COLLABORATE17
TECHNOLOGY AND APPLICATIONS FORUM FOR THE ORACLE COMMUNITY

Free Oracle Performance Tools

Solving Performance Problems on a Shoestring

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@PerlDBA

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IOUG OAUG Quest #C17LV

About Me

- Jared Still
  - jkstill@gmail.com
- Principal Consultant @Pythian
- Oracle DBA since 1994
- Oak Table Member
- Oracle ACE
- Known to dabble in Perl
- Claim to fame: started Oracle-L

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Free Tools
with some overlap of definitions…

- Profiling 10046 Trace Files
- Displaying 10053 Trace Files
- SQL Tuning
- Diagnostic Tools
- Monitors
- Nearly Empty Slides…
  - Many tools I know of but not yet tried
  - Included here for reference

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10046 Profilers

Perl Profiler – Millsap and Holt

- From Optimizing Oracle Performance, page 96
  - Jeff Holt and Cary Millsap
  - O'Reilly Media 2004
  - Buy the book!
- Perl script to profile 10046 trace
  - Works on filtered data, eg. a single cursor
  - see comments and example
- (modified for later Oracle versions)

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```
# Copyright (c) 1999-2003 by Hotsos Enterprises, Ltd. All rights reserved.
# partial script shown
while (<>) {
   if (/^WAIT #(\d+): nam='([^']*)' ela=\s*(\d+)/i) {
      $ela{$2} += $3;
      $sum_ela += $3;
   } elsif (/^$action #(\d+):c=(\d+),e=(\d+)/i) {
      $ela{"total CPU"} += $2;
   }
   $r += $3;
   if (!defined $cid) {
      $cid = $1;
   } else {
      die "can't mix data across cursor ids $cid and $1" if $1 != $cid;
   }
}

$ela{"unaccounted-for"} = $r - ($ela{"total CPU"} + $sum_ela);

printf "%9s %6s %-40s\n", "Duration", "Pct", "Oracle kernel event";
printf "%8s- %5s- %-40s\n", "-"x8, "-"x5, "-"x40;
printf "%8.2fs %5.1f%% %-40s\n", $ela{$_}/$ticsPerSec, $ela{$_}/$r*100, $_ for sort { $ela{$b} <=>
$ela{$a} } keys %ela;
printf "%8s- %5s- %-40s\n", "-"x8, "-"x5, "-"x40;
printf "%8.2fs %5.1f%% %-40s\n", $r/$ticsPerSec, 100, "Total response time";
```


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- Find cursor of interest:

```
grep -A5 PARSING js122a1_ora_9447_10046-test.trc

…
PARSING IN CURSOR #140393346266296 len=44 dep=0 uid=104 oct=3 lid=104
tim=2887502430839 hv=3071810026 ad='62696560' sqlid='5kzhan6vjh6ga'
select *
from ora54_test
where owner = 'SYS'
END OF STMT
PARSE
#140393346266296:c=10000,e=56347,p=10,cr=119,cu=0,mis=1,r=0,dep=0,og=1,plh
=933114381,tim=2887502430829
…
```


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- Filter and profile
  - profiler-1.pl

```
grep -E \
'FETCH #140393346266296|PARSING IN CURSOR
#140393346266296.*5kzhan6vjh6ga|WAIT #140393346266296'
js122a1_ora_9447_10046-test.trc \
 | ./profiler-1.pl

 Duration    Pct Oracle kernel event
--------- ------ ----------------------------------------
    6.01s  91.5% SQL*Net message from client
    0.28s   4.3% unaccounted-for
    0.21s   3.2% db file scattered read
    0.03s   0.5% total CPU
    0.01s   0.2% KSV master wait
    0.01s   0.2% gc cr multi block request
    0.00s   0.0% library cache pin
    0.00s   0.0% row cache lock
    0.00s   0.0% db file sequential read
    0.00s   0.0% library cache lock
    0.00s   0.0% SQL*Net message to client
    0.00s   0.0% ASM file metadata operation
    0.00s   0.0% SQL*Net more data to client
    0.00s   0.0% Disk file operations I/O
--------- ------ ----------------------------------------
    6.57s 100.0% Total response time
```


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Perl Profiler - Millsap (new)

- Perl script to profile 10046 trace
  - Aggregates all events in file
  - see comments and example
- (modified for later Oracle versions)

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```
# partial script shown – entire calculation portion
sub betweener($) {
    my ($nam) = @_;
    # Return true iff $nam is a between-call event.
    return 1 if $nam eq 'SQL*Net message from client';
    return 1 if $nam eq 'SQL*Net message to client';
    return 1 if $nam eq 'single-task message';
    return;
}
while (<>) {
    if (/^WAIT #(\d+): nam='([^']*)' ela=\s*(\d+)/i) {
        $ela{$2} += $3;
        $n{$2}++;
        $sum_ela += $3;
        $sum_ela_between += $3 if betweener($2);
    }
    elsif (/^$action #(\d+):c=(\d+),e=(\d+),.*dep=0/i) {
        $sum_c_dep0 += $2;
        $sum_e_dep0 += $3;
        $n{"CPU service"}++;
    }
}
my $R = $sum_e_dep0 + $sum_ela_between;
$ela{"unaccounted-for"} = $R - ($sum_c_dep0 + $sum_ela);
$n{"unaccounted-for"} = 1;
$ela{"CPU service"} = $sum_c_dep0;
```


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- profiler-2.pl

```
profiler-2.pl js122a1_ora_9447_10046-test.trc

Response Time Component                    Duration     Pct    # Calls      Dur/Call
----------------------------------------  ---------  ------  ---------  ------------
SQL*Net message from client                   6.01s   94.2%        424     0.014185s
db file scattered read                        0.21s    3.3%         28     0.007625s
unaccounted-for                               0.05s    0.7%          1     0.047083s
CPU service                                   0.04s    0.7%        427     0.000098s
db file sequential read                       0.03s    0.5%         11     0.002902s
KSV master wait                               0.01s    0.2%          2     0.007016s
gc cr multi block request                     0.01s    0.2%         23     0.000538s
library cache pin                             0.00s    0.0%          2     0.001457s
row cache lock                                0.00s    0.0%         19     0.000145s
gc cr grant 2-way                             0.00s    0.0%          3     0.000301s
library cache lock                            0.00s    0.0%          2     0.000268s
SQL*Net message to client                     0.00s    0.0%        424     0.000001s
ASM file metadata operation                   0.00s    0.0%          1     0.000087s
SQL*Net more data to client                   0.00s    0.0%          1     0.000086s
Disk file operations I/O                      0.00s    0.0%          1     0.000002s
----------------------------------------  ---------  ------  ---------  ------------
Total response time                           6.38s  100.0%
```


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10046_events.pl

- Clive Bostock
  - https://sites.google.com/site/oraclemonitor/10046-pl
- Portable Perl script to profile 10046 trace
  - Too big to show here – provides different level of detail.
  - Paste it into a window and go to work
- DB install required: No

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```
./10046_events.pl -t ../tracefile-identifier/trace/js122a1_ora_9447_10046-test.trc

EVENT AGGREGATES
================

Wait Event                                      Count        Elapsed (ms)     Avg Ela (ms)  %Total
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ ~~~~~~~~~~~~ ~~~~~~~~~~~~~     ~~~~~~~~~~~~~  ~~~~~~
                  SQL*Net message from client          424         6014                14   95.57
                       db file scattered read           28          213                 7    3.39
                      db file sequential read           11           31                 2    0.51
                               KSV master wait           2           14                 7    0.22
                    gc cr multi block request           23           12                 0    0.20
                            library cache pin            2            2                 1    0.05
                               row cache lock           19            2                 0    0.04
                            gc cr grant 2-way            3            0                 0    0.01
                           library cache lock            2            0                 0    0.01
                    SQL*Net message to client          424            0                 0    0.01
                  ASM file metadata operation            1            0                 0    0.00
                  SQL*Net more data to client            1            0                 0    0.00
                     Disk file operations I/O            1            0                 0    0.00
                                                                ~~~~~~~~~~~~~
                                         Total Elapsed:          6293
```


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```
EVENT AGGREGATE BREAKDOWN
=========================

Object Id          : Wait Event                                      Count        Tot Ela (ms) %Total Avg Ela (ms)
~~~~~~~~~~~~~~~~~~ : ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ ~~~~~~~~~~~~ ~~~~~~~~~~~~ ~~~~~~ ~~~~~~~~~~~~
95165              : SQL*Net message from client                            423         6014  95.56           14
95165              : db file scattered read                                 28          213   3.39            7
18                 : db file sequential read                                 1           15   0.24           15
95165              : KSV master wait                                         2           14   0.22            7
14                 : db file sequential read                                 1           12   0.20           12
95165              : gc cr multi block request                              23           12   0.20            0
8694               : library cache pin                                       2            2   0.05            1
8694               : row cache lock                                         19            2   0.04            0
3                  : db file sequential read                                 1            1   0.02            1
95165              : db file sequential read                                 1            0   0.01            0
8694               : library cache lock                                      2            0   0.01            0
8694               : SQL*Net message from client                             1            0   0.01            0
57                 : gc cr grant 2-way                                       1            0   0.01            0
95165              : SQL*Net message to client                             422            0   0.01            0
...
```


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```
EVENT HISTOGRAM BREAKDOWN (Edited to fit the page)
==========================

This section splits the event counts into elapsed time
buckets so that we can see if there are any suspicious
or anomalous response time / frequency patterns.

Object Id          : Wait Event                                    <1ms    <2ms    <4ms    <8ms    <512ms  >=1024ms
~~~~~~~~~~~~~~~~~~ : ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ ~~~~~~~ ~~~~~~~ ~~~~~~~ ~~~~~~~ ~~~~~~~ ~~~~~~~~
95165              : SQL*Net message from client                          0       1       0       0       0        0
95165              : db file scattered read                             31       0       0       1       0        0
18                 : db file sequential read                             0       0       0       0       0        0
95165              : KSV master wait                                     1       0       0       0       0        0
14                 : db file sequential read                             0       0       0       0       0        0
95165              : gc cr multi block request                          45       0       0       0       0        0
8694               : library cache pin                                   2       0       1       0       0        0
8694               : row cache lock                                     37       0       0       0       0        0
3                  : db file sequential read                             0       1       0       0       0        0
95165              : db file sequential read                             1       0       0       0       0        0
8694               : library cache lock                                  3       0       0       0       0        0
8694               : SQL*Net message from client                         1       0       0       0       0        0
57                 : gc cr grant 2-way                                   1       0       0       0       0        0
95165              : SQL*Net message to client                         843       0       0       0       0        0
57                 : db file sequential read                             1       0       0       0       0        0
31                 : db file sequential read                             1       0       0       0       0        0
70                 : db file sequential read                             1       0       0       0       0        0
...
```


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tvdxtat

- Christian Atognini
- As seen in Troubleshooting Oracle Performance 2nd Edition
  - http://antognini.ch/category/apmtools/tvdxtat/
  - http://antognini.ch/downloads/top2/chapter03/tvdxtat_40beta10_20140630.zip
- DB install required: No
- Reports are ***very*** detailed

```
./tvdxtat.sh -r 12 -t text.xsl  -i js122a1_ora_9447_10046-test.trc  -o tvdstat-report.txt
```

- Report too large to reproduce here
  - See tvdxstat-report.txt

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OraSRP

- Egor Starostin
  - http://oracledba.ru/orasrp/
- Well known 10046 profiler
  - Linux, Windows and Mac OS X
- DB install required: No

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OraSRP

- Example Usage

```
orasrp --google-charts js122a1_ora_14809_SQLRUN-20170001185254.trc
js122a1_ora_14809_SQLRUN-20170001185254.html

orasrp --google-charts js122a1_ora_9447_10046-test.trc js122a1_ora_9447_10046-
test.html
```

- See example reports

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10053 Viewers

10053 TreeViewer

- Hans-Peter Sloot
- Robert van der Erde
  - http://www.oaktable.net/contribute/10053-viewer
  - http://www.oaktable.net/sites/default/files/new_treeview.zip.doc

- Tested with a 12.1.0.2 10053 trace

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10053 TreeViewer

10053 TreeViewer v0.1 10g

C:\Users\jkstill\Documents\Presentations\Free-Oracle-Performance-Tools\ | Open trace file | Registered qb: SEL$1 0x392c1098 (PARSER)|26 | Show trace file

```
QUERY BLOCK SIGNATURE
----- Current SQL Statement for this session (sql_id=5kzhan6vjh6ga) -----
  select *
  from ora54_test
  where owner = 'SYS'
Legend
PARAMETERS USED BY THE OPTIMIZER
  PARAMETERS WITH ALTERED VALUES
  Compilation Environment Dump
  sqlstat_enabled                     = true
  statistics_level                    = all
  parallel_max_degree                 = 4
  total_processor_group_count         = 2
  Bug Fix Control Environment
  PARAMETERS WITH DEFAULT VALUES
  PARAMETERS IN OPT_PARAM HINT
Considering Query Transformations on query block SEL$1 (#0)
  Query transformations (QT)
  JF: Checking validity of join factorization for query block SEL$1 (#0)
  JF: Bypassed: not a UNION or UNION-ALL query block.
  ST: not valid since star transformation parameter is FALSE
  TE: Checking validity of table expansion for query block SEL$1 (#0)
  TE: Bypassed: No partitioned table in query block.
  VT: Initial VT validity check for query block SEL$1 (#0)
  VT: Bypassed: inmemory is disabled.
  CBQT bypassed for query block SEL$1 (#0): no complex view, sub-queries or UNION (ALL) queries.
  CBQT: Validity checks failed for 5kzhan6vjh6ga.
  CSE: Considering common sub-expression elimination in query block SEL$1 (#0)
  Common Subexpression elimination (CSE)
Considering Query Transformations on query block SEL$1 (#0)
Peeked values of the binds in SQL statement
Final query after transformations:******* UNPARSED QUERY IS *******
QUERY BLOCK SIGNATURE
SYSTEM STATISTICS INFORMATION
BASE STATISTICAL INFORMATION
OPTIMIZER STATISTICS AND COMPUTATIONS
----- Current SQL Statement for this session (sql_id=5kzhan6vjh6ga) -----
----- Explain Plan Dump -----
Content of other_xml column
Optimizer state dump:
```

RvdE & HGS 25/02/2010

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10053 TreeViewer

10053 TreeViewer v0.1 10g

C:\Users\jkstill\Documents\Presentations\IOUG\Free-Oracle-Performance- | Open trace file | Registered qb: SEL$1 0x392c1098 (PARSER)|26 | Show trace file

```
SYSTEM STATISTICS INFORMATION
BASE STATISTICAL INFORMATION
Table Stats::
  Table: ORA54_TEST  Alias: ORA54_TEST
  #Rows: 91245  SSZ: 0  LGR: 0  #Blks:  1629  AvgRowLen:  120.00  NEB: 0  ChainCnt:  0.00  SPC: 0  RFL: 0  RNF: 0  CBK: 0  CHR: 0
  #IMCUs: 0  IMCRowCnt: 0  IMCJournalRowCnt: 0  #IMCBlocks: 0  IMCQuotient: 0.000000
Index Stats::
  Index: ORA54_TEST_PK  Col#: 1
  LVLS: 1  #LB: 190  #DK: 91245  LB/K: 1.00  DB/K: 1.00  CLUF: 1595.00  NRW: 91245.00 SSZ: 0.00 LGR: 0.00 CBK: 0.00 GQL: 0.00 CHR:
  KKEISFLG: 1
=====================================
SPD: BEGIN context at query block level
=====================================
Query Block SEL$1 (#0)
Return code in qosdSetupDirCtx4QB: NOCTX
=====================================
SPD: END context at query block level
=====================================
Access path analysis for ORA54_TEST
SINGLE TABLE ACCESS PATH
  Single Table Cardinality Estimation for ORA54_TEST[ORA54_TEST]
  SPD: Return code in qosdDSDirSetup: NOCTX, estType = TABLE
  Column (#2): OWNER(VARCHAR2)
    AvgLen: 6 NDV: 25 Nulls: 0 Density: 0.040000
  Table: ORA54_TEST  Alias: ORA54_TEST
    Card: Original: 91245.000000  Rounded: 3650  Computed: 3649.800000  Non Adjusted: 3649.800000
  Scan IO  Cost (Disk) =   443.000000
  Scan CPU Cost (Disk) =   28353475.760000
  Total Scan IO  Cost  =   443.000000 (scan (Disk))
                         + 0.000000 (io filter eval) (= 0.000000 (per row) * 91245.000000 (#rows))
                       =   443.000000
  Total Scan CPU  Cost =   28353475.760000 (scan (Disk))
                         + 4562250.000000 (cpu filter eval) (= 50.000000 (per row) * 91245.000000 (#rows))
                       =   32915725.760000
  Access Path: TableScan
    Cost:  444.223599  Resp: 444.223599  Degree: 0
      Cost_io: 443.000000  Cost_cpu: 32915726
      Resp_io: 443.000000  Resp_cpu: 32915726
  Best:: AccessPath: TableScan
         Cost: 444.223599  Degree: 1  Resp: 444.223599  Card: 3649.800000  Bytes: 0.000000


OPTIMIZER STATISTICS AND COMPUTATIONS
----- Current SQL Statement for this session (sql_id=5kzhan6vjh6qa) -----
```

RvdE & HGS 25/02/2010

COLI TECHNOLOGY FOR THE ORA

SQL Tuning

SQLTXPLAIN

- Oracle Note 215187.1
- Carlos Sierra
  - http://carlos-sierra.net/
- DB install required: Yes
- Installation can require significant effort
  - Oracle recommends starting with SQLHC
  - Use SQLT if SQLHC insufficient

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SQLHC

- SQL Health Check
  - SQLT's little brother
- Oracle note 1366133.1
- DB install required: No

- Execution:
  - @sqlhc T <SQL_ID>
- Example Report
  - @sqlhc T dwph5wy8fpbk8
- See SQL-Tuning/sqlhc reports *(main page only)*

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SQLd360

- Mauro Pagano
- Blog: https://mauro-pagano.com/2015/02/16/sqld360-sql-diagnostics-collection-made-faster/
- Github: https://github.com/mauropagano/sqld360/
- DB Install: No
- Extracts all info required for offline SQL analysis
- Execution
  - @sqld360.sql SQL_ID T
- Example Report
  - @sqld360 dwph5wy8fpbk8 T
  - See SQL-Tuning/sqld360 reports *(main page only)*

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eDB360

- Carlos Sierra
- Blog: https://carlos-sierra.net/2014/07/27/edb360/
- Github: https://github.com/carlos-sierra/edb360
- DB install required: No
- Read the docs
  - It can take some time to run (hours for large databases)
  - Comprehensively documents everything about the database
- Execution
  - @edb360 T NULL
  - Runtime: 14.75 Hours – Two node 12c RAC on Virtual Box
    - 4 PDBs
- Example Report
  - *See SQL-Tuning/edb360 reports (main page only)*

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Monitors

Snapper

- Who hasn't heard of Snapper?
- Tanel Poder
- Snapper 3
  - 9.2 Oracle, no RAC
  - http://blog.tanelpoder.com/files/scripts/snapper3.sql
- Snapper 4
  - 10.1+ and RAC
  - http://blog.tanelpoder.com/files/scripts/snapper4.sql
  - DB install required: No

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Snapper - Sample output

```
SQL> @snapper ash=sql_id+event+wait_class 5 1 all
Sampling SID all with interval 5 seconds, taking 1 snapshots...

-- Session Snapper v4.12 BETA - by Tanel Poder ( http://blog.tanelpoder.com ) -
Enjoy the Most Advanced Oracle Troubleshooting Script on the Planet! :)



-----------------------------------------------------------------------------
Active% | SQL_ID          | EVENT                                | WAIT_CLASS
-----------------------------------------------------------------------------
     4% |                 | control file sequential read         | System I/O

--  End of ASH snap 1, end=2017-02-03 11:58:29, seconds=5, samples_taken=45
```


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Snapper - Sample filtered output

```
SQL> @snapper ash 300 1 "select inst_id,sid from gv$session where status = 'ACTIVE' and
state = 'WAITING' and type = 'USER'"

-- Session Snapper v4.12 BETA - by Tanel Poder ( http://blog.tanelpoder.com ) - Enjoy the
Most Advanced Oracle Troubleshooting Script on the Planet! :)


-----------------------------------------------------------------------------------------
--------Active% | INST | SQL_ID          | SQL_CHILD | EVENT
| WAIT_CLASS
-----------------------------------------------------------------------------------------
--------
    99% |    2 | 6avfua5g1gkh2   | 0         | SQL*Net more data to client         |
Network
     0% |    2 |                 |           | library cache lock                  |
Concurrency
     0% |    2 | 6avfua5g1gkh2   | 0         | SQL*Net message to client           |
Network
     0% |    2 | 6avfua5g1gkh2   | 0         | ON CPU                              | ON
CPU


--  End of ASH snap 1, end=2017-02-03 11:23:33, seconds=300, samples_taken=298
```


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Snapper – Example queries

```
@snapper ash 600 1 "select inst_id,sid from gv$session where status = 'ACTIVE'
and state = 'WAITING' and type = 'USER'"


-- 10 seconds snap - send output to trace file in USER_DUMP_DEST
@snapper4 all,trace 10 1 "select inst_id,sid from gv$session where status =
'ACTIVE' and type = 'USER'"


-- no trace, every 5 seconds, stats only
@snapper stats 5 1000 "select inst_id,sid from gv$session where status =
'ACTIVE' and state = 'WAITING' and type = 'USER'"


@snapper ash=sql_id+event+wait_class 5 1 "select inst_id,sid from gv$session
where status = 'ACTIVE' and state = 'WAITING' and type = 'USER'"
```


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MOATS

- Mother Of All Tuning Scripts
- Tanel Poder
- Adrian Billington
  - http://blog.tanelpoder.com/2011/03/29/moats-the-mother-of-all-tuning-scripts/
- DB install required: Yes

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MOATS 2.0 for RAC

- MOATS 2.0 (RAC-aware) by Sidney Chen:
  - Fork of MOATS
  - https://github.com/dbsid/moats_rac
- DB install required: Yes

- Command line
  - `SELECT /*+ no_monitor */* FROM TABLE(moats.top(2));`
  - Screenshot on next slide

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```
+ Database: JS122A   | Activity Statistics Per Second  | Interval: 2s    | Screen Window = 40 * 175 | Ash Height = 13 | SQL Height = 8  | Arraysize should be 80   +--------+
|Inst|CPU: idle%--usr%--sys%| Logons|   Execs|   Calls| Commits|  sParse|  hParse|  ccHits| LIOs(K)|   PhyRD|   PhyWR| READ MB|Write MB| Redo MB|Offload%| ExSI MB|ExFCHits|
|  1|        .0  63.3  31.6|      2|       2|     660|       0|       2|       0|       0|       4|       0|       0|       0|       0|       0|      .0|       0|       0|
|  2|       9.3  44.5  39.4|      2|       4|     649|       0|       2|       0|       1|       6|       0|       0|       0|       0|       0|      .0|       0|       0|
+-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------+
                    Total :       4;       6;    1308;       0;       4;       0;       1;       9;       0;       0;       0;       0;       0;       ;       0;       0;
                                                                                                  Active Session Graph
+   AAS| TOP|Instance| Top Events-----------------+ WAIT CLASS -+      15 | CPU:+ IO:* Others:@                                                                  | 15
|   4.0| 53%| inst(2)| ON CPU                    | ON CPU      |      14 |                                                                                      | 14
|   2.0| 27%| inst(2)| SQL*Net more data to client | Network     |      13 |                                                                                @     @ | 13
|   1.0| 13%| inst(1)| ON CPU                    | ON CPU      |      12 |                       @                                @  @ @       @     @ | 12
|   0.5|  7%| inst(1)| SQL*Net more data to client | Network     |      11 |                     @  @                               @ @@ @       @   @ @ | 11
+-------------------------------------------------------------+      10 |                     @  @      @  @                     @ @@ @   @@  @   @ + | 10
                                                                      9 |         @           @  @      +  @   @            @@ @ @ ++@+  @ @@  @   @ + | 9
                                                                      8 |         @     @  @  @@  +  @   +  @ @@ +   @  + @ @  @@@@@+@++@+  @ @@@@+   @ + @ | 8
                                                                      6 |         +@   +  +@  ++ @+  @@@ @+ @+ +@ ++ @@@  + +@+@ +@@++++++@+  @ +++@+@  @+ +@@ | 6
                                                                      5 |        @+@@@+ +  +++@++ @+@ +@+ ++@@+ ++ ++@@++@ + +++@ +++++++++++ @+ +++++@ @++ +@+ | 5
                                                                      4 |        ++@+++@+ ++++@++@+++@+++++++++@++++++++++ ++++++@++++++++++ ++@++++++@+++ +++ | 4
                                                                      3 |        ++++++@+++++++++++++++++++++++++++++++@++++++@++++++++++++++++++++++++ +++ | 3
                                                                      2 |        ++++++++++++++++++++++++++++++++++++++++@++++++++++++++++++++++++++++++++++ | 2
                                                                      1 | ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++ | 1
                                                                      0 +-------------------------------------------------------------------------------------+ 0
                                                                          ^ 12:42:07                    12:43:33 ^                            12:44:59 ^
+   AAS| TOP| SQL_ID -------+ 1st TOP Event(%) -----------------+ 2nd TOP Event(%) -----------------+ Inst_Cnt + TOP SESSIONS (sid@inst_id) ----------------------------+
|   6.5| 87%| 6avfua5g1gkh2 | ON CPU (62%)                    | SQL*Net more data to client (38%)  |       2 | 75@2,61@2,78@2,96@1,85@2,91@2,92@2,95@2                |
|   1.0| 13%| auyf8px9ywc6j | ON CPU (100%)                   |                                    |       1 | 90@1                                                    |
+-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------+
+ TOP SQL_ID ----+ PLAN_HASH_VALUE + SQL TEXT ---------------------------------------------------------------------------------------------------------------------------------+
| 6avfua5g1gkh2  | 2733869014      | select * from dba_objects                                                                                                                                                          |
+-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------+
```

AMON Oracle Monitor from Andrej Simon

- Binary only, but available for:
  - Linux
    - I have tested on OEL 5 and Ubuntu 16.10
  - AIX
  - HPUX
  - Solaris
  - OS X

- https://sites.google.com/site/freetoolamon/
  - Extensive documentation

- Sample screen shots follow

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AMON Screenshot

- Instance IO

```
   Host: ora12c102rac02  Instance: js122a2 (ID 2)  PDB: CDB$ROOT  User: SYS  Interval: 3 sec
Type h or hh for help or q to exit AMON
== Instance I/O statistics (V$SYSSTAT). ==

Ph. reads per sec.(1, 5, 15 min. ago): 1859.96, 0.00, 0.00
Ph. writes per sec.(1, 5, 15 min. ago): 3.00, 0.00, 0.00
Ph. bytes read per sec.(1, 5, 15 min. ago): 16.7MB, 47.2KB, 56.5KB
Ph. bytes written per sec.(1, 5, 15 min. ago): 40.0KB, 10.7KB, 10.1KB

Used CPU per sec.: 0.597 seconds
Redo writes per sec.: 0.7  Redo size per sec.: 2.7KB

Total blocks / bytes read and written per sec.: 1830.0 / 16.5MB
              Blocks/sec.  Cache/sec.     Direct/sec.    Bytes/sec.
     ph. read 1828.0       1828.0 (100%)  0.0 (0%)       16.4MB
  ph. written 2.0          2.0 (100%)     0.0 (0%)       32.7KB

Total logical blocks read per sec.: 3560.7
                Gets/sec.  Cache/sec.       Direct/sec.      Changes/sec.
     db blocks  5.3        5.3 (100%)       0.0 (0%)         5.0
  cons. blocks  3555.3     3555.3 (100%)    0.0 (0%)         0.0

lob reads/sec.: 0.0  lob writes/sec.: 0.0
```


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AMON Screenshot

- ASH

```
   Host: ora12c102rac02  Instance: js122a2 (ID 2)  PDB: CDB$ROOT  User: SYS  Interval: 3 sec
Toggle shown interval between default interval and 5 minutes(i)
== RAC Sampled session activity (GV$ACTIVE_SESSION_HISTORY). ==

ASH samples for the last 60 minutes. (Only every 10th sample is shown).

Sample   Inst Con Sess.  Sess.  Wait. Sampled sessions view.
Time     ID   ID  Count On CPU Sess. (Each letter represents one session.)
18:15:56 2    6   2     2      0     CC
18:15:56 1    6   4     4      0     CCCC
18:15:46 2    1   1     0      1     W
18:15:46 2    6   2     0      2     WW
18:15:46 1    6   6     4      2     CCCCWW
18:15:36 2    6   2     2      0     CC
18:15:36 1    6   6     6      0     CCCCCC
18:15:26 2    6   2     2      0     CC
18:15:26 1    6   6     6      0     CCCCCC
18:15:16 2    6   2     2      0     CC
18:15:16 1    6   6     6      0     CCCCCC
18:15:06 2    6   2     2      0     CC
18:15:06 1    6   6     6      0     CCCCCC
18:14:56 2    6   2     2      0     CC
18:14:56 1    6   6     2      4     CCWWWW
18:14:46 2    1   1     1      0     C
18:14:46 2    6   2     1      1     CW
18:14:46 1    6   6     5      1     CCCCCW
18:14:36 2    6   2     0      2     WW
18:14:36 1    6   6     2      4     CCWWWW
18:14:26 2    6   2     2      0     CC
18:14:26 1    6   6     5      1     CCCCCW
18:14:16 2    6   2     1      1     CW
18:14:16 1    6   6     6      0     CCCCCC
18:14:06 2    1   1     0      1     W
18:14:06 2    6   2     0      2     WW
18:14:06 1    6   6     3      3     CCCWWW
18:13:56 2    6   2     1      1     CW
18:13:56 1    1   1     1      0     C
18:13:56 1    6   6     3      3     CCCWWW
18:13:46 2    6   2     0      2     WW
18:13:46 1    1   1     1      0     C
18:13:46 1    6   6     6      0     CCCCCC
18:13:36 2    6   2     2      0     CC
18:13:36 1    6   6     4      2     CCCCWW
18:13:26 2    6   2     2      0     CC
18:13:26 1    6   6     6      0     CCCCCC
18:13:16 1    6   6     6      0     CCCCCC
18:13:15 2    6   2     0      2     WW
18:13:06 1    6   6     6      0     CCCCCC
18:13:05 2    6   2     0      2     WW
18:12:56 1    6   6     5      1     CCCCCW
18:12:55 2    1   1     0      1     W
18:12:55 2    6   2     0      2     WW
18:12:46 1    1   1     1      0     C
18:12:46 1    6   6     4      2     CCCCWW
18:12:45 2    6   2     2      0     CC
18:12:36 1    6   6     3      3     CCCWWW
18:12:35 2    6   2     2      0     CC
18:12:26 1    1   1     1      0     C
   * Session state: 'C'-on CPU, 'W'-waiting.
```


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AMON Screenshot

- Library Cache

```
  Host: ora12c102rac02  Instance: js122a2 (ID 2)  PDB: CDB$ROOT  User: SYS  Interval: 3 sec
Move page forward(f), page back(b), row down(j), row up(k)
== Library cache statistics (V$DB_OBJECT_CACHE). ==                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Page: 1/2

100 largest database objects from the library cache.

Alloc.   Owner Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Type    DB.   Kept Loads
Memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                Link
4.1MB            WITH MONITOR_DATA AS (SELECT INST_ID, KEY, NVL2(PX_QCSID, NULL, STATUS) STATUS, FIRST_REFRESH_TIME, LAST_REFRESH_TIME, REFRESH_.. CURSOR        NO  3
4.1MB            WITH MONITOR_DATA AS (SELECT INST_ID, KEY, NVL2(PX_QCSID, NULL, STATUS) STATUS, FIRST_REFRESH_TIME, LAST_REFRESH_TIME, REFRESH_.. CURSOR        NO  14
4.1MB            WITH MONITOR_DATA AS (SELECT INST_ID, KEY, NVL2(PX_QCSID, NULL, STATUS) STATUS, FIRST_REFRESH_TIME, LAST_REFRESH_TIME, REFRESH_.. CURSOR        NO  2
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  56
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  8
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  96
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  9
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  8
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  95
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  90
2.6MB            SELECT /*+ OPT_PARAM('_fix_control' '16391176:1') */ GROUP_TYPE, BUCKET_START, BUCKET_END, TM_GROUP_TYPE, TM_BUCKET_START, TM_B.. CURSOR        NO  8
2.4MB            SELECT AUDIT_OPTION_TYPE, COUNT(DISTINCT POLICY_NAME) POL_CNT FROM AUDIT_UNIFIED_POLICIES GROUP BY AUDIT_OPTION_TYPE              CURSOR        NO  2
1.8MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  4
1.8MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  9
1.8MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  8
1.8MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  3
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  3
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  6
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  6
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  7
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  10
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  9
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  6
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  4
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  1
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  5
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  13
1.7MB            SELECT T.CLIENT_ID,         T.OPERATION_ID,         T.TARGET_TYPE,         T.TARGET_NAME,         T.CURR_JOB_NAME,         TO_N.. CURSOR        NO  4
1.2MB            WITH binds as          (select :dbid                 as dbid                 , :inst_id_low          as instIdLow           .. CURSOR        NO  7
1.2MB            WITH binds as          (select :dbid                 as dbid                 , :inst_id_low          as instIdLow           .. CURSOR        NO  9
1.2MB            WITH binds as          (select :dbid                 as dbid                 , :inst_id_low          as instIdLow           .. CURSOR        NO  8
1.2MB            WITH binds as          (select :dbid                 as dbid                 , :inst_id_low          as instIdLow           .. CURSOR        NO  9
1.2MB            WITH binds as          (select :dbid                 as dbid                 , :inst_id_low          as instIdLow           .. CURSOR        NO  9
```


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AMON Screenshot

- Sessions

```
   Host: ora12c102rac02  Instance: js122a2 (ID 2)  PDB: CDB$ROOT  User: SYS  Interval: 3 sec
Toggle columns program(7), machine(8), service name(@)
== RAC session statistics window I (GV$SESSION). ==

All sessions: 123 (active: 119).  Top 3 instances by number of sessions ==>
 Inst.ID => Sessions (Active): 1 => 64 (61); 2 => 59 (58)

SID,Ser#    Con SPID  User    S Program                                CPU     Logical  Physical
Inst.       ID                                                         (sec.)  Reads    Reads
63,41575,2  6   29218 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.91    5172     874
88,57849,2  6   29216 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.90    5159     4443
88,3924,1   6   20827 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.28    2096     711
79,47954,1  6   20825 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.27    2052     153
93,55306,1  6   20823 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.28    2047     399
97,44783,1  6   20821 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.26    2017     368
95,36563,1  6   20831 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.28    2006     328
65,41514,1  6   20829 JKSTILL A perl@poirot.jks.com (TNS V1-V3)        0.27    1991     789
82,52768,1  0   17477         A oracle@ora12c102rac01.jks.com (W000)  0.00    19       11
80,38903,2  0   21127         A oracle@ora12c102rac02.jks.com (W001)  0.00    19       11
29,12450,2  0   32108         A oracle@ora12c102rac02.jks.com (MMON)  0.01    7        0
2,7342,1    0   8881          A oracle@ora12c102rac01.jks.com (PMON)  0.00    0        0
3,34569,1   0   8883          A oracle@ora12c102rac01.jks.com (PSP0)  0.00    0        0
```


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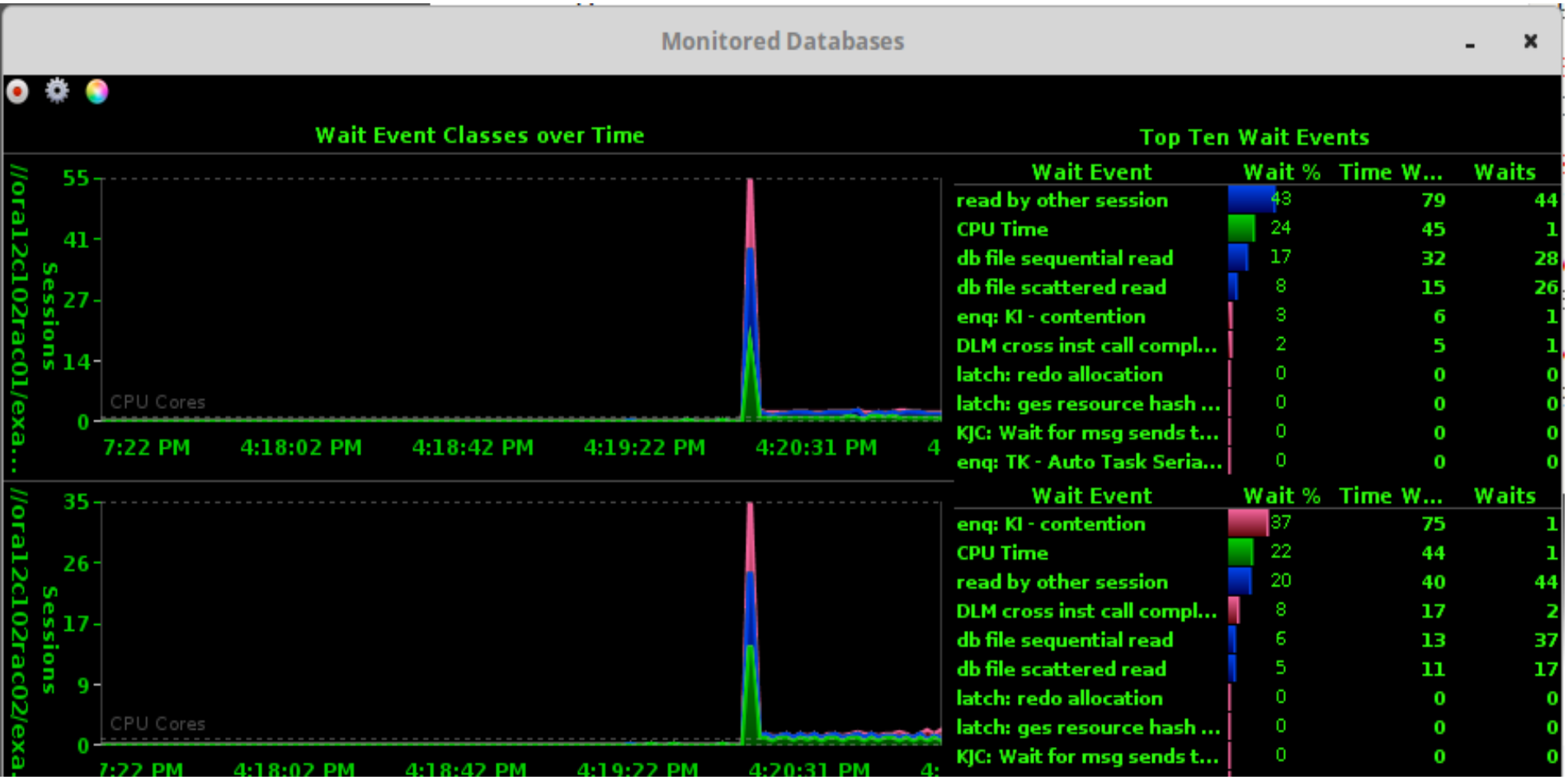
AMON Screenshot

- Dynamic Session Details

```
   Host: ora12c102rac02  Instance: js122a2 (ID 2)  PDB: CDB$ROOT  User: SYS  Interval: 3 sec
Real time SQL monitoring(4), real time SQL plan(5)
== Session details (V$SESSION). - Dynamic view. ==

Inst: 2 SID: 63 Ser: 41575  SPID: 29218  Status: ACTIVE

Logon time  : 22-mar-17 18:10:53
Session type: USER  Cont-Name: EXAMPLES (Cont-ID: 6)
DB user name: JKSTILL
OS user name: jkstill
SOSID       : 29218  (SPID: 29218  STID: 29218)
Program     : oracle@ora12c102rac02.jks.com
Machine     : poirot.jks.com
Service name: examples.jks.com
Client Info :
Module: perl@poirot.jks.com (TNS V1-V3)
Action:

Session statistics (delta values) from V$SESSTAT.
  Used CPU(s): 0.9         Log. reads : 4675        Cons. changes: 0
  Ph. reads  : 1292        Ph. writes : 0           Redo size    : 0

Event: read by other session
P1,P2,P3: 27, 13458, 1
Seconds in wait: 0  Wait time: 2  State: WAITED KNOWN TIME
Wait class: User I/O

SQL cursor details (V$SQL).
  SQL-ID: fuf0znmf257at  Child number: 0  Plan hash value: 41734245
  SQL Exec. ID: 33556065  Exec. start: 22-mar-17 18:23:56
  Optimizer cost: 289
  Is shareable? : YES  Is bind sensitive? : NO  Is bind aware? : NO
  Is reoptimizable? : N  Is resolved adaptive plan? : NULL
  IM column store segment scans: 0
  SQL plan baseline:
  SQL profile:
  SQL patch:
  Outline category:

Blocking session. Status: NOT IN WAIT
Row wait details. Object: 92064  File: 27  Block: 13458  Row: 0

Allocated PGA:  Other: 1.9MB, Freeable: 128.0KB, SQL: 26.2KB, PL/SQL: 1.9KB
PGA tunable memory: 0

SQL cursor execution statistics (total / per execution).
  Executions: 1634 / n.a    Executions by PX servers: 0 / n.a.
  Parses calls: 2 / 0.0    Fetches: 1632 / 1.0    Rows: 1632 / 1.0
```

Tools From SwingBench Author Dominic Giles

- Database Time Monitor
  - http://dominicgiles.com/dbtimeviewer.html



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Tools From SwingBench Author Dominic Giles

- Monitor DB
  - http://dominicgiles.com/styled/monitordb.html
  - Screenshot follows

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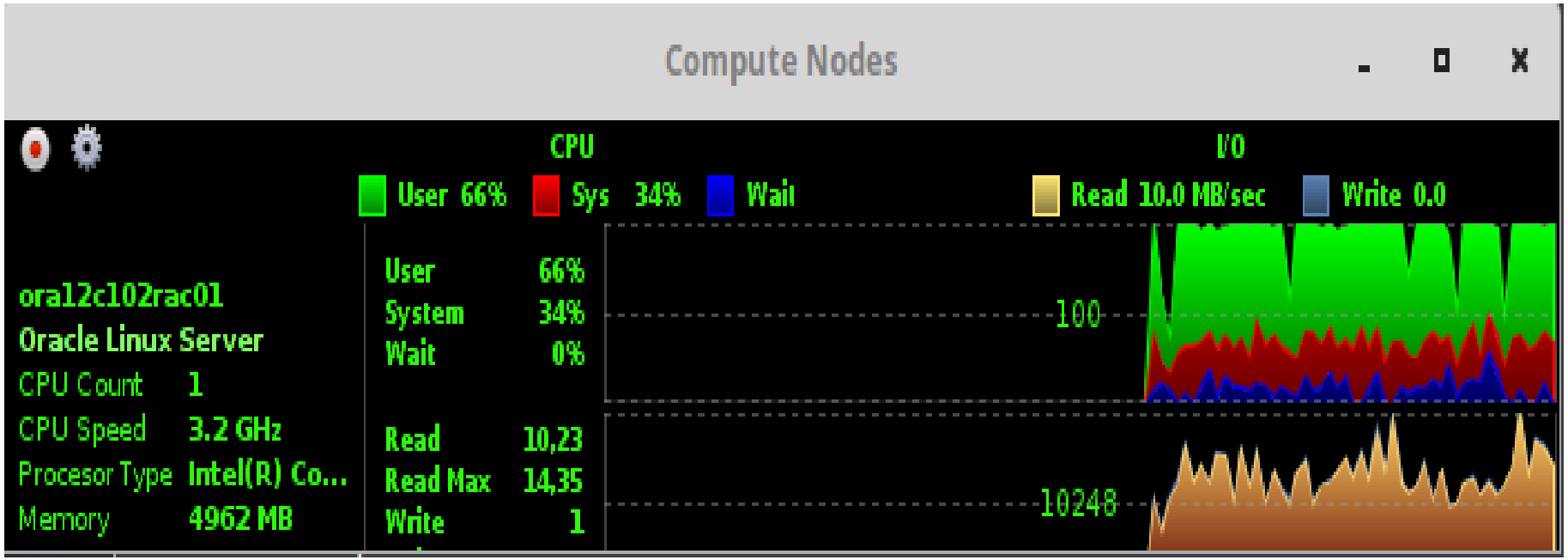
Tools From SwingBench Author Dominic Giles

- CPU Monitor
  - http://dominicgiles.com/cpumonitor.html



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oratop

- ‘top’ like monitor from Oracle
  - oratop - Utility for Near Real-time Monitoring of Databases, RAC and Single Instance (Doc ID 1500864.1)
  - Also installed with TFA (Trace File Analyzer)
  - See video

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Nmon – Nigel's Monitor

- AIX – written by Nigel Griffiths at IBM
  - ported to Linux as well
- Incredible amount of data collected
  - http://www.ibm.com/support/knowledgecenter/ssw_aix_61/com.ibm.aix.cmds4/nmon.htm
  - https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Power+Systems/page/nmon_FAQ

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Nmon – Nigel's Monitor

Example script

```
#!/usr/bin/bash
# nmon-collect.sh
# collect for several days


cd /home/oracle/working/still/nmon
mkdir -p logs


for day in 1 2 3 4 5 6 7 8
do
        # -p prints PID
        PID=$(nmon -Flogs/nmon-pdw01-$(date +%Y%m%d-%H%M%S).csv -p -w 8 -V -A -d -L -M  -s 60 -c 1440)


        # wait for current nmon to complete
        # this bit is necessary as nmon automatically runs in the background and is inherited by init
(PID 1)
        # so 'wait PID' will not work
        # this just to break it up in to several more manageable files of ~ 18M each


        while kill -0 "$PID"; do
                sleep 20
        done
done
```


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Nmon analyzer

- Extremely good utility
  - Transforms nmon data into useful information (MS Excel based)
    - https://www.ibm.com/developerworks/aix/library/au-nmon_analyser/

- Sorry, I do not have an example I can share
  - It is very well documented

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dstat – replacement for vmstat, iostat, netstat and ifstat

- Dag Wieers
- http://dag.wiee.rs/home-made/dstat/
- https://github.com/dagwieers/dstat
- Python based
  - Usable from your home directory
  - No need to install by root if unable
- Output CSV directly
  - Plugin architecture
  - Allows extending dstat
- Many plugins available

Short List of Plugins

- aio
- cpu
- cpu24
- disk
- disk24
- disk24old
- epoch
- fs
- int
- int24
- io
- ipc
- load
- lock
- mem
- mem
- net
- page
- page24
- proc
- raw
- socket
- swap
- swapold
- sys
- tcp
- time
- udp
- unix
- vm(ware)

dstat – replacement for vmstat, iostat, netstat and ifstat

```
[root@oravm01 dstat]# ~/build/dstat/dstat -tcndylp --top-cpu
----system---- --total-cpu-usage-- -net/total- -dsk/total- ---system-- ---load-avg--- ---procs--- -most-expensive-
     time     |usr sys idl wai stl| recv  send| read  writ| int   csw | 1m   5m  15m |run blk new|  cpu process
06-04 07:35:10| 10  11  79   0   0|   0     0 | 121k  105k| 640  8529 |0.40 0.33 0.27|  0   0 5.2|osysmond.bin 2.4
06-04 07:35:11| 11  17  72   0   0| 748B 1656B|  16k   73k|5243  8516 |0.40 0.33 0.27|1.0   0 6.0|osysmond.bin 3.0
06-04 07:35:12|  8  12  79   0   0| 250B  486B|  32k   41k|5376  8628 |0.40 0.33 0.27|  0   0   0|osysmond.bin 2.5
06-04 07:35:13|  6  13  80   0   0|  66B  486B|  80k   81k|5451  8805 |0.40 0.33 0.27|1.0   0   0|osysmond.bin 3.0
06-04 07:35:14|  8  12  80   0   0|  66B  486B|  32k   33k|5440  8620 |0.40 0.33 0.27|1.0   0   0|evmd.bin     2.0
06-04 07:35:15|  9  15  76   0   0|  66B  486B|  32k  177k|5293  8471 |0.44 0.34 0.28|  0   0   0|crsd.bin     2.5
06-04 07:35:16|  9  15  75   0   0|1032B  486B|  80k   65k|5249  8458 |0.44 0.34 0.28|1.0   0 6.0|ocssd.bin    2.5
06-04 07:35:17| 10  17  74   0   0| 272B  486B|  32k   33k|5437  8547 |0.44 0.34 0.28|1.0   0   0|osysmond.bin 3.0
06-04 07:35:18|  7  13  80   0   0|  66B  486B|  16k   49k|5527  8663 |0.44 0.34 0.28|  0   0   0|crsd.bin     2.0
06-04 07:35:19| 10  15  75   0   0|  66B  486B|  96k   33k|5408  8699 |0.44 0.34 0.28|  0   0 5.0|ohasd.bin    2.5
06-04 07:35:20|  7  13  80   0   0|  66B  486B|  32k   93k|5380  8689 |0.41 0.33 0.28|  0   0   0|osysmond.bin 3.0
06-04 07:35:21| 10  14  75   0   0| 386B  486B|  80k   57k|5445  8666 |0.41 0.33 0.28|  0   0 6.0|osysmond.bin 2.5
06-04 07:35:22|  7  14  80   0   0|  66B  486B|  96k   33k|5368  8328 |0.41 0.33 0.28|  0   0   0|osysmond.bin 3.0
06-04 07:35:23|  7  11  82   0   0| 272B  486B|  16k   37k|5417  8689 |0.41 0.33 0.28|  0   0   0|osysmond.bin 2.5
06-04 07:35:24|  6  14  80   0   0|  66B  486B|  32k   41k|5502  8729 |0.41 0.33 0.28|  0   0   0|osysmond.bin 2.5
06-04 07:35:25|  9  11  80   0   0| 422B  588B|  96k   33k|5399  8665 |0.38 0.32 0.27|4.0   0   0|crsd.bin     2.0
```

Load Test and Benchmarking

SLOB

- Silly Little Oracle Benchmark
  - https://kevinclosson.net/slob/
- Simple to use

```
export SYSDBA_PASSWD=XXXX

export NON_ADMIN_CONNECT_STRING=oravm
export ADMIN_SQLNET_SERVICE=oravm
export SQLNET_SERVICE_BASE=oravm

bash setup.sh slob 2

bash runit.sh  2
```


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SLOB

- Runs in background during test
  - iostat
  - vmstat
  - mpstat
- AWR Snapshots before and after test
- AWR Reports
  - NOTIFY : 2017.02.03-11:59:56 : Generating AWR reports. HTML reports will be compressed. Connect string is "sqlplus -L sys/XXX@oravm as sysdba"
  - Generates AWR reports from the *before* and *after* and AWR snapshots

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Swingbench

- Dominic Giles
  - http://dominicgiles.com/swingbench.html
- GUI and CLI
- Use for realistic and repeatable benchmarking
- Configurable
  - Type of transactions
  - Size of transactions
  - Number of users
  - Think time – min and max
- Charts metrics in real time
  - Examples follow

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SwingBench 2.5.0.971 (//ora112304a/js02)

File Help

Configuration | Preferences | Output | Events

User Details | Connection Pooling | Properties

Username: soe

Password: •••

Connect String: //ora112304a/js02

Driver Type: Oracle jdbc Driver

☑ Collect database statistics

☑ Take AWR snapshots at start and end (10g/11g only)

System Username: jkstill

System Password: ••••

Load | Environment Variables | Distributed Controls

Number of Users	1
Min. Inter Delay Between Transactions (ms)	0
Max. Inter Delay Between Transactions (ms)	0
Min. Intra Delay Within Transactions (ms)	5
Max. Intra Delay Within Transactions (ms)	5
Logon Delay (milliseconds)	1
Logon Group	1
Wait Till All Sessions Log On	true
Logoff Post Transaction	false
Tx. per Reconnect	0

Transactions | Jobs

Id	Class Name	Short Na...	Load Ratio	Activate ?
Customer Registr...	com.dom.benchmarking.swingbench.plsqltrans...	NCR	15	☑
Update Customer ...	com.dom.benchmarking.swingbench.plsqltrans...	UCD	10	☑
Browse Products	com.dom.benchmarking.swingbench.plsqltrans...	BP	50	☑
Order Products	com.dom.benchmarking.swingbench.plsqltrans...	OP	40	☑
Process Orders	com.dom.benchmarking.swingbench.plsqltrans...	PO	5	☑
Browse Orders	com.dom.benchmarking.swingbench.plsqltrans...	BO	5	☑
Sales Rep Query	com.dom.benchmarking.swingbench.plsqltrans...	SQ	2	☐
Warehouse Query	com.dom.benchmarking.swingbench.plsqltrans...	WQ	2	☐
Warehouse Activit...	com.dom.benchmarking.swingbench.plsqltrans...	WA	2	☐

Chart Type: Overview Logged on Sessions: 0/1

Overview Chart

Transactions Per Minute — Maximum TPM 0 — Average TPM

Transactions Per Second — Maximum TPS 0 — Average TPS

Response Time (5 second Rolling Window) — Maximum 0 — Average

CPU — Usr, System, I/O Wait

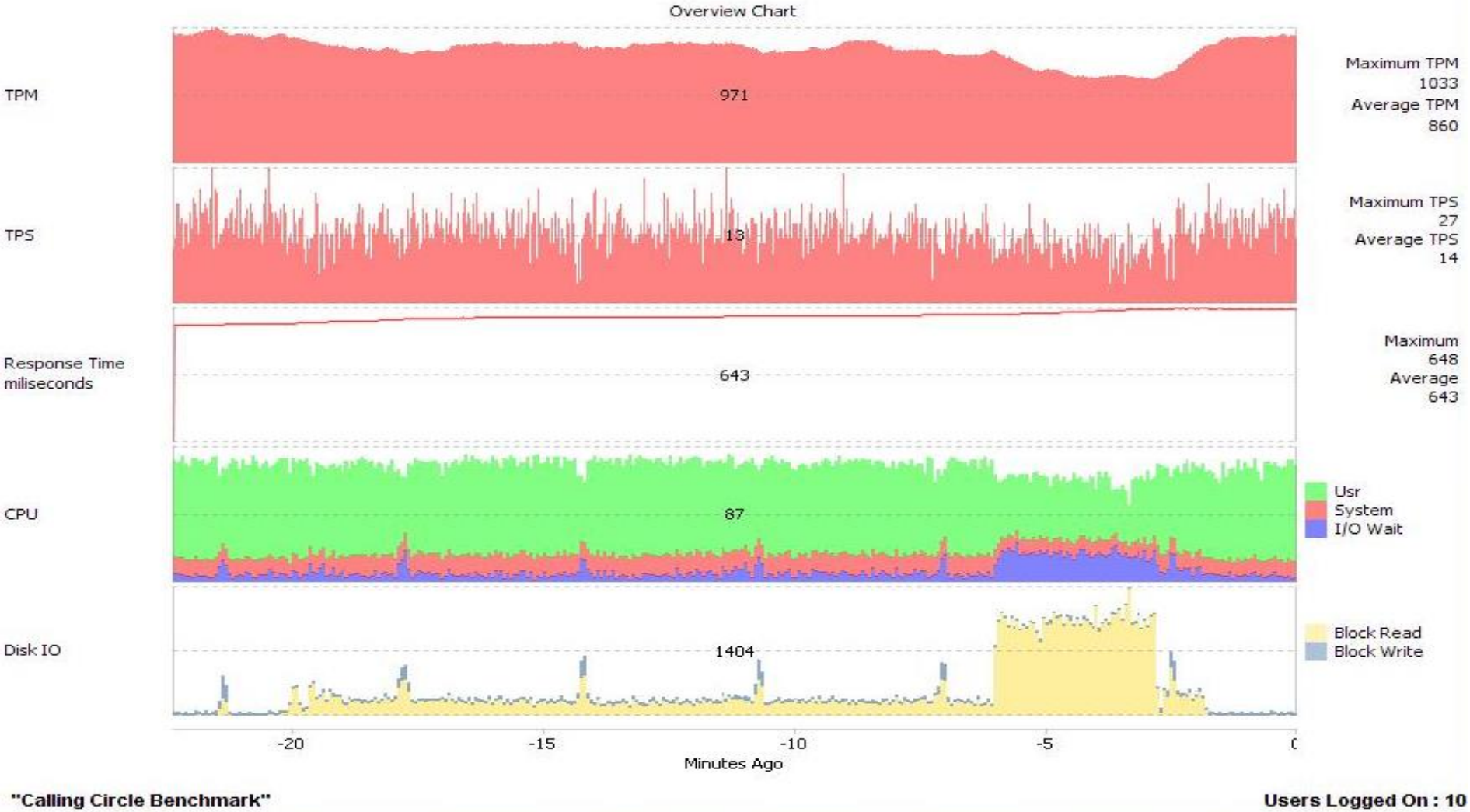
Disk IO — Block Read, Block Write

1:00:15 PM, 1:00:33 PM, 1:00:50 PM, 1:01:08 PM, 1:01:26 PM, 1:01:44 PM, 1:02:

"Order Entry (PLSQL) V2" Users Logged On : 0

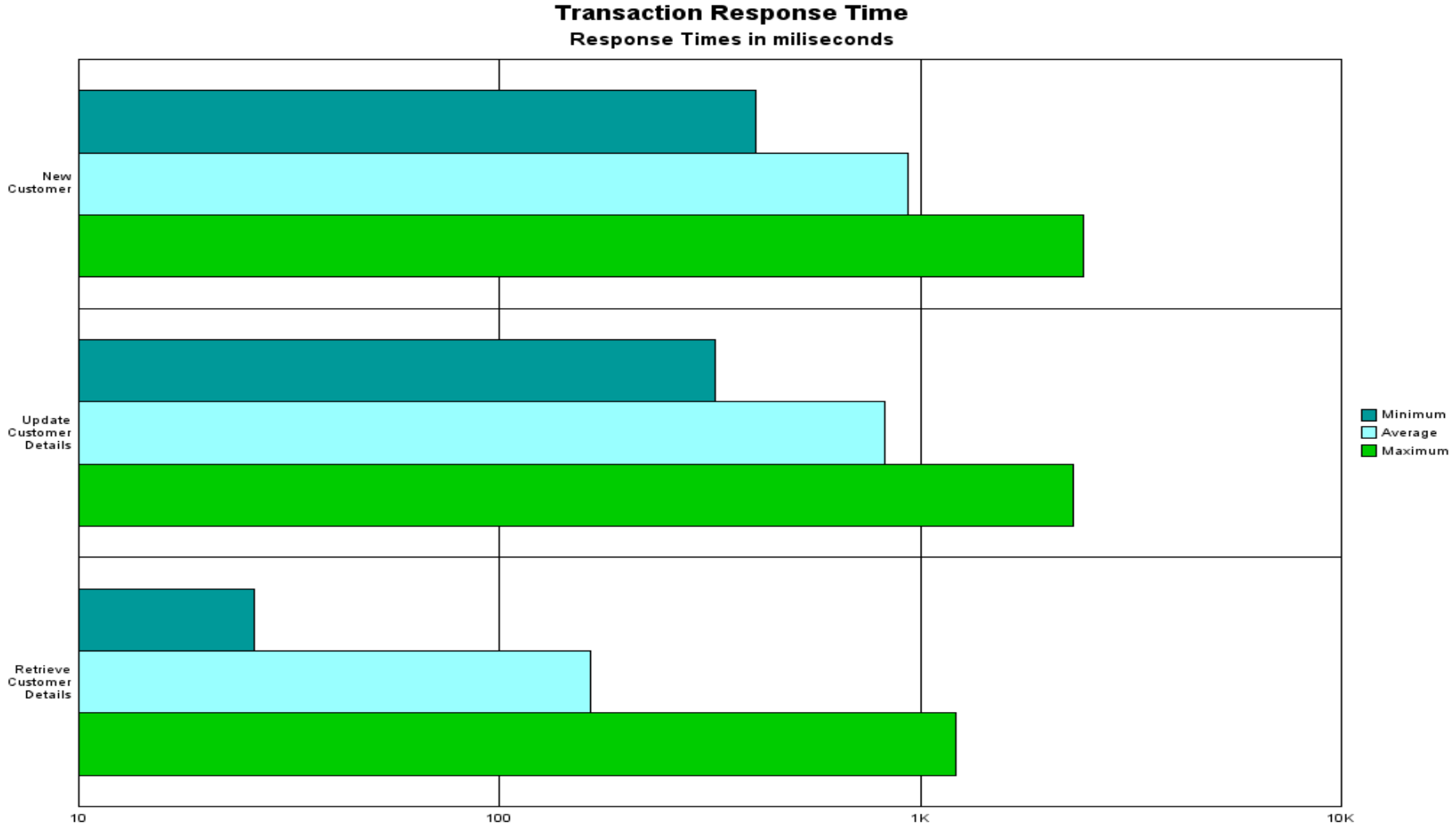
LVL 1 - SET LIMIT…READRATE - BCT

- Update 10% of database blocks in RMANPERF test data
- RATE = 6000K



LVL 1 - SET LIMIT…READRATE – BCT-Response

- Update 10% of database blocks in RMANPERF test data
- RATE = 6000K



sqlrun

- Jared Still
  - https://github.com/jkstill/sqlrun
- Run many different SQL statements in multiple sessions
  - Supports bind variables
  - Currently supports SELECT only
  - DML tests have been performed with modification
- Instructions on github

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sqlrun – some options

- exe-delay
  - seconds to delay between sql executions
- connect-delay
  - seconds to delay between connections
  - valid only for --connect-mode trickle
- connect-mode [trickle | flood | tsunami]
  - trickle: gradually add sessions up to max-sessions
  - flood: startup sessions as quickly as possible
  - tsunami: wait until all sessions are connected before they are allowed to work
- exe-mode [sequential | semi-random | truly-random]
  - sequential: each session iterates through the SQL statements serially
  - semi-random: a value assigned in the sqlfile determines how frequently each SQL is executed
  - truly-random: SQL selected randomly by each session

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ORAPUB

- Craig Shallahamer
  - http://www.orapub.com
- Many tools available here
  - CPU Speed Test
    - http://www.orapub.com/tools-cpu-speed-test
  - DB Time Test
    - http://www.orapub.com/tools-dbtime-test
  - Many others
  - Example next slide

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ORAPUB – CPU Speed Test

- Reports time per LIO

```
SQL> @op-cpu-speed-test-3b.sql 30

.....................................................................
... Results
.....................................................................
.
Speed Factor (higher is faster) : 2.5691  <----
.
Supporting Details:
samples_v = 28 sum_walltime_ms_per_lio_v = 10.898795
avg_walltime_ms_per_lio_v = .389243
The speed factor = 1 / avg_walltime_ms_per_lio_v
.
```


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HammerDB

- http://www.hammerdb.com/about.html
- Originally known as *HammerORA*
- Supports many different databases
- GUI Interface
- Disclaimer – I know of this, but have not used it.

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Diagnostic Tools

Perf

- Perf Overview
  - Does quite a bit
- Brendan Gregg
  - http://www.brendangregg.com/perf.html
- Most interested in profiling database processes
- Frits Hoogland
  - https://fritshoogland.wordpress.com/2012/07/10/the-linux-perf-utility-with-el-6/
- Riyaj Shamsudeen
  - https://orainternals.wordpress.com/tag/perf/
- Luca Canali
  - https://db-blog.web.cern.ch/blog/luca-canali/2016-01-linux-perf-probes-oracle-tracing

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Perf - Simple Example

- Get Oracle server PID
- perf record –p PID
  - CTL-C when done
- perf report

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Perf Example

```
# Samples: 333  of event 'cpu-clock'
# Event count (approx.): 333
# Overhead          Command      Shared Object                          Symbol
# ........  ...............  .................  ..................................
    25.83%  oracle_14692_js  [vdso]             [.] 0x0000000000000bb0
     9.31%  oracle_14692_js  oracle             [.] qerstUpdateStats
     6.31%  oracle_14692_js  [e1000]            [k] e1000_xmit_frame
     6.01%  oracle_14692_js  oracle             [.] qerstRowP
     6.01%  oracle_14692_js  oracle             [.] sltrgftime64_cgt
     4.80%  oracle_14692_js  oracle             [.] qerstSnapStats
     4.80%  oracle_14692_js  librt-2.12.so      [.] clock_gettime
     4.20%  oracle_14692_js  [kernel.kallsyms]  [k] __do_softirq
...
```

- What can you do with this?
  - Start by searching MOS for keywords, such as *qerstUpdateStats (several bugs found)*

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Perf

- OraPub fulltime.sh
- http://blog.orapub.com/20131129/The-Situation-Detailing-Oracle-Process-CPU-Consumption.html
- http://blog.orapub.com/20131210/Tool-Options-Detailing-Oracle-Database-Process-CPU-Consumption.html
- http://blog.orapub.com/20131210/Tool-Options-Detailing-Oracle-Database-Process-CPU-Consumption.html
- http://www.orapub.com/tools.html

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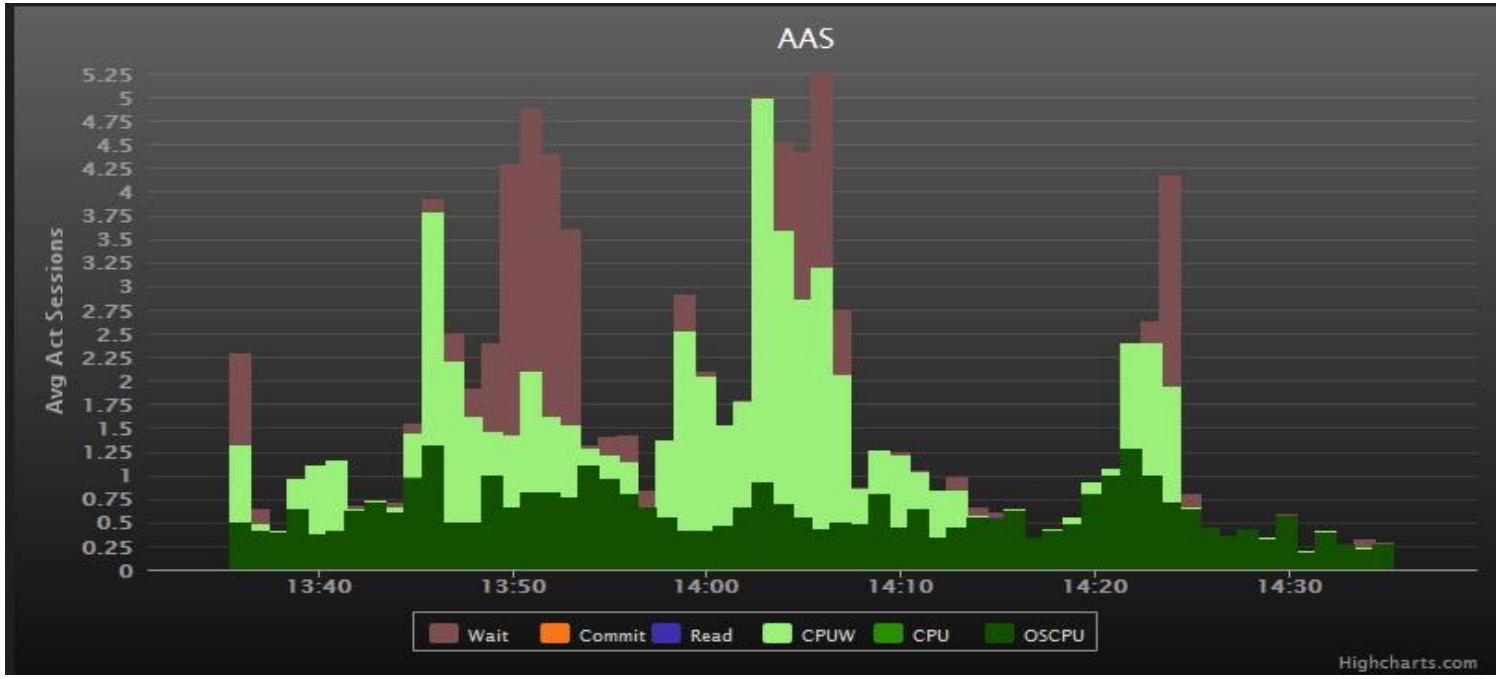
Oracle CPU Time

- Kyle Hailey
  - http://datavirtualizer.com/oracle-cpu-time/
  - Current data from database
  - ASH - compare OS CPU, Oracle CPU, CPU Wait
  - Chart illustrates data gathered



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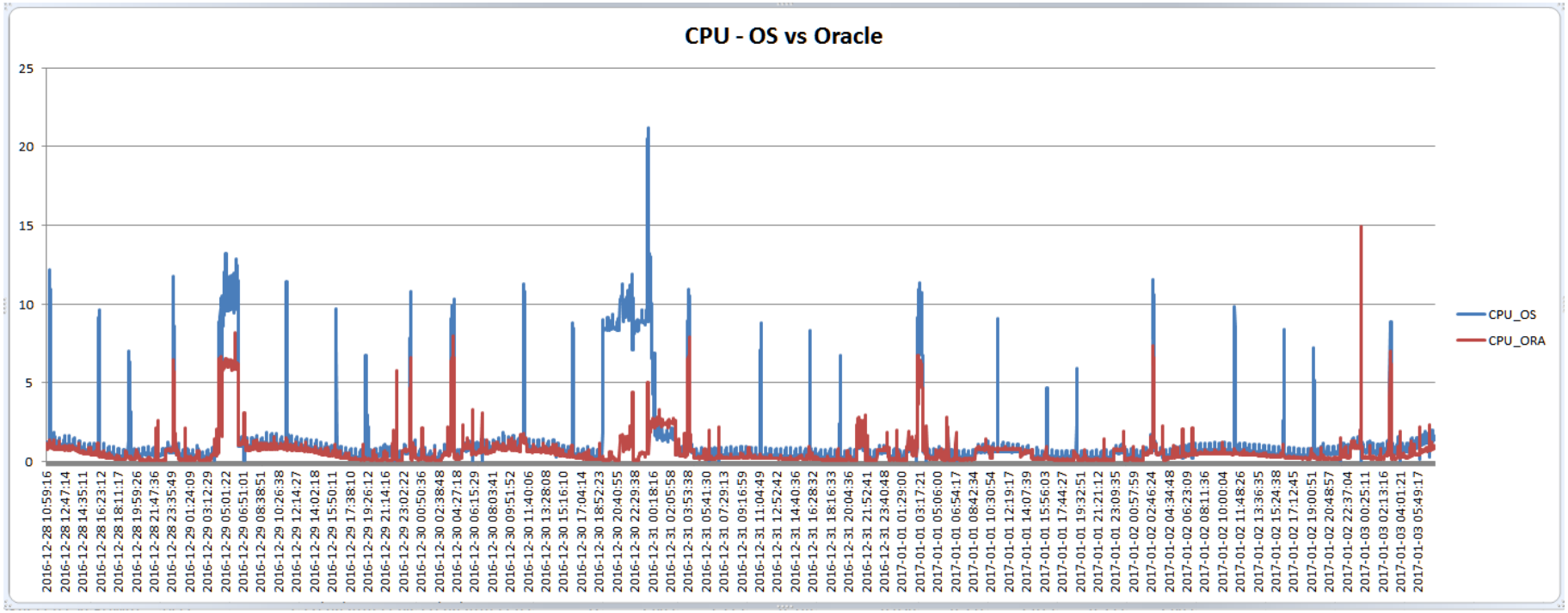
Oracle CPU Time

- RAC Aware Monitor based on modified version of SQL
  - Jared Still
  - Collects data over time
  - https://github.com/jkstill/cpu-aas
  - https://github.com/jkstill/cpu-aas/blob/master/cpu-aas.sql



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Perfmon.sh

- Yong
  - http://yong321.freeshell.org/computer/Perfmon.html
- DB install required: No

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ASH Viewer

- Alexander Kardapolov
  - http://sourceforge.net/projects/ashv/
  - Tutorial: http://timurakhmadeev.wordpress.com/2010/02/18/ash-viewer/
- DB install required: ??

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OraSASH – Oracle Simulated ASH

- Originated by Kyle Hailey
- Maintained by Marcin Przepiorowski
  - http://pioro.github.io/orasash/
- Blog by Marc Fielding
  - http://www.pythian.com/blog/trying-out-s-ash/

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ASH Masters

- Repo of ASH scripts – Kyle Hailey
  - https://github.com/khailey/ashmasters
- Other ASH info
  - http://datavirtualizer.com/ash-masters/

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ASH Scripts

- Tanel Poder
  - http://blog.tanelpoder.com/files/scripts/ash/

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asm_metrics.pl csv_asm_metrics.pl

- Bertrand Drouvot
  - https://bdrouvot.wordpress.com/asm_metrics_script/
  - https://bdrouvot.wordpress.com/asm_metrics_source/
- Modified to include complete datestamp
  - asm_metrics-datestamp.pl

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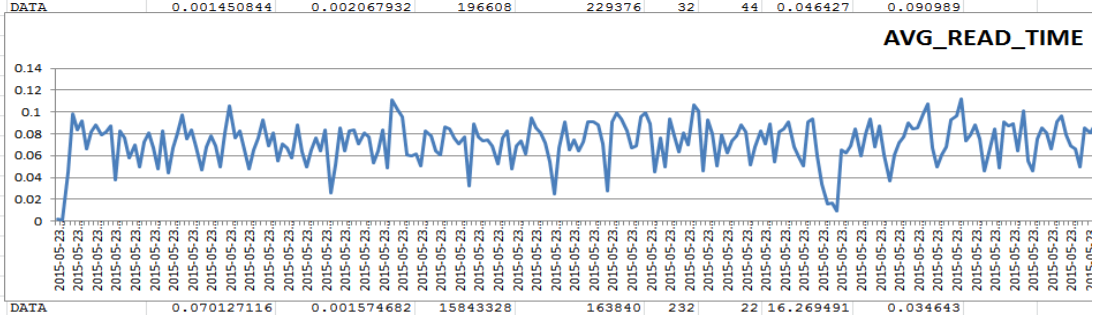
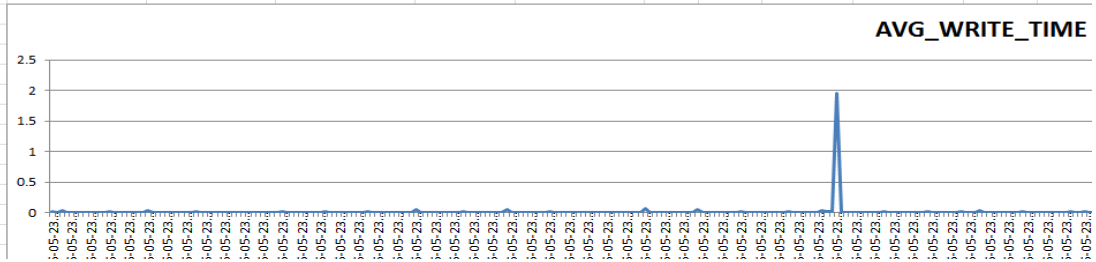
asm_metrics

- Jared Still
  - https://github.com/jkstill/asm-metrics
  - https://www.pythian.com/blog/tracking-asm-metrics/
- Saves raw data in CSV format
- Utilities to:
  - Cut columns from data
  - Aggregate data at the command line
- All output in CSV
- Scripts included for creating Excel with Charts

	A	B	C	D	E	F	G	H	I	J	K	L
1	DISPLAYTIME	ELAPSEDTIME	DBNAME	DISKGROUP_NAME	AVG_READ_TIME	AVG_WRITE_TIME	BYTES_READ	BYTES_WRITTEN	READS	WRITES	READ_TIME	WRITE_TIME
2	2015-05-23 17:32:30	10.833516	oravm	DATA	0.001939149	0.0113888	344064	212992	47	45	0.09114	0.512496
3	2015-05-23 17:32:40	10.82475	oravm	DATA	0.001450844	0.002067932	196608	229376	32	44	0.046427	0.090989
4	2015-05-23 17:32:51	10.821195	oravm									
5	2015-05-23 17:33:02	10.739901	oravm									
6	2015-05-23 17:33:13	10.648695	oravm									
7	2015-05-23 17:33:23	10.69473	oravm									
8	2015-05-23 17:33:34	10.701468	oravm									
9	2015-05-23 17:33:45	10.786722	oravm									
10	2015-05-23 17:33:55	10.665135	oravm									
11	2015-05-23 17:34:06	10.588829	oravm									
12	2015-05-23 17:34:17	10.691735	oravm									
13	2015-05-23 17:34:27	10.708584	oravm									
14	2015-05-23 17:34:38	10.638062	oravm									
15	2015-05-23 17:34:49	10.641654	oravm									
16	2015-05-23 17:34:59	10.70171	oravm									
17	2015-05-23 17:35:10	10.614901	oravm									
18	2015-05-23 17:35:21	10.746561	oravm	DATA	0.070127116	0.001574682	15843328	163840	232	22	16.269491	0.034643
19	2015-05-23 17:35:31	10.525977	oravm									
20	2015-05-23 17:35:42	10.74207	oravm									
21	2015-05-23 17:35:53	10.683789	oravm									
22	2015-05-23 17:36:03	10.591431	oravm									
23	2015-05-23 17:36:14	10.592998	oravm									
24	2015-05-23 17:36:25	10.642141	oravm									
25	2015-05-23 17:36:35	10.628777	oravm									
26	2015-05-23 17:36:46	10.838876	oravm									
27	2015-05-23 17:36:56	10.471475	oravm									
28	2015-05-23 17:37:07	10.479854	oravm									
29	2015-05-23 17:37:17	10.519282	oravm									
30	2015-05-23 17:37:28	10.623789	oravm									
31	2015-05-23 17:37:39	10.637358	oravm									





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Data Generator

- http://dominicgiles.com/datagenerator.html

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JMeter

- Apache project
  - More robust than Swingbench
  - more work to setup
  - http://jmeter.apache.org/
- Tutorial
  - http://www.tutorialspoint.com/jmeter/

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iometer

- Originally Intel
- Now by OSDL (Open Source Development Lab)
  - http://www.iometer.org/

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blktrace

- Trace IO at low level
  - https://www.cse.unsw.edu.au/~aaronc/iosched/doc/blktrace.html
- See how disk IO is occurring at a very low level.
- What perf is to processes, blktrace is to storage IO
  - Detailed low level information about disk IO
- This software could be the subject of it's own presentation

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blktrace

- Q2Q
  - time between requests sent to the block layer - provides some idea as to how quickly IOs are being handed to the block IO layer
- Q2G
  - how long it takes from the time a block I/O is queued to the time it gets a request allocated for it
- G2I
  - how long it takes from the time a request is allocated to the time it is Inserted into the device's queue
- Q2M
  - how long it takes from the time a block I/O is queued to the time it gets merged with an existing request
- I2D
  - how long it takes from the time a request is inserted into the device's queue to the time it is actually issued to the device time the I/O is “idle” on the request queue

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blktrace

- M2D
  - how long it takes from the time a block I/O is merged with an exiting request until the request is issued to the device
- D2C
  - service time of the request by the device - time the I/O is “active” in the driver and on the device
- Q2C
  - measures the times for the complete life cycle of IOs during the run - Q2C = Q2I + I2D + D2C
- D2D
  - set of indicators showing how close the IO requests are that are handled by underlying drivers
- Q2I
  - Time it takes to process an I/O prior to it being inserted or merged onto a request queue - Includes split, and remap time

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blktrace

- Example Report (real system)

```
==================== All Devices ====================

            ALL           MIN           AVG           MAX           N
--------------- ------------- ------------- ------------- -----------

Q2Q               0.000003835   0.015245647   1.792735418       32069
Q2G               0.000001010   0.000004158   0.000409840       95232
G2I               0.000000863   0.000006381   0.000411564       95232
Q2M               0.000001509   0.000004528   0.000021076         978
I2D               0.000000990   0.002275400   0.721137866       95232
M2D               0.000064584   0.041312133   0.553562256         978
D2C               0.000280517   0.005035470   0.735377878       32070
Q2C               0.000286389   0.007718166   0.750686357       32070
```


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blktrace

```
==================== Device Overhead ====================

       DEV |       Q2G       G2I       Q2M       I2D       D2C
---------- | --------- --------- --------- --------- ---------
(  8, 64) |   0.1600%   0.2455%   0.0018%  87.5442%  65.2418%
---------- | --------- --------- --------- --------- ---------
   Overall |   0.1600%   0.2455%   0.0018%  87.5442%  65.2418%

==================== Device Merge Information ====================

       DEV |       #Q       #D   Ratio |   BLKmin   BLKavg   BLKmax    Total
---------- | -------- -------- ------- | -------- -------- -------- --------
(  8, 64)  |    95232    95232     1.0 |        1      230     1024 21968610

==================== Device Q2Q Seek Information ====================

       DEV |          NSEEKS            MEAN          MEDIAN | MODE
---------- | --------------- --------------- --------------- | ---------------
(  8, 64) |           32070      15892460.5               0  | 0(15449)
---------- | --------------- --------------- --------------- | ---------------
   Overall |          NSEEKS            MEAN          MEDIAN | MODE
   Average |            32070      15892460.5               0 | 0(15449)
```


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netperf

- http://www.netperf.org/netperf/

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iperf

- Home
  - https://iperf.fr/
- Tutorial
  - http://openmaniak.com/iperf.php
- Jperf front end
  - http://sourceforge.net/projects/iperf/files/jperf/

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iperf3

- Home
  - https://code.google.com/p/iperf/
- Github
  - https://github.com/esnet/iperf
- Documentation
  - http://software.es.net/iperf/

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oratcptest

- Measuring Network Capacity using oratcptest (Doc ID 2064368.1)
- Configurable
  - Network message size
  - Delay time in between messages
  - Parallel sending streams
  - Whether Oratcptest-server should write messages on disk, or not.
  - Whether Oratcptest-client should wait for ACK before it sends next message
    - simulating the ASYNC and SYNC transport used by Data Guard.
  - Also suitable for general network test
    - https://fritshoogland.wordpress.com/2017/02/14/performing-in-the-cloud-network-latency

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DIY

Make your own tools

Why DIY?

- Target specific metrics
- Tool you want does not exist

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CLI Histogram

- data-histogram.pl
  - https://github.com/jkstill/Histogram
  - Example usage:

```
grep shrprd01 /home/jkstill/perl/modules/roc/data/asm-dg-metrics-1.csv  | cut -f7 -d, |
data-histogram.pl --lower-limit-op '>=' --lower-limit-val 1 --upper-limit-op '<=' --
upper-limit-val 10
Bucket Count Decreased to 18 to avoid modulus divide by zero

     2:  50.1%  ****************************************************************************************
     3:  33.4%  ****************************************************************
     4:   8.4%  ****************
     5:   2.7%  *****
     6:   0.7%  *
     7:   1.0%  **
     8:   1.8%  ***
     9:   0.2%
    10:   1.1%  **
    11:   0.6%  *
```


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CLI Exe Plan Formatter

- plan-format.pl
  - https://github.com/jkstill/cli-explain-plan
  - Example usage:

```
Cursor: #47443176334328-1:

SQL:select a.name, b.value-a.value run1, c.value-b.value run2,
        ( (c.value-b.value)-(b.value-a.value)) diff
from run_stats a, run_stats b, run_stats c
where a.name = b.name
        and b.name = c.name
        and a.runid = 'before'
        and b.runid = 'after 1'
        and c.runid = 'after 2'
        and (c.value-a.value) > 0
        --and (c.value-b.value) <> (b.value-a.value)
        and abs((c.value-b.value)-(b.value-a.value)) > 1000
order by abs( (c.value-b.value)-(b.value-a.value))

Line#  Operation                                  Rows        LIO      Read   Written Seconds
====== ================================ ============  ========= ========= ========= =========
000001 SORT ORDER BY                              67          .         .         .   0.03
000002   HASH JOIN                                67          .         .         .   0.03
000003     TABLE ACCESS FULL RUN_STATS           1179         37         0         0   0.00
000004     HASH JOIN                             1179          .         .         .   0.02
000005       TABLE ACCESS FULL RUN_STATS         1179         37         0         0   0.00
000006       TABLE ACCESS FULL RUN_STATS         1179         37         0         0   0.00
```


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sar disk IO processor

- get-sar-disk-csv.sh
  - Processes data directly from sar binary using sadf
  - Passes sar options to get disk labels
  - Dump to CSV for analysis
- See script
  - sar-tools directory
  - Output used to create Excel Pivot chart

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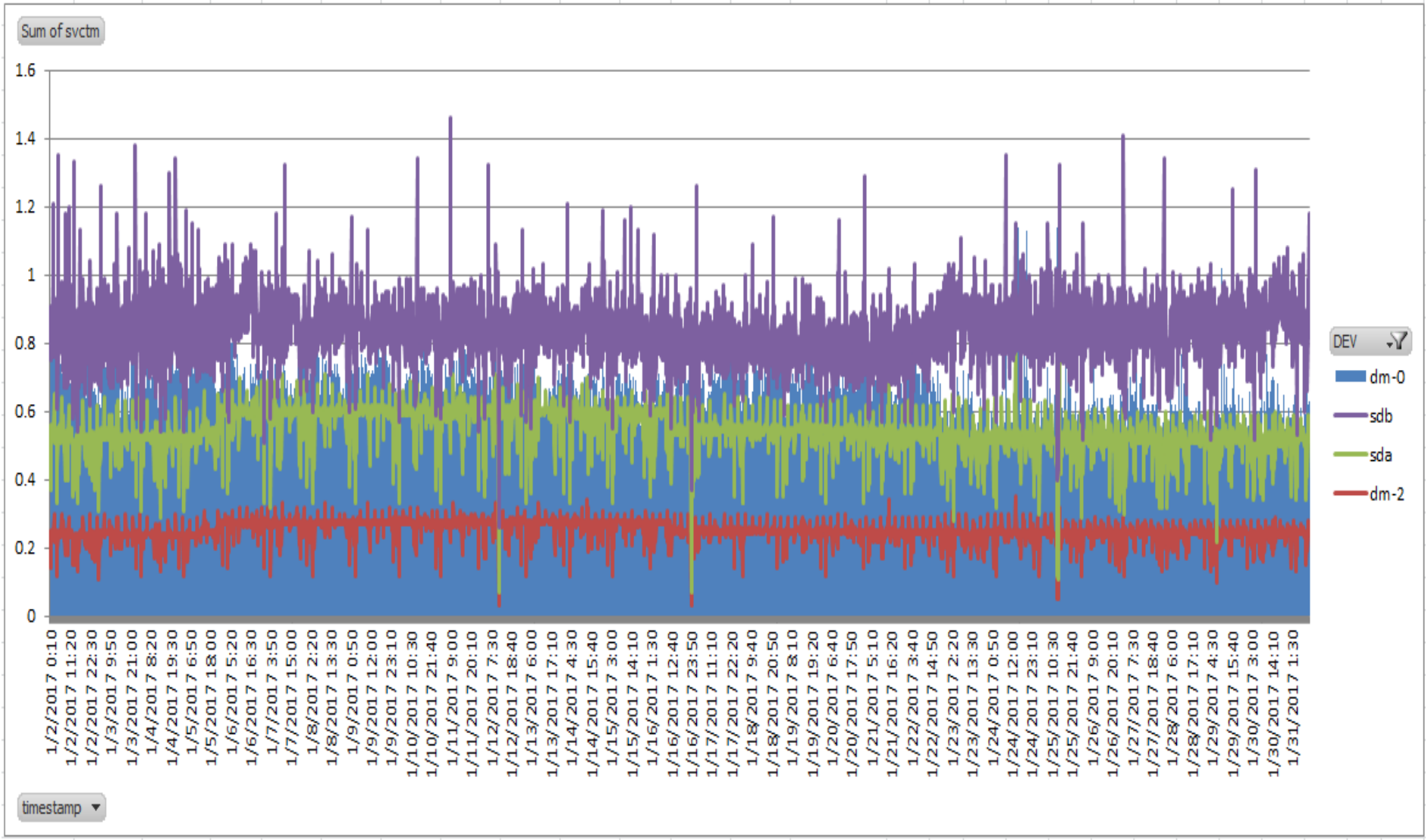
sar disk IO processor – chart service times



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Q&A