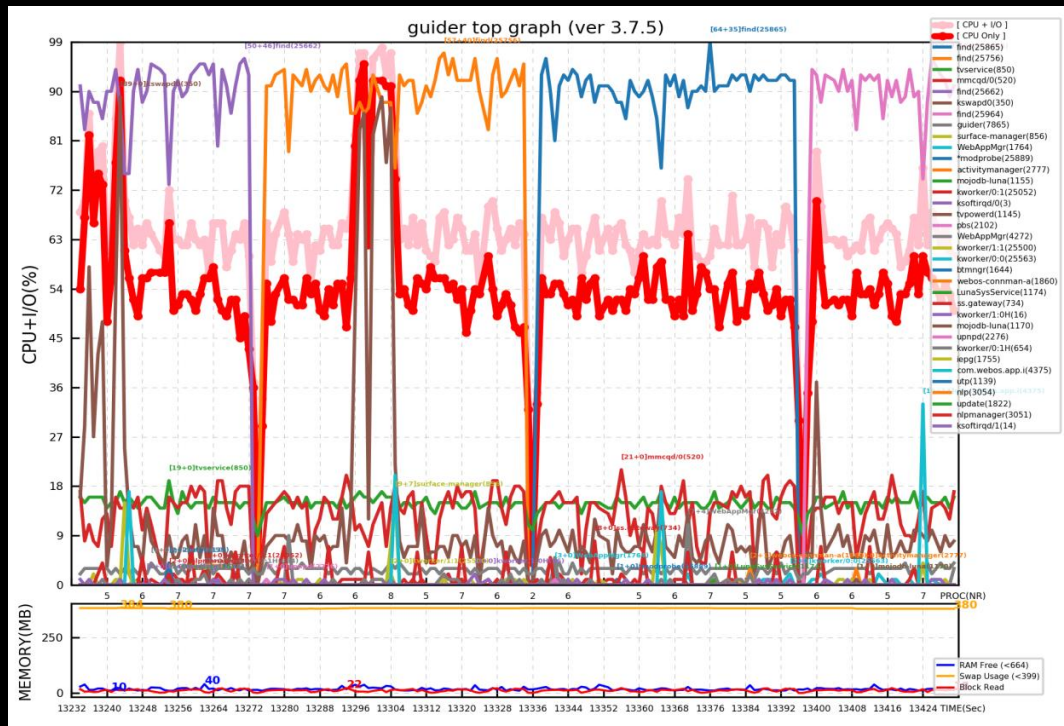
```
********************************************************** Detailed Statistics **********************************************************

[Top Info] [Time: 14722.250] [Interval: 1.0] [Ctxt: 9270] [Fork: 0] [IRQ: 6000] [Core: 4] [Task: 211/872] [RAM: 3000] [Swap: 599] [Unit: %/MB]
=================================================================================================================================================
  ID   | CPU (Usr/Ker/Blk/IRQ)| Mem (Free/Anon/File/Slab)| Swap (Used/ InOut )| Reclaim  | BlkRW | NrFlt | NrBlk | NrSIRQ  | NrMlk | NrDrt  |   NetIO    |
-------------------------------------------------------------------------------------------------------------------------------------------------
Total  | 16 %(12 / 4 / 0 / 0 )| 500 ( -1 / 0  / -1 / 0  )|  0   ( 0  /  0/0  )|   0/0    |  0/0  |   0   |   0   |   894   |   3   |   8    |   2K/2K    |
=================================================================================================================================================
    Process      ( ID  / Pid / Nr / Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    SignalHandler    |
-------------------------------------------------------------------------------------------------------------------------------------------------
 surface-manager ( 1380/    1/  23/C  0)|  18( 17/  1/  5)|  563(243/  0/141/  0)|   0(   -/   -/    0)|   52|   189| 256|  4: 5:20|      18001c4e8      |
         chrome (29381/ 3861/  25/C  0)|  16( 15/  1/  1)|  520(121/  0/ 56/  0)|   0(   -/   -/    0)|   79|    51| 256|  0: 0:21|      18000c4e8      |
       tvservice ( 1378/    1/ 140/C  0)|   6(  1/  5/  -)| 1109( 41/ 20/ 22/  0)|   0(   -/   -/    0)|    0|     0| 512|  4: 5:20|      180018eee      |
      qml-runner ( 1487/ 1448/  13/C  0)|   5(  0/  5/  0)|  202( 43/  0/ 31/  0)|   0(   -/   -/    0)|  104|     4|  32|  4: 5:11|      1800184e8      |
         guider ( 3994/    1/   1/C  0)|   3(  3/  0/  0)|   30( 25/  0/  1/  0)|   0(   -/   -/    0)|    1|    34| 512|  4: 4:10|      1800084ee      |
         chrome (29422/ 3861/  10/C  0)|   1(  1/  0/  0)|  347( 80/  0/ 34/  0)|   0(   -/   -/    0)|   67|     8| 256|  0: 0:13|      18000c4e8      |
-------------------------------------------------------------------------------------------------------------------------------------------------

[Top Info] [Time: 14721.210] [Interval: 1.0] [Ctxt: 9178] [Fork: 3] [IRQ: 6166] [Core: 4] [Task: 211/872] [RAM: 3000] [Swap: 599] [Unit: %/MB]
=================================================================================================================================================
  ID   | CPU (Usr/Ker/Blk/IRQ)| Mem (Free/Anon/File/Slab)| Swap (Used/ InOut )| Reclaim  | BlkRW | NrFlt | NrBlk | NrSIRQ  | NrMlk | NrDrt  |   NetIO    |
-------------------------------------------------------------------------------------------------------------------------------------------------
Total  | 45 %(36 / 9 / 0 / 0 )| 500 ( -5 / 4  / 0  / 0  )|  0   ( 0  /  0/0  )|   0/0    |  0/0  |   0   |   0   |   985   |   3   |   8    |   8K/4K    |
=================================================================================================================================================
    Process      ( ID  / Pid / Nr / Pri)| CPU(Usr/Ker/Dly)|  Mem(RSS/Txt/Shr/Swp)| Blk( RD / WR /NrFlt)| Yld | Prmt | FD | LifeTime|    SignalHandler    |
-------------------------------------------------------------------------------------------------------------------------------------------------
         chrome (29422/ 3861/  10/C  0)|  86( 86/  0/  3)|  347( 80/  0/ 34/  0)|   0(   -/   -/    0)|   14|   491| 256|  0: 0:12|      18000c4e8      |
 surface-manager ( 1380/    1/  23/C  0)|  19( 10/  9/  3)|  563(243/  0/141/  0)|   0(   -/   -/    0)|  102|   191| 256|  4: 5:19|      18001c4e8      |
         chrome (29381/ 3861/  25/C  0)|  17( 12/  5/  3)|  520(121/  0/ 56/  0)|   0(   -/   -/    0)|   74|    22| 256|  0: 0:20|      18000c4e8      |
      qml-runner ( 1487/ 1448/  13/C  0)|   5(  0/  5/  0)|  202( 43/  0/ 31/  0)|   0(   -/   -/    0)|   78|   105|  32|  4: 5:10|      1800184e8      |
       tvservice ( 1378/    1/ 140/C  0)|   5(  2/  3/  -)| 1109( 41/ 20/ 22/  0)|   0(   -/   -/    0)|    0|     0| 512|  4: 5:19|      180018eee      |
         guider ( 3994/    1/   1/C  0)|   4(  4/  0/  0)|   30( 25/  0/  1/  0)|   0(   -/   -/    0)|    1|    64| 512|  4: 4: 9|      1800084ee      |
         chrome ( 3861/ 1450/  38/C  0)|   1(  1/  0/  0)|  523(146/  0/110/  0)|   0(   -/   -/    0)|    7|     2| 256|  4: 4:26|      18001c4eb      |
-------------------------------------------------------------------------------------------------------------------------------------------------
```

Real-time analysis

- Show system graph and memory chart

  $ guider top -e g -I guider.out

  View guider_graph.png

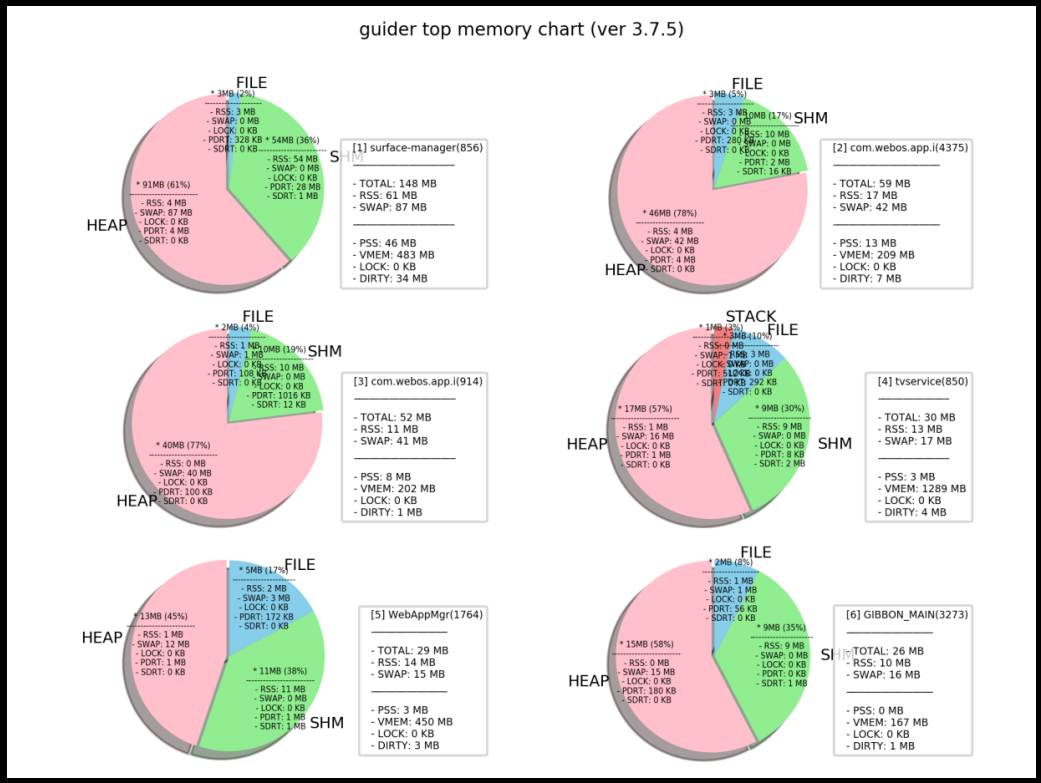


Real-time analysis

- Show system graph and memory chart

  $ guider top -e g -I guider.out

  View guider_chart.png



Real-time analysis

- Restrictions
  - It is possible that statistics of some process is loss
    - Because sampling rate of real-time mode is bigger than 1 second
  - Sampling rate that is shorter than 1 second is not supported
  - Python matplotlib is required to draw graph and chart

Contents

- A system-wide performance analyzer
  - thread analysis
  - function analysis
  - real-time analysis
  - file analysis
- Open-source contribution
  - https://github.com/iipeace/guider

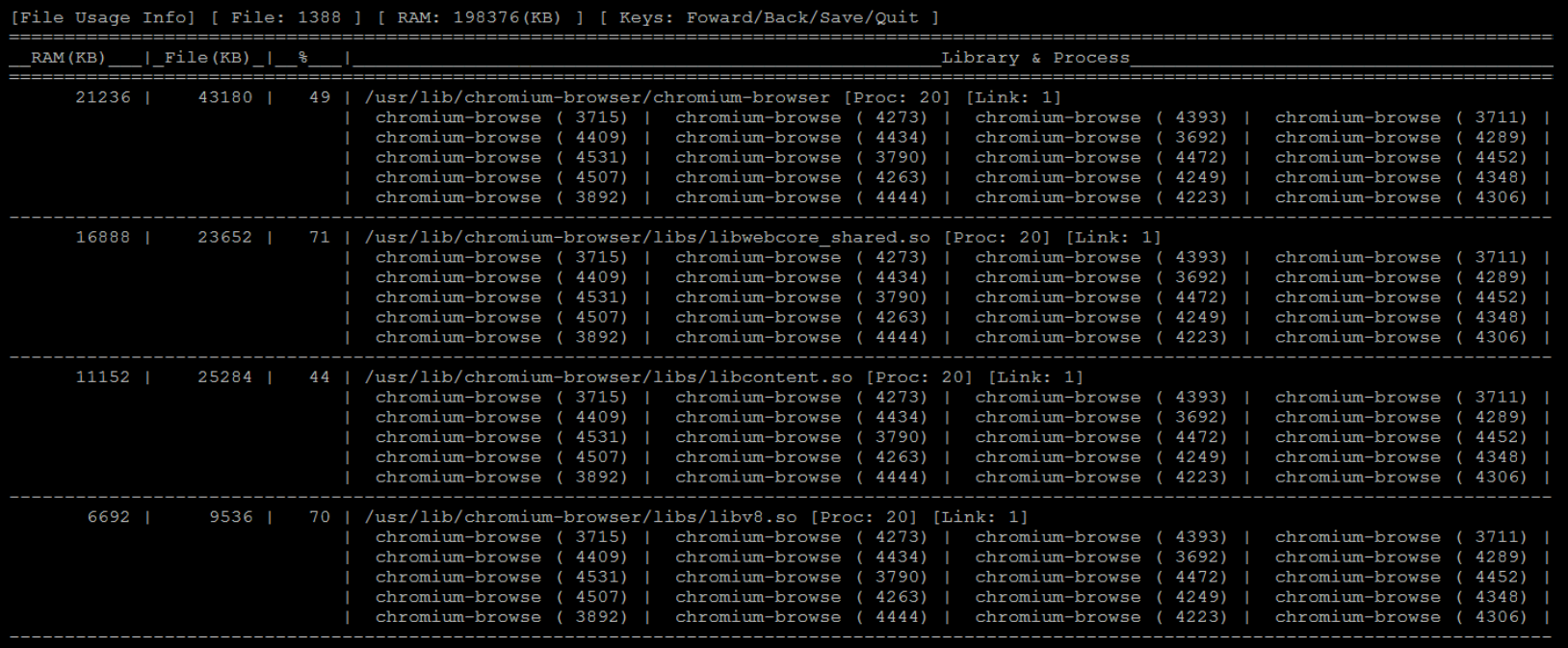
File analysis

- Show usage of files mapped to processes

  # guider record -F -o ./

  -F: File mode

  -o ./: Save report file in current directory



File analysis

- Show usage of files mapped to processes

```
# guider record -F -o ./ -i -u
# guider send
# guider send
# guider stop
View guider.out
```

Run in background

Show diff of files

Save report file in current directory

File mode

Get diff of files between previous and current

Total file size

Initial on-RAM file size

diff on-RAM file size

last on-RAM file size

```
[File Usage Info] [ File: 1388 ] [ LastRAM: 128164(KB) ] [ Keys: Foward/Back/Save/Quit ]
=============================================================================================================================
InitRAM(KB)|File(KB)|_%_|______1______|______2______|LastRAM(KB)|_%_|_____________________________Library_____________________
=============================================================================================================================
      23240 |   43180 | 53|+     0/-  14824|+ 34764/-     0|      43180|100| /usr/lib/chromium-browser/chromium-browser
      18608 |   23652 | 78|+     0/-   9356|+     0/-     0|      18608| 78| /usr/lib/chromium-browser/libs/libwebcore_shared.so
      12560 |   25284 | 49|+     0/-   8396|+     0/-     0|      12560| 49| /usr/lib/chromium-browser/libs/libcontent.so
       7056 |    9536 | 73|+     0/-   1888|+     0/-     0|       7056| 73| /usr/lib/chromium-browser/libs/libv8.so
       5616 |    8548 | 65|+     0/-   4556|+     0/-     0|       5616| 65| /usr/lib/chromium-browser/libs/libmodules.so
       3744 |    5696 | 65|+     0/-   2144|+     0/-     0|       3744| 65| /usr/lib/chromium-browser/libs/libblink_platform.so
       3676 |    5868 | 62|+     0/-   1756|+     0/-     0|       3676| 62| /usr/lib/chromium-browser/libs/libnet.so
```

Commands

- $ guider -h -a

```
[examples]
        [thread mode]
                - record cpu usage of threads
                        # ./guider.py record -s .
                - record all resource usage of threads i
                        # ./guider.py record -s . -e mbi
                - record all resource usage excluding cp
                        # ./guider.py record -s . -e mbi
                - record specific systemcalls of specifi
                        # ./guider.py record -s . -t sys
                - record specific user function events
                        # ./guider.py record -s . -U evt
                - record specific kernel function events
                        # ./guider.py record -s . -K evt1:func1,evt2:0x1234
                - record specific kernel function events with register values
                        # ./guider.py record -s . -K evt1:func1:%bp/u32.%sp/s64,evt2:0x1234:$stack:NONE
[file mode]
        - record memory usage of mapped files to the specific file
                # ./guider.py record -F -o .
        - record memory usage of mapped files and compare each intervals
                # ./guider.py record -F -i

[etc]
        - view page property of specific pages
                # ./guider.py view -g 1234 -I 0x7abc1234-0x7abc67
        - convert text to image
                # ./guider.py guider.out -L
        - wait for signal
                # ./guider.py record|top -W
        - show running guider processes
                # ./guider.py list
        - send event signal to guider processes
                # ./guider.py send
        - send stop signal to guider processes
                # ./guider.py stop
        - send some signal to specific processes
                # ./guider.py send -9 1234, 4567
```

```
[top mode]
        - show real-time resource usage of processes
                # ./guider.py top
        - show real-time file usage of processes
                # ./guider.py top -ef
        - show real-time resource usage of processes by sorting memory
                # ./guider.py top -S m
        - show real-time resource usage including disk of threads per 2 sec interval
                # ./guider.py top -e td -i 2 -a
        - show real-time resource usage of specific processes/threads involved in specific process group
                # ./guider.py top -g 1234,4567 -P
        - record resource usage of processes to the specific file in background
                # ./guider.py top -o . -u
        - record and report system status to the specific file in background
                # ./guider.py top -o . -e r -j . -u
        - record and save system status to the specific file if some events occur
                # ./guider.py top -o . -e r -e f
        - record and report system status to the specific image
                # ./guider.py top -o . -e r -e f
        - convert a analysis text to a graph image
                # ./guider.py top -I guider.out -e g
        - report system status to the specific server
                # ./guider.py top -n 192.168.0.5:5555
        - report system status to the specific server if some events occur
                # ./guider.py top -er -N REPORT_ALWAYS@192.168.0.5:5555
        - record and send analysis output to specific clients that asked dyanmic request
                # ./guider.py top -x 5555
        - receive and print analysis output from client
                # ./guider.py top -x 5555 -X
        - set event configuration file
                # ./guider.py top -I guider.json
```

```
eturn value
::*string,evt2:0x1234:NONE:**string
e information

 of specific threads
```

```
[function mode]
        - record cpu usage of functions in all threads
                # ./guider.py record -f -s .
        - record specific events of only kernel functions in all threads
                # ./guider.py record -f -s . -d u -c sched/sched_switch
        - record all usage of functions in specific threads
                # ./guider.py record -f -s . -e mbh -g 1234
        - analize record data by expressing all possible information
                # ./guider.py guider.dat -o . -r /home/target/root -l $(which arm-addr2line) -a
        - record specific kernel functions in a specific thread
                # ./guider.py record -f -s . -e g -c SyS_read -g 1234
        - record segmentation fault event in all threads
                # ./guider.py record -f -s . -K segflt:bad_area -ep
        - record blocking event without cpu usage in all threads
                # ./guider.py record -f -s . -dc -K block:schedule
```

Thanks ☺

https://github.com/iipeace/guider